



Transport for NSW

# Beaches Link and Gore Hill Freeway Connection

## Part C

Response to community submissions

November 2021



## C Response to community submissions

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Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C1 – Assessment process





## C1.1 Adequacy and accuracy

### C1.1.1 Adequacy of the environmental impact assessment process

#### ***Issue raised***

Submitters raised concerns regarding the adequacy of the environmental impact assessment process in providing a comprehensive and rigorous assessment consistent with the *Environmental Planning and Assessment Act 1979*. Specific concerns included that the environmental impact assessment was:

- Incorrectly scoped
- Conducted too quickly and too early in the design process
- Based on inadequate or inappropriate studies, investigations and modelling.

#### ***Response***

The environmental impact assessment was carried out 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 (NSW). Refer to Appendix A (Secretary's environmental assessment requirements checklist) and Appendix B (Environmental Planning and Assessment Regulation 2000 (NSW)) for further information.

The environmental impact assessment was prepared by Jacobs/Arcadis and certified on 4 December 2020. The certification page is included at the front of the environmental impact statement after the table of contents.

The environmental impact assessment process requires detailed technical studies/working papers to be prepared by appropriately qualified and experienced specialists in accordance with the issues identified in the Secretary's environmental assessment requirements, relevant guidelines and current industry best management practice. The technical working papers are then used to inform an environmental impact statement which provides a description of the project and its construction so that the impacts of the project can be comprehensively addressed.

The environmental impact statement for the project was developed using a conservative approach, by a team of qualified professionals, who objectively and thoroughly assessed the potential worst case impacts and scenarios across study areas likely to be affected by construction and operation of the project. It is contemporary practice that the environmental impact statement is carried out based on a preliminary design, with further design development and construction planning to be conducted later, following any project approval given. The preparation of the Beaches Link and Gore Hill Freeway Connection project environmental impact statement is consistent with other recent major NSW transport infrastructure projects in this regard. The assessment presented in the environmental impact assessment is considered to be a robust assessment of potential project impacts.

Transport for NSW has carried out an extensive community engagement program to date. Engagement with the community and broader stakeholders for the project commenced in March 2017 and continued through to the preparation and exhibition of the environmental impact statement. This has included a range of consultation and communication activities aimed at providing opportunities for community and stakeholder involvement throughout the project's development. As a result, the project has benefitted from the input of local knowledge, insight, experience, goals and priorities, to identify issues, potential environmental management strategies,

design refinements and opportunities to improve project outcomes, which were presented in the environmental impact statement. Submissions on the environmental impact statement are considered in this submissions report.

Specific concerns relating to the environmental impact statement are also addressed in sections C1.1 to C1.4 of this submissions report, and specific technical concerns in other chapters of this submissions report, as relevant.

Moving forward through the remainder of the planning process and into the construction period, stakeholder and community engagement would continue (refer to the overview of the consultation process for the project in Figure A2-1 of this submissions report).

### **C1.1.2 Adequacy of the environmental impact statement**

#### ***Issue raised***

Submitters raised concerns regarding the adequacy of the environmental impact statement in documenting the environmental impact assessment process. Specific concerns include:

- Inadequate level of detail provided for project risks
- The environmental impact statement does not effectively consider the project's impacts on existing utilities
- Generic environmental management measures were provided that are not evidence based
- The environmental impact statement does not consider new schools in the North Sydney/Cammeray area
- The environmental impact statement is an extremely large and complex document that includes language that is difficult to understand.

#### ***Response***

##### Environmental risks

The environmental risk analysis was carried out using a likelihood and consequence approach which included the best available technical information, and adopted good practice environmental standards, goals and measures to minimise environmental risks (refer to Appendix C (Environmental risk analysis)). The environmental risk analysis:

- Identified environmental issues, including key issues in the Secretary's environmental assessment requirements
- Examined potential impacts and proposed environmental management measures in relation to the identified issues
- Identified the impacts likely to remain after environmental management measures are applied (ie the residual impacts).

The analysis was conducted by qualified professionals and subject matter specialists in accordance with recognised international and Australian best practice: Australian and New Zealand standard *AS/NZ ISO 31000:2009 Risk Management – Principles and Guidelines* (Standards Australia, 2009a).

##### Utilities

The assessment of utilities impacts and adjustments are inherent in the assessment of key issues presented in the environmental impact statement. A utilities management strategy for the project (refer to Appendix D (Utilities management strategy)) was developed to provide a framework for

utility installations, relocations, adjustments and protection during construction and operation of the project, as described in Section 5.2.9 of the environmental impact statement. The utilities management strategy provides information in relation to utility installations, relocations and adjustments which are currently:

- Known and proposed within the construction footprint
- Unknown and/or located outside of the construction footprint.

The utilities management strategy provides the framework for how these utility relocations and adjustments would be identified, assessed and managed.

The location of existing utilities and any changes required would be confirmed during further design development of the project in consultation with the relevant utility provider, and is discussed further in Chapter 5 (Project description) of the environmental impact statement and Appendix D (Utilities management strategy).

### Environmental management measures

The environmental impact statement has been prepared with consideration of all relevant legislative requirements and assesses key impacts during construction and operation objectively and thoroughly, to provide confidence that the project would be constructed and operated within acceptable levels of impact, as set out in Chapter 2 (Assessment process) of the environmental impact statement. The assessments presented in the environmental impact statement clearly outline the environmental receivers and communities that may be affected by the project, and detail the expected level of impact, applicable assessment criteria and environmental 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. However, many environmental management measures are project specific and have been informed by the detailed technical studies carried out by specialists and included in the environmental impact statement.

The environmental management measures would 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 in accordance with industry standards and guidelines. The approach to environmental management would 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 would issue conditions of approval for the management of the key issues. These would need to be adhered to by both Transport for NSW and the contractor/s, in addition to the environmental management measures specified in Table D2-1 of this submissions report.

### Engagement with new schools

Ongoing engagement will be carried out with schools potentially affected by construction works and temporary construction support sites about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measures SE2 and SE3 (refer to Table D2-1 of this submissions report). No new schools in proximity to the project have been identified to be included in the engagement process, but, should they be approved during the next stages of the project, the project team would consult with them about relevant issues.

### Size and complexity of the 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 the project. This includes a description of the project and all components and activities required for its construction and operation, 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 Beaches Link and Gore Hill Freeway Connection, 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 in the document appendices, to the main document and the executive summary which is written more plainly to aid comprehension.

To further help the reader to navigate and understand the environmental impact statement, a summary guide to the environmental impact statement was also 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 publicly available from the start of exhibition of the environmental impact statement.

Further discussion on accessibility of the environmental impact statement is provided in Section C6.1 of this submissions report.

### **C1.1.3 Compliance with the Secretary's environmental assessment requirements**

#### ***Issue raised***

Submitters commented that the Secretary's environmental assessment requirements have not been adequately addressed, including the required analysis of alternatives to inform the selection of the preferred option.

There was also concern that early scoping of the project as set out in the scoping report (Roads and Maritime Services, 2017b) did not include impacted suburbs, particularly in relation to route selection which has created a technical gap in terms of risk assessment.

#### ***Response***

#### Adequacy in addressing the Secretary's environmental assessment requirements

The environmental impact statement has been prepared in accordance with the Secretary's environmental assessment requirements, first issued by the Department of Planning, Industry and Environment in December 2017 and subsequently updated in April 2020. A copy of the Secretary's environmental assessment requirements, including an indication of where each requirement is addressed in the environmental impact statement is provided in Appendix A (Secretary's environmental assessment requirements checklist).

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

#### Adequacy of scoping report to inform the environmental impact statement

A preliminary environmental assessment (scoping report) was carried out as part of the State significant infrastructure application report (Roads and Maritime Services, 2017b) to allow early

identification of the key environmental issues and to inform the State significant infrastructure application.

The Secretary's environmental assessment requirements for the project were informed by the State significant infrastructure application, along with the scoping report and feedback provided by other NSW Government agencies who were consulted about the project. 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.

The identification and assessment of key issues of the environmental impact statement has been guided by the environmental risk analysis process described in Appendix C (Environmental risk analysis) that included:

- An assessment of the key issues identified in the Secretary's environmental assessment requirements for the project (refer to Appendix A (Secretary's environmental assessment requirements checklist))
- An environmental risk review carried out to confirm the impacts based on the results of the detailed investigations presented in the environmental impact statement.

Following the selection of the preferred route and receipt of the Secretary's environmental assessment requirements in December 2017 and revised version in April 2020, a comprehensive impact assessment of the project as detailed in Chapter 5 (Project description) of the environmental impact statement was carried out.

## **C1.2 Approval process**

### **C1.2.1 Transparency of the approval process**

#### ***Issue raised***

Submitters expressed concerns regarding the transparency of the approval process for the project, including:

- Properties have been acquired and jobs advertised for the project but the project has not been approved
- The State significant infrastructure approval process was not transparent
- Concerns that not all documentation related to the project was exhibited
- Concerns that community submissions would not be considered.

#### ***Response***

##### **Property acquisition**

The project has been designed and developed to minimise property acquisitions and has prioritised the use of Transport for NSW land where possible. Notwithstanding this, some temporary use and permanent acquisition of properties is required.

Property acquisition prior to project approval for major infrastructure projects can be carried out under certain circumstances as set out in *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime Services, 2014). This includes owner initiated acquisition under the 'hardship' provisions of the *Property Acquisition (Just Terms Compensation) Act 1991* or owner initiated acquisition under the 'preferred option' policy. In addition, and prior to the preferred

option being confirmed and/or released to the public, properties can be purchased by Transport for NSW if they become available on the open market and funds are available.

Properties required for the project would be acquired by Transport for NSW in accordance with the provisions of the *Property Acquisition (Just Terms Compensation) Act 1991* and the Land Acquisition Reform 2016 process. The *Property Acquisition (Just Terms Compensation) Act 1991* provides the basis for assessing compensation. Transport for NSW has started consultation with affected property owners about the acquisition process and potential adjustments required to properties. Consultation would continue throughout further design development for the project.

#### Advertising of jobs

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.

#### State significant infrastructure approval process

Under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*, some infrastructure projects can be classified as State significant infrastructure if they are important to the State for economic, environmental or social reasons. Infrastructure projects, such as the development of a road and road infrastructure, are identified in the State Environmental Planning Policy (State and Regional Development) 2011 as State significant infrastructure if an environmental impact statement is required to be prepared.

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 detailed 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. More information on the statutory context, the environmental impact assessment and approval process for the project as well as other relevant environmental planning and statutory approval requirements is provided in Chapter 2 (Assessment process) of the environmental impact statement.

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.

Should the project be approved, Transport for NSW as the proponent must comply with all requirements of the conditions of approval for State significant infrastructure set out by the Department of Planning, Industry and Environment.

For more information on the State significant infrastructure process refer to [www.planningportal.nsw.gov.au/major-projects/assessment/state-significant-infrastructure/ssi-process](http://www.planningportal.nsw.gov.au/major-projects/assessment/state-significant-infrastructure/ssi-process).

#### Exhibited documents

Transport for NSW consulted with the Department of Planning, Industry and Environment prior to submission of the State significant infrastructure application and scoping report in 2017, to discuss the project and likely key issues. Prior to this, numerous studies and investigations were carried out to support route option analysis, design development and constructability. This work was an essential stage in the early strategic planning process, to ensure that Transport for NSW had sufficient information to support and to justify a State significant infrastructure application to the Department of Planning, Industry and Environment.

Transport for NSW has addressed the Secretary's environmental assessment requirements in preparing the environmental impact statement and associated technical working papers, all of which have been publicly exhibited in accordance with statutory requirements under the *Environmental Planning and Assessment Act 1979* and the Environmental Planning and Assessment Regulation 2000. The scoping report was published on the Department of Planning, Industry and Environment's website prior to issue of the Secretary's environmental assessment requirements.

With the large number of studies and investigations carried out over many years during the pre-planning of the project, it is not possible or necessary to exhibit every document as part of the environmental impact statement. However, the environmental impact statement and associated technical working papers have used the pre-planning information where relevant, including where it has led to further refinement or expansion of the project's scope.

### Consideration of community submissions

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 the proponent (Transport for NSW) in the management of submissions received. When making a submission, submitters are able to request that their private details are not disclosed to Transport for NSW. This approach is consistent across all development sectors.

The new online Department of Planning, Industry and Environment 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 are 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.

The *Environmental Planning and Assessment Act 1979* provides for the Secretary of the Department of Planning, Industry and Environment to request that Transport for NSW, as the project's proponent, prepare a response to issues raised in submissions. The request was provided on 11 March 2021 and this submissions report fulfils this requirement. In this submissions report, Transport for NSW are required to consider and respond to the submissions raised. The Department of Planning, Industry and Environment then considers the environmental impact statement and the submissions report and prepares the Secretary's environmental impact assessment report, and makes recommendations to the NSW Minister for Planning and Public Spaces. The Minister then makes a determination on the project.

The assessment and approval process for the project is shown in Figure A2-1 of the environmental impact statement.

### **C1.2.2 Adequacy of timing and duration of the environmental impact statement exhibition**

#### ***Issue raised***

Submitters raised concerns about the duration of the exhibition period for the environmental impact statement and its timing. Specific comments include:

- The exhibition period occurred over the school holidays and Christmas period

- Concern that the Public Health (COVID-19 Northern Beaches) Order 2020 stay-at-home advisory impacted on people's ability to engage with and understand the project and consultation would be more participatory after COVID-19 has passed.

### **Response**

The Beaches Link and Gore Hill Freeway Connection project environmental impact statement was placed on public exhibition on 9 December 2020, with an exhibition closing date of 1 March 2021. This equated to a total exhibition period of 61 days, noting that the period between 20 December 2020 and 10 January 2021 (inclusive) was not included within the 61 days as part of the official exhibition period. The length of the exhibition period for the environmental impact statement was substantially greater than the minimum 28 day requirement in recognition of the timing of the exhibition period over the Christmas and school holiday period, and as directed by the Department of Planning, Industry and Environment.

During the exhibition period, Transport for NSW launched an interactive portal, ran a series of virtual information sessions, doorknocked properties in close proximity to the project, letterbox dropped information postcards to the project area and answered email and phone enquiries from the community. Unfortunately, the timing of exhibition of the environmental impact statement partially aligned with the Public Health (COVID-19 Northern Beaches) Order 2020 stay-at-home advisory issued in December 2020. Given the COVID-19 restrictions during December and January, Transport for NSW adapted the community engagement in line with the health advice regarding COVID-19 to focus on providing an enhanced online engagement such as the virtual information sessions and being available by phone and email to answer questions. Further detail on community engagement during the exhibition of environmental impact statement is provided in Section A2.3 of this submissions report.

Transport for NSW would continue to engage with the community and other key stakeholders during further design development, in accordance with Appendix E (Community consultation framework).

### **C1.2.3 Additional studies and update of the environmental impact statement**

#### **Issue raised**

Submitters requested that additional studies are carried out prior to the project being approved and for the environmental impact assessment to be updated and re-advertised to the community. Submitters also requested independent monitoring of construction impacts.

#### **Response**

The environmental impact statement was prepared in accordance with Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*. The technical studies/working papers were prepared by independent specialists in accordance with the key issues identified in the Secretary's environmental assessment requirements, 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 studies carried out for the environmental impact statement are considered to be robust and appropriate for this stage of the project. Further information regarding the adequacy of the environmental impact statement is included above in Section C1.1.2 of this submissions report.

Additional studies and investigations that will be carried out during further design development or prior to construction and incorporated into the construction environmental management plan and/or the operational framework for the project (as required) are identified in Appendix Y (Compilation of environmental management measures). An update of the environmental management measures is provided in Table D2-1 of this submissions report. There is no requirement to update the



environmental impact statement as a result of the additional studies and investigations proposed to be carried out.

The contractor/s would be responsible for implementing the conditions of approval, and Transport for NSW would monitor the contractor's compliance with the conditions of approval during construction. There would be numerous obligations on the contractor/s and Transport for NSW in terms of ongoing monitoring and communication of environmental impacts during construction. These are (in part) 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.

## **C1.3 Other statutory requirements**

### **C1.3.1 Project compliance with legislation**

#### ***Issue raised***

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

- The project is not in accordance with the local environmental plan zoning
- The project does not consider the requirements of NSW State Environmental Planning Policy No 19 – Bushland in Urban Areas and Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
- The project is inconsistent with the Draft Design and Place State Environmental Planning Policy
- Compliance with the *Infrastructure NSW Act 2011* Sections 3(a) and 3(b)
- Compliance with the Commonwealth *National Greenhouse and Energy Reporting Act 2007*
- Compliance with the *Work Health and Safety Act 2011*
- Compliance with NSW Environment Protection Authority licensing
- Compliance with the *United Nations Convention on the Rights of the Child* article 24 with regard to air quality emissions from the project
- The project was not referred to the Australian Government Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999*.

#### ***Response***

##### Local environmental plan and environmental planning instruments

The assessment and approval framework applicable to the project is outlined in Section 2.1.1 of the environmental impact statement. In summary, Transport for NSW is seeking approval for the Beaches Link and Gore Hill Freeway Connection project as State significant infrastructure under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

The project is State significant infrastructure under Section 5.12 of the *Environmental Planning and Assessment Act 1979* and does not require consent under Part 4 of the *Environmental Planning and Assessment Act 1979*.

Clause 94 of the NSW State Environmental Planning Policy (Infrastructure) 2007 (the Infrastructure SEPP) applies to development for the purpose of a road or road infrastructure facilities and provides that these types of works are development which is permissible without consent. Clause 14 of the State Environmental Planning Policy (State and Regional Development) 2011 (the State and

Regional Development SEPP) declares infrastructure development to be State significant infrastructure if it is permissible without consent and specified in Schedule 3.

By reason of Section 5.22 of the *Environmental Planning and Assessment Act 1979* the relevant environmental planning instruments that apply to the project are the Infrastructure SEPP and the State and Regional Development SEPP.

The environmental planning instruments including local environmental plans that determine the land use zoning do not apply to State significant infrastructure in accordance with Section 5.22(2) of the *Environmental Planning and Assessment Act 1979*.

Both the State Environmental Planning Policy No 19 – Bushland in Urban Areas and Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 are also environmental planning instruments and through the action of Section 5.22(2) of the *Environmental Planning and Assessment Act 1979*, do not apply to the project.

The *Design and Place State Environmental Planning Policy* ([www.planning.nsw.gov.au/Policy-and-Legislation/State-Environmental-Planning-Policies/Design-and-Place-SEPP](http://www.planning.nsw.gov.au/Policy-and-Legislation/State-Environmental-Planning-Policies/Design-and-Place-SEPP)) is currently in draft form and was placed on public exhibition for the first time following commencement of exhibition of the Beaches Link and Gore Hill Freeway Connection environmental impact statement. Specific guidelines which underpin the State Environmental Planning Policy are still being developed and are expected to be available at the end of 2021. The intent of the new State Environmental Planning Policy is to simplify and consolidate how to deliver good design in NSW. However, it is expected to include some of the same information and guidelines that the project design had reference to over the past several years. This includes consideration of aspects such as Crime Prevention through Environmental Design (CPTED) and *Better Placed – an integrated design policy for the built environment in NSW* (Government Architect NSW, 2017a). Existing legislation and guidelines considered in the urban design, landscape character and visual impact assessment may include similar key principals and aspects and are outlined in Section 22.1 of the environmental impact statement.

#### *Infrastructure NSW Act 2011*

The *Infrastructure NSW Act 2011* was an Act to establish Infrastructure NSW as an agency and does not apply to the project. However, the *Infrastructure NSW Act 2011* guides Infrastructure NSW in its project assurance role and responsibilities in relation to the project. Infrastructure NSW provides independent advice to the NSW Government on infrastructure policies and priorities and monitors the infrastructure pipeline to ensure projects are delivered on time and on budget.

The project has 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. Table 3-2 of the environmental impact statement provides an overview of relevant strategic plans, policies and strategies and their relationship to the project. This includes the *State Infrastructure Strategy 2018-2038* (Infrastructure NSW, 2018) which was prepared by Infrastructure NSW and is a 20 year strategy which identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth. The *State Infrastructure Strategy 2018-2038* identified the Beaches Link as a near-term priority for the Sydney motorway network to provide an alternative to the Military Road/Spit Road corridor and bypass the Spit Bridge. The NSW Government is committed to commencing work on a new crossing of Middle Harbour. The Beaches Link and Gore Hill Freeway Connection project, as part of the Western Harbour Tunnel and Beaches Link program of works, is the result of that commitment. Further, the *NSW Infrastructure Pipeline* (Infrastructure NSW, 2017) was prepared by Infrastructure NSW to outline infrastructure proposals under development by the NSW Government. This includes the opportunity to develop the Beaches Link and Gore Hill Freeway Connection project.

### Commonwealth National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* requires constitutional corporations which exceed certain emissions limits to collect and report annually on their greenhouse gas emissions and energy use. The Act may affect contractors working on the construction of the road and users of the road where they are part of an organisation covered by the Act. However, the Act does not apply to the approvals process or Transport for NSW.

### Work Health and Safety Act 2011

The NSW *Work Health and Safety Act 2011* applies to the project.

The NSW *Work Health and Safety Act 2011* aims to secure the health and safety of workers and workplaces through the elimination or minimisation of risks, so as to provide workers and others with the highest level of protection from hazards and risks, so far as is reasonably practicable.

The design development, construction planning, environmental assessment process and development of environmental management measures have considered the *Work Health and Safety Act 2011* and have identified particular risks which might result from construction and operation of the project. Where necessary, further investigations or activities are recommended to address these risks more fully. For example, further investigations will be carried out on areas identified to be potentially contaminated prior to construction proceeding. Demolition works will be carried out in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including the Work Health and Safety Regulation 2011 (NSW) to minimise potential exposure of construction personnel and the public to hazardous materials (refer to revised environmental management measure SG11 in Table D2-1 of this submissions report).

### Environment protection licences

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 would be complied with by Transport for NSW and its contractor/s.

### United Nations Convention on the Rights of the Child

Article 24 of the United Nations Convention on the Rights of the Child, as incorporated into Australian law, is intended to protect the rights of children to the highest attainable standard of health. The air quality impacts and human health impacts of the project are addressed in Chapter 12 (Air quality) and Chapter 13 (Human health) respectively of the environmental impact statement. Both chapters support a conclusion that the project would have no significant impact on the health of children.

### Referral to the Minister under the *Environment Protection and Biodiversity Conservation Act 1999*

The assessments carried out during preparation of the environmental impact statement concluded 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 therefore formed the opinion that that no referral is required under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, as stated in Chapter 2 (Assessment process) of the environmental impact statement.

Matters of national environmental significance were considered for the assessments carried out as part of Appendix S (Technical working paper: Biodiversity development assessment report) and Appendix T (Technical working paper: Marine ecology), as described in in Section 19.5.6 of the environmental impact statement. Assessment of significance of impacts were carried out on matters of national environmental significance including threatened species and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* that are known or considered highly likely to occur in the construction footprint and project area/marine biodiversity study area.

The assessments of significance concluded that the project would not have a significant impact on these species, therefore the project does not require referral to the Australian Government Minister for the Environment.

### **C1.3.2 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 at Flat Rock Reserve and surrounds had been reported to the NSW Environment Protection Authority in accordance with the requirements of the *Guidelines on the Duty to Report Contamination* (NSW Environment Protection Authority (NSW EPA), 2015) under the *Contaminated Land Management Act 1997*.

#### ***Response***

The *Guidelines on the Duty to Report Contamination* (NSW EPA, 2015) under the *Contaminated Land Management Act 1997* were considered in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement. The duty to report arises when a landowner or a person whose activities have contaminated the land become aware of the contamination. The guidelines set out triggers for notification to the NSW Environment Protection Authority, the need for further investigation of contamination as well as situations where a duty to report is not intended.

A Stage 1 contamination investigation was carried out for the environmental impact statement as documented in Appendix M (Technical working paper: Contamination). The investigation included a review of existing land uses, geology and hydrogeology, previous contaminated site investigations and searches of the NSW Environment Protection Authority Contaminated Sites Register, Record of Notices and the Yellow Pages business directory.

Potentially contaminated areas directly affected by the project, including Flat Rock Reserve, will be further investigated and managed in accordance with the requirements of guidance endorsed under Section 105 of the *Contaminated Land Management Act 1997* in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report).

Subject to the outcomes of the further investigations, the NSW Environment Protection Authority will be notified of contamination identified during detailed investigations, in accordance with the *Guidelines on the Duty to Report Contamination* (NSW EPA, 2015) under the *Contaminated Land Management Act 1997*. Refer to Section C15.1.4 of this submissions report for further information.

### **C1.3.3 Recommendations by the Parliament of New South Wales Public Accountability Committee**

#### ***Issue raised***

Submitters requested that the recommendations of the inquiry into the impacts of the WestConnex project provided by the Parliament of New South Wales Public Accountability Committee are adopted for the project, as these would benefit the community.

## **Response**

The inquiry into the WestConnex project by the Public Accountability Committee related to the impact and some specific circumstances of the WestConnex project. While WestConnex has similarities to the project, some of the recommendations provided by the Public Accountability Committee final report are specific to WestConnex and are not applicable to the project. The NSW Government response to the adoption of the other broader recommendations detailed in the Public Accountability Committee final report can be found here [www.parliament.nsw.gov.au/lcdocs/inquiries/2497/Government%20response%20-%20WestConnex.pdf](http://www.parliament.nsw.gov.au/lcdocs/inquiries/2497/Government%20response%20-%20WestConnex.pdf). The project has adopted and will comply with a number of the recommendations outlined in the NSW Government's response, where appropriate. This includes:

- Compliance with the NSW Government's Infrastructure Investor Assurance Framework, where major projects, with an estimated cost of \$10million and above, are subject to expert and independent gateway reviews and health checks
- Infrastructure NSW preparing and publishing an independent Business Case summary of the project once the NSW Government has made its investment decision
- Improving communication and engagement on air quality, which has included targeted engagement with key stakeholders, improvements on how air quality information is presented to the community, the introduction of a general air quality portal (<https://caportal.com.au/rms/air-quality/>) and the requirement to provide real time air quality data once the project is operational
- Providing personalised support for residents and businesses impacted by property acquisition. All property owners for the project were provided with a dedicated Personal Manager at the very beginning to guide and support them through the acquisition and relocation process. Confidential counselling services have also made been available to affected residents.

There is also a Government inquiry into the impact of the Western Harbour Tunnel and Beaches Link program of works which is more specific to this project. Refer to the inquiry into the impacts of the Western Harbour Tunnel and Beaches Link for further information, including the terms of reference for the inquiry here [www.parliament.nsw.gov.au/committees/inquiries/Pages/inquiry-details.aspx?pk=2767](http://www.parliament.nsw.gov.au/committees/inquiries/Pages/inquiry-details.aspx?pk=2767). Notwithstanding, due to the inquiry timeframe the Government is not yet in a position to issue any findings/recommendations.

## **C1.4 Post approval pathways**

### **C1.4.1 Clarity about post approval changes to the concept design**

#### ***Issue raised***

Submitters commented that the environmental impact statement is based on a concept design and were concerned that the concept design would be changed and result in additional impacts to residents. There were requests to know the process of reviewing additional project impacts due to design changes and for the community to be consulted about any design changes or other project variations.

Submitters raised specific concerns that further design changes may have the potential to damage known and unknown Aboriginal heritage sites.

#### ***Response***

##### **Further design development**

The process for design development following approval of the project is discussed in Section 2.3 and Section 28.3 of the environmental impact statement.

As with many projects of the nature and scale of this project, the project design would continue to be refined during further investigations and design development. Some flexibility has been provided in the design to:

- Allow for refinement during further design development and the construction planning phase to consider alternative construction techniques
- Allow for refinement in response to submissions received following the exhibition of the environmental impact statement
- Respond to improved technologies or materials
- Improve value for money.

Key project components that have been identified as requiring resolution during further design development, construction and/or operation are outlined in Table 28-2 of the environmental impact statement.

Any refinements to the approved project during further design development would be reviewed for consistency with the approval. This consistency review would be carried out to consider whether the refinement would:

- Result in any of the conditions of approval not being met
- Be consistent with the objectives and operation of the project as described in the environmental impact statement
- Result in a significant change to the approved project
- Result in any potential environmental or social impacts of a greater scale or impact than that considered by the environmental impact statement.

Where design refinements do not meet these criteria, an approval for a modification may be required to be sought from the NSW Minister for Planning and Public Spaces in accordance with the requirements of Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

#### Aboriginal cultural heritage sites

Throughout design development and refinement, the project's alignment and associated required infrastructure have been modified where possible to avoid or reduce the impact to identified Aboriginal heritage sites, particularly those of high significance (refer to Chapter 4 (Project development and alternatives) of the environmental impact statement and Section C14.1 of this submissions report).

Aboriginal cultural heritage sites along the alignment have already been identified and these are included in the updated mapping provided in Appendix A of this submissions report. Transport for NSW is committed to preserving Aboriginal cultural heritage along the project corridor and minimising project impacts. Any design refinement would follow the process outlined above and would consider potential impacts on Aboriginal cultural heritage.

#### **C1.4.2 Compliance with the conditions of approval and compliance monitoring**

##### ***Issue raised***

Submitters raised concerns that environmental management measures would not be implemented and requested independent monitoring during construction and operation of the project. Submitters also questioned who is responsible for meeting the conditions of approval, how non-compliances would be addressed and what the timeframes are for rectifying breaches. Specific concerns about the conditions of approval include:

- What action the NSW Environment Protection Authority would be authorised to take if air quality was poor
- That Northern Beaches Council would be responsible for fixing local traffic as a result of the project. Requests for Transport for NSW to work with Council to solve local traffic issues.

### ***Response***

#### Responsibility for implementation of mitigation measures and non-compliance

Should the project be approved, Transport for NSW and the contractor/s must comply with all requirements of the conditions of approval for the project. 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 would also be required.

Transport for NSW and the contractor/s would be responsible for implementing the conditions of approval, and Transport for NSW would monitor the contractor's compliance. In addition to Transport for NSW's own monitoring and auditing of compliance, the conditions of approval would also likely specify the appointment of an independent environmental representative who would regularly monitor the compliance with and implementation of key project commitments, including environmental management measures. A regular monthly report would be prepared by the environmental representative for the Department of Planning, Infrastructure and Environment and other government agencies. The environmental representative would be a suitably qualified and experienced person who was not involved in the preparation of the environmental impact statement and is independent from Transport for NSW and the companies involved in the design and construction of the project.

In addition, the conditions of approval would also likely specify requirements for independent audits of the project.

The timeframes for rectifying any non-compliances would be dependent upon the individual matter but would be specified by the environmental representative and/or relevant conditions of approval and rectification progress tracked through regular reporting mechanisms.

#### Environment Protection Authority

The *Protection of the Environment Operations Act 1997* allows the NSW Environment Protection Authority to regulate air emissions in NSW. Further, it specifies that road tunnel emissions are regulated by the NSW Environment Protection Authority.

The monitoring and management of air quality during operation would be regulated under an environment protection licence issued under the *Protection of the Environment Operations Act 1997*. Monitoring would be in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016) or as otherwise agreed with the NSW Environment Protection Authority. Transport for NSW would provide public access to real time air quality monitoring data as required by the conditions of approval and/or environment protection licence for the project.

The NSW Environment Protection Authority may inspect a licenced premises at any time. Further, the holder of an environment protection licence would normally be obliged as a condition of the licence to commission regular independent audits and to provide the NSW Environment Protection Authority with regular compliance reports. Non-compliance could result in a breach of the environment protection licence conditions and would be investigated by NSW Environment Protection Authority officers. Penalties may be levied on the licence holder in the case of a licence breach, in accordance with the provisions of the *Protection of the Environment Operations Act 1997*.

Additional information is available in the *Environment Protection Authority Compliance Policy* (NSW EPA, 2013c) and available online at: [www.epa.nsw.gov.au/publications/legislation/epa-compliance-policy-130251](http://www.epa.nsw.gov.au/publications/legislation/epa-compliance-policy-130251).

Further information on air quality is provided in Section C11 of this submissions report.

### Traffic impacts on local roads

Modelling of traffic travel times in the Balgowlah and surrounds area indicates that travel times across the network and on most key routes throughout the area are expected to improve as a result of the project (refer to Section 9.4.5 of the environmental impact statement). In the Frenchs Forest and surrounds area, under the 'Do something' scenario, the changes to traffic patterns associated with the project would result in potential localised increases in travel times on the key corridors of Warringah Road and Wakehurst Parkway within the area. These localised impacts are expected to be less than five minutes during the busiest peak hours in the future, and overall traffic modelling predicts that potentially increased localised delays at intersections would be offset by the broader improvement in connectivity and reduction in congestion created by the project. For example, average travel time savings between key centres, eg Dee Why to and from Macquarie Park, are expected to be about 20 minutes. In this example, a net saving would still be created by the project providing new high capacity connectivity and reducing congestion on existing regional routes like Warringah Road west of Frenchs Forest. It is also noted that overall travel times for general traffic on Warringah Road and Forest Way in the Frenchs Forest area would remain generally unaffected by the project, indicating that potentially increased delays along Wakehurst Parkway and Warringah Road surface lanes would not impact east-west trips.

Notwithstanding this, additional review and assessment of the environmental impact statement operational traffic models has been carried out at the request of the Department of Planning, Industry and Environment, including additional modelling (where considered necessary) to further refine the operational models and to provide further clarity on the modelling outcomes, including any potential localised intersection performance benefits or residual impacts as a result of the project. The additional review and assessment is documented in Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report. Consistent with findings presented in the environmental impact statement, additional modelling and analysis indicates that there would be no overall significant adverse effects to local roads across the operational traffic study areas as a result of the project.

Specific to the Northern Beaches local government area, the preferred infrastructure report provides additional detail of the benefits in the Balgowlah area presented in the environmental impact statement, confirming that the local road network is not expected to be materially adversely impacted by the project in this area. The additional traffic modelling carried out for the preferred infrastructure report also indicates that the impacts presented in the environmental impact statement in the Frenchs Forest area would not be most appropriately mitigated by road network upgrades and management alone, and that a public transport and demand management approach would be more appropriate. Transport for NSW would continue to collaborate on options to mitigate potential localised network performance issues in the area, and further leverage the overall benefits and opportunities of the project. This underlines the importance of NSW Government and Council working in collaboration to develop integrated, multi-modal transport solutions which will reduce car dependence, and consequently enable and accommodate the desired growth and improve place outcomes in Frenchs Forest and surrounds. This approach is consistent with and reliant on the outcomes of the ongoing implementation of the *Northern Beaches Hospital Precinct Structure Plan* (Northern Beaches Council, 2017) and accompanying plans (eg Frenchs Forest Precinct Place strategy), which highlight that future precinct development beyond Stage 1 of the development is



dependent on further delivery of improved transport infrastructure and operations beyond the scope of the project and a continued modal shift from private to public transport.

Notwithstanding, 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 in accordance with environmental management measure OT1 (refer to 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 that used in Appendix F (Technical working paper: Traffic and transport). Where required, additional feasible and reasonable mitigation measures will be identified in consultation with Department of Planning, Industry and Environment and the relevant council to manage any additional traffic performance impacts identified during the review of operational network performance.

Where required, Transport for NSW will investigate local area traffic management measures to minimise any unexpected impact of the project on the surrounding local road network. Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable, as outlined in environmental management measure OT2 (refer to Table D2-1 of this submissions report).



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C2 – Strategic context and project need

## C2 Strategic context and project need

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## C2.1 Strategic context

### C2.1.1 General

#### ***Issue raised***

Submitters raised concerns regarding the strategic need for the project, including concerns that the project is not strategically justified:

- The project does not meet the Premier's Priorities, as improving on-time travel is not one of the Premier's 14 priorities (see <https://iworkfor.nsw.gov.au/state-priorities>)
- Concerns that the project does not align with the proposed changes to planning policy which will encourage cycling over cars, provide access to green space, build apartments with working from home in mind and City of Sydney Council's vision for Sydney to be recognised as a leader with outstanding environmental performance and new green industries driving economic growth
- Concerns that the project does not align with Transport for NSW and the NSW Government's changing policy post COVID-19 which actively supports more people to work from home or remotely.

#### ***Response***

##### Achieving the Premier's priorities, draft planning policy and City of Sydney Council's vision

The Western Harbour Tunnel and Beaches Link program of works 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.

The Premier's priorities have been set with the purpose of delivering on the NSW Government's key policy priorities which include a strong economy and well connected communities with quality local environments. The Western Harbour Tunnel and Beaches Link program of works has been designed as part of an integrated transport network, with a focus on new public and active transport connections and improved travel times and reliability for buses. The Western Harbour Tunnel and Beaches Link program of works therefore delivers on both these two key NSW Government policy priorities.

Of the Premier's priorities, two are directly relevant to the project; those being 'Greener public spaces' and 'Greening our city'. The project has been designed and developed to minimise property acquisitions, prioritise the use of Transport for NSW owned land where possible and avoid or minimise vegetation removal. However, due to the location of the project there are limited opportunities for the project to create new areas of open space without impacting on existing bushland or acquiring additional properties.

The NSW Government is proposing a *Design and Place State Environmental Planning Policy* ([www.planning.nsw.gov.au/Policy-and-Legislation/State-Environmental-Planning-Policies/Design-and-Place-SEPP](http://www.planning.nsw.gov.au/Policy-and-Legislation/State-Environmental-Planning-Policies/Design-and-Place-SEPP)) which aims to deliver healthy and prosperous places that support the wellbeing of people, the community and Country. The Policy would include a number of principles including designing places that are beautiful, public spaces which are inviting and places which are green and sustainable. These principles align with the project objectives to 'unlock potential for urban regeneration, landscape improvements as well as active and public transport upgrades along the project corridor' and 'embed sustainability considerations into the design and delivery of the project in order to minimise environmental and social impacts while delivering positive economic outcomes for the people of NSW'.

In Balgowlah, the project will return an area equivalent to around 90 per cent of the current open space to the community as new and improved public open space and recreation facilities. A specific community consultation program will be implemented for the Balgowlah area after planning approval and well in advance of construction starting. Further information is provided in Section C2.1.2 below.

The project would deliver improved active transport infrastructure, including a new shared user path along Wakehurst Parkway with overpass links to the new Northern Beaches Hospital precinct, and shared user underpasses beneath Wakehurst Parkway to provide safe connections between Garigal National Park and Manly Warringah War Memorial State Park. Additional shared user pathways would be provided in and around the new and improved open space and recreation facilities at Balgowlah, integrating with existing paths to nearby commercial and community receivers. Realignment and reconstruction of the shared user path along the southern side of the Gore Hill Freeway would also be provided.

Transport for NSW is also committed to replacing and offsetting vegetation removed as part of the project. All areas disturbed by construction and not required for operation of the project will be restored as soon as practicable to their existing condition or in accordance with the urban design and landscape plan where applicable in accordance with environmental management measure V11 (refer to Table D2-1 of this submissions report). Where mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016*) are removed as a result of construction, they will be replaced at a ratio of 2:1 in accordance with the revised environmental management measure V13 (refer to Table D2-1 of this submissions report).

In addition, it is noted that the project is not located within the City of Sydney local government area.

### The effect of COVID-19

The COVID-19 pandemic is an unprecedented event that has changed the way people work and their travel patterns, while creating uncertainty about the future, as discussed in Section A5.1.17 of this submissions report and Section 3.1 of the environmental impact statement. At this time, the duration of impacts to transport demands and behaviours from the COVID-19 pandemic are still unknown, and current traffic conditions and travel behaviours are the result of a variety of temporary factors, including reduced public transport capacity and demand.

While the COVID-19 pandemic presents immediate to medium term challenges for Sydney (and NSW more broadly), the project has been developed with a long term view to address the challenges Greater Sydney will face over the next 40 years, to enable and accommodate growth, and to deliver long-lasting benefits for road users, communities and businesses. As such, the need for the project and other strategic transport projects to meet the demands of a growing population and economy remains critical to ensuring the future success of Sydney.

While it is difficult to fully assess the long term impact of the COVID-19 pandemic, evidence of Greater Sydney's resilience to such disruptions is already apparent. Ongoing traffic and transport monitoring shows that traffic levels on most roads in the project area returned to levels near that of the pre-COVID-19 pandemic period in early 2021, prior to the mid-2021 lockdown (acknowledging that public transport capacity and user behaviours are still in a temporary state). It is expected that similar trends will be observed once the lockdown rules have been eased, and traffic levels will return to those levels in the pre-COVID-19 pandemic period. Transport for NSW will continue to monitor and analyse the potential long term effects of the COVID-19 pandemic on travel demand, including changes to existing travel conditions as well as future travel behaviours and underlying economic demand drivers.

Furthermore, the NSW Government is demonstrating its commitment to supporting the recovery from the COVID-19 pandemic through its guaranteed infrastructure pipeline to drive the creation of jobs and contribute to economic growth. The project is part of the NSW Government's infrastructure pipeline.

### **C2.1.2 NSW Government agency policies**

#### ***Issue raised***

Submitters raised comments and concerns regarding NSW Government agency policies, including whether the project is consistent with the:

- *Future Transport Strategy 2056* (NSW Government, 2018)
- *Greater Sydney Region Plan - A Metropolis of Three Cities* (Greater Sydney Commission, 2018a), incorporating the '30-Minute City' concept and the Greater Sydney Commission Green Grid plans
- *North District Plan - connecting communities* (Greater Sydney Commission, 2018b), particularly planning priorities N6, N10, N13 and N20
- *Road User Space Allocation Policy* (Transport for NSW, 2021a)
- *NSW Disability Inclusion Plan* (NSW Government, 2015)
- *Older Persons Transport and Mobility Plan 2018-2022: Staying active, independent and connected* (Transport for NSW, 2019a)
- *Sydney's Cycling Future* (Transport for NSW, 2013a)
- *A 50-Year Vision for Sydney's Open Space and Parklands: A Discussion Paper* (NSW Department of Planning, Industry and Environment (DPIE), 2020a)
- *Local Character and Place Guideline* (NSW DPIE, 2019b)
- Planning Circular 18-001 *Stepping up planning and designing for better places: Respecting and enhancing local character* (NSW DPIE, 2019c)
- *Draft Social Impact Assessment Guideline* (NSW DPIE, 2020b).

#### ***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 project's alignment with a number of national and State policies is provided in Section 3.7 of the environmental impact statement.

#### **Future Transport Strategy 2056**

The *Future Transport Strategy 2056* (NSW Government, 2018) 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 in 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 Strategy 2056* (NSW Government, 2018) 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. Further information is provided in Table 3-2 of the environmental impact statement.

### Greater Sydney Region Plan

The *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) 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* (Greater Sydney Commission, 2018a) references the Western Harbour Tunnel and Beaches Link program of works as infrastructure that would further improve accessibility from 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. Objective 32 of the Plan seeks to link parks, open spaces, bushland and walking and cycling paths with the Green Grid, which is discussed further below and in Section C21.1 of this submissions report. Further information on the relationship of the *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) with the project is provided in Table 3-2 of the environmental impact statement.

### North District Plan

The *North District Plan – connecting communities* (Greater Sydney Commission, 2018b) builds on the *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a). The Beaches Link and Gore Hill Freeway Connection project would be located in the North District of the Eastern Harbour City, an area of strategic economic importance for Sydney.

The *North District Plan – connecting communities* (Greater Sydney Commission, 2018b) includes the Western Harbour Tunnel and Beaches Link program of works as a transport initiative that would provide improved connections and access. The project would support a number of the objectives of the Plan including enhancing the role of the Eastern Economic Corridor, including North Sydney as part of the Harbour CBD, supporting jobs growth in strategic centres, providing fast and efficient transport connections to achieve a 30 minute city and improving walking and safe cycling ways. Further information is provided in Table 3-2 of the environmental impact statement.

### Road users and mobility

The project is aligned with the objectives of Transport for NSW's *Road User Space Allocation Policy* (Transport for NSW, 2021a), deliberately allocating road user space and considering the place, function and movement requirements of local and arterial roads. The project design considers the limited amount of space available to accommodate competing road user needs and achieves the strategic intent and outcomes set out in the state, metropolitan and regional strategies and plans provided in Table 3-2 of the environmental impact statement.

The project also aims to improve road safety and provide additional active transport infrastructure, where appropriate. Active transport infrastructure to be provided by the project and adjustments of public transport infrastructure would be designed and implemented with consideration of both Transport for NSW's *Disability Inclusion Action Plan 2018-2022* (Transport for NSW, 2017a) and *Older Persons Transport and Mobility Plan 2018-2022: Staying active, independent and connected* (Transport for NSW, 2019a).

### Sydney's Cycling Future

*Sydney's Cycling Future* (Transport for NSW, 2013a) identifies priority cycleways to improve connections to major centres for trips of up to five kilometres and is addressed in Section 9.1.4 of the environment impact statement.

Active transport provided by the project is outlined in Chapter 5 (Project description) of the environmental impact statement, with several new or upgraded shared user paths and underpasses proposed in the Balgowlah, Killarney Heights and Frenchs Forest areas. The project would provide a new shared user path along Wakehurst Parkway between Seaforth/North Balgowlah and the developing Northern Beaches Hospital precinct, improving connectivity to the new strategic centre.

#### Provision of green space

The *Sydney Green Grid* (Government Architect NSW, 2017b) offers a network of green spaces to encourage healthy lifestyles, support walking and cycling, provide better access to open spaces, enhance bushland and support ecological resilience. Similarly, the *A 50-Year Vision for Greater Sydney's Open Space and Parklands: A Discussion Paper* (NSW DPIE, 2020a) imagines greener streets, higher quality parklands and more green connections that support healthy people and communities. The project's alignment with both documents is further discussed in Section C21.1 of this submissions report.

#### Local place and character

The *Local Character and Place Guideline* (NSW DPIE, 2019b) aims to support councils and communities to consider and nurture the unique identity of a place, while at the same time meeting the needs of a changing NSW. The guideline provides tools to help define existing character and set a desired future character that aligns with the strategic direction for an area. In addition, Planning Circular 18-001 *Stepping up planning and designing for better places: Respecting and enhancing local character* (NSW DPIE, 2019c) describes what local character is and recognises the important role it plays in planning for development that is contextual and meets the growing needs of NSW.

By providing additional motorway capacity and bypassing existing congested corridors, the project would reduce congestion and through traffic in a number of urban areas. This would facilitate improvements to urban amenity in the Harbour CBD and Northern Beaches. Where relevant, local council urban design policies and guidelines have been considered within the urban design framework for the project (refer to Section 4 of Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment)). Consideration of Local Environmental Plans and Development Control Plans of affected councils assists the project in embedding project infrastructure into the local character of areas as part of design and planning. An urban design and landscape plan would be developed in consultation with the community and implemented as per environmental management measure V1 (refer to Table D2-1 of this submissions report).

#### Draft social impact assessment guideline

The socio-economic assessment (refer to Appendix U (Technical working paper: Socio-economic assessment)) for the project was developed and carried out in accordance with the guidelines indicated in the Secretary's environmental assessment requirements for the project. The draft *Social Impact Assessment Guideline* (NSW DPIE, 2020b) was not placed on public exhibition until November 2020. At this time, the assessment for the project had already been substantially completed prior to the commencement of exhibition of the environmental impact statement on 9 December 2020.

### **C2.1.3 Local government policies**

#### ***Issue raised***

Submitters raised concerns regarding the alignment of the project to local government policies including:



- The project should respond to strategies and plans such as the *Military Road Corridor Planning Study – Stage 1* (North Sydney Council, 2021)
- Concerns the *Move: Northern Beaches Transport Strategy 2038* (Northern Beaches Council, 2018a) which aspires to reduce the usage of cars by 30 per cent by 2038 has not been considered
- The project is inconsistent with a number of priorities outlined in the Northern Beaches Local Strategic Planning Statement
- Concerns that given COVID-19, there is now a shortage of golf facilities in the Northern Beaches in contradiction to the *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b) and that the Council does not have a current strategy
- Concerns that the project promotes car traffic in the city and does not align with the City of Sydney’s plan to create more pedestrian ways in the CBD and divert traffic away from the city
- Concerns regarding the project’s impacts on North Sydney roads especially the arterial traffic function of Berry Street, Pacific Highway, Miller Street and Falcon Street and proposed public domain initiatives
- Concerns the North Sydney Integrated Transport Program and the requirements in the Western Harbour Tunnel and Warringah Freeway Upgrade project approval instrument are not addressed within the environmental impact statement.

### **Response**

#### Military Road Corridor Planning Study

The project would support the objectives outlined in the *Military Road Corridor Planning Study – Stage 1* (North Sydney Council, 2021) through the benefit of reduced traffic volumes and congestion along the Military Road/Spit Road corridor, enhancing the connectivity and amenity of Military Road. Further information regarding this Study is provided in Table 3-3 of the environmental impact statement. Opportunities to reimagine the Military Road/Spit Road corridor and how it services the Lower North Shore and Northern Beaches are outlined in sections B13.2 and B14.1.4 of this submissions report.

#### Northern Beaches Transport Strategy

The public transport network servicing the Northern Beaches region, including the B-Line, is constrained by the performance of the existing surface arterial corridors, particularly the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors. By improving travel times and travel time reliability on these roads as a result of reduced traffic demand and congestion, the project would support the operation of the B-Line as well as local and interregional buses. By increasing the capacity of the road network, the project would create opportunities for new express bus services, making public transport a more attractive option and supporting and encouraging a mode shift to public transport. The project is therefore considered to be aligned with the *Move: Northern Beaches Transport Strategy 2038* (Northern Beaches Council, 2018a).

#### Northern Beaches Local Strategic Planning Statement

*Towards 2040 – Local Strategic Planning Statement* (Northern Beaches Council, 2020b) is Northern Beaches Council’s local strategic planning statement which guides planning for the Northern Beaches over the next 20 years. *Towards 2040 – Local Strategic Planning Statement* (Northern Beaches Council, 2020b) outlines the strategic importance the implementation of the project has for the Northern Beaches region and identifies the need for infrastructure to be delivered with predicted employment and housing growth within the Northern Beaches Council area. Further information is provided in Table 3-3 of the environmental impact statement.

### Northern Beaches Sportsground Strategy

The *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b) indicates that the local government area comprises 13 golf courses covering 453 hectares, seven of which are on public land. This is double the number of courses per head of population compared with other areas in Sydney. The strategy also indicates membership is declining at public courses and that a reduction in supply may assist the market to achieve greater sustainability. The currency of the council strategy is a matter for Northern Beaches Council.

The proposed future use of the existing Balgowlah Golf Course would be subject to a dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council to give the community an opportunity to provide input into the final layout of the new and improved open space and recreation facilities. Further information on the proposed future use of the Balgowlah Golf Course and the consultation process is provided in Section 5.2.13 of the environmental impact statement.

### Alignment with City of Sydney plans

The Western Harbour Tunnel and Beaches Link program would improve the resilience of the Eastern Harbour City's road network, facilitate improvements to urban amenity by reducing through-traffic movements and relieve pressure on motorways and arterial roads connecting the broader Eastern City and North Districts to the Harbour CBD.

The program of works is expected to transfer a significant volume of through traffic currently on surface roads underground. In addition, reduced congestion on the motorway and arterial road network would provide flow-on benefits to the adjoining local road network. These benefits would include improvements in amenity related to physical safety, air quality and noise levels and the facilitation of improved pedestrian access and activity.

The general reduction in traffic and congestion would provide the opportunity for Transport for NSW and other stakeholders such as the City of Sydney to investigate alternative uses for existing road space.

### North Sydney Integrated Transport Program

The transport modelling and assessment carried out by Transport for NSW for the project does not indicate substantial additional traffic and performance issues would occur in the North Sydney CBD (refer to Chapter 9 (Operational traffic and transport) of the environmental impact statement).

The capacity and configuration work proposed in North Sydney CBD as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project are considered to provide an equitable and balanced outcome from the perspective of maintaining a balanced and integrated transport network through North Sydney. Further refinements and changes to network operations may occur as part of the North Sydney Integrated Transport Program works. The North Sydney Integrated Transport Program is a staged program of road based network and place improvements developed by Transport for NSW in close partnership with North Sydney Council, Greater Sydney Commission and Government Architect NSW. Further details of the objectives and status of the North Sydney Integrated Transport Program and condition of approval E162 for the Western Harbour Tunnel and Warringah Freeway Upgrade project are discussed in Section B14.5.2 of this submissions report. Any changes to the Western Harbour Tunnel and Beaches Link program of works as a result of the North Sydney Integrated Transport Program would be considered during further design development.

Transport for NSW will continue to work closely with North Sydney Council and 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 Western Harbour Tunnel and Beaches Link program of works. Community consultation would also be carried out. Issues raised by the community would be considered in any final decision to refine the project.

#### **C2.1.4 Other Commonwealth and international policies**

##### ***Issue raised***

Submitters raised concerns regarding the project's commitment to other Commonwealth and international policies and documents, requesting that compliance should be demonstrated with:

- *National Forest Policy Statement – A New Focus for Australia's Forests* (Department of Agriculture, Water and Environment (DAWE), 1995)
- The *National Clean Air Agreement* (DAWE, 2015).

##### ***Response***

###### National Forest Policy Statement

The *National Forest Policy Statement – A New Focus for Australia's Forests* (DAWE, 1995) commits to the sustainable management of all Australian forests, whether the forest is on public or private land, or is reserved or available for production. As the project does not impact any designated forests, the policy is not directly relevant to the project. Notwithstanding this, the project commits to a number of measures that will minimise the clearance of and impacts to native vegetation as per revised environmental management measure B6 (refer to Table D2-1 of this submissions report). Additionally, where reasonable and feasible, salvaged logs from the clearing process will be reused on site and/or reused as per revised environmental management measure WM8 (refer to Table D2-1 of this submissions report)

###### National Clean Air Agreement

The *National Clean Air Agreement* (DAWE, 2015) aims to address the impacts of air pollution on human and environmental health and ensure the community continues to enjoy clean air. The tunnel ventilation system has been designed and would be operated to achieve some of the most stringent standards in the world for in-tunnel air quality, and would be effective at maintaining or improving local air quality, reducing community exposure to pollutants as far as reasonable and feasible. Further information on air quality impacts during operation, including the environmental management measures to mitigate those impacts, are discussed in sections C11.4 and C11.5 of this submissions report.

#### **C2.1.5 Climate change policies**

##### ***Issue raised***

Submitters raised concerns regarding the alignment of the project with climate change policies including:

- Concerns about the project's compliance with the following NSW Government, Commonwealth Government and international policies on climate change:
  - *NSW Climate Change Policy Framework* (Office of Environment and Heritage (OEH), 2016a)
  - *Environmental Sustainability Strategy 2019-2023* (Roads and Maritime Services, 2019)
  - *Direct Action Plan* (Australian Government, 2014)
  - *Kyoto Protocol to the United Nations Framework Convention on Climate Change* (The Kyoto Protocol) (United Nations Framework Convention on Climate Change (UNFCCC), 1998)

- *Doha Amendment to the Kyoto Protocol* (UNFCCC, 2012)
- *Paris Agreement* (UNFCCC, 2015)
- Concerns about the project's compliance with the climate change goals set by Northern Beaches Council.

### **Response**

#### NSW Government, Commonwealth and international policies

The greenhouse gas and climate change assessment was conducted in accordance with the Secretary's environmental assessment requirements and is summarised in Chapter 26 (Climate change and greenhouse gas) of the environmental impact statement. The assessment considered the risk and vulnerability of the project to climate change effects as well the emissions likely to be generated by the project during construction and operation. The assessment was prepared according to the principles and objectives outlined in the following policies (refer to Section 26.2.1 of the environmental impact statement):

- *The Kyoto Protocol to the United Nations Framework Convention on Climate Change* (UNFCCC, 1998)
- *Doha Amendment to the Kyoto Protocol* (UNFCCC, 2012)
- *Paris Agreement* (UNFCCC, 2015)
- *Direct Action Plan* (Australian Government, 2014)
- *NSW Climate Change Policy Framework* (OEH, 2016a)
- *Environmental Sustainability Strategy 2019-2023* (Roads and Maritime Services, 2019).

The NSW Government's *Net Zero Plan Stage 1: 2020-2030* (NSW DPIE, 2020c) is the foundation for NSW's action on climate change and the goal to reach net zero emissions by 2050. It outlines the NSW Government's plan to grow the economy, create jobs and reduce emissions over the next decade. The plan will support a range of initiatives targeting electricity and energy efficiency, electric vehicles, hydrogen, primary industries, coal innovation, organic waste and carbon financing.

The predicted greenhouse gas emissions across the project lifecycle are documented in Chapter 26 (Climate change and greenhouse gas) of the environmental impact statement and are projected to increase as traffic numbers across the road network grow. 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: 2020-2030* (NSW DPIE, 2020c), are projected to assist in reducing emissions.

Additionally, Priority 4 of the *Net Zero Plan Stage 1: 2020-2030* (NSW DPIE, 2020c) would be met through the implementation of the Beaches Link and Gore Hill Freeway Connection sustainability vision and policy, outlined in Chapter 25 (Sustainability) of the environmental impact statement. This includes integration of sustainability-specific processes into procurement and labour practices, aligning with the policy commitment to bring sustainable goods, services and practices into the market. A Sustainability Management Plan for the project would be developed following engagement of the contractor/s and further design development and construction planning, in accordance with revised environmental management measure SU2 (refer to Table D2-1 of this submission report). It 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.

Greenhouse gas emissions would be managed and minimised as part of the Sustainability Management Plan which will be implemented to assist in achieving 'Design' and 'As Built' ratings of Excellent under the Infrastructure Sustainability Council rating scheme, in accordance with revised environmental management measure SU2 (refer to Table D2-1 of this submission report). This commitment is generally aligned with the NSW Government stated intention to reduce net greenhouse gas emissions.

### Northern Beaches Council Climate Change Action Plan

The *Northern Beaches Climate Change Action Plan* (Northern Beaches Council, 2021c) has been prepared to mitigate future climate change by reducing carbon emissions both in Northern Beaches Council's operations, and by encouraging and supporting the community to do the same.

The risk and vulnerability of the project to climate change effects, as well the emissions likely to be generated by the project during construction and operation are considered in Chapter 26 (Climate change and greenhouse gas) of the environmental impact statement and are discussed above. Although predicted greenhouse gas emissions across the project lifecycle are projected to increase as traffic numbers across the road network grow, 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, are projected to assist in reducing emissions.

## **C2.2 Project objectives**

### ***Issue raised***

Submitters raised comments and concerns regarding the objectives of the project. Specific comments and concerns include:

- Concerns that the project objectives stated in Section 3.4 of the environmental impact statement are general and aspirational in nature and would not be met
- Concerns that the project would not meet its stated objectives of addressing long term traffic congestion in the Northern Beaches. Submitters raised concerns that some transport experts believe that building more roads will not achieve this objective and that there is little evidence that tolled roads alleviate congestion, rather they instead lead to induced demand and congestion in the future
- Concerns that the project prioritises freight and through traffic (road capacity) as an objective of the project above reducing local congestion
- Concerns that the project would increase car travel into Sydney's CBD, creating adverse impacts with additional traffic congestion in the CBD
- Concerns that if the project is constructed, the Northern Beaches will be less likely to receive equitable public transport as the project encourages private vehicle use and does not have a primary focus on public transport
- Concerns that the strategic objectives would be better served by public transport. Submitters raised concerns that analysis of public transport use in Sydney's northern sector demonstrates the area would be better served by an investment in new public transport infrastructure and network coverage improvements that would move more people more efficiently and at higher speeds across and within the region
- Concerns that the project objective of 'improving amenity and safety in local centres by reducing congestion, through traffic and rat runs' would not be achieved at Balgowlah and North Balgowlah because the project would create rat runs, with traffic taking short cuts through these suburbs to access the Balgowlah tunnel portal

- Concerns that the project will not solve the existing traffic issues in and around North Sydney, Cremorne and Neutral Bay or on Military Road, Spit Road, Ourimbah Road, Eastern Valley Way and Mona Vale Road as this traffic is generated by local trips
- Parramatta is being set up as a second CBD yet the tunnel would not provide a transport solution from the Northern Beaches to Parramatta
- Concerns that the goals and aims of the project will not be met if it opens to traffic in 2028 or later.

### **Response**

#### Achievement of the project objectives

The Beaches Link and Gore Hill Freeway Connection project is one part of a complementary and integrated, multi-modal transport strategy being implemented by the NSW Government to meet the needs of customers now and in the future. The project challenges, corresponding objectives and project benefits are discussed in Section 3.4 of the environmental impact statement, with detail on how the project will meet these objectives in Section 3.6.

The project has been designed to provide additional motorway capacity and connectivity for both east-west journeys between the Northern Beaches and employment centres such as Chatswood and Macquarie Park, as well as north-south journeys including to and from the Sydney CBD. This is key to improving travel times for both north-south and east-west road journeys to and from the Northern Beaches, and alleviating congestion on a number of arterial roads in northern Sydney that are used for these journeys, including Military Road/Spit Road, Warringah Road, Boundary Street, and Eastern Valley Way. These benefits in travel times would apply to private vehicles, cars, freight vehicles and public transport services.

The removal of through traffic from existing local and arterial roads reduces congestion and rat running on these local streets and improves neighbourhood amenity by reducing noise and emissions, creating opportunities for more liveable urban and green spaces to be created.

Traffic modelling carried out for the project acknowledges that new roads can induce changes in trip patterns and includes forecasted induced demand as a result of the project. Even with induced demand accounted for by the traffic model, the project is anticipated to substantially reduce peak period traffic demand and improve travel times on Military Road, Spit Road, Warringah Road, Mona Vale Road and Eastern Valley Way in 2037. This would deliver reduced travel times and therefore productivity for freight services, greater trip reliability and increased resilience for public transport and other road users that continue to use these routes, consistent with the stated project objectives.

#### Freight

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 connecting goods and services between the source and end markets, including intermediary destinations in the supply chain. All road users would benefit from the project through faster and more reliable road travel times between the Northern Beaches region and key centres across Greater Sydney. By connecting the Northern Beaches to the Sydney motorway network, the project would provide faster connections to strategic commercial and industrial centres across Greater Sydney. For example, customers travelling between Frenchs Forest and Macquarie Park would be able to bypass about 20 sets of traffic lights travelling via the Beaches Link tunnel, Gore Hill Freeway, Lane Cove Tunnel and M2 Motorway. Such improvements in traffic flow will assist in easing congestion within the Northern Beaches for all road users.

## Sydney CBD

Faster, safer and more reliable journeys between the Northern Beaches and the Harbour CBD would be achieved alongside the objective for the Western Harbour Tunnel and Beaches Link program of works to relieve congestion on key roads around the Harbour CBD.

Traffic modelling performed as part of the environmental impact statement indicates that the Western Harbour Tunnel and Beaches Link program of works would redistribute through traffic away from Sydney CBD, shifting large volumes of through traffic currently using surface roads within and around the Sydney CBD into the Western Harbour Tunnel. It would also result in a reduction in traffic using the Sydney Harbour bridge, Sydney Harbour Tunnel, Western Distributor and Eastern Distributor to enter the Sydney CBD. In addition to the direct benefit of moving bypass traffic underground, reduced congestion on the surface arterial network offers flow on benefits to the adjoining local network, reducing the impact of queuing on arterial and local roads.

## Public transport

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 multi-modal transport needs of Sydney. During project development, improvements to alternative transport modes, including bus, rail, ferry and active transport, were considered including their effectiveness of meeting the project need, as outlined in Chapter 4 (Project development and alternatives) of the environmental impact statement. While many of these modes and upgrades are complementary to the project as part of a broader integrated, multi-modal transport network, none of the proposed initiatives negate the need to provide additional cross-harbour motorway capacity identified in the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012a) and *Future Transport Strategy 2056* (NSW Government, 2018). For example, public transport is well suited to provide people with access to central locations, such as the Sydney and North Sydney business districts. Those trips, however, only represent a portion of overall trips on the road network. A large proportion of private and commercial trips have dispersed origins and destinations, and/or varying purposes which are not well served by public transport alone.

As such, an integrated transport network is required to service the needs of a very diverse range of origins, destinations and journey purposes. 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.

The Beaches Link component of the project has been designed to be a key piece of the public transport network of the Northern Beaches, allowing for the future provision of express bus connections with North Sydney, the Sydney CBD, Macquarie Park, St Leonards and other key centres across greater Sydney, like the Northern Beaches Hospital precinct via the motorway network. Accordingly, the Beaches Link tunnels have been designed to allow use by buses, including double decker bus services. The tunnel portals at the Warringah Freeway have also been designed to integrate with a new southbound bus lane on the Warringah Freeway (delivered as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project), and provide the opportunity for efficient access and interchange with the new Victoria Cross Metro Station at North Sydney.

The Northern Beaches B-Line began operation in 2017 and provides frequent and more reliable services between the Northern Beaches and Sydney CBD. The project would support the continued operation of the B-Line program along with other existing and proposed bus services by improving travel times and reliability on key routes, connecting the Northern Beaches to key centres including Spit Road/Military Road and Warringah Road/Eastern Valley Way. By reducing network congestion, improving network resilience and increasing reliability in peak periods, the project would make

buses a more attractive transport option, supporting and encouraging a mode shift to public transport.

### Amenity

By providing additional motorway capacity and bypassing communities underground, the project would reduce through traffic volumes in many areas. This would result in reduced noise, emissions and improved amenity. Specific benefits as outlined in Chapter 3 (Strategic context and project need) of the environmental impact statement would include:

- Diversion of through-traffic from Military Road and Spit Road, improving the amenity of local town centres along the corridor including Mosman, Cremorne and Neutral Bay
- Reduced rat-running on local streets, including Ourimbah Road
- Reduced through traffic on Eastern Valley Way and down through Willoughby, Naremburn, Cammeray and Northbridge
- Reduced traffic within Seaforth town centre (due to a reduction in traffic using Wakehurst Parkway to access the Spit Bridge).

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. Specific anticipated benefits include reduced congestion and reduced levels of delay within Balgowlah due to the transfer of traffic demand from surface arterial roads to the project, and improvements at the intersection of Sydney Road, Manly Road and Burnt Bridge Creek Deviation during the AM peak. However, 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.

### Parramatta CBD

Access to Parramatta from the Northern Beaches would be facilitated by the project through connections to the Gore Hill Freeway and subsequently the broader Sydney motorway network. Improved access to the Lane Cove Tunnel and M2 Motorway from the project and via the Western Harbour Tunnel to the New M4/WestConnex would facilitate improved travel times between the Parramatta CBD and the Northern Beaches. With the project implemented, travel during peak traffic periods between Manly and Parramatta will be reduced to just over an hour with travel time savings of about 34 minutes as shown in Figure 3-8 of the environmental impact statement.

### Project commencement

The commencement of project construction is subject to several factors including planning approval granted by the Department of Planning, Industry and Environment and Transport for NSW's procurement of contractor/s. The final construction program would depend on future project procurement and packaging decisions by the Transport for NSW and the contractor/s. While the project benefits outlined in the environmental impact statement have been considered based on the indicative construction program for the project (refer to Table 6-3 of the environmental impact statement), these benefits have also been identified in traffic modelling scenarios for the years 2027 and 2037.



## C2.3 Project need and justification

### C2.3.1 Need for the project

#### ***Issue raised***

Submitters raised comments and concerns regarding the project need. Specific comments and concerns include:

- The environmental impact statement fails to make the case for the project as a transport solution for the Northern Beaches. Alternative options other than a tolled tunnel should be investigated and are considered to be more cost effective
- The justification of the project has not been supported with a business case. A business case should take into consideration filtering of ventilation outlets, public transport as an alternative, diminished quality of life, environmental impacts and show evidence of travel time saving and benefits to local areas
- Concerns that the justification for the project relates to attracting vehicles to the WestConnex project
- Concerns that the project is not a high priority on Infrastructure Australia's priority list, with many other projects considered to be more important and the highest priority identified in the *State Infrastructure Strategy 2018-2038* (Infrastructure NSW, 2018) being public transport. Concerns that the project is being prioritised over other transport projects in Greater Sydney that are more urgently needed
- Concerns that the project benefits of reducing travel times are not on routes popular enough (regular and everyday) to justify the cost of the project
- Considers existing roads are sufficient to support current traffic demands, as traffic modelling in Chapter 8 (Construction traffic and transport) of the environmental impact statement shows the existing road network can handle additional construction traffic each day therefore the tunnel is not necessary
- The project is not close to the key employment centre for the Northern Beaches at Brookvale
- Private car travel is not an option for many people since parking is an issue at their destination, negating the need for the project
- The decrease in air pollutant concentrations during the COVID-19 pandemic should not provide justification to build more roads and increase air pollutant concentrations.

#### ***Response***

Freight services, public transport and other road users travelling to and from the Northern Beaches region currently experience some of the slowest and most unreliable travel times across Greater Sydney. The North District and Northern Beaches region transport challenges face a number of key issues including:

- Limited arterial road capacity servicing the Northern Beaches Region
- Low population density across the region resulting in a wide variety of origins and destinations for transport journeys that are not well suited to high-frequency mass transit modes
- Road based transport modes, which provide the greatest flexibility to service the diverse trip needs, are constrained by a congested road network.

Giving consideration to future land use, population density and transport requirements, the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012a) and *Future Transport Strategy 2056* (NSW Government, 2018) identified road based transport, including improvements to bus services,

as an important mode to meet the needs of the Northern Beaches region. Furthermore, the need for additional core motorway capacity at the crossings of Middle Harbour and Sydney Harbour was identified as key to the development of an appropriate multi-modal Sydney transport network – and specifically identified the Western Harbour Tunnel and Beaches Link program of works as transport projects required to support the plan.

The Beaches Link and Gore Hill Freeway Connection project is one part of a complementary and integrated, multi-modal transport strategy being implemented by the NSW Government to meet these needs now and in the future. The project would improve the efficiency of freight movement, resulting in reduced freight operational costs, and has been designed as part of an integrated transport network with a focus on new public transport connections, and improved travel times and travel time reliability for buses to provide major benefits to public transport commuters. This includes opportunities for new express bus services in the Beaches Link Tunnel between the Northern Beaches and Sydney CBD, North Sydney, as well as other strategic centres via the Gore Hill Freeway and Artarmon such as St Leonards and Macquarie Park.

The project would provide additional motorway capacity and connectivity for both east-west journeys between the Northern Beaches and employment centres such as Chatswood and Macquarie Park, as well as north-south journeys including to and from the Sydney CBD. This is key to improving travel times for both north-south and east-west road journeys to and from the Northern Beaches, and alleviating congestion on a number of arterial roads in northern Sydney that are used for these journeys, including Military Road/Spit Road, Warringah Road, Boundary Street, and Eastern Valley Way. These benefits would apply to private vehicles, cars, freight vehicles and public transport services.

Considering the identified requirements of the *NSW Long Term Transport Master Plan* (NSW Government, 2012a) and the *Future Transport Strategy 2056* (NSW Government, 2018), a number of strategic alternatives were considered for delivering the required road capacity, as follows:

- Do nothing
- Travel demand management
- Improvements to the existing arterial road network
- A new motorway crossing of Middle Harbour (the project)
- Improvements to alternative transport modes, including public transport.

These strategic alternatives are described and evaluated in Chapter 4 (Project development and alternatives) of the environmental impact statement. The project was considered the preferred strategic alternative; in combination with the Western Harbour Tunnel and Warringah Freeway Upgrade project and WestConnex network it would provide a step-change in transport capacity between the Northern Beaches and strategic centres across Greater Sydney. This would materially improve travel times and travel time reliability for freight services, public transport and other road users on both the new motorway link and bypassed surface routes. Reduced pressure on existing surface routes would also improve the safety, efficiency and amenity of these corridors.

#### Availability of the business case

The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW process. Through this process the program of works has demonstrated its economic merit and successfully passed, for this development stage of the project, 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 Beaches Link and Gore Hill Freeway Connection project has undergone extensive scrutiny throughout its development.

The analysis for the business case for the Western Harbour Tunnel and Beaches Link program of works 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.

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

Separate business cases were prepared for the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project. The business case carried out for the project contains confidential and market-sensitive information such as forecast construction costs, which if made public, could jeopardise the integrity of the procurement process for the project and risk achieving value for money for the people of NSW.

Consistent with NSW Government policy, a summary of the business case for the project will be released by Infrastructure NSW at an appropriate time once an investment decision has been made. It is noted that Infrastructure NSW has released a summary of the Final Business Case for the Western Harbour Tunnel and Warringah Freeway Upgrade project, which is available online: [www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel\\_bc-summary-may-2020.pdf](http://www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel_bc-summary-may-2020.pdf).

#### Access to WestConnex

The Western Harbour Tunnel and Beaches Link program of works would deliver new strategic road links for Greater Sydney, improving travel times for freight services, public transport and other road users and alleviating pressure on some of the city's most critical transport corridors. The program of works is designed to improve the capacity, reliability, and travel times on cross harbour transport corridors near the Harbour CBD and improve connectivity to the Northern Beaches. The key benefits of the program of works are outlined in Section 3.5 of the environmental impact statement. Although the project would provide access to WestConnex via the broader strategic motorway network, the project has been developed to address the following road transport challenges within the North District as described in Section 3.2 of the environmental impact statement:

- High traffic volumes and limited capacity at the eastern Sydney Harbour and Middle Harbour crossings, and roads around the Harbour CBD
- Limited arterial road capacity servicing the Northern Beaches region
- Low population density across the Northern Beaches region (which is better served by road based and bus transit than by other mass transit modes of travel)
- Travel time reliability and speed of public transport journeys constrained by a congested road network.

#### Priority list

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, 2021) identifies the Western Harbour Tunnel and Beaches Link program of works as a priority initiative.

### Travel times

The Northern Beaches is connected to the rest of Greater Sydney by a small number of transport corridors. The three road corridors that connect the Northern Beaches with the rest of Greater Sydney are Mona Vale Road (A3), Military Road/Spit Road (A8) and Warringah Road (A38)/Eastern Valley Way, including two Middle Harbour crossings at the Spit Bridge and Roseville Bridge. These three corridors are required to accommodate journeys to and from strategic centres across Greater Sydney, as well as local and intraregional trips, including a large number of bus trips. Of the Middle Harbour crossings, the Spit Bridge is the tenth busiest road corridor in NSW, carrying over 69,500 vehicles per day and over 34,000 bus passengers per day, while the Roseville Bridge is the third most congested road corridor in Sydney, carrying over 79,500 vehicles per day and over 9,500 bus passengers per day.

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 a range of trips that would be carried out by users of the project. The modelled travel times included trips for key routes such as along Spit Road, Warringah Road, Mona Vale Road and Eastern Valley Way.

Analysis of the modelled forecast traffic demands across Middle Harbour with the project in 2037 indicates that:

- Peak period traffic demand on Military Road and Spit Road would decrease as a result of the project, by up to 11 per cent and 33 per cent respectively
- Peak period traffic demand on Warringah Road would decrease as a result of the project by up to 23 per cent
- Peak period traffic demand on Mona Vale Road would decrease by up to eight per cent as a result of the project
- Daily traffic demand on Eastern Valley Way would decrease substantially as a result of the project, by up to 40 per cent.

The overall reduction in traffic on the above surface arterial routes would result in improved travel speeds on these routes as a result of the project by 2037. This would deliver improved travel times and travel time reliability for freight services, public transport and other road users that continue to use these routes.

### Existing road capacity

Although the road network is predicted to have sufficient capacity to support an increase in vehicles in the short term, ie during construction, this does not mean that the road network is able to support the longer term demands of a growing population and economy. The project aims to address existing transport challenges with the road network within the North Shore and Northern Beaches, including roads not expected to be used by construction vehicles, by providing additional capacity which is needed now, as well as providing for the future needs of the network.

### Strategic centres

The North District's economy is focused on the cluster of strategic centres along the Eastern Economic Corridor, including North Sydney, St Leonards, Chatswood, Macquarie Park and centres further north in the district including Frenchs Forest and Brookvale-Dee Why. These centres play an important economic role in supporting the growth of Sydney as a global city, although arterial links are highly congested and unreliable during peak periods. As a result, a small proportion of jobs within Greater Sydney are accessible to North District residents within 30 minutes by private vehicle or public transport during the morning peak. Forecast 30-minute catchments by road for strategic

centres in the vicinity of the project are provided in Figure 3-11, Figure 3-12 and Figure 3-13 of the environmental impact statement. These figures indicate that the project would substantially increase accessibility for the Dee Why-Brookvale area, improving access from North Sydney and Chatswood (and beyond) to this centre so that it is accessible within 30 minutes.

#### Availability of parking

As outlined in Section C2.2 above, in addition to the travel time savings and travel time reliability benefits provided for freight services and private vehicle commuters, the project would unlock considerable improvements for public transport users (and a broad range of other road users) travelling on some of Sydney's busiest road corridors, including the project alignment. Subsequently, users of the project may not necessarily require parking at their destination.

#### Air pollution

Justification for the project is outlined in Chapter 3 (Strategic context and project need) of the environmental impact statement and is not dependent on any air quality benefits experienced during the COVID-19 pandemic.

### **C2.3.2 Traffic volumes**

#### ***Issue raised***

Submitters raised comments and concerns and made requests regarding the predicted traffic volumes used to justify the need for the project. Specific concerns, comments and requests include:

- Requests that the project be delayed until the benefits of the Western Harbour Tunnel and Warringah Freeway Upgrade project have been realised and modelling confirms traffic volumes are sufficient to justify the project
- Concerns that the project is not justified as the submitters assert that traffic volumes on Spit Road, Warringah Road, Condamine Street and Burnt Bridge Creek Deviation have largely been static for a number of years and that the project is addressing an ever-decreasing problem
- Based on Census data and Metro website data, it appears likely that fast and frequent public transport between Chatswood and Dee Why along the Warringah Road corridor could make a significant contribution to reducing traffic along both the Spit Road/Military Road corridor and the Warringah Road corridor, reducing the justification and need for the project
- Census data indicates that the majority of car trips on the Northern Beaches originate in Dee Why and further north and most car trips within Balgowlah are for short distances, therefore the tunnel is not justified
- Concerns that justification for the project is based on outdated travel data from 2016 and does not factor in:
  - Increased bus transport capacity (eg the Dee Why to Chatswood Express Bus Service)
  - The popularity of the B-line service
  - Completion of Sydney Metro City and Southwest
  - The growing adoption of work from home or hybrid work models since COVID-19.

#### ***Response***

#### Forecast traffic volumes and project benefits

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 was used to model traffic impacts

associated with both the Western Harbour Tunnel and Warringah Freeway Upgrade project and Beaches Link and Gore Hill Freeway Connection project and is considered appropriate for the determination of traffic demands for both projects. The process 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 operational traffic modelling scenarios for the project presented in the environmental impact statement consider the operation of the Western Harbour Tunnel and Warringah Freeway Upgrade project as part of the 'Do something cumulative' scenario. The project, when combined with the Western Harbour Tunnel and Warringah Freeway Upgrade project, would result in further reduced traffic volumes on Warringah Road, Spit Road/Military Road corridor, Brook Street and Eastern Valley Way with more of this traffic using the Beaches Link tunnel, as shown in Table 9-4 of the environmental impact statement. This would also result in reduced travel times, as vehicles travelling south would have the additional option of using the Western Harbour Tunnel.

In addition, both the Western Harbour Tunnel and Warringah Freeway Upgrade project and Beaches Link and Gore Hill Freeway Connection project will complete a review of operational network performance 12 months and five years from the opening of the projects to confirm the operational impacts of the projects on surrounding arterial roads and major intersections, in accordance with environmental management measure OT1 (refer to Table D-1 of this submissions report). Where required, additional feasible and reasonable mitigation measures will be identified in consultation with Department of Planning, Industry and Environment and the relevant council to manage any additional traffic performance impacts identified during the review of operational network performance.

#### Traffic volume trends and trip origins

The nature of existing traffic within the context of the broader road network is detailed in Section 8.3 of the environmental impact statement. Travel times and speeds along key corridors are presented for both the AM and PM peaks in Figure 8-2 and Figure 8-3 respectively of the environmental impact statement. Typical operating speeds during peak periods are shown to be in the range of 20 to 40 kilometres per hour, indicating these corridors are operating at capacity resulting in congestion and delays.

The Northern Beaches is connected to the rest of Greater Sydney by a small number of transport corridors, which contributes to high levels of congestion, long and unreliable travel times and consequently, poor accessibility to and from the region. Just three road corridors connect the Northern Beaches with the rest of Greater Sydney: Mona Vale Road, Warringah Road and Military Road/Spit Road. The region is particularly reliant on the southernmost corridors: Warringah Road via Roseville Bridge and Military Road/Spit Road via the Spit Bridge. Currently, these links carry 71 per cent of all interregional road journeys to and from the Northern Beaches, with traffic volumes forecast to increase by about 10 per cent by 2037. The heavy reliance on these corridors results in them being highly congested during peak times, and journeys that rely on them are highly susceptible to delays caused by incidents. Current average travel speeds in the AM peak are below 30 kilometres per hour on Military Road and Spit Road. Travel speeds are expected to reduce by about 40 to 60 per cent in the southbound direction and about 20 per cent in the northbound direction by 2037. The project would add new capacity and reduce pressure on existing road corridors leading to faster and more reliable journeys.

As only three road corridors connect the Northern Beaches with the rest of Greater Sydney, the capacity of these roads impacts traffic throughout the Northern Beaches regardless of the origin of the trip. The improvement to road capacity provided by the project, regardless of the traffic volume

trends on particular roads and the origin of local trips, would have positive impacts for the entirety of the Northern Beaches.

The project would create faster, more reliable travel times for freight services, public transport and other road users between the Northern Beaches region and other strategic centres across Greater Sydney, including North Sydney, the Harbour CBD, Macquarie Park and St Leonards providing benefits for the entirety of the Northern Beaches.

The project would also provide a new motorway link between the Northern Beaches and the existing road network near North Sydney and Artarmon, bypassing the congested Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors. Peak period traffic demand on Warringah Road would decrease as a result of the project by up to 23 per cent. Improvements in the capacity of the road network would encourage opportunities for new express bus services, as evidenced by the new rapid bus service from Dee Why to Chatswood which is currently being planned, which would benefit from reduced congestion on the Warringah Road corridor.

### Travel data from 2016

The 2016 baseline year is considered appropriate as the traffic and transport assessment commenced in 2017 and this baseline year represents transport network conditions at the time of assessment. One of the purposes of base year models, which are developed for typical commuter peak periods, is to calibrate the general road network settings to develop a road network assessment framework that would be suitable for future year applications, and to provide a comparative assessment of expected operating conditions in the future. Future demands were estimated by applying future year traffic growth forecast by the Sydney Strategic Travel Model to the Sydney Motorway Project Model to produce the most likely future base case scenario, as discussed further in Section C8.1 of this submissions report.

Data inputs into the Sydney Motorway Project Model consider forecast population and employment data, traffic volume counts and road travel time data, along with changes resulting from recently completed and proposed future infrastructure projects (including Sydney Metro City and Southwest project as well as other future improvements to bus networks). Population and employment growth forecasts provided by the Transport for NSW Transport Performance and Analytics division are consistent with demographics released by the NSW Department of Planning, Industry and Environment.

The Sydney Motorway Planning Model is used to establish existing and future traffic volumes based on data available at the time. The model considers future traffic demand based on land use projections and demographics, enabling existing and future traffic and transport conditions and road network performance to be characterised, both with and without the project. The forecasts produced are therefore considerate of existing travel patterns for the Northern Beaches and elsewhere across Sydney.

### Verification of COVID-19 statements

The COVID-19 pandemic is an unprecedented event that is currently impacting the way people work and their travel patterns, while creating uncertainty about the future, as discussed in Section 3.1 of the environmental impact statement. At this time, the duration of impacts to transport demands and behaviours from the COVID-19 pandemic are still unknown, and current traffic conditions and travel behaviours are the result of a variety of temporary factors, including reduced public transport capacity and demand.

Given the immediate to medium term nature of current conditions, the modelling approach used for the environmental impact statement is considered to be the most appropriate methodology for long term planning and was completed in accordance with appropriate standards and guidelines.

While it is difficult to fully assess the long term impact of the COVID-19 pandemic event, evidence of Greater Sydney's resilience to such disruptions is already apparent. Ongoing traffic and transport monitoring shows that traffic levels on most roads in the project area returned to those levels near that of the pre-COVID-19 pandemic period in early 2021, prior to the mid-2021 lockdown (acknowledging that public transport capacity and user behaviours are still in a temporary state). It is expected that similar trends will be observed once the lockdown rules have been eased, and traffic levels will return to those levels in the pre-COVID-19 pandemic period. Transport for NSW will continue to monitor and analyse the potential long term effects of the COVID-19 pandemic on travel demand, including changes to existing travel conditions as well as future travel behaviours and underlying economic demand drivers.

### C2.3.3 Population

#### ***Issue raised***

Submitters raised concerns regarding justification for the project based on population forecasts presented in the environmental impact statement. Specific concerns include:

- Concerns that on a per capita basis the project is not viable and that population growth figures for the Northern Beaches for the next 40 years should be provided to justify the project need. This is particularly relevant given that COVID-19 has reduced the population growth via immigration and the relocation of residents out of Sydney
- Concerns that insufficient population growth on the Northern Beaches (estimated at 20 per cent over the next 10-15 years) does not support a rail investment, however the toll road tunnels are predicated on significant population growth.

#### ***Response***

The North District is home to 886,550 residents (or 19 per cent of Greater Sydney's population), which is forecast to increase by 18 per cent by 2036. It accommodates 483,300 jobs (or 20 per cent of Greater Sydney's jobs), with the highest share of employment in knowledge-intensive and professional jobs (35 per cent compared to the Greater Sydney average of 32 per cent) and health and education (21 per cent compared to the Greater Sydney average of 19 per cent) (Greater Sydney Commission, 2018b). These sectors are among the fastest growing in the North District, reinforcing their significance in the North District's economy and, more broadly, to Greater Sydney (Greater Sydney Commission, 2018b).

The above information has been extracted from the publication *North District Plan - connecting communities* by the Greater Sydney Commission, (2018b) which is publicly available. Additionally, the Sydney Motorway Planning Model includes population and employment growth forecasts which are consistent with publicly available demographic data released by the NSW Department of Planning, Industry and Environment (population projections for the current period (2019-2022), along with relevant assumptions and datasets are available here:

[www.planning.nsw.gov.au/Research-and-Demography/Population-projections](http://www.planning.nsw.gov.au/Research-and-Demography/Population-projections)).

Access between the North District and employment hubs along the Eastern Economic Corridor is primarily provided by private vehicle and bus services using the Military Road/Spit Road (A8) and Warringah Road (A38)/Eastern Valley Way corridors. These arterial links are highly congested and unreliable during peak periods. As a result, a small proportion of jobs within Greater Sydney are accessible to North District residents within 30 minutes by private vehicle or public transport during



the morning peak. The project targets the needs of customers on long distance personal trips to non-centre locations, involving diffuse origins and destinations, where locations are set away from trunk public transport corridors and interchanges, such as the Northern Beaches, and addresses major capacity constraints of the road network, as outlined in sections 2.6 and 2.7 of Appendix F (Technical working paper: Traffic and transport).

The Northern Beaches region is home to a large population however the population density is relatively low. This results in a wide variety of origins and destinations for transport journeys that are not well suited to high-frequency mass transit modes. Accordingly, the most appropriate transport modes for the region continue to be road based, including high-quality express bus services such as the B-Line. These modes provide the greatest flexibility to service the diverse trip needs of the dispersed Northern Beaches population. The project would materially improve the capacity, efficiency and travel time reliability of bus services for the Northern Beaches region and ensure the longer term success of the B-Line. This would be delivered by providing an underground bypass route, which would enable express bus services to travel via the tunnel and motorway network to destinations like North Sydney, the Harbour CBD, Macquarie Park and St Leonards. This would result in more rapid and reliable travel times and more direct routes for express bus services, while simultaneously improving the capacity and efficiency of existing surface corridors by reducing conflicts between express and multi-stop services.

#### **C2.3.4 Future planning**

##### ***Issue raised***

Submitters raised concerns that the project is inappropriate for future transport needs with the trend towards reduced car dependency, electric vehicles and automated systems.

##### ***Response***

The *Future Transport Strategy 2056* (NSW Government, 2018) sets the 40-year vision, strategic directions and outcomes for customer mobility in NSW. The plan identifies the transport challenges that need to be addressed to support NSW's economic and social performance and establishes 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 Strategy 2056* (NSW Government, 2018) as a 'Committed' project forming part of the vision for the future strategic road network in Greater Sydney that supports 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 the project was the preferred solution to achieve the project objectives (refer to Chapter 4 (Project development and alternatives) of the environmental impact statement). It is one of a suite of transport initiatives being implemented by the NSW Government.

The need for the project is described in Chapter 3 (Strategic context and project need) of the environmental impact assessment and includes existing and forecast congestion on Sydney's arterial road network due to limited cross harbour connection capacity, limited arterial road capacity servicing the Northern Beaches and low population density across the Northern Beaches region.

The project would create faster, more reliable travel times for freight services, public transport and other road users between the Northern Beaches region and other strategic centres across Greater Sydney, including North Sydney, the Harbour CBD, Macquarie Park and St Leonards, providing benefits for the entirety of the Northern Beaches as discussed in Section C2.3.1 above. Electric vehicles would be fully compatible with the project, with further detail on NSW's *Electric and Hybrid Vehicle Plan* (NSW Government, 2019b) in Section C28.11 of this submissions report. In addition,

automated systems (eg Connected and Autonomous Vehicles) would further improve the capacity and efficiency of the project and other road-based transport solutions.

The public transport network servicing the Northern Beaches region, including B-Line, is constrained by the performance of the existing surface arterial corridors, particularly the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors. By relieving pressure on these existing surface arterial road corridors, the project would support the operation of the B-Line as well as local and interregional buses, by improving travel times and travel time reliability on these roads as a result of reduced traffic demand and congestion. Improvements in the capacity of the road network would encourage opportunities for new express bus services, as evidenced by the new rapid bus service from Dee Why to Chatswood which is currently being planned, which would benefit from reduced congestion on the Warringah Road corridor. By reducing network congestion, and therefore improving network resilience and reliability, particularly in peak periods, the project would make bus routes to and from the Northern Beaches a more attractive transport option, supporting and encouraging a mode shift to public transport.

## C2.4 Project benefits

### *Issue raised*

Submitters raised concerns and praised the benefits of the project, including:

- Concerns that the project does not provide long term benefits in relation to traffic reduction and that the environmental impact statement predicts that the tunnel will reach capacity within 10-15 years
- Concerns that the negative impacts/cost of the project outweigh the benefits, with limited benefits in terms of travel time savings and a focus only on the positive socio-economic benefits
- Concerns that the project will only benefit a small part of Sydney and that many of the suburbs impacted by construction would not experience the benefits of the project
- The project will return local streets to communities by moving traffic underground, freeing up local streets for local traffic, and supporting the sustainability of local town centres
- The project will enable opportunities to enhance the local community by improving active transport (pedestrian and cyclist facilities) connections and providing new and improved public open space and recreation facilities such as the new and improved open space at Balgowlah which will support and benefit the community, supporting local supporting clubs and providing facilities for use by nearby schools.

### *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. The project would create an alternative to the Military Road/Spit Road and Warringah Road corridors, to relieve traffic pressure on the North Shore. The project is one part of a complementary and integrated multi-modal strategy being implemented by the NSW Government. A description of the North District'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.

The project would deliver a range of benefits that outweigh its potential impacts, as described in Chapter 3 (Strategic context and project need) of the environmental impact statement. It has been designed to improve travel times for both north–south and east–west road journeys to and from the Northern Beaches, and alleviate congestion on a number of arterial roads in northern Sydney that

are used for these journeys, including Military Road/Spit Road, Warringah Road, Boundary Street, and Eastern Valley Way. The forecast major reductions in traffic volumes that are expected due to the project are shown in Figure 3-9 of the environmental impact and show improved travel speeds as a result of the project by 2037 on surface arterial routes, including Military Road, Spit Road, Mona Vale Road and Eastern Valley Way. This would deliver improved travel times for freight services, public transport and other road users that continue to use these routes.

The environmental impact statement provides a balanced assessment of impacts and benefits for traffic, access, air quality and green space, and more broadly across the environment and community. Residual impacts are expected to be effectively managed in accordance with the environmental management measures provided in Table D2-1 of this submissions report. The project would benefit communities of the Lower North Shore and Northern Beaches, increasing accessibility and reducing travel times as well as being part of a broader transport strategy improving the resilience of the Harbour CBD road network.

The positive project benefits identified by submitters are noted by Transport for NSW.

## **C2.5 Project funding**

### ***Issue raised***

Submitters raised comments and concerns regarding the funding of the project, including:

- The environmental impact statement does not estimate what construction and operational costs of the project will be, with a concern raised that estimates are likely to be exceeded
- Concerns that a project final investment decision by the NSW Government has not been made and significant taxpayer funds would be spent on an unapproved project
- Funding appears to have been released from the Restart Fund prior to the required business case review by Infrastructure NSW. In the recent budget, the Generations Fund was earmarked for future funding, however it is not clear how the criteria for the use of the Generations Fund are met by this project, ie improving the wellbeing of communities and reducing debt
- Several project funding alternatives were suggested in submissions, such as raising the tolls at the Harbour Bridge, making cuts to public transport, applying a congestion tax or reducing investment in other industries such as education
- Concerns that recent disasters and events (drought, bushfires, floods and COVID-19 pandemic) have impacted the current and future State and Federal Government budgets and that the project would increase the State's debt but only benefit a minority of the State's population
- Concerns that the environmental impact statement notes that the project could be built as part of the 'infrastructure-led recovery' from COVID-19 for NSW when there is no analysis of the value to the economy for various projects, in order to select projects with the greatest net benefit from public infrastructure spend.

### ***Response***

The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW processes. Through this process the program has demonstrated its economic merit and successfully passed, for this development stage of the project, 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 Beaches Link and Gore Hill Freeway Connection project has undergone extensive scrutiny throughout its development.

The analysis for the business case for the Western Harbour Tunnel and Beaches Link program of works 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 and environmental impacts and improve project outcomes.

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

Separate business cases were prepared for the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project. The business case carried out for the project contains confidential and market-sensitive information such as forecast construction costs, which if made public, could jeopardise the integrity of the procurement process for the project and risk achieving value for money for the people of NSW.

Consistent with NSW Government policy, a summary of the business case for the project will be released by Infrastructure NSW at an appropriate time once an investment decision has been made. It is noted that Infrastructure NSW has released a summary of the Final Business Case for the Western Harbour Tunnel and Warringah Freeway Upgrade project, which is available online: [www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel\\_bc-summary-may-2020.pdf](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 the 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. Operational and maintenance costs of the project are considered in the economic analysis (refer to Chapter 21 (Socio-economics) of the environmental impact statement). Further design development would confirm operating costs and funding would be sourced as required by the NSW Government.

The environmental impact statement was prepared to address the Secretary's environmental assessment requirements and does not discuss the project cost.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C3 – Project development and alternatives

## C3 Project development and alternatives

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## C3.1 Project development

### C3.1.1 Project review and further investigations

#### ***Issue raised***

Submitters raised comments and concerns in regard to further review of the project and additional investigations. Specific comments and concerns included:

- Concerns that the environmental impact statement is based on a design that is less than 50 per cent complete and, therefore, not capable of being comprehensively assessed
- Concerns that many of the technical working papers contain statements indicating further design development, additional investigations and planning phases are required, which leaves the community with the impression that there are too many unknowns on the project
- Concerns that the preliminary works (investigations and surveys) described in Section 5.1.3 of the environmental impact statement were not carried out prior to the environmental impact statement given that they may inform the design
- The design does not acknowledge the future growth of Chatswood and the impact of the new Sydney Metro on this growth. Chatswood already has significant congestion issues
- The environmental impact statement does not evaluate a scenario where the Western Harbour Tunnel proceeds without the Beaches Link tunnel
- Concerns that the Beaches Link tunnel is not needed based on current demand now that more people work from home (as compared to the 2016 data used for modelling)
- Objections to separating the Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project, and requests that the geographic extent of both projects be better defined to avoid interface issues at the project boundaries
- Concerns that significant changes have been made to the design after community consultation was carried out from 2017 to 2019
- Concerns that the project does not include scope for future population growth
- Suggestions that two completely independent major road crossings of Sydney Harbour should be developed so that the Western Harbour Tunnel is not reliant on the Warringah Freeway
- The study area has been limited to immediate connections to the existing network in and around North Sydney and has not taken a strategic planning approach
- The environmental impact statement states that Beaches Link is a long-required bypass of the Spit Bridge but fails to mention that Beaches Link in the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012a) was a plan to investigate a bus tunnel under Military Road.

#### ***Response***

##### Further design development and preliminary works

As is normally the case for a complex major infrastructure project subject to an environmental assessment process, the design detail and construction methodology presented and assessed in the environmental impact statement is not finalised and is at the reference design stage only. The reference design is subject to further refinement once submissions have been received, project approval is obtained and the contractor/s delivering the project have further developed the design and construction methodologies (commonly referred to as detailed design or further design development). This process is outlined in Section 2.3 of the environmental impact statement.

Issues raised during exhibition of the environmental impact statement have resulted in a number of refinements to the project design. These are identified in the project refinements included in Section A4 of this submissions report.

A preferred infrastructure report has also been prepared for the project as required by the Department of Planning, Industry and Environment. The preferred infrastructure report provides further information, describes design changes and assesses the environmental impact of these changes. Refer to the separate preferred infrastructure report for further details.

As is typical for a project of this scale, the project does not include assessment of a range of preliminary works such as surveys, geotechnical and other investigations which would be carried out, as outlined in Section 5.1.3 of the environmental impact statement. These preliminary works are currently permitted under separate existing approvals and/or are subject to separate assessment and determination in accordance with the *Environmental Planning and Assessment Act 1979*. They therefore do not require approval as part of the environmental impact statement, but would inform the design as the project progresses.

Any refinements to the approved project during further design development would be reviewed for consistency with the approval in accordance with the process outlined in Section 2.3 of the environmental impact statement. Where design refinements do not meet these criteria, approval for a modification would be sought from the Minister of Planning and Public Spaces in accordance with the requirements of Division 5.2 of the *Environmental Planning and Assessment Act 1979*. This process is also discussed in Section 28.3 of the environmental impact statement.

#### Future growth at Chatswood

The forecast future land use and transport demand growth at Chatswood including the effects of the Sydney Metro City & Southwest project is recognised and reflected in the transport modelling which underpins the environmental impact statement. Consequently, it is considered and addressed throughout the environmental impact statement including Section 3.1. The Sydney Metro City & Southwest project is included in the 'Do minimum', 'Do something' and 'Do something cumulative' traffic scenarios that were modelled for the project, as identified in Table 9-3 of the environmental impact statement.

The project has been designed to provide motorway standard connectivity for both east-west journeys between the Northern Beaches and employment centres such as Chatswood and Macquarie Park, and north-south journeys including to and from the Sydney CBD. Tunnelled connections would be provided to and from the Gore Hill Freeway and Warringah Freeway and the Western Harbour Tunnel and enable through traffic to divert from surface roads to the Beaches Link tunnel resulting in reduced congestion. These changes are key to improving travel times for both north-south and east-west road journeys to and from the Northern Beaches, and alleviating congestion on a number of arterial roads in northern Sydney that are used for these journeys, including Military Road, Spit Road, Warringah Road, Boundary Street, and Eastern Valley Way. Associated travel time savings would provide the opportunity to investigate new high-quality express bus services to employment centres including Chatswood and Macquarie Park, as well as resulting in improved connectivity to the Sydney Trains network and new Victoria Cross Metro Station at North Sydney. It should be noted that planning and assessment of proposed future express bus services would not form part of the scope of the project.

An analysis of 30-minute catchments by road for strategic centres around the project, including Chatswood, under the 'Do something' and 'Do something cumulative' scenarios is discussed in Section 9.1.4 of the environmental impact statement. Overall, the project would substantially increase accessibility from the Northern Beaches to nearby strategic centres, including Chatswood, St Leonards, Macquarie Park and North Sydney.



### Western Harbour Tunnel and Beaches Link program of works

The project forms a core component of the broader Western Harbour Tunnel and beaches Link program of works. The program of works would unlock substantial travel time savings and travel time reliability for freight services, public transport and other road users travelling between the Northern Beaches region and strategic centres across Sydney.

While the Western Harbour Tunnel and Beaches Link program of works is an integrated program, the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project are subject to separate and coordinated environmental assessment and approval processes and are being delivered as separate projects, each with their own program start and completion times.

The Western Harbour Tunnel and Warringah Freeway Upgrade project received planning approval from the NSW Minister for Planning and Public Spaces on 21 January 2021 under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* and will commence construction before the Beaches Link and Gore Hill Freeway Connection project (which is still subject to planning approval).

It is assumed that the Western Harbour Tunnel and Warringah Freeway Upgrade project would commence construction before the Beaches Link and Gore Hill Freeway Connection project. However, should timeframes for the Beaches Link and Gore Hill Freeway Connection project be advanced, some elements of the Beaches Link component may be delivered as part of the Western Harbour Tunnel and Warringah Freeway Upgrade works to maximise construction efficiency and minimise impacts in particular areas.

### Scenarios modelled for the Western Harbour Tunnel and Beaches Link program of works

The modelling carried out for the environmental impact assessment investigated four scenarios as detailed in Table 9-3 of the environmental impact statement. These scenarios are:

- 'Base year' – This scenario describes the existing environment in 2016 eg existing traffic volumes
- 'Do minimum' – Includes approved, under construction and/or recently opened motorway projects. This scenario excludes the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project
- 'Do something' – Includes the Beaches Link and Gore Hill Freeway Connection project and the Warringah Freeway Upgrade project. The Warringah Freeway Upgrade project is included in this scenario on the basis that the project requires this to function. This scenario excludes the Western Harbour Tunnel
- 'Do something cumulative' – Includes both the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project.

The environmental impact statement does not include a scenario that includes the Western Harbour Tunnel and Warringah Freeway Upgrade project but not the Beaches Link and Gore Hill Freeway Connection project. Such a scenario was included in the 'Do something' scenario assessed in the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement (detailed in Table 9-3 of that environmental impact statement).

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 2020 traffic conditions in the project area.

### Work from home / COVID-19

A clarification is provided in Section A5.1.17 of this submissions report regarding the effect of COVID-19 on modelling carried out for the environmental impact statement and project need.

### Boundary with the Warringah Freeway Upgrade project

Some elements of the project would be constructed as part of the Warringah Freeway Upgrade project to minimise the cumulative construction impacts of the combined projects, as detailed in Chapter 6 (Construction work) of the environmental impact statement. Figure 6-1 of the environmental impact statement shows the interface between the project and the connecting Warringah Freeway Upgrade project. Specific works for the project that would be constructed as part of the Warringah Freeway Upgrade project include:

- Structural works for the cut and cover and trough structures for the ramps to and from the Warringah Freeway (refer to Section 6.4.3 of the environmental impact statement)
- The civil construction of the ventilation outlet at the Warringah Freeway (refer to Table 6-6 of the environmental impact statement)
- The Cammeray Golf Course construction support site (BL1) would initially be established as a temporary construction support site for the Western Harbour Tunnel and Warringah Freeway Upgrade project.

The construction impacts of these works have been assessed in the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement. Works carried out at the interface between the two projects would need to comply with the conditions of approval relevant to the works and would be managed in accordance with the construction environmental management plan relevant to the works.

### Design changes in response to issues raised by the community

The engagement process for the project aims to provide opportunities for community and stakeholder involvement throughout all project phases.

The design of the project has evolved during its development over the period 2017 to 2019, as discussed in Section 7.2.6 of the environmental impact statement. Feedback and issues identified during the engagement program by stakeholders and the community informed the environmental assessment and the ongoing development of the project. The project has benefited from the input of local knowledge, insight, experience, goals and priorities and learnings from other major infrastructure projects, which has helped to identify issues, potential mitigation strategies and opportunities to improve project outcomes.

In July 2018, the NSW Government announced the proposed reference design for the Western Harbour Tunnel and Beaches Link program of works. Feedback on the proposed reference design was invited between 26 July 2018 and 1 December 2018, supported by community engagement activities summarised in Table 7-6 of the environmental impact statement. Feedback from this period helped to inform the design, which was then the design included in the project environmental impact statement.

In November 2019, the NSW Government announced an updated design for the project. The community were advised of the preferred temporary construction support sites at Wakehurst Parkway east (BL13) and Flat Rock Drive (BL2), an updated design of the Balgowlah access road (noting the Balgowlah access road has since evolved to that presented in the environmental impact statement), and the updated timing for the Beaches Link and Gore Hill Freeway Connection project environmental impact statement. Community updates were uploaded onto the project website and

distributed to 46,500 properties along the Beaches Link alignment and suburb specific fact sheets were created to update the community about design changes in their area. The fact sheets focussed on Balgowlah, Cammeray, Willoughby, Seaforth and Frenchs Forest. In addition, an email was sent to 2592 subscribers, informing them of the changes and linking them to the community update on the website.

For further information on how community and stakeholder feedback has been incorporated into the project and contributed to design development refer to Section 7.4 of the environmental impact statement.

#### Consideration of future population growth

Future population growth in Sydney is a key element of the project need and is discussed extensively in Section 3.1 of the environmental impact statement. The population of Greater Sydney is forecast to grow from five million to eight million people over the next 40 years. To accommodate this growth, the Greater Sydney Commission's *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) envisages a global metropolis of three liveable, productive and sustainable cities. The Beaches Link and Gore Hill Freeway Connection project would be located in the North District of the Eastern Harbour City which is an area of strategic economic importance for Sydney.

The *Greater Sydney Region Plan – A Metropolis of Three Cities* 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. 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 (refer to Section 7.1 of Appendix F (Technical working paper: Traffic and transport)).

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 multi-modal transport needs of Sydney. 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 an integrated transport network (including roads as a critical element) is required to service the needs of a very diverse range of origins, destinations and journey purposes.

On this basis, the Beaches Link and Gore Hill Freeway Connection project, as part of a multi-modal solution, provides the opportunity to accommodate the transport demand and mitigate the transport impacts of future population growth.

Future population growth (and other key factors which influence transport demand) is incorporated into the modelling for the project as discussed in Section 9.2.2 of the environmental impact statement.

Data inputs into the Sydney Motorway Planning Model used for forecasting, included forecast population and employment data consistent with demographics released by NSW Department of Planning and Environment in 2017, traffic volume counts and road travel time data, along with recently completed and future infrastructure project lists.

### Two independent crossings of Sydney Harbour

Corridor alternatives that would provide a new crossing of Sydney Harbour that is independent of the Warringah Freeway corridor were considered as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, as shown in Figure 4-5 and discussed in Section 4.4 of the environmental impact statement for that project. The reasons why the preferred corridor for that project includes a connection to the Warringah Freeway are detailed in Section 4.4.3 of the environmental impact statement.

### Connections at North Sydney

The project objectives have taken account of relevant strategic planning and policy documents at both a national and State level and the consistency of the project with those documents is outlined in Section 3.7 of the environmental impact statement. Consistency of the project with a number of local strategic planning statements and specific transport strategies relevant to the project are also outlined in Section 20.1 and Section 9.1 respectively of the environmental impact statement.

The project has taken a strategic planning approach with a key objective being connectivity of the Northern Beaches region to other key strategic centres across Greater Sydney including North Sydney, The Harbour CBD, Macquarie Park and St Leonards. Strategic context for the project is outlined in Chapter 3 (Strategic context and project need) of the environmental impact statement. The overarching objectives of the Western Harbour Tunnel and Beaches Link program of works, as well as the specific objectives of the Beaches Link and Gore Hill Freeway connection project are documented in Section 3.4 of the environmental impact statement.

Consideration of the integration between the project and the North Sydney Integrated Transport Program (or North Sydney Program) is discussed in Section 9.1.1 of the environmental impact statement. The North Sydney Program is being developed to support and facilitate the outcomes envisaged by the *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) and *Future Transport Strategy 2056* (NSW Government, 2018). 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 of works, integrate with the North Sydney CBD in a manner that supports the globally connected 'Harbour CBD' and enables delivery of befitting place-based outcomes.

The project has also taken a strategic approach to how it connects to North Sydney by recognising the opportunity for new express bus services between the Northern Beaches region and North Sydney to interchange with the new Victoria Cross Metro Station at North Sydney. Transport for NSW is also working with North Sydney Council to investigate options to improve movement and place outcomes within North Sydney as part of the North Sydney Integrated Transport Program, as discussed in Table 3-3 of the environmental impact statement.

### NSW Long Term Transport Master Plan 2012

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012a) is discussed in Table 3-2 of the environmental impact statement. It notes that the *Future Transport Strategy 2056* (NSW Government, 2018) builds on the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012a) and sets the 40-year vision, strategic directions and outcomes for customer mobility in NSW. The *Future Transport Strategy 2056* (NSW Government, 2018) is a suite of strategies and plans that includes the *Greater Sydney Services and Infrastructure Plan* which lists the Western Harbour

Tunnel and Beaches Link program of works as a 'Committed' project (within the next ten years, subject to final business case) forming part of the vision for the future strategic road network for Greater Sydney that would support key movements by road, including freight, public transport and private vehicles.

As the *Future Transport Strategy 2056* effectively builds on the *NSW Long Term Transport Master Plan* it is appropriate that the environmental impact statement focus on how the project alignments with this more recently developed strategy.

### **C3.1.2 Business case**

#### ***Issue raised***

Submitters raised concern that the business case for the project has not been released to the public and there is currently no costing available. Submitters requested release of this publication. Specific comments, requests, recommendations and concerns include:

- Objections to there not being separate business cases for the Beaches Link and Gore Hill Freeway Connection project and the Western Harbour Tunnel and Warringah Freeway Upgrade project
- The benefit cost ratio for the project is questioned
- A cost-benefit analysis be carried out for the project and compared with a public transport alternative
- Recommendations that the business case is revised following analysis of changes to traffic movements due to the increased working from home resulting from the COVID-19 pandemic
- Requests that the business case consider filtered ventilation outlets
- Recommendations that the business case be reassessed after the rapid bus service between Dee Why and Chatswood is introduced.

#### ***Response***

##### **Business case for Western Harbour Tunnel and Beaches Link program of works**

The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW process. Through this process the program of works has demonstrated its economic merit and successfully passed, for this development stage of the project, 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 Beaches Link and Gore Hill Freeway Connection project has undergone extensive scrutiny throughout its development.

The analysis for the business case for the Western Harbour Tunnel and Beaches Link program of works 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.

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

Separate business cases were prepared for the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project. The business case carried out for the project contains confidential and market-sensitive information such as forecast construction costs, which if made public, could jeopardise the integrity of the procurement process for the project and risk achieving value for money for the people of NSW.

Consistent with NSW Government policy, a summary of the business case for the project will be released by Infrastructure NSW at an appropriate time once an investment decision has been made. It is noted that Infrastructure NSW has released a summary of the Final Business Case for the Western Harbour Tunnel and Warringah Freeway Upgrade project, which is available online: [www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel\\_bc-summary-may-2020.pdf](http://www.infrastructure.nsw.gov.au/media/2528/western-harbour-tunnel_bc-summary-may-2020.pdf).

### Impact of COVID-19

A clarification is provided in Section A5.1.17 of this submissions report regarding the effect of COVID-19 on modelling carried out for the environmental impact statement and project need.

### Filtration

Filtration of the ventilation outlets is not proposed as part of the project and therefore would not have formed part of the business case assessment.

Further information on air quality management measures that were considered for the project is included in Section 12.7.2 of the environmental impact statement.

### Integrated transport approach

The project is part of an integrated transport approach as discussed in Section C3.1.1. The project would reduce vehicle congestion and result in travel time savings and improved reliability for users of existing corridors including Military/Spit Road, Warringah Road and Eastern Valley Way. This would leverage opportunities for improved public transport services such as the proposed bus service enhancements between Dee Why and Chatswood, as discussed in Section 9.1.3 of the environmental impact statement.

## **C3.2 Assessment of strategic alternatives**

### **C3.2.1 Adequacy**

#### ***Issue raised***

Submitters raised comments and concerns in regard to the adequacy of the consideration of alternatives to the project. Specific comments, requests and concerns include:

- The environmental impact statement does not satisfactorily address the Secretary's environmental assessment requirements in regard to assessment of alternatives, particularly public transport options
- Alternatives to the project should be considered due to the environmental impacts of construction. The project is counter to the *Environmental Planning and Assessment Act 1979*, which highlights our inter-generational responsibility, and need to conserve wildlife and biodiversity for long-term social, economic and environmental survival
- Concerns that there is an inadequate level of detail and no cost benefit analysis provided for the project alternatives. Suggestions that a full options analysis is needed that considers the environmental, economic and transport efficiency performance of alternatives

- Requests for further analysis of the need, impacts and alternative solutions to the project. Concerns that alternative options could be implemented at a negligible cost compared to the project
- Objections to the disturbance of Burnt Bridge Creek and requests for an ecologically sustainable alternative
- Concerns that the project alternatives are similar in nature and variations on the same theme and that other alternatives would prioritise biodiversity, have less environmental impact and reduce emissions
- Concerns that the transport method, design and route selected for the project would lead to a higher level of impact than alternative routes would
- Concerns that the environmental impact statement's discussion on alternatives is unbalanced as it focusses on alternative tunnel routes and tunnelling
- The Northern Beaches is a geographically constrained area that is not suitable for a motorway. The project is considered to be a poorly designed solution.

### ***Response***

A summary of the alternatives that were considered as part of the project development process and selection of the preferred alternative are discussed in Chapter 4 (Project development and alternatives) of the environmental impact statement. The preferred alternatives presented are based on technical, environmental and planning considerations. Stakeholder and community considerations which have been incorporated into the project development process are outlined in Chapter 7 (Stakeholder and community engagement). The assessment of project alternatives has been extensive and is considered to be appropriate for a project of this scale.

### **Assessment process**

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 Secretary's environmental assessment requirements relevant to project development and alternatives are also listed in Table 4-1 of the environmental impact statement. The environmental impact assessment addresses the Secretary's environmental assessment requirements relevant to project development and alternatives by including an analysis of feasible alternatives to the project, description of feasible options within the project including alternative methods of construction and staging of the project, and a description of how alternatives to - and options within - the project were analysed to inform the selection of the preferred alternative.

The Secretary's environmental assessment requirements relevant to project development and alternatives do not specifically require consideration of a public transport alternative. However, improvements to alternative transport modes to road transport are considered in Section 4.3.5 of the environmental impact statement.

### **Economic considerations**

Figure 4-6 of the environmental impact statement includes the technical, environment and planning and economic criteria used to evaluate each corridor alternative. Capital costs of each corridor

alternative were considered as part of the evaluation of the preferred alternative. Section 4.4.2 of the environmental impact statement provides an evaluation of the shortlisted corridor alternatives and broadly provides discussion on cost comparison.

Refer to Section C3.1.2 for discussion on the project business case.

#### Alternatives and consideration of biodiversity

Strategic alternatives, corridor alternatives and design changes that resulted from further design development are detailed in sections 4.3, 4.4 and 4.5 of the environmental impact statement.

As stated above, Figure 4-6 of the environmental impact statement includes the technical, environment and planning and economic criteria used to evaluate each corridor alternative. Considerations in the environment and planning category included improving long-term outcomes for flora and fauna in key areas through landscape design and fauna crossings as well as minimising impacts to environmentally and culturally sensitive sites.

Connection alternatives for the project were also evaluated against a number of relevant technical, environmental, community and financial criteria including traffic and transport impacts and environmental and heritage considerations, some of which included minimising impacts to existing vegetation and highly sensitive areas such as creek lines. Consideration of sustainability in design and construction to reduce resource requirements and environmental footprint was also included in the design assessment criteria.

#### Public transport options

The project is one part of a complementary, integrated, multi-modal strategy being implemented by the NSW Government that includes a suite of current and future transport initiatives outlined in *Future Transport Strategy 2056* (NSW Government, 2018) 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. Buses continue to be the most appropriate public transport mode for the Northern Beaches area given the low population density and subsequently wide variety of origins and destinations for transport customers in the area. Buses provide the ability for flexibility and will be critical in supporting predicted future demand in the area.

Key benefits of the project to public transport include:

- Relieving pressure on surface arterial roads, allowing surface bus routes to operate more efficiently
- Providing an underground bypass route, which would enable express bus services to travel via the tunnel and motorway network to destinations like North Sydney, the Harbour CBD, Macquarie Park and St Leonards. This would result in more rapid and reliable travel times and more direct routes for express bus services, while simultaneously improving the capacity and efficiency of existing surface corridors by reducing conflicts between express and multi-stop services
- Contributing to an integrated transport network by enabling direct bus access to North Sydney and an efficient transfer to the Victoria Cross Metro Station.

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 road capacity.

### Burnt Bridge Creek

Balgowlah connection alternatives were extensively considered as part of the design process and are discussed in Section 4.5.5 of the environmental impact statement. Key objectives of the project for the Balgowlah area included minimising impacts on Burnt Bridge Creek including to existing vegetation, particularly intact portions of the Burnt Bridge Creek corridor west of the Burnt Bridge Creek Deviation and east of Kitchener Street (refer to Table 4-7 of the environmental impact statement).

The tunnel connection to and from Burnt Bridge Creek Deviation and associated surface works was redesigned to include for various enhancements in response to community and stakeholder feedback received prior to finalisation of the environmental impact statement. The redesigned connection as presented in Chapter 5 (Project description) of the environmental impact statement was assessed within Appendix S (Technical working paper: Biodiversity development assessment report). Refer to Section C18.1.2 of this submissions report for further discussion.

The Balgowlah connection preferred alternative (refer to Table 4-19 of the environmental impact statement) requires only localised adjustment to Burnt Bridge Creek and eliminates extensive diversion works within the existing creek, reducing impacts on flora and fauna, including potentially reduced impact on mature trees in the golf course compared to other alternatives. With the preferred alternative, impacts would be restricted to the east side of Burnt Bridge Creek Deviation. In addition, potential direct vegetation impacts around Burnt Bridge Creek have been significantly reduced by moving the portal to the south and establishing an exclusion zone around riparian native vegetation adjoining the creek (refer to Section 19.4 of the environmental impact statement for further detail).

### Tunnelled motorway options

Options for a motorway connection to the Northern Beaches requiring a new bridge over Middle Harbour have been discussed since the 1930s when a new surface road corridor was contemplated in the Cumberland Plan. However, the concept of building a surface motorway was abandoned some 40 years ago, with the principal concerns being the environmental and community impacts of a surface alignment and the limited benefits offered given the downstream capacity constraint at the Sydney Harbour crossing. At this time, tunnelling technology was not sufficiently advanced to allow a road tunnel to be cost-effectively implemented (refer to Section 4.3.4 of the environmental impact statement).

The release of the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012a) and *State Infrastructure Strategy Update 2014* (Infrastructure NSW, 2014) confirmed new motorway crossings of Sydney Harbour and Middle Harbour as transport priorities for the city and State.

The population of Greater Sydney is forecast to grow from five million to eight million people over the next 40 years. To accommodate this growth, the Greater Sydney Commission's *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) envisages a global metropolis of three liveable, productive and sustainable cities. The *Future Transport Strategy 2056* (NSW Government, 2018) was prepared concurrently and identifies the Western Harbour Tunnel and Beaches Link program of works as one of several major transport projects to facilitate the predicted growth. Furthermore, the *State Infrastructure Strategy 2018-2038* (Infrastructure NSW, 2018) identifies the Beaches Link as a near-term priority for the Sydney motorway network to provide an alternative to the Military Road/Spit Road corridor and bypass the Spit Bridge.

A new tunnelled motorway was the preferred strategic alternative determined for the project and as such, alternative corridor options all adopted this same approach. The pink corridor alternative (refer to Figure 4-10 of the environmental impact statement) included a tunnel with surface connections from Burnt Bridge Creek Deviation (with onward tunnel from Wakehurst Parkway), a high-level bridge over Middle Harbour east of the existing Spit Bridge (refer to Figures 4-11 and 4-12 of the environmental impact statement), connecting to a tunnelled alignment broadly following the Military/Spit Road corridor. The pink corridor option was not preferred for various reasons, including significant environmental impacts.

For further information refer to Chapter 4 (Project development and alternatives) for a description of the alternatives that were considered as part of the project development process and explanation of the selection of the preferred alternative.

### Suitability of a motorway to the Northern Beaches

The reasons why a motorway was selected as the preferred strategic alternative for the project are provided in sections 4.3.4 to 4.3.6 of the environmental impact statement.

Extending Sydney's tunnelled motorway network to the Northern Beaches would provide faster, more efficient and more reliable journeys between the Northern Beaches and Greater Sydney and address capacity, efficiency and reliability issues on the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors as well as providing broader benefits through reduced congestion on the wider local and arterial surface road networks.

The project would also materially improve the functionality and performance of the bus network, providing opportunities for faster and more reliable express bus services to travel via the tunnel and motorway network from the Northern Beaches to strategic centres including North Sydney, the Sydney CBD, Macquarie Park and St Leonards. In addition, the design for Beaches Link would allow for these services to interchange with the new Victoria Cross Metro Station at North Sydney. The use of the Beaches Link tunnel for express bus services would also reduce pressure on the Military Road/Spit Road and Warringah Road/Eastern Valley Way bus corridors, allowing for further optimisation of local surface services and infrastructure.

Improved safety and amenity in local centres as a result of heavy vehicles being redirected into the Beaches Link tunnel is also another project benefit. The project would significantly improve the efficiency and safety for freight and heavy vehicles access to and from the Northern Beaches via the new tunnel. This includes for the safety of other motorists using the new motorway which would otherwise travel the existing routes with these heavy vehicles. This would also deliver greater efficiencies for businesses when accessing the Northern Beaches area.

## **C3.2.2 Assessment of public transport alternatives**

### ***Issue raised***

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

- Concerns that the environmental impact statement has not considered how existing and planned projects such as the B-Line have been successful at relieving congestion from the network. Before the COVID-19 pandemic, Sydney was showing a very strong mode shift to public and active transport which would negate the need for the project
- Concerns that prior to COVID, Transport for NSW data shows that the daily average traffic across the Spit Bridge had been decreasing for the last four years due to the successful implementation of the B-Line, while during the same period the traffic on Mona Vale Road through to Macquarie Park has been increasing

- Clear plans on what future public transport services will be provided in the Beaches Link, the patronage targets for these services and the provision for the electrification of public transport are not provided
- Public transport options have not been considered appropriately prior to the commencement of the project concept stage. An independent cost-benefit analysis for all transport options should be conducted and publicly released
- An alternative public transport feasibility study/comparative analysis of mass transit alternatives should be published before any further planning occurs so that impacts and outcomes can be fairly compared and the risks and benefits against the project can be understood
- Concerns that former Premier Mike Baird stated that finding a solution to traffic congestion along the Military Road corridor would not involve considering public transport options and as a result, consideration of options has not been an objective investigation
- Concerns that the project would add further emissions of pollutants and greenhouse gases 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, health, environmental impact and often better cost-benefit outcomes
- Concerns that there was no community consultation regarding the justification of the project relative to the cost and advantages of rail or other public transport alternatives
- Concerns that in 40 years or so the Northern Beaches will have the critical mass of population to support more public transport solutions, however the project does not respond to this
- Concerns that the environmental impact statement states that the Northern Beaches is a low-density area, which, while broadly accurate, ignores the medium-high density areas of Manly Vale, Manly, Brookvale, Dee Why, Narrabeen/Collaroy, Mona Vale and soon to be developed hospital precinct in Frenchs Forest. Therefore, these areas may be able to support public transport alternatives
- The project should be conditioned to review options for more public transport
- Concerns that Figure 4-1 in the environmental impact statement mentions 'improvements to alternative transport modes' but it does not include addition of a new transport mode eg rail. Also, Chapter 29 (References) of the environmental impact statement does not mention any rail-related studies apart from the *Northern Beaches Transport Action Plan* (Transport for NSW, 2016b)
- Concerns that the environmental impact statement states that 'demand would not be high enough to make investing in a specific or dedicated rail link to the Sydney CBD a viable alternative'. However, there is nothing that supports this statement, and that precludes non roads-based transport solutions for the Northern Beaches.

### **Response**

#### Consideration of the B-Line and other planned projects

*Sydney's Bus Future* (Transport for NSW, 2013c) acknowledges that improvements to the bus network are essential to meet changing customer needs, including access to major centres outside the Sydney CBD. *Sydney's Bus Future* aims for seamless connection to other transport modes to deliver the right mix of services. In response to changing passenger needs and an increase in demand, additional services have already been added to the Sydney bus network. However, without measures to improve travel times by increasing the road efficiency or capacity, the addition of more buses to the network can contribute to congestion, making bus services less effective at meeting customer needs.

The success to date of the B-Line program is recognised in Section 4.3.5 of the environmental impact statement. The operation of the B-Line since November 2017 is also recognised in the traffic impact assessment of the project (refer to Section 9.1.3 of the environmental impact statement and Section 2.3 of Appendix F (Technical working paper: Traffic and transport)).

Despite the complementary nature of the B-Line and the rapid bus service planned between Dee Why and Chatswood, improved bus services on existing surface corridors alone would not be sufficient to provide the level of additional transport capacity that is required for the expected growth of Northern Beaches region. The ability of the bus network to provide extra capacity is limited by the capacity of the road network itself, particularly the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors.

While the B-Line program has been successful in improving capacity and travel times in the short to medium-term, additional road capacity is required to reduce congestion to build on this success and enable further improvements to future bus services and infrastructure in the long term.

#### Inclusion of public transport in the project

The project would materially improve the functionality and performance of the bus network, by reducing congestion and providing travel time savings and improved trip reliability on the surface road network as discussed in Section 4.3.5 of the environmental impact statement. The project would also provide opportunities for faster and more reliable express bus services to travel via the tunnel and motorway network from the Northern Beaches to strategic centres including North Sydney, the Sydney CBD, Macquarie Park and St Leonards. The design for Beaches Link would also allow for these services to interchange with the new Victoria Cross Metro Station at North Sydney. Furthermore, the use of the Beaches Link tunnel for express bus services would reduce pressure on the Military Road/Spit Road and Warringah Road/Eastern Valley Way bus corridors, enabling opportunities for further optimisation of local bus services.

While the Beaches Link tunnels have been designed to allow use by buses, including taller double decker bus services, the provision and operation of new bus services is not part of the scope of the project for which approval is being sought. The future bus network which would use the tunnel and motorway network and less congested surface roads would be identified closer to the commencement of operation and with consideration of the existing bus services and demand for bus services at that time.

Further discussion of the inclusion of public transport infrastructure in the project is provided in Section C4.4 of this submissions report.

#### Objectivity of the alternatives considered

The project has undergone extensive evaluation of alternatives from pre-feasibility and strategic investigations through to design development and refinement, as outlined in the alternatives development process flowchart provided in Figure 4-1 of the environmental impact statement. Details of the findings in each step in the alternatives development process are provided in Chapter 4 (Project development and alternatives) of the environmental impact statement.

Refer to Section C3.1.2 for discussion on the business case.

#### Consideration of vehicle emissions

Vehicle emissions and greenhouse gases are discussed in Chapter 26 (Climate change risk and greenhouse gas) of the environmental impact statement. 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 increase the efficiency of vehicles and assist in reducing emissions.

The project would not preclude use by low or no emission vehicles or autonomous vehicles.

#### Community and stakeholder engagement on public transport alternatives

Stakeholder and community feedback received during the 2017 and 2018 engagement periods for the Western Harbour Tunnel and Beaches Link program of works was recorded and considered during the preparation of the environmental impact statement and is summarised in Table 7-7 of the environmental impact statement. On the topics of transport mode, public transport alternatives, network integration, connectivity, integration with other key projects and proposed infrastructure (eg Northern Beaches B-Line, Sydney Metro), a total of 547 comments were received in 2017 and 1974 comments were received in 2018.

#### Future critical mass on the Northern Beaches for public transport

The NSW Government plans for managing the forecast growth in Greater Sydney over the next 40 years are detailed in the *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a) and *Future Transport Strategy 2056* (NSW Government, 2018). The *Greater Sydney Region Plan* was prepared concurrently with the *Future Transport Strategy 2056* and the *State Infrastructure Strategy 2018–2038* (Infrastructure NSW, 2018) to align land use, transport and infrastructure outcomes for Greater Sydney. The Western Harbour Tunnel and Beaches Link program of works is one of several major transport projects identified in these documents to facilitate the predicted growth.

The project has been developed with a long term view to address the challenges Greater Sydney will face over the next 40 years, and to deliver long-lasting benefits for road users, communities and businesses. As such, the need for the project and other strategic transport projects to meet the demands of a growing population and economy remains critical to ensuring the future success of Sydney.

Current planning is focussed on the next 40 years of growth in Greater Sydney. Planning for periods beyond this will occur in the future and would reflect the population growth and transport demand forecasts at that time. For the Northern Beaches at that time, factors such as population size, the population growth profile, current conditions on all transport modes and forecast growth in transport demand would all be important considerations in determining the need for additional transport infrastructure. As noted in Section C3.2.1, buses continue to be the most appropriate public transport mode for the Northern Beaches area given the low population density and subsequently wide variety of origins and destinations for the commuters in the area. Buses – and other road transport modes which would benefit from Beaches Link – provide the ability for flexibility and will be critical in supporting predicted future demand in the area.

#### Consideration of a rail alternative

Alternative transport modes including rail were considered as strategic alternatives to the project and are discussed in Section 4.3.5 of the environmental impact statement. 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 resolve the existing road network capacity constraints between the lower North Shore and the Northern Beaches.

Transport for NSW understands that public transport patronage is increasing in line with population and economic growth. Accordingly, 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, such as diverse origins, destinations, purposes and timing.

The physical and urban geography of the Northern Beaches region presents barriers to the consideration of rail-based solutions in addressing the transport challenges faced by the region. The provision of rail infrastructure is also reliant on the location of and accessibility to high density residential or commercial property in close proximity to the proposed location of stations as well as along its route. Given the high cost of constructing and operating rail infrastructure and the low density nature of the Northern Beaches, it is considered that demand would not be high enough to make investing in a specific or dedicated rail link to the Sydney CBD a viable alternative in the immediate future. Similarly, topography and population density issues mean that light rail is also not a viable alternative.

Due to the high cost and long lead time for a heavy or light rail solution, the alternative approach for public transport improvement is to focus on improving the speed and reliability of road based public transport such as bus services – for example, by implementing bus priority measures and developing rapid bus services. Such investment can be delivered as part of a long-term, staged approach to increasing corridor capacity, as and when required, at substantially lower cost than heavy and light rail infrastructure. With a relatively high carrying capacity, rapid or express bus services offer a mass transit solution for bus corridors where a rail based solution is unsuitable. As such, adequate, reliable and efficient public transport using road infrastructure (ie rapid and express bus services) is considered a more suitable and appropriate public transport solution for the Northern Beaches area.

The project would materially improve the functionality and performance of the bus network, by reducing congestion and providing travel time savings and improved trip reliability on the surface road network as discussed in Section 4.3.5 of the environmental impact statement. The project would also provide opportunities for faster and more reliable express bus services to travel via the tunnel and motorway network from the Northern Beaches to strategic centres including North Sydney, the Sydney CBD, Macquarie Park and St Leonards. The design for Beaches Link would also allow for these services to interchange with the new Victoria Cross Metro Station at North Sydney. Furthermore, the use of the Beaches Link tunnel for express bus services would reduce pressure on the Military Road/Spit Road and Warringah Road/Eastern Valley Way bus corridors, enabling opportunities for further optimisation of local bus services in consultation with key government and other project stakeholders such as councils.

The project would also allow for more direct and safer access to and from the Northern Beaches for freight and heavy vehicles using the new tunnel further enabling opportunities for improving the speed and reliability of road based public transport on arterial routes. This would deliver greater efficiencies and safety for business and road users at a local and regional level. A rail alternative is unable to provide opportunities for any freight and heavy vehicle improvements which will otherwise be facilitated by the project.

The Beaches Link tunnel was recommended for further review and development in the *State Infrastructure Strategy Update 2014* (Infrastructure NSW, 2014), as noted in Table A5-13 of this submissions report. The *Northern Beaches Transport Action Plan* (Transport for NSW, 2016b) outlined proposed rail initiatives of relevance to the project. These included a second harbour rail crossing as well as a new rail line to the Sydney CBD. Subsequently, this new rail line to the CBD was realised by the Sydney Metro City & Southwest project, which is a 30 kilometre extension of metro rail line from the end of the existing Sydney Metro Northwest terminus at Chatswood. The Sydney Metro City & Southwest project will travel from Chatswood, under Sydney Harbour, through newly established stations in the Sydney CBD through to Bankstown in the south west of the city. The Sydney Metro City & Southwest project will enhance the Sydney rail network and enable it to

carry an additional 100,000 people per hour in peak periods, delivering sufficient capacity to serve the city well into the future. Supplemented by a rapid bus service between Dee Why and Chatswood that is currently being planned, this means more people are likely to travel by rail, helping to reduce the number of buses travelling into the Sydney CBD from locations north of Sydney Harbour. This would also provide increased capacity for buses and cars travelling from the Northern Beaches to the Sydney CBD.

It should be noted that the project does not preclude the consideration of heavy rail links to the Northern Beaches in the future, should population growth and density drive this need.

#### Insufficient demand for rail link between the Northern Beaches and Sydney CBD

The statement made above '*Given the high cost of constructing and operating rail infrastructure and the low density nature of the Northern Beaches, it is considered that demand would not be high enough to make investing in a specific or dedicated rail link to the Sydney CBD a viable alternative*' is also made in Section 4.3.5 of the environmental impact statement. The statement is made in conclusion to a discussion on the physical and urban geography of the Northern Beaches as compared to that most suited to rail infrastructure. In summary, rail infrastructure is most suited to high density residential or commercial property that is clustered at locations where stations can be built and along corridors where connections can be made to link a series of such clusters. By comparison, the Northern Beaches is characterised by low density development, despite pockets of medium density development.

The topography on either side of Middle Harbour also presents a challenge for constructing a rail tunnel with a gradient that would be acceptable in terms of engineering design and safety. The necessity to excavate stations at large depths and provide surface connections to these stations for a tunnelled rail link under Middle Harbour was another key consideration. Whilst a rail tunnel may be technically feasible, these physical constraints would result in substantial challenges for engineering, with large implications for cost and amenity during construction.

Further discussion on rail considerations is provided in Section 4.3.5 of the environmental impact statement.

### **C3.2.3 Suggestions for public transport alternatives**

#### ***Issue raised***

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

- The Beaches Link tunnel should be used exclusively for public transport
- A dedicated public transport alternative along the Dee Why to Chatswood or Mona Vale Road to Macquarie Park would better address traffic trends and relieve congestion
- Improving existing bus services through more dedicated bus lanes and exchanges, park 'n' ride facilities and improved scheduling and additional routes such as buses direct to universities such as Macquarie or a dedicated bus lane at Kentwell and Condamine Streets through Manly Vale
- Provision of intermodal transport interchanges
- Re-route B1 B-Line buses through the tunnel when constructed
- Provision of dedicated bus lanes and light rail services on surface road capacity made available by the project
- An east to west public transport link to connect Chatswood to Dee Why and/or Manly to Seaforth either via heavy rail or metro, light rail or express bus
- Rail line via Mosman and Neutral Bay Junction potentially linking to North Sydney

- Metro or heavy rail link to the Northern Beaches
- There should be a train tunnel built adjacent to the car tunnel to enable sustainable public transport being built at the same time
- Reinstating light rail between Narrabeen and Manly
- Suggestion to implement Bradfield's rail plan for the peninsula
- Improving ferry travel times and the frequency of ferry services
- Ferry services from Balmoral to the City and/or Clontarf to the City
- Installing dedicated cycling infrastructure and upgrading active transport.

### ***Response***

Strategic context and project need is discussed in Chapter 3 (Strategic context and project need) of the environmental impact statement. The project objectives are provided in Figure 3-7 of the environmental impact statement.

While the Northern Beaches region is home to a large population, the population density is relatively low. This results in a wide variety of purposes, origins and destinations for transport journeys that are not well suited to high-frequency mass transit modes. Accordingly, the most appropriate transport modes for the region continue to be road based, as these modes provide the greatest flexibility to service the diverse trip needs of the dispersed Northern Beaches population.

Alternative transport modes to the project, including bus, rail, light rail, ferry and active transport, and their effectiveness in meeting the project need were considered as part of the analysis of strategic alternatives (refer Section 4.3.5 of the environmental impact statement). While many of the suggested modes and upgrades are complementary to the project as part of a broader, integrated transport network, none would be as effective as the project in providing improvements to travel times and travel time reliability for freight services, public transport and other road users, while at the same time, improving efficiency and amenity along existing arterial road corridors. This includes the effectiveness of express bus services, which would substantially improve with the improvements to road capacity and travel reliability provided by the project.

Further information regarding submitter suggested public transport alternatives to the project, is provided below.

#### **Improvements to the Sydney bus network**

The project would materially improve the functionality and performance of the bus network, providing opportunities for faster and more reliable express bus services to travel via the tunnel and motorway network from the Northern Beaches to strategic centres including North Sydney, the Sydney CBD, Macquarie Park and St Leonards, as discussed in Section 3.6.3 of the environmental impact statement.

The design of Beaches Link would also allow for these services to interchange with the new Victoria Cross Metro Station at North Sydney. Furthermore, the use of the Beaches Link tunnel for express bus services would reduce pressure on the Military Road/Spit Road and Warringah Road/Eastern Valley Way bus corridors, allowing for further optimisation of surface bus services. Improvements in the capacity of the existing surface road network would create opportunities for new express bus services and infrastructure, as evidenced by the new rapid bus service from Dee Why to Chatswood which is currently being planned, which would benefit from reduced congestion on the Warringah Road corridor.



While the B-Line program has been successful in improving capacity and travel times in the short to medium-term, additional road capacity is required to enable and accommodate growth and deliver long-term benefits for bus services and unlock the opportunity for new and improved express services between key centres. Improved bus services on existing surface corridors alone would not be sufficient to provide the level of additional transport capacity that is required for the Northern Beaches region. The ability for the bus network to provide extra capacity is strictly limited by the capacity of the road network itself – particularly the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors.

The project would be designed to facilitate its use by double-decker buses and would achieve the same travel time savings and trip reliability as other vehicles using the tunnel. Further details on the improvements to public transport by the project is provided in Section C3.2.1 and Section C3.2.2.

#### Specific suggestions for bus alternatives

A dedicated public transport alternative along Dee Why to Chatswood or Mona Vale Road to Macquarie Park would not be a viable alternative to the project and would not meet the strategic objectives of the project which are outlined in Section 3.4 of the environmental impact statement.

There were also various other suggestions raised in community submissions such as: improving existing bus services through more dedicated bus lanes and exchanges, park 'n' ride facilities and improved scheduling and additional routes such as buses direct to universities such as Macquarie or a dedicated bus lane at Kentwell and Condamine Streets through Manly Vale; provision of intermodal transport interchanges; re-routing of B1 B-Line buses through the tunnel when constructed; and provision of dedicated bus lanes and light rail services on surface road capacity made available by the project.

While the project could create opportunities for these types of complementary initiatives, and many of these suggestions could be complementary to the project as part of a broader integrated transport network, none of the proposed initiatives would negate the need to resolve the existing road network capacity constraints between the lower North Shore and the Northern Beaches and would not be as effective in reducing congestion on arterial roads compared to the project.

#### Improvements to the rail network

As noted in the response in Section C3.2.2 above, the topography on either side of Middle Harbour presents a challenge for constructing a rail tunnel with a gradient that would be acceptable in terms of engineering design and safety. The necessity to excavate stations at large depths and provide surface connections to these stations for a tunnelled rail link under Middle Harbour was another key consideration. These physical constraints would result in substantial challenges for engineering, with significant implications for cost and amenity during construction and a longer lead time to development. Similar constraints would also apply to a light rail alternative, although less than for heavy rail.

The provision of rail infrastructure (heavy or light) is also reliant on the location of and accessibility to high density residential or commercial property close to the proposed location of stations as well as along its route. Given the high cost of constructing and operating rail infrastructure and the low density nature of development on the Northern Beaches, it is considered that demand would not be high enough to make investing in a specific or dedicated rail link to the Sydney CBD a viable alternative.

Due to the high cost and long lead time for a heavy or light rail solution, the alternative approach for public transport improvement is to focus on improving the speed and reliability of road based public transport such as bus services – for example, by implementing bus priority measures and

developing rapid bus services. Such investment can be delivered as part of a long-term, staged approach to increasing corridor capacity, as and when required, at substantially lower cost than heavy and light rail infrastructure. With a relatively high carrying capacity, rapid or express bus services offer a mass transit solution for bus corridors where a rail based solution is unsuitable. As such, adequate, reliable and efficient public transport using road infrastructure (ie rapid and express bus services) is considered a more suitable and appropriate public transport solution for the area which will be provided by the project.

More information on consideration of improvements to the rail network are provided in Section 4.3.5 of the environmental impact statement.

#### Specific suggestions for rail alternatives

An east to west public transport link to connect Chatswood to Dee Why and/or Manly to Seaforth either via heavy rail or metro, light rail or express bus would not meet the strategic objectives of the project. Similarly, reinstating light rail between Narrabeen and Manly would also not address the strategic objectives of the project (refer to Section 3.4 of the environmental impact statement for project objectives).

There were various other rail alternatives suggestions raised in community submissions such as: a rail line via Mosman and Neutral Bay Junction potentially linking to North Sydney; Metro or heavy rail link to the Northern Beaches; a train tunnel built adjacent to the car tunnel to enable sustainable public transport being built at the same time; reinstating light rail between Narrabeen and Manly and suggestions to implement Bradfield's rail plan for the peninsula.

As stated in Section C3.2.2 above, given the physical constraints, high cost of constructing and operating rail infrastructure and the low density nature of the Northern Beaches, it is considered that demand would not be high enough to make investing in a specific or dedicated rail link from the Northern Beaches a viable alternative to the project.

#### Improvements to the ferry network

As also discussed in Section 4.3.5 of the environmental impact statement, additional ferry services on Sydney Harbour were considered as a strategic alternative to the project. Additional ferry services would provide an improved cross-harbour public transport link and would contribute to relieving congestion on existing cross-harbour road connections, however would not provide sufficient additional capacity to relieve the existing harbour crossings. This is due to comparatively small passenger catchments that use the ferry network.

#### Improvements to active transport

An active transport solution alone is not a viable alternative to meet the project objectives that are outlined in Section 3.4 of the environmental impact statement. Whilst active transport is complementary to the project, it is not a mass transit mode or suited to long distances and would not provide the required improvements to travel times and travel time reliability for freight services, public transport and other road users.

However, the project does provide the opportunity to make improvements to walking and cycling infrastructure and provide more shared transport options. As part of the project, the development of new or improved active transport links in a number of locations are included, being generally associated with surface works for the project. These include the provision of new and upgraded shared user paths in Balgowlah, Killarney Heights, Seaforth and Frenchs Forest, as well as a number of new shared user underpasses and new shared user and pedestrian bridges which would provide connectivity across Wakehurst Parkway.

These links would improve connectivity between communities, open space areas, public transport modes and the existing active transport network. This is described in further detail in Chapter 5 (Project description) and Chapter 9 (Operational traffic and transport) of the environmental impact statement. Further information on the consideration of improvements to active transport is included in Section 4.3.5 of the environmental impact statement.

### **C3.2.4 Travel demand alternatives**

#### ***Issue raised***

Submitters raised concerns and made requests regarding travel demand alternatives considered during the development of the project and suggested alternatives, including:

- The environmental impact statement does not consider travel demand management measures and claims that measures would 'require considerable changes in social attitudes, travel behaviour and government policy' and 'can take many years to achieve'. Australians have demonstrated that such changes can be implemented effectively and rapidly during the COVID-19 pandemic
- The NSW Government should introduce measures to encourage a mode shift away from private vehicle use including incentivising public transport by reducing fares or making public transport free and increasing the toll to drive over the Sydney Harbour Bridge during peak times
- Consideration should have been given to imposing a vehicle tax or congestion charge on vehicles entering the North Sydney and Sydney central business districts during peak hours
- Suggestions that placing tolls on Spit Bridge, Roseville Bridge and Mona Vale Road would solve congestion issues
- Suggestions to provide more carparks linked to bus stops to discourage private vehicle use
- Active transport should be encouraged and safer bike lanes constructed
- Alternative initiatives such as encouraging working from home, setting up shared working hubs within the Northern Beaches to avoid the need for commuting, car share/ride sharing, park 'n' ride, changing school start and finish times to use buses more efficiently or staggering work hours to reduce peak hour traffic would be a better solution and people moving for work or further away from city centres should be considered.

#### ***Response***

Travel demand management measures are considered in Section 4.3.2 of the environmental impact statement. These include land use planning policies promoting town 'centres' to reduce the need for travel, augmenting existing public transport, road use charges and flexible working arrangements.

Given the current road network servicing the Northern Beaches is already highly congested, even with considerably reduced per capita travel demand through demand management and improvements to public transport, an expanded road network would still be required to accommodate the forecast population growth in Sydney and the Northern Beaches over the next 40 years.

The project would, however, provide opportunity and incentive to use public transport and make improvements to active transport infrastructure. Travel times and reliability of service routes would improve as a result of the project, and the project would also enable express bus services to travel via the tunnel and motorway network to destinations like North Sydney (with improved connection to the new Victoria Cross Metro Station at North Sydney), the Harbour CBD, Macquarie Park and St Leonards. This would result in more rapid and reliable travel times and more direct routes for express bus services, while simultaneously improving the capacity and efficiency of existing surface

corridors by reducing conflicts between express and multi-stop services. In addition, the project would provide development of new or improved active transport links generally associated with surface works for the project.

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. Travel demand management changes alone are therefore not a viable strategic alternative to the project, and are outside the scope of the project. They are, however, viewed as complementary initiatives, together with the project, to reduce the level of congestion on Sydney's road network as the city's population grows.

Discussion on the impact of COVID-19 on the project is provided in Section A5.1.17 and Section C3.1.1.

Infrastructure would be installed as part of the project to provide the NSW Government with the option to apply tolls to traffic using the Beaches Link tunnel. However the management of tolling across NSW is outside the scope of this project.

Although the provision of more commuter car parking is outside the scope of the project, it is noted that as part of the delivery of the B-Line Program by Transport for NSW, six new commuter car parks were provided at Mona Vale, Warriewood, Narrabeen, Dee Why, Brookvale and Manly Vale. In addition, car parks in the vicinity of bus stops would continue to be considered by relevant divisions of Transport for NSW in consultation with other agencies (including councils), as relevant, in relation to future bus network plans and operations. As discussed above, the project creates significant opportunities to enhance the bus network servicing the Northern Beaches.

### **C3.2.5 Existing road upgrades**

#### ***Issue raised***

Submitters raised concerns and made requests regarding the upgrades to existing roads proposed as part of the project and suggested alternatives, including:

- Concerns that the options for possible improvements to the existing arterial road network were not adequately addressed in the environmental impact statement. Project costs should be directed to maintaining or upgrading existing roads
- Requests evidence that surface solutions along existing arterial routes would result in unreasonable amounts of land acquisition and environmental and social impact, and how this was measured against the land acquisitions and social and environmental impacts of the project
- Boundary Street at Roseville and Warringah Road should be developed to support forecast traffic levels
- Alternative options over Roseville Bridge should be considered that would avoid tunnelling under Middle Harbour
- Recommendations that similar travel outcomes could be achieved by improving existing roads at a lower cost such as the addition of 24-hour clearways along existing roads such as Military Road and Spit Road
- Suggestions to upgrade the Spit Bridge as an alternative including raising the bridge, widening the bridge or constructing a new bridge
- Requests evidence that the initiatives to provide additional capacity along Military Road/ Spit Road corridor without major widening schemes (eg peak period parking restrictions, bus lanes, T3 lanes and reducing Spit Bridge openings) would only provide minor and short-term benefits

- The project should not proceed without having tried all the other alternatives such as reducing Spit Bridge openings
- Suggestions to construct an underpass at the intersection of the Burnt Bridge Creek Deviation, Sydney Road and Manly Road to remove the pinch point created by this intersection, similar to the underpasses at Northern Beaches Hospital along Warringah Road
- Suggestions that Wakehurst Parkway be upgraded to North Narrabeen, and Warringah Road be upgraded between Northern Beaches Hospital and Dee Why
- Suggestions to grade separate the intersections of Warringah Road and Pittwater Road, Manly Road and Sydney Road, and Warringah Road and Forestville Avenue.

### ***Response***

Alternatives that were considered as part of the project development process are detailed in Chapter 4 (Project development and alternatives) of the environmental impact statement.

Improvements to the existing arterial road network to provide additional transport capacity from the lower North Shore to the Northern Beaches are considered in Section 4.3.3 of the environmental impact statement. Options to provide additional capacity without major widening schemes have included investigations into various operational changes to the Military Road/Spit Road corridor, including tidal flow, peak period parking restrictions, introduction of bus lanes and T3 transit lanes and reductions in Spit Bridge opening times. Given the corridor-wide conflicts with existing signalised intersections and various other pinch points and constraining factors, such initiatives only provide relatively minor and short-term benefits.

The scale of surface solutions required to provide meaningful improved travel times along the existing surface arterial road corridors would be substantial and would result in unreasonable amounts of land acquisition and significant environmental and social impacts. These works would heavily impact business and communities along the entire route during construction and operation. Users of the existing surface corridors would also be considerably impacted during construction of these upgrades.

In addition, upgrading existing surface arterial road corridors, which would still remain within the urban centres of North Sydney, Willoughby, Mosman and/or Northern Beaches local government areas, would not provide comparable outcomes to the project in terms of travel time savings, capacity, reliability and enabling and accommodating growth. The project would provide a motorway bypass of Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors and major urban centres and substantially improve travel times and trip reliability for millions of freight vehicles, public transport users and other commuters who rely on the transport links of Military Road/Spit Road and Warringah Road/Eastern Valley Way each year.

Given the above, it is considered that improvements to the existing surface arterial road network would ultimately result in higher levels of impact with less benefit compared to the project.

Several surface road enhancements suggested in submissions are outside the scope of the project as they would not fulfil the strategic objectives. More generally, Transport for NSW has an extensive program of upgrades to the existing road infrastructure across Sydney to address congestion and improve travel times. These projects are considered complementary because they would improve the capacity of Sydney's existing motorway and arterial road network, but they would not provide the necessary additional transport capacity between the Northern Beaches and other key centres.

### C3.3 Assessment of corridor alternatives

#### *Issue raised*

Submitters raised concerns regarding the corridor alternatives provided by the project and suggested alternatives, including:

- Concerns that the preferred alternative is the shortest route and only the ease for drivers has been considered
- The alignment should be reconsidered to reduce the reliance on the Warringah Freeway and the need for multiple temporary construction support sites in built up areas. Suggestions that an alternative route such as following the Warringah Freeway corridor further north should be considered
- Suggestions that negatives associated with the red corridor alternative regarding Condamine Street and Sydney Road surface roads are not accurate as both roads have adequate capacity without needing to be widened. The red corridor alternative would also remove the need for traffic lights on the Burnt Bridge Creek Deviation
- Objections to the tunnel alignment passing under Cammeray and Northbridge. Submitters questioned why the underground tunnel route is not as originally proposed under Castlecrag and note that some of this land is still vacant. Other alignment suggestions include under Bantry Bay (from Northbridge)
- The project does not serve the northern part of the Northern Beaches from Manly Vale up to Palm Beach, despite most of the traffic coming from north of Manly Vale. Suggestions that the tunnels should extend to Manly Vale, North Manly, Brookvale or Dee Why to address existing traffic pressures
- Suggestions for smaller tunnels with more portals to spread traffic throughout the Northern Beaches instead of funneling traffic to arterial roads. Concerns that there are insufficient entry/exits to the tunnels for residents of the Manly, Fairlight and Balgowlah areas
- Concerns that the project does not connect with existing road network infrastructure on the Northern Beaches
- Suggestions to build the tunnels under Military Road
- The project does not extend sufficiently far north to the Pacific Highway and Chatswood. Suggestions to extend the Western Harbour Tunnel to go beyond Chatswood with portals on the Pacific Highway, and to replace the Beaches Link tunnel with an east-west tunnel under Chatswood between Roseville Bridge and the Delhi Road interchange at the M2 Motorway to improve east-west traffic flow and support future growth in western Sydney
- East to west alternatives should be considered
- Alternatives should be considered that direct as much traffic as possible into/from the WestConnex network
- Comments that Spit Bridge is the main problem and the project should only provide a tunnel under Spit Bridge or a tilt lock under the Spit Bridge should be considered
- Objections to two tunnel entrances in the Seaforth, Manly Dam, Balgowlah and Manly Vale area; both are not considered necessary
- An alternative to the project would be to complete the North West Freeway from the CBD to the M2 Motorway, which would allow for counter peak flows and is only missing sections of tunnel under Drummoyne and Lane Cove and bridges across water

- Objections to the project because it departs from the previous plans for a North West Freeway and Warringah Freeway to the Northern Beaches. The Western Harbour Tunnel and Beaches Link program of works is considered unsuitable for the Northern Beaches.

### ***Response***

#### General approach to assessment of corridor alternatives

The process for selection of the preferred tunnel alignment included consideration of broad corridors, and detailed assessment of five shortlisted strategic corridors, as discussed in Section 4.4 and shown in Figure 4-7 to Figure 4-13 of the environmental impact statement. Corridor alternatives were assessed against the evaluation criteria shown in Figure 4-6 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. These included connectivity, transport network performance, constructability, design, community, environmental and economic criteria specific to the scope item and area being considered.

The preferred corridor provides strong connectivity and lower amenity and environmental impacts, smaller construction footprint compared to other alternatives reducing exposure to poor geology, reducing construction risk, cost and program duration.

The evaluation criteria included providing a faster connection for freight, public transport and other road users, minimising construction duration and providing value for money. A shorter alignment would generally be more likely to achieve these objectives than a longer alignment.

#### Moving the tunnels further north on the Warringah Freeway

The green corridor alternative considered a connection to the Warringah Freeway further north than the preferred alignment, as shown in Figure 4-7 of the environmental impact statement. A disadvantage of this alignment is that it would require widening of the Gore Hill Freeway corridor, which would cause substantial private property impacts and significant traffic staging during construction. Shortening the length of the tunnel would also generate steeper grades impacting on journey experience and efficiency of the road.

#### Disadvantages of the red corridor alternative

The red corridor alternative is shown in Figure 4-8 of the environmental impact statement. The red corridor alignment features a tunnel alignment that broadly follows the Military Road/Spit Road corridor and at its western end, would surface at a signalised intersection at the Falcon Street interchange on the Warringah Freeway, and at its eastern end would connect to Condamine Street at Manly Vale. The key disadvantages of the red corridor alternative were the unacceptable construction impacts associated with the required construction method across Middle Harbour, traffic management issues associated with Sydney CBD-bound traffic at Falcon Street and widening of Sydney Road as well as private property impacts, as discussed in Section 4.4.2 of the environmental impact statement. Widening of Condamine Street with associated property acquisitions through to Sydney Road would be required to accommodate traffic travelling to and from the tunnels at Balgowlah, Balgowlah Heights, Seaforth, Fairlight and Manly.

#### Disadvantages of a tunnel alignment under Castlecrag

The green corridor alternative includes a tunnel alignment under Castlecrag and is shown in Figure 4-7 of the environmental impact statement. The key disadvantages of the green corridor alternative were the steep grades required to connect to the Wakehurst Parkway and Burnt Bridge Creek Deviation, which would impact journey experience and efficiency of the road, and the number of residential properties that would need to be acquired, as discussed in Section 4.4.2 of the

environmental impact statement. A specific disadvantage of a tunnel alignment under Castlecrag compared to under Cammeray and Northbridge is that there are limited opportunities for a viable intermediate tunnelling site, which significantly impacts the construction cost, program and risk.

#### Extension of the tunnels north of Balgowlah

Extension of the tunnels further north into the Northern Beaches would be cost prohibitive and not provide value for money.

Transport for NSW has an extensive program of upgrades to the existing road infrastructure across Sydney to address congestion and improve travel times. Information on these projects can be found on the Transport for NSW website [www.transport.nsw.gov.au/projects/current-projects](http://www.transport.nsw.gov.au/projects/current-projects). These projects are considered complementary because they would improve the capacity of Sydney's existing motorway and arterial road network, but they would not provide the necessary additional transport capacity between the Northern Beaches and other key centres.

#### Providing more tunnel portals and connections to non-arterial roads

As noted above, extending the tunnels further north into the Northern Beaches would not provide value for money.

Surface connections to the tunnels require a large area of land for construction of the ramps and to provide connections to the existing surface road network. Providing additional tunnel portals would increase the property and other construction impacts as well as the cost of the project, without increasing the number of vehicles that use the tunnel.

The tunnel portals connect to existing arterial roads to minimise the impacts of the operation of the project to the existing road network. It also for construction vehicles to access the tunnel from arterial roads.

#### Locating the tunnels under Military Road

Tunnel alignments that broadly follow the Military Road corridor were considered as part of the red, purple and pink corridor alternatives shown in Figure 4-8, Figure 4-9 and Figure 4-10 of the environmental impact statement respectively. These alternatives were not preferred due to topography, private property and existing network constraints that impacted the viability of surface level connections to the tunnel and difficulty in establishing intermediate tunnelling sites. These alternatives also resulted in poorer connectivity to the Gore Hill Freeway for east-west trips, reduced benefit to Warringah Road and additional pressure through Naremburn Cut.

The project follows the blue corridor alternative (preferred) and improves network performance by providing east-west linkages, delivers the highest benefits to Warringah Road and results in lower traffic volumes through Naremburn Cut compared to the red, purple and pink corridor alternatives.

#### Extending the tunnels to Chatswood

The project has been designed to connect to the existing motorway network in the most efficient way possible to minimise the cost and environmental impacts as well as maximise value for money by efficiently connecting with the existing motorway network. Accordingly, the tunnels connect to the Gore Hill Freeway to provide efficient access to Macquarie Park via the Lane Cove Tunnel and M2 Motorway to support improved access to north-western Sydney. Improved access to Chatswood would also result as the project would reduce congestion on the Warringah Road corridor.

If the tunnels were to extend to Chatswood, the project would require significantly more property acquisition and construction costs and the efficiencies gained by connecting to the existing Gore Hill Freeway corridor would be lost.



### East to west alternatives

The project has been designed to provide motorway standard connectivity for both east-west journeys between the Northern Beaches and employment centres such as Macquarie Park and along the M2 corridor (as discussed in the response above), and north-south journeys including to and from the Sydney CBD. This is key to improving travel times for both north-south and east-west road journeys to and from the Northern Beaches, and alleviating congestion on a number of arterial roads in northern Sydney that are used for these journeys, including Military Road, Spit Road, Warringah Road, Boundary Street and Eastern Valley Way.

Replacing the Beaches Link tunnel with an east-west tunnel between Roseville Bridge and the Delhi Road interchange at the M2 Motorway would not address the congestion that occurs along the Military Road/Spit Road corridor.

### Connection to WestConnex

The project would connect to the Western Harbour Tunnel, which will join the M4-M5 Link at Rozelle. The Western Harbour Tunnel will substantially improve accessibility, travel times and travel reliability across Sydney Harbour as a result of vehicles using the tunnel in preference to existing surface routes including Sydney Harbour Bridge, ANZAC Bridge, and the Western Distributor. The underground connections between Western Harbour Tunnel and the M4-M5 Link would also enable traffic to avoid the surface road network and enable direct access to WestConnex.

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 would provide surface connectivity between the M8 and M4 corridors and Victoria Road, The Crescent, City West Link, ANZAC Bridge and underground motorway to motorway connectivity to and from Western Harbour Tunnel and onward to Beaches Link.

### Spit Bridge

Solely tunnelling underneath the Spit Bridge or removing the need to open the Spit Bridge for marine traffic through a tilt lock would not alleviate congestion on surrounding arterial roads and broader pinch points and congestion issues in the Northern Beaches. The region is particularly reliant on the southernmost corridors: Warringah Road via Roseville Bridge and Military Road/Spit Road via the Spit Bridge. Currently, these links carry 71 per cent of all interregional road journeys to and from the Northern Beaches, with traffic demand forecast to increase by about 10 per cent by 2037. The heavy demand on these corridors results in them being highly congested during peak times, and journeys that rely on them are highly susceptible to delays caused by incidents.

### Connections to Wakehurst Parkway and the Burnt Bridge Creek Deviation

Providing connections to both Wakehurst Parkway and the Burnt Bridge Creek Deviation would provide connectivity for residents and businesses in the north and south of the Northern Beaches peninsula respectively, as discussed in Section 4.4.3 of the environmental impact statement.

An explanation of why Wakehurst Parkway is suited for connection to a motorway is provided in Section 4.5.4 of the environmental impact statement. New tunnelled connections to and from Wakehurst Parkway would provide a strategic link between the Northern Beaches Hospital Precinct and centres in the upper Northern Beaches, and key centres across Greater Sydney. This would greatly improve connectivity for the northern areas of the Northern Beaches and assist in reducing demand for the Warringah Road, Roseville Bridge and Eastern Valley Way corridors.

The Balgowlah connection would link the Beaches Link tunnels and the eastern area of the Northern Beaches peninsula, including Seaforth, Balgowlah, North Balgowlah, Manly and Brookvale, as discussed in Section 4.5.5 of the environmental impact statement.

### North West Freeway

The Western Harbour Tunnel and Beaches Link program of works is proposed as part of the NSW Government's implementation of the *Future Transport Strategy 2056* (NSW Government, 2018), which is a plan that sets the 40 year vision, directions and outcomes framework for customer mobility in NSW. The program of works would provide additional road network capacity across Sydney Harbour and Middle Harbour thereby improving transport connectivity with Sydney's Northern Beaches.

The North West Freeway was abandoned by the NSW Government in the 1970s and is not included in the *Future Transport Strategy 2056*. The North West Freeway is not a viable alternative to the project as it would not deliver the same level of connectivity improvements to the Northern Beaches or effectively address traffic congestion along the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors.

## **C3.4 Assessment of project alternatives**

### **C3.4.1 Tunnelling method**

#### ***Issue raised***

Submitters raised concerns regarding the tunnelling alternatives considered for the project and suggested alternatives, including:

- Concerns that of the potential advanced engineering methods considered, the cheapest and most environmentally damaging option is preferred
- Suggestions that tunnel boring machines be used to construct the tunnel
- Concerns that an immersed tube design was assessed and not selected by Sydney Metro - Chatswood to Sydenham, due to the high contamination risks to Sydney Harbour. Requests for the reconsideration of the immersed tube methodology at Middle Harbour and consideration of a tunnel through the bedrock or a submerged floating tunnel in order to not disturb contaminated sediment.

#### ***Response***

#### Preferred tunnel construction method

The process for selection of the preferred tunnel construction method included the development and evaluation of several 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 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 tunnel projects in 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.

The majority of the tunnelling for the project is expected to be constructed through high quality Hawkesbury Sandstone. The favourable Hawkesbury Sandstone geology combined with the requirement for a wide but lower height cross-section are the key variables that have combined to

make roadheaders the most efficient and cost effective method for delivering motorway tunnels in Sydney.

Tunnel boring machines are much larger than roadheaders, and use a circular rotating cutting head that houses many individual cutting tools. Due to the circular cutting head, tunnel boring machines excavate and produce a circular tunnel cross-sectional area that is around 50 per cent larger than required for the project.

The indicative cross-sections of the Beaches Link tunnel if roadheaders or tunnel boring machines are used are shown in Figure 4-15 of the environmental impact statement. This diagram demonstrates that the cross-section required for a modern motorway does not fit efficiently within the circular cross-section provided by a tunnel boring machine. This geometric challenge creates several practical obstacles to the deployment of tunnel boring machines for the Beaches Link tunnel:

- Substantial increase in spoil generation, increasing spoil trucks on the road by around 50 per cent
- Need for substantial increase in heavy haulage associated with transport of large pre-cast segments required for the tunnel boring machine method of tunneling
- Increased construction activity, as following excavation, the pavement level within the tunnel needs to be raised and backfilled with re-handled spoil back up to the widest point in the cross-section
- Tunnel boring machines 16 metres in diameter and larger are rare as a tunnelling solution, as tunnel boring machines of this size significantly increase engineering complexity thereby increasing construction cost and risk
- Tunnel boring machines are typically not preferred where there are multiple major changes in cross-section or geology. These occur at several locations along the Beaches Link alignment. This means that roadheaders would still be required to build access tunnels from intermediate sites to construct the caverns where ramps merge and diverge from the tunnels under Northbridge and Seaforth, and at either side of the harbour crossing.

When considering the above issues, these contribute to a significant increase in construction time and cost and roadheaders emerge as the preferred tunnelling methodology for all tunnelling north and south of the Middle Harbour crossing.

#### Sydney Metro tunnelling methodology

The Sydney Metro tunnelling methodology using tunnel boring machines is discussed in Section 4.5.1 of the environmental impact statement.

To allow for tunnelling in many different types of geology, there are many different types of tunnel boring machines. With no one type of machine ideally suited to tunnelling through both rock and soft ground, major changes in geology, such as the transition to the soft sediments found beneath Middle Harbour, or the highly fractured rock below this, would require a different type of tunnel boring machine to the landside tunnels being constructed through Hawkesbury Sandstone.

This is best demonstrated by the construction method adopted for construction of the new Sydney Metro crossing of Sydney Harbour, where the poor geology under Sydney Harbour required a different type of tunnel boring machine to the landside tunnels. Accordingly, the Sydney Metro City & Southwest project used five tunnel boring machines – two north and two south of the harbour to complete tunnelling through rock, with one specialised machine for the crossing of Sydney Harbour. This required the establishment of large shafts at Barangaroo and Blues Point either side of Sydney Harbour to launch, retrieve and support the tunnel boring machine for the harbour crossing.

At about seven metres in diameter, the tunnel cross-section required to deliver a metro rail tunnel is well suited to a small diameter tunnel boring machine. In contrast, at 15.5 metres wide, a modern three lane motorway tunnel requires a wide, but stout cross-section. This does not fit very efficiently into a circular cross-section, meaning that delivering a motorway with a tunnel boring machine requires considerably larger machines than employed on metro rail projects. This means that the tunnel boring machine required to deliver each Beaches Link tunnel would have an area five times that of a machine used to construct the Sydney Metro City & Southwest tunnels.

As discussed above, roadheaders are the preferred tunnelling methodology for the project.

It should also be noted that the geology of Middle Harbour differs to that of Sydney Harbour. Middle Harbour geology is discussed further below.

### Immersed tube tunnels

The major change in geology beneath Middle Harbour introduces a constructability challenge that is very different to the alignment north and south of the harbour. Compared to the bedrock either side of the harbour, the rock beneath Middle Harbour is very deep below the softer sediments on the bed of the harbour and characterised by fracturing and is therefore prone to major water ingress under pressure. Given the depth and pressure, this creates a challenging tunnelling environment. Without suitable mitigation measures, major water ingress issues would be likely to arise during construction using a driven or bored tunnelling method. This was observed during construction of the Northside Storage Tunnel beneath Middle Harbour in the late 1990s using a tunnel boring machine. These water ingress issues are normally controlled and managed through pre-grouting ahead of tunnelling operations where required and installing appropriate waterproof linings following tunnel excavation. Despite utilising forward grouting on the Northside Storage Tunnel project, the project encountered considerable water ingress during construction due to cracking of grout from initial rock relaxation along with substantial water pressures at depth.

Immersed tube tunnels are proposed to cross Middle 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 advantages of the immersed tube tunnel method (as described in Table 4-4 of the environmental impact statement) include:

- Provides the shallowest possible tunnel alignment at the Middle 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
- Has lower construction and operational costs when compared to alternative methodologies
- Minimises logistics and the size of waterside sites when compared to those required to launch roadheaders or large diameter tunnel boring machines
- Substantially 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 revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report) and included in a dredge management plan (refer to Section D1.1 of this submissions report).

### **C3.4.2 Warringah Freeway connection alternatives**

#### ***Issue raised***

Submitters raised concerns regarding the connections provided by the project and suggested alternatives, including:

- Requests that the surface connection is relocated to reduce local traffic impacts and protect amenity and sustainable transport in North Sydney
- Requests that on/off ramps in the Naremburn area be moved further north, away from schools
- Requests for portals to be moved elsewhere in the Naremburn area, away from CBD locations to suburbs
- Suggestions for additional tunnel portals at Northbridge, Cremorne, Mosman and Balmoral to reduce traffic on Military Road
- Requests for a connection from Eastern Valley Way and/or Sailors Bay Road to provide direct access for residents of Northbridge, Castlecrag, Middle Cove, Castle Cove and Willoughby.

#### ***Response***

The location and design of the portals were developed to satisfy transport objectives while minimising potential environment, property and community impacts.

#### **Justification for the preferred surface connection alternative at Cammeray**

Warringah Freeway connection alternatives that were considered during the development of the project design are discussed in Section 4.5.2 of the environmental impact statement. Both an underground interchange and a surface interchange were considered for the Beaches Link tunnel. Consideration of the alternatives for the surface connection took into account the location and configuration of ramps, potential connections with existing infrastructure and minimisation of environmental, community and property impacts. The preferred surface connection alternative at Cammeray takes advantage of the width of the Warringah Freeway, sympathetic topography and provides the connectivity required to service key origins and destinations, while minimising private property impacts and disruption to the local community. The surface connection would also integrate with the Western Harbour Tunnel and Warringah Freeway Upgrade project, ensuring that the location and extent of ramp connections and portals, as well as the preferred construction methodology, could be optimised between the projects, reducing disruption to the local community as much as possible.

#### **Connections to local centres at Northbridge, Cremorne, Mosman, Balmoral, Castlecrag, Middle Cove, Castle Cove and Willoughby**

The project objectives are outlined in Section 3.4 of the environmental impact statement. It is not an objective of the project to provide new connections to local centres on the lower North Shore.

The objective of the project with regards to these local centres is to improve amenity and safety by reducing congestion, through-traffic and 'rat runs'. The project would achieve this objective by reducing through traffic along the Spit Road/Military Road and Warringah Road/Eastern Valley Way corridors.

### **C3.4.3 Gore Hill Freeway connection alternatives**

#### ***Issue raised***

Submitters made suggestions regarding the connection to the Gore Hill Freeway, including:

- To improve the performance of the Pacific Highway, suggestions for an additional southbound link lane from the Pacific Highway to the Gore Hill Freeway and other changes that would allow access to the Beaches Link and encourage traffic to use the Pacific Highway rather than traveling via Artarmon village
- Suggestions to add an additional link from the tunnel to the Pacific Highway and Longueville Road
- Suggestions that two right hand turn lanes are added for Pacific Highway northbound traffic to turn onto the Gore Hill Freeway
- Suggestions that the surface connection should be moved to the east and centre of the Gore Hill Freeway so that emerging traffic would be provided the full range of destinations presently available and avoid closing Dickson Avenue east of Reserve Road. This change would avoid redirection of traffic from the Pacific Highway and Longueville Road into Artarmon.

#### ***Response***

##### Additional connections to the Pacific Highway

The project has been developed over several years by a team of subject matter experts with direct experience in the design and construction of major infrastructure within urban environments and in order to meet the project objectives. An overview of the development process and options considered as part of this process is provided in Chapter 4 (Project development and alternatives) of the environmental impact statement. The project design provides access to and from the Artarmon industrial area and wider residential areas, to St Leonards/Crows Nest and to the Pacific Highway and Gore Hill Freeway/Lane Cove Tunnel. This east-west connectivity to key employment and residential areas, including to the north west (for example Macquarie Park), is an important function of the project design.

While the various suggested alternatives for connection to the Pacific Highway, have not been assessed in detail as part of the project's development process, they would generally present the following potential impacts and challenges:

- Increased property impacts, due to the requirement to widen the Pacific Highway to accommodate new portals/ramps/lanes
- Significant cost increases, due to additional tunnelling required, additional structural elements and associated property acquisition costs
- Additional constructability challenges and impacts due to the highly constrained works areas
- Likely decreased traffic performance (compared to the proposed design), due to the requirement to construct additional infrastructure in an already congested corridor
- Potentially increased duration of work due to additional tunnelling, work in a constrained corridor and during limited (off-peak) traffic periods.

Considering the above challenges, these options are not considered to be desirable alternatives to the current project design.

#### Suggested changes to the surface connection at Gore Hill Freeway

Moving the surface connection to the centre of the Gore Hill Freeway would likely require widening of the freeway as a result of users travelling between Beaches Link and Lane Cove Tunnel. Widening works would also present substantial engineering challenges and resulting community impacts if widening is required at the Naremburn Cut. Additionally, widening of the Gore Hill Freeway would also likely require significant acquisition of residential and commercial properties. This option is therefore not considered to be desirable when compared to other options.

#### ***Issue raised***

Submitters raised concerns and made suggestions regarding the connection to Reserve Road, including:

- Concerns that the project would worsen traffic on Reserve Road and connecting roads, and that this would not be adequately ameliorated by the proposed traffic changes on Reserve Road
- Suggestions that the Reserve Road interchange should be upgraded as part of the project due to existing congestion. A 'diverging diamond' interchange to optimise the turning capacity from Reserve Road onto the Gore Hill Freeway, Beaches Link tunnel, Lane Cove Tunnel and Longueville Road is suggested
- Suggestions for an additional southbound traffic lane on Reserve Road, to reduce queuing at the interchange, similar to the additional northbound lane proposed as part of the project
- Suggestions to remove the right turn from Reserve Road into Dickson Avenue westbound to maximise southbound traffic flows on Reserve Road and improve the performance of the intersection of Reserve Road and Barton Road. Traffic accessing the Artarmon industrial area could turn right at Carlotta Street where a roundabout or traffic lights could be installed
- Suggestions to allow two lanes of traffic to turn right from Reserve Road onto the Gore Hill Freeway and Beaches Link tunnel eastbound and two lanes of traffic to turn right from Reserve Road onto the Gore Hill Freeway and Longueville Road westbound
- Suggestions to add an exit at the Reserve Road-Dickson Avenue intersection, to provide a direct link to the Gore Hill Freeway's Pacific Highway and Longueville Road off ramp, with associated cycle lane realignment.

#### ***Response***

#### Suggested changes to the design of the project at the Reserve Road interchange

The design of the project at the Reserve Road interchange has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. The proposed design is also cognisant of the highly constrained urban nature of the area around Reserve Road, including spatial constraints, property impacts and the local traffic network. The traffic forecasting and modelling carried out for the project indicates that the currently proposed scope of the Reserve Road interchange, including widening south of the Gore Hill Freeway to accommodate required turn movements, would efficiently accommodate forecast traffic. Traffic forecasting and modelling does not suggest that further local road network modifications are required to mitigate project-related impacts.

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, in

accordance with environment management measure OT1 (refer to Table D2-1 of this submissions report). Any proposed changes as a result of this review would be considered in line with the process outlined in Section 2.3 of the environmental impact statement.

#### **C3.4.4 Wakehurst Parkway connection alternatives**

##### ***Issue raised***

Submitters raised concerns regarding the connection of the tunnels at Wakehurst Parkway and suggested alternatives, including:

- Suggestions to move the surface connection at Wakehurst Parkway further north (for example to Warringah Road) to minimise traffic noise and emissions impacts to nearby residents, utilise existing topography and mitigate the removal of bushland and Aboriginal heritage areas either side of Wakehurst Parkway
- Concerns that the choice of portal location option B over portal location option C at Wakehurst Parkway was to save costs and did not consider the community
- Suggestions for an additional slip road to the surface connection at Wakehurst Parkway to support residents in north Seaforth and North Balgowlah accessing the tunnels.

##### ***Response***

A range of alternatives were considered for the connection to Wakehurst Parkway, including the location of the tunnel portals along Wakehurst Parkway, as discussed in Section 4.5.4 of the environmental impact statement. A portal location further north along Wakehurst Parkway (option C) was considered as shown in Figure 4-21 of the environmental impact statement. Constraints to constructing the tunnel portal further north include mobility and access to and from work areas within the Wakehurst Parkway roadway corridor and lack of space for temporary construction support sites, material laydown and processing along the Wakehurst Parkway corridor. Additionally, a surface connection located further north would have more sustainability and cost impacts associated with the construction and operation of a longer tunnel including energy, water and materials use, the creation of spoil and related construction haulage impacts.

A 'turn around' option was considered to provide access to and from the northern part of Seaforth. This option would have involved an underpass and ramps that would allow Seaforth residents to get to and from the tunnels. This option was modelled, however the demand was predicted to be extremely low due to the distance to be travelled combined with the bypass of the southern portion of Wakehurst Parkway and its connection at Balgowlah. As a consequence, satisfactory access for Seaforth and North Balgowlah residents is provided via Frenchs Forest Road/Sydney Road and the new access road connected to the Burnt Bridge Creek Deviation and the Beaches Link portal.

#### **C3.4.5 Balgowlah connection alternatives**

##### ***Issue raised***

Submitters raised concerns regarding the connection of the tunnels at the Burnt Bridge Creek Deviation at Balgowlah and suggested alternatives, including:

- Concerns that the assessment behind Figure 4-33 of the environmental impact statement is arbitrary and not objective, which swayed alternatives away from surpassing the selected design. It is not clear why Alternative 5 is less aligned with project development considerations than Alternative 4c. Alternative 5 is considered to be preferable
- Concerns regarding the assessment of the Balgowlah connection alternatives in Table 4-9, Table 4-10 and Table 4-16 of the environmental impact statement, with some categories being



considered to be under or over weighted within the assessment. Concerns that benefits are selectively mentioned

- Concerns about the future of Burnt Bridge Creek and suggestions that an alternate route is found for the construction of the tunnel to save the creek
- Concerns that the project's impacts on Burnt Bridge Creek are not being compensated for elsewhere in the design
- Suggestions that the tunnel portals should be moved north along the Burnt Bridge Creek Deviation including to the north of the Kitchener Street overbridge
- Suggestions to widen Sydney Road from the intersection of Sydney Road and Manly Road east to Maretimo Street and two short, steep, one lane tunnels descending to the northbound and southbound mainline tunnels from this location
- Suggestions that no access be provided from Sydney Road to the tunnels
- Suggestions that an access tunnel be built from one lane on Sydney Road into the tunnel similar to the access tunnel from the Pacific Highway westbound into the Lane Cove Tunnel
- Requests to redesign the surface connection at Balgowlah to reduce the footprint of the project, including the use of vertically stacked ramps (on and off ramps that are built one above the other).

### ***Response***

The Balgowlah connection designs have evolved between 2016 and 2020 from concept design through to reference design and were guided by key project objectives for the Balgowlah area. The specific key objectives for the Balgowlah area were refined through community and stakeholder inputs between 2018 and 2020 and are outlined in Table 4-7 of the environmental impact statement. The design process included consideration of around 37 road and tunnel alignment options which were initially checked on suitability against the key project objectives. Eleven of those design options were elevated beyond initial checks and were considered and reviewed in more detail against the key project objectives for the Balgowlah area and with comparison against previous preferred design iterations. The reference design taken through to the environmental impact statement was the preferred design which was selected after comparison against the other ten alternatives.

Balgowlah connection alternatives are further discussed in Section 4.5.5 of the environmental impact statement.

### **Evaluation of the Balgowlah connection alternatives**

As discussed above, the specific key objectives of the project for the Balgowlah area are outlined in Table 4-7 of the environmental impact statement. Categories for consideration of the best design option included traffic and transport, environment and heritage, community, flooding, constructability and engineering and cost. Alternative design options were assigned a colour coded ranking for each category to identify whether the option aligned with the project development considerations. For connections to Sydney Road, various alternatives were evaluated as part of the project development. The design selection process was extensive and thorough to reach the final selected preferred alternative of north facing tunnel ramps to the Burnt Bridge Creek Deviation with a short access road to distribute traffic and connect to the new and improved open space and recreation facilities at Balgowlah Golf Course. The design selection process was progressive as it developed and adapted to accommodate important inputs from the community and key stakeholders over the period between 2017 and 2020.

Each alternative was assigned a ranking for each category to identify whether it aligns with the project development considerations, as per the colour coding shown below Table 4-7 of the environmental impact statement. Assessment of these rankings were made through an extensive design alternatives process that was carried out by a multi-disciplinary team over several years comprising design, constructability, and environmental specialists with direct experience in delivering major infrastructure projects in Australian and NSW contexts.

A visual representation of how each of the 11 Balgowlah connection alternatives perform against one another and the key objectives of the project for the Balgowlah area using the colour coded rankings mentioned above is provided in Figure 4-33 of the environmental impact statement. This table is based on the analysis of each alternative provided in Table 4-8 to Table 4-18 of the environmental impact statement. Alternative 4c (the preferred alternative) performs the same or better than alternative 5 in all of the categories considered for the reasons summarised below and as further detailed in Table 4-13 and Table 4-14 of the environmental impact statement:

- Reduced property acquisition and associated disruption eg on Condamine Street
- Efficient distribution of traffic to the local area and beyond
- Reduced environmental impacts of Burnt Bridge Creek
- Reduced flooding risk at tunnel portals during construction and operation
- Reduced staging complexity for construction within the Burnt Bridge Creek Deviation portals
- Better value for money with reduced tunnelling and associated cost and time
- Opportunity to access the new open space and facilities earlier
- Removes impacts on existing Kitchener Street Bridge.

A summary of the evaluation of the Balgowlah connection preferred alternative is provided in Table 4-19 of the environmental impact statement. The benefits of the preferred alternative include that it would improve local traffic network performance, minimise impacts to Burnt Bridge Creek and flora and fauna and reduce the length of tunnel required and the associated haulage of spoil.

#### Impacts of the preferred corridor at Burnt Bridge Creek

Minimising the impacts of the preferred corridor at Burnt Bridge Creek was a key objective for the Balgowlah connection to the tunnels, as identified in Table 4-7 of the environmental impact statement. Only two of the 11 alternatives (alternative 4c and alternative 5) investigated for the Balgowlah connection were fully consistent with the objective of minimising impacts to the creek, as shown in Figure 4-33 of the environmental impact statement. Alternative 4c was selected as the preferred Balgowlah connection alternative for the reasons identified in Table 4-19 of the environmental impact statement.

#### Locating the tunnel portals north of the Kitchener Street overbridge

Tunnel connections to the Burnt Bridge Creek Deviation in the vicinity of the Kitchener Street overbridge were considered in Alternatives 7, 8 and 9, which are shown in Figure 4-30, Figure 4-31 and Figure 4-32 and evaluated in Table 4-16, Table 4-17 and Table 4-18 of the environmental impact statement respectively. All three options had poor local traffic network performance and would require additional vegetation clearing and property acquisitions and cost more than the preferred option providing reduced value for money.

Surface connections to the north of Kitchener Street (without an Access Road) would have a significant impact on Condamine Street which would then be required to distribute traffic to and from the project and the greater Manly area. Significant impacts would include multiple additional

property acquisitions and associated disruption to facilitate required traffic adjustments and resultant project cost increase implications.

#### On ramp and off ramp from Sydney Road into the tunnels

The suggestions from the community for an on ramp and off ramp from Sydney Road at Balgowlah into the mainline tunnels are not considered feasible in respect of the environmental impacts compared to the benefits they deliver. These impacts would include significant commercial and private property acquisitions and associated disruptions on Sydney Road, poor access between Seaforth and the tunnels if the Sydney Road tunnel portal were to face directly to the east, significant staging and utility relocation challenges for a tunnel portal in Sydney Road, direct impacts to Northern Beaches Secondary College Balgowlah Boys Campus and significant additional construction and operational costs for additional tunnel connections to and from Sydney Road.

#### Vertically stacked ramps

The suggestion to vertically stack the underground on ramp and off ramp would still require a similar area at the surface to make connections between the on ramp and off ramp and surface roads, so the footprint of the surface works would be unchanged. Also, a disadvantage of vertically stacked ramps is that they do not provide level cross passage connections for emergency egress or emergency vehicle crossover. This would result in a lower level of safety for road users and operational staff during potential emergency situations.

### **C3.4.6 Ventilation alternatives**

#### ***Issue raised***

Submitters made a suggestion that the ventilation design of the tunnel should be transverse and not longitudinal.

#### ***Response***

A response to this issue is provided in Section C11.4.6 of this submissions report.

## **C3.5 Active transport**

### **C3.5.1 Active transport at North Sydney, Cammeray, Naremburn and Northbridge**

#### ***Issue raised***

Submitters raised concerns and made suggestions regarding active transport to be provided as part of the project at North Sydney, Cammeray, Naremburn and Northbridge, including:

- Concerns that there is no mention of improving pedestrian and cyclist links across and beyond the North Sydney local government area. Active transport and supporting infrastructure from Naremburn and Cammeray to Miller Street at North Sydney, and on to Sydney CBD via the Sydney Harbour Bridge, should be encouraged and provided
- The project should be conditioned to deliver the North Shore Cycleway as part of the project
- East to west active transport routes over the Warringah Freeway should be considered as part of the project
- A pedestrian footbridge or underground walkway should be constructed at Brook Street, near Merrenburn Avenue to ensure safety of those crossing the road
- Requests that as part of remediation activities, a bridge is built straddling the point between the intersection of Alpha Road and Sailors Bay Road, and Brook Street and Grafton Avenue

- The existing cycleway that terminates at Merrenburn Avenue should be extended to West Street at an equivalent standard including protection from the motorway and total separation from vehicles through an overpass bridge.

### **Response**

#### **Active transport infrastructure at North Sydney**

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. As noted above, by providing additional motorway capacity and bypassing communities underground, the project would reduce through traffic volumes in many areas and improve amenity in these areas. Through changing trip patterns and reduced demand on some routes, the project would provide the opportunity for Transport for NSW network management teams and other stakeholders, including councils, to investigate further opportunities for urban renewal, public transport, active transport and changes to transport management on key corridors.

The capacity and configuration work proposed in North Sydney CBD as part of the Western Harbour Tunnel and Beaches Link program are considered to provide an equitable outcome from the perspective of maintaining a balanced and integrated transport network through North Sydney. However, further refinements and changes to network operations within the North Sydney CBD may occur as part of the North Sydney Integrated Transport Program (North Sydney Program) works. 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. Led by Transport for NSW since 2018, it aims to deliver a shared place-based vision for the North Sydney CBD, with validation of the vision for North Sydney currently underway.

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 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 that supports the globally connected 'Harbour CBD' and enables delivery of befitting place-based outcomes.

It is also noted that Transport for NSW is also working with local council and other government stakeholders to develop a place based transport plan for the lower North Shore, which would identify potential transport opportunities to respond to the changing needs of the community, including movement types, and initiatives for mode shift and network operation across all transport modes. The development of the plan would consider the transport needs for the area based on transport and land use changes within the area, including their purpose, connections between centres and modal priority, eg light vehicle, freight, buses and cyclists, and changes to the transport network as a result of major infrastructure projects currently proposed and being delivered in the area. Transport for NSW is commencing engagement with North Sydney Council, Willoughby City Council, Mosman Council and Lane Cove Council in the last quarter of 2021.

In summary, Transport for NSW will continue to work closely with North Sydney Council and 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 Western Harbour Tunnel and Beaches Link program of works. This includes improvements to pedestrian and cyclist links within the broader North Sydney local government that are beyond the scope of the

project. Community consultation would also be carried out. Issues raised by the community would be considered in any final decision to refine the project.

The proposed North Shore Cycleway and Streetscape Upgrade is an initiative of North Sydney Council working in partnership with the NSW Government. The proposed North Shore Cycleway is not part of the scope of the project and the proposed route would not be impacted by the project.

#### Connectivity across Warringah Freeway

As part of the broader Western Harbour Tunnel and Beaches Link program of works, the Western Harbour Tunnel and Warringah Freeway Upgrade project would provide new and upgraded active transport infrastructure in the vicinity of the Warringah Freeway, as discussed in Section 9.4.2 of the environmental impact statement. A new dedicated cycleway would be provided along the eastern side of the Warringah Freeway between Miller Street at Cammeray and Falcon Street, as well as a number of new and upgraded shared user bridges, which would provide connectivity across the Warringah Freeway.

#### Active transport infrastructure at Naremburn and Northbridge

The inclusion of additional bridges and underpasses generally require a lot of space and introduce significant impacts in constrained environments. Additionally, they are less preferable to at-graded crossings due to accessibility and desire line issues. The project is expected to reduce traffic demand on Brook Street. Further, there are existing signalised crossings of Brook Street at Merrenburn Avenue and Alpha Road at Sailors Bay Road. As such, a pedestrian bridge or underpass would not be required near Merrenburn Avenue, Grafton Street or at the intersection of Alpha Road and Sailors Bay Road, with the existing signalised crossings providing an alternative, which is preferable from a connectivity, safety and accessibility perspective.

The project is also not expected to increase demand on the Warringah Freeway at the Brook Street interchange and, therefore, new cyclist infrastructure would not be required between Merrenburn Avenue and West Street to mitigate the impacts of the project.

However, as required by environmental 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.

Councils may 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* (NSW Government, 2018), 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 [www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program](http://www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program).

### **C3.5.2 Active transport at Gore Hill Freeway**

#### ***Issue raised***

Submitters suggested improvements regarding active transport to be provided by the project, including:

- Amendments to the Gore Hill Freeway shared user path:
  - Along the Beaches Link off ramp to Reserve Road the shared user path should be diverted to the alignment at Punch Street and Taylors Lane cycle underpass

- If detoured away from the existing cycleway alignment, to connect directly back to the path from Waltham Street to avoid Reserve Road
- Provision of additional active transport facilities:
  - Upgrade of the existing stormwater tunnel to include pedestrian access between Artarmon Reserve and Artarmon Park
  - Including a shared user path along the east side of the rail corridor between 37 Hampden Road and where Lambs Road crosses the rail line
  - An increase in the width of Herbert Street bridge to enable continuity of Willoughby Council's proposed separated cycleway
  - Provision of an underpass at Herbert Street
  - Provision of a cycling underpass of the railway line connecting to Punch Street to avoid steep hills and merging with vehicles on and around railway overpass road.

### ***Response***

The project is one part of a complementary integrated multi-modal strategy being implemented by the NSW Government. As part of this overarching integrated transport network, the project includes the development of new or upgraded active transport links in a number of locations, generally associated with surface works for the project. These links would improve connectivity between communities, open space areas, public transport modes and the existing active transport network. Section 5.1.1 of the environmental impact statement identifies the improvements to active transport infrastructure proposed by the project.

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. Section 9.5 of the environmental impact statement assesses the potential operational impacts to active transport in accordance with the Secretary's environmental assessment requirements and concludes that overall, the project would result in improved active transport connectivity. In the Gore Hill Freeway and Artarmon area specifically, existing connectivity would be maintained. The existing shared user path along the southern side of the Gore Hill Freeway would be replaced in areas directly impacted by the project west of the T1 North Shore and Western Line and T9 Northern Line. It is not proposed to materially detour the shared user path from the current alignment.

The additional active transport facilities raised by submitters above are not project related, and as such are out of scope of the project. The project would enable opportunities for other divisions of Transport for NSW and other agencies (including councils) to explore opportunities for urban renewal, public transport and active transport and changes to traffic management on key corridors. This includes working with local councils and other government stakeholders to develop a place based transport plan for the lower North Shore, which would identify potential transport opportunities to respond to the changing needs of the community, including movement types, and initiatives for mode shift and network operation across all transport modes. The development of the plan would consider the transport needs for the area based on transport and land use changes area, including their purpose, connections between centres and modal priority, eg light vehicle, freight, buses and cyclists, and changes to the transport network as a result of major infrastructure projects currently proposed and being delivered in the area. Transport for NSW is commencing engagement with Willoughby City Council and Lane Cove Council in the last quarter of 2021.

Councils may also 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* (NSW Government, 2018), 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 [www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program](http://www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program).

### C3.5.3 Active transport at Balgowlah

#### *Issue raised*

Submitters raised concerns and made suggestions regarding active transport to be provided by the project, including:

- Concerns that the proposed shared user paths at Balgowlah are insufficient to promote active transport
- At the southern end of Dudley Street, a 'Bicycles Excepted' sign should be added to the 'No right turn' sign from Dudley Street into Sydney Road and consideration of associated requirements for time restrictions, road markings and safe queuing areas
- A north-south bridge should be implemented across the Burnt Bridge Creek Deviation intersection to maintain current active transport travel times
- A bicycle crossing should be added to the pedestrian crossing on the left turn slip lane from the Burnt Bridge Creek Deviation southbound into Sydney Road eastbound
- For cyclists travelling south via Seaforth, the current corkscrew ramp that riders encounter after exiting the Burnt Bridge Creek tunnel under the Burnt Bridge Creek Deviation needs to be made more cyclist friendly. This should be replaced as part of the underpass extension. Access design for the replacement approach should follow current best practice standards, and focus on wider radius turns, reduced gradients and safe sight lines.

#### *Response*

Active transport infrastructure proposed at Balgowlah is identified in Table 5-9 and shown in Figure 5-21 of the environmental impact statement. This includes:

- Realignment and reconstruction of the shared user path along the south eastern side of the Burnt Bridge Creek Deviation between the Kitchener Street bridge and Dudley Street. The realigned and reconstructed shared user path would connect with the existing shared user path at Dudley Street and extension of the existing active transport underpass beneath the Burnt Bridge Creek Deviation to the north of Dudley Street
- A new shared user path along the eastern side of the new access road between Burnt Bridge Creek Deviation and Sydney Road
- New at-grade pedestrian crossings of the new access road adjacent to the:
  - Intersection with Sydney Road
  - Intersection with Burnt Bridge Creek Deviation
  - New public car park within the new and improved open space and recreation facilities at Balgowlah.

The existing pedestrian bridge over Sydney Road would be retained.

As noted above, the design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient

operation, while also balancing and minimising impacts. Section 9.4.5 of the environmental impact statement assesses the potential operational impacts to active transport in accordance with the Secretary's environmental assessment requirements. The assessment concluded that overall, the project would result in improved active transport connectivity, including an appropriate level of transport performance as provided by the crossings of the new access road.

As such, the following additional scope items suggested within submissions are considered to not be project related issues:

- Bicycle right turn exemption from Dudley Street into Sydney Road (this section of Sydney Road is forecast to experience a reduction in road traffic as a result of Beaches Link)
- Bicycle crossing of the intersection of Sydney Road and the Burnt Bridge Creek Deviation (the project would reduce traffic demand at the intersection of Sydney Road and the Burnt Bridge Creek Deviation)
- Corkscrew ramp at the Burnt Bridge Creek underpass.

As noted above, councils may 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* (NSW Government, 2018), 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 [www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program](http://www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program).

### **C3.5.4 Active transport at Seaforth, Killarney Heights and Frenchs Forest**

#### ***Issue raised***

Submitters raised concerns that the proposed shared user paths at Wakehurst Parkway would be insufficient to promote active transport.

#### ***Response***

Public and active transport infrastructure to be provided by the project at Seaforth, Killarney Heights and Frenchs Forest is identified in Table 5-9 of the environmental impact statement. The project would provide the following new infrastructure along Wakehurst Parkway for active transport users:

- A new shared user path along the eastern side of Wakehurst Parkway, from the northern end of Kirkwood Street at Seaforth to the intersection with Warringah Road at Frenchs Forest. The new shared user path includes a new bridge over a drainage culvert and fauna underpass (constructed as part of Northern Beaches Hospital road upgrade project), about 150 metres south of the intersection with Warringah Road
- A new shared user underpass beneath Wakehurst Parkway about 700 metres north of Kirkwood Street to connect Garigal National Park and the Engravings Trail to Manly Warringah War Memorial State Park
- A new shared user underpass beneath Wakehurst Parkway about 1150 metres north of Kirkwood Street to connect Garigal National Park to Manly Warringah War Memorial State Park
- A new shared user underpass beneath Wakehurst Parkway about 750 metres south of the intersection with Warringah Road at Frenchs Forest
- Replacement of the existing pedestrian bridge across Wakehurst Parkway, with a new shared user bridge about 350 metres south of Warringah Road at Frenchs Forest.

This new infrastructure would improve the quality and extent of active transport infrastructure in the Seaforth, Killarney Heights and Frenchs Forest areas, linking these centres. Improvements to



pedestrian and cyclist links within the broader Northern Beaches local government area are beyond the scope of the project and are a matter for Northern Beaches Council. As noted above, councils may apply for funding for cycleways under the NSW Government's *Walking and Cycling Program* (Transport for NSW, 2019c).

## C3.6 Other suggestions

### C3.6.1 Design requests

#### *Issue raised*

Submitters raised concerns and made requests regarding other design alternatives, including:

- The project does not address vehicle pollution by building a tunnel. The project should instead include the phase-out of internal combustion engine vehicles in tunnels in favour of electric and hydrogen powered vehicles
- Requests to expand Artarmon Park by constructing a deck over the motorway between Hampden Road and the T1 North Shore and Western Line and T9 Northern Line.

#### *Response*

##### Vehicle fuel types

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). The composition of the fleet assumed in the ventilation analysis consists of a range of emissions standards for different vehicle types and includes a proportion of high emitting pre-Euro emissions standards through to ADR79/04 (Euro 6). Although the vehicle fleet composition would change over time as cleaner vehicles enter the fleet, this assumption was not applied to the wider air quality assessment. The in-tunnel air quality and surface road emissions factors do not account for the continued shift towards alternative fuelled low emission vehicles such as hybrids and battery electric vehicles, which allows for a conservative assessment of potential air quality impacts.

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.

##### Deck over the motorway at Artarmon Park

Land subject to temporary use, such as Artarmon Park, will be rehabilitated as soon as practicable to an appropriate condition, taking into consideration the location, land use characteristics, area and adjacent land uses or in accordance with the urban design and landscape plan where applicable in accordance with environmental management measure LP5 (refer to Table D2-1 of this submissions report)). Rehabilitation will be carried out in consultation with the relevant landowner, the local council and community (where appropriate).

The inclusion of a deck or land bridge over the motorway between Hampden Road and the T1 North Shore and Western Line and T9 Northern Line would be challenging from an engineering and traffic staging perspective as well as being cost prohibitive. Consideration of a deck or land bridge in this location is out of scope for the project.

### **C3.6.2 Public transport infrastructure**

#### ***Issue raised***

Submitters requested that a bus lane and bus stop are provided on Brook Street, to support use of the tunnel and reduce traffic on Brook Street. Implementing a bus lane would both support the use of the tunnel and reduce traffic further on the street.

#### ***Response***

The project is expected to reduce traffic demand on Brook Street and, therefore, neither bus lanes or bus stops are needed to mitigate the impacts of the project at this location. Also, there would be no access between Brook Street and either the Beaches Link tunnel or the Western Harbour tunnel, so any buses entering or exiting the Warringah Freeway at Brook Street would not be able to travel along the proposed new motorways.

### **C3.6.3 Surface road work alternatives at Artarmon**

#### ***Issue raised***

Submitters made suggestions regarding the proposed surface road works at Artarmon and suggested alternatives, including:

- Suggestions for traffic lights or a roundabout at the intersection of Clarendon Street and Dickson Avenue to improve safety and alleviate project impacts
- Suggestions to remove the right-hand turn into Dickson Avenue from Cleg Street and allow left hand turns in and out of Cleg Street at this intersection.

#### ***Response***

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts.

Traffic lights or a roundabout at the intersection of Clarendon Street and Dickson Avenue were investigated, with the analysis concluding that the existing intersection could accommodate the forecast traffic.

Traffic forecasting and modelling carried out for the project does not suggest that further local road network modifications are required to mitigate project-related impacts, including at the intersection of Cleg Street and Dickson Avenue.

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, in accordance with environment management measure OT1 (refer to Table D2-1 of this submissions report). Any proposed changes as a result of this review would be considered in line with the process outlined in Section 2.3 of the environmental impact statement.

### **C3.6.4 Surface road work alternatives at Wakehurst Parkway**

#### ***Issue raised***

Submitters made requests and suggestions regarding the proposed surface road works at Wakehurst Parkway. Specific requests and suggestions include:

- Requests that a flyover or tunnel should be included at the intersection of Wakehurst Parkway and Warringah Road

- Suggestions that Wakehurst Parkway should be an elevated roadway or the tunnel extended to avoid impacts.

### ***Response***

The suggestion to elevate Wakehurst Parkway at Killarney Heights and Frenchs Forest would not be acceptable due to the significant visual amenity impact that it would have due to the distinct bushland character of the area, limited urban development and the position along a topographical ridge. Construction of an elevated roadway may result in a similar construction footprint to the proposed project, and would therefore do little to minimise the predicted impacts.

Increasing the length of the tunnel along Wakehurst Parkway would introduce several constructability constraints, significant cost increases due to additional tunnelling or bridge structure required and as a consequence, reduce the sustainability of the project, as discussed in Section C3.4.4.

## **C3.6.5 Surface works at Balgowlah**

### ***Issue raised***

Submitters made suggestions and requests regarding the proposed surface road works at Balgowlah. Specific suggestions and requests include:

- Suggestions to significantly reduce the existing proposed roadworks required along the Burnt Bridge Creek Deviation, thereby further reducing construction traffic and congestion
- Requests for left turning from Coral Street to Sydney Road at Balgowlah to be prohibited at all times, with resident traffic exempt.

### ***Response***

#### **Roadworks along the Burnt Bridge Creek Deviation**

Surface road works at Balgowlah are discussed in Section 5.2.6 of the environmental impact statement. Surface road works would be required along and around the Burnt Bridge Creek Deviation at Balgowlah to connect and integrate the project with the surrounding road network. The surface road works would include realignment and widening of the Burnt Bridge Creek Deviation including cut and cover and trough works east of Hope Street and localised adjustment of a small section of Burnt Bridge Creek for road widening and extension of the existing culvert and provision of scour protection.

The scope of works proposed along the Burnt Bridge Creek Deviation at Balgowlah is directly related to the surface connection selected. Balgowlah connection alternatives are discussed in Section 4.5.5 of the environmental impact statement.

One of the key objectives for the connection was to minimise construction staging works in busy road corridors and the program duration as identified in Table 4-7 of the environmental impact statement. The preferred Balgowlah connection would minimise construction within the Burnt Bridge Creek Deviation corridor, as mentioned in Table 4-13 of the environmental impact statement.

#### **Adjustments to local roads at Balgowlah**

No adjustments would be made to surface roads beyond those described in Section 5.2.6 of the environmental impact statement. Adjustments to traffic movements on local roads are a matter for local council. Notwithstanding, Transport for NSW will investigate, if deemed to be required after opening, the requirement for local area traffic management measures to minimise the impact of the project on the surrounding local road network in consultation with environmental management

measure OT2. Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable. Therefore, further restrictions to the left turn from Coral Street to Sydney Road at Balgowlah would only occur as part of the project if deemed to be required following the opening of the project, and in consultation with Northern Beaches Council.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C4 – Project description

## C4 Project description

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## C4.1 Beaches Link

### C4.1.1 Tunnel design

#### ***Issue raised***

Submitters raised concerns and made requests regarding the design of the tunnels. Specific concerns and requests include:

- The standard of design is considered to be inferior to that provided for WestConnex
- Concerns regarding the gradient of the tunnel and that the tunnel is not designed in accordance with the Austroads guidelines and subsequently, that exits may be too steep for use by buses. Others consider that the length of the tunnel could be shortened using steeper gradients
- Concerns about the potential impacts of the length of the tunnel on travel and the community
- Concerns that the design is not fully developed and that there is no evidence that the gradients would be correct in Middle Harbour and that tunnelling would be feasible
- Concerns that the tunnel length at North Balgowlah shown in Figure E-2 'Overview of the temporary construction support sites' of the environmental impact statement is inaccurate
- The tunnel should have a clearance of 5.1 metres as per other recent tunnels constructed in Sydney
- Concerns regarding the depth of the tunnel and possible changes to tunnel depths following approval of the project
- The tunnel should be reduced from six lanes to four lanes, as it is 50 per cent wider than the Sydney Harbour Tunnel but would service a smaller population. The recently completed NorthConnex tunnel only has four lanes to service a larger proportion of traffic between the major centres of Sydney and Newcastle
- Ramp tunnels should be three lanes not two
- Requests for dedicated T3 priority lanes, a dedicated lane for slower vehicles or a dedicated bus lane to be provided within the tunnel in both directions
- The environmental impact statement has not provided details on the placement of toll gantries
- Objects to any permanent tunnel access being established within Clive Park at the corner of Coolawin Road and Sailors Bay Road
- Concerns that future proofing has not been considered and the tunnel gradients are too steep for it to be converted to a rail option.

#### ***Response***

##### Standard of design

The Beaches Link and Gore Hill Freeway Connection project has been developed 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. The design which was assessed in the environmental impact statement was developed in accordance with all relevant design standards and guidelines, similar to other tunnelling projects currently being constructed or recently constructed within NSW, as is appropriate for the current phase of the project. Further design development and construction planning would continue to be carried out in accordance with relevant Austroads guidelines, Transport for NSW standards and Australian Standards.

### Tunnel gradient and length

As indicated above, 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. The corridor alternatives were evaluated to identify the solution that best balanced technical, community and environmental outcomes while meeting the transport objectives. A summary of alignment options considered is provided in Chapter 4 (Project development and alternatives) of the environmental impact statement.

The length of the proposed tunnel was determined by the strategic context, project need and delivery of the project objectives. Selection of the preferred corridor required consideration of various technical and environmental factors to achieve acceptable vertical gradients to achieve desired traffic performance, reduce environmental impacts, reduce whole of life emissions and operational costs and improve safety outcomes. 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.

The tunnel length shown in Figure E-2 of the environmental impact statement is indicative. Estimates of tunnel lengths are provided on page E-7 of the Executive summary and in further detail in Chapter 5 (Project description) of the environmental impact statement.

The gradient of the Beaches Link tunnel is described in Section 5.2.2 and shown in Figures 5-10, 5-11 and 5-12 of the environmental impact statement. The tunnel mainline is generally at a 0.5 per cent grade but steepens to four per cent on approach to the Middle Harbour crossing and near ramp portals. The three ramp connections at the Gore Hill Freeway are graded at six to eight per cent to maximise the clearance under the T1 North Shore and Western Line and T9 Northern Line, while still being able to provide suitable merge/diverge arrangements as well as maintain immunity for the tunnel in flooding events. Similarly, the ramp tunnels at Wakehurst Parkway and Balgowlah are graded at four to six per cent, and the length of six per cent gradient has been minimised where feasible. Steeper gradients, and their potential implications for heavy vehicle speeds, have been taken into account in the operational traffic model and associated impact assessments.

The potential impacts on travel and the community that would arise from the operation of the tunnel are described in Chapter 9 (Operational traffic and transport) and Chapter 21 (Socio-economics) of the environmental impact statement. Overall, the project would result in improved travel times, road safety, improved connections and reliability for users of the project, as well as a reduction in traffic for users of existing key corridors including Military Road, Spit Road, Warringah Road and Eastern Valley Way. In addition, the project would provide better access to jobs and businesses as well as new opportunities for public transport by providing the opportunity to operate double decker and express buses in the tunnel to Sydney CBD and North Sydney (and beyond).

The preferred tunnel alignment across Middle Harbour would likely intersect estuarine, marine and alluvial sediments overlying Hawkesbury Sandstone. The immersed tube tunnel construction method is considered a feasible option for the harbour crossing as it provides for the shallowest harbour crossing alignment and optimum road grades. Additionally, the preferred vertical alignment of the immersed tube tunnel improves constructability, reduces dredging and reduces the vertical grade required for the connections at Balgowlah and Wakehurst Parkway. During further design development, additional geotechnical investigations would be carried out to inform further design development and construction planning.



### Tunnel height

The vertical height of the tunnel would be 5.3 metres, allowing for use by heavy vehicles and double decker buses.

### Tunnel depth

Additional geotechnical investigations would be carried out during further design development for the project to confirm required tunnel depths and finalise associated tunnel route alignments. Any refinements to the approved project during further design development, 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.

The indicative vertical alignment of the mainline and ramp tunnels including depths from key locations at the surface to the tunnel road surface, is shown in Figure 5-10 to Figure 5-12 of the environmental impact statement. To identify the approximate depth to the top of the tunnel, subtract eight metres from the depth shown on the figure.

### Number of lanes

The mainline tunnels comprise three lanes of traffic in each direction connecting Cammeray to ramp tunnels under Naremburn, Northbridge and Seaforth, with each ramp tunnel comprising twin two lane tunnels. The number of lanes provided by the project was determined by traffic modelling. A summary of midblock performance of the project's mainline tunnel and on ramps and off ramps for the 2027 and 2037 forecast years is provided in Table 7-9 and Table 7-10 of Appendix F (Technical working paper: Traffic and transport). The modelling carried out indicates that the tunnel is expected to operate efficiently within capacity at all locations (both northbound and southbound) during traffic peak periods in the design year of 2037, for both the 'Do something' and 'Do something cumulative' scenarios. Operating speeds are expected to be maintained within around 10 kilometres per hour of posted speeds during traffic peak periods at all locations, illustrating free-flow operations with little or no queuing expected. As a result, a reduction in the number of lanes may reduce the operational efficiency of the project and additional ramp tunnels are not considered to be required.

### Dedicated and priority lanes

The tunnels have been designed to allow use by buses including double decker and express bus services. Traffic modelling carried out for the operational traffic and transport assessment (provided in Appendix F (Technical working paper: Traffic and transport)) indicates that the project would improve traffic flows, removing the need for priority infrastructure in the tunnels, such as dedicated bus lanes or priority lanes for private vehicles. In addition, the number of existing bus services likely to use the Beaches Link tunnel relative to private vehicles does not justify the reduction in tunnel capacity that would result from the creation of dedicated bus lanes. 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. Priority bus infrastructure that would be provided and maintained by the project is discussed in Section C8.1.5 of this submissions report.

### Toll gantries

As no decision on the final tolling strategy of the project has been made, the positioning of toll gantries along the alignment would be confirmed during further design development. An indicative location of toll points within the mainline tunnel would be between the ramp merge points as noted on Figure 5-3 of the environmental impact statement.

### Tunnel access at Clive Park

Transport for NSW confirms that there are no temporary or permanent tunnel portals/access in Clive Park or the road network surrounding Clive Park. The tunnel alignment under Clive Park would be about 50 metres below ground level as indicated in Figure 5-10 in the environmental impact statement, and no surface accesses, permanent or temporary, are proposed. It is noted that there is a chamber offset from the driven tunnel shown on Figure 6-26 of the environmental impact statement in the vicinity of Clive Park. It should be noted that this is not a tunnel connection – rather this is for an underground high voltage substation.

### Future proofing

The project has been designed to improve current road use and address future needs of the road network within Sydney to 2037. Future conversion of the tunnel into a railway has therefore not been considered.

## **C4.1.2 Operational facilities**

### ***Issue raised***

Submitters requested additional detail and raised concerns regarding operational facilities. Specific requests and concerns include:

- Requests for confirmation of the location of permanent support facilities for tunnel operation
- Requests for confirmation of why five different operational facilities are required along the project alignment
- Requests for confirmation of why operational facilities cannot be remote from tunnel portals given improvements in telecommunications
- Concerns that the operational facilities at Balgowlah would be set eight metres into the ground and that subsequently the surrounding land would be sloped and unfit for any practical use.

### ***Response***

The operational facilities and ancillary infrastructure required for the project are presented in Figure 5-1 to Figure 5-9 and are described in Table 5-2 of the environmental impact statement. These facilities include:

- Motorway facilities and ventilation outlets, and ventilation tunnels to connect traffic tunnels to motorway facilities, at:
  - Warringah Freeway at Cammeray. Ventilation tunnels would connect the southbound mainline and ramp tunnels to the ventilation outlet at Cammeray. The ventilation outlet at the Warringah Freeway would be constructed as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, with fitout and the ventilation tunnel connection of this structure completed by the project
  - Gore Hill Freeway, Artarmon. Ventilation tunnels would not be required at the ventilation outlet at Artarmon as the outlet would be located above the ramp tunnel alignment
  - Burnt Bridge Creek Deviation at Balgowlah. Ventilation tunnels would connect the eastbound ramp tunnels to the ventilation outlet at Burnt Bridge Creek Deviation at Balgowlah
  - Wakehurst Parkway at Killarney Heights. Ventilation tunnels would not be required at the ventilation outlet at Killarney Heights as the outlet would be located above the tunnel portal
- A motorway control centre at the Gore Hill Freeway

- Tunnel support facilities at the Gore Hill Freeway at Artarmon and Wakehurst Parkway at Frenchs Forest
- Groundwater and tunnel drainage management and treatment systems, including a wastewater treatment plant at the Gore Hill Freeway at Artarmon
- Signage, tolling, fire and life safety systems, lighting, emergency evacuation and emergency smoke extraction infrastructure
- Closed Circuit Television (CCTV) and other traffic management systems.

The above facilities would be required for the effective management of the motorway and are typical for a motorway project of this scale.

The locations of operational facilities and ancillary infrastructure have been developed in consideration of existing land uses, future development to minimise permanent impacts (including minimising property acquisitions, especially private residential dwellings), and maximisation of operational efficiencies through close proximity to the tunnel. Locating operational facilities at temporary construction support sites would minimise disturbance to local communities caused by the project.

The Beaches Link motorway facilities and ventilation outlets have been architecturally designed to reduce their perceived scale and would utilise materials that integrates with the local environment. The ground floor of the facility at Balgowlah Golf Course would be buried about eight metres into the ground, with only one level (about eight metres) above ground. The design of the eastern and western elevations of the building would differ to integrate the building with the road corridor and open space setting. The facilities would be subject to further design development during future project design stages.

The indicative gradient around the Balgowlah operation facilities is shown in Section 4.8.7 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). There would be a small sloping batter on the eastern side of the building which would have minimal impact on use of the surrounding land. The plan is for internal access to the basement levels. The design of the operational facilities would be included within the urban design and landscape plan which will be made available to relevant councils and the public for feedback in accordance with environmental management measure V1 (refer to Table D2-1 of this submissions report).

The project has identified the potential for residual land at Balgowlah to be re-purposed as new and improved open space and recreation facilities for the community, as discussed in Section 5.2.13 of the environment impact statement. A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input into the final layout of the new and improved open space and recreation facilities at Balgowlah, as required by revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). This consultation will be separate to the consultation for the environmental impact statement and is expected to commence after planning approval and in advance of construction starting. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space. An expression of interest for participating in the consultation process is expected to be issued in early 2022.

### **C4.1.3 Surface connections – general**

#### ***Issue raised***

Submitters raised concerns and made requests regarding surface connections. Specific concerns and requests include:

- Concerns regarding the width of the surface connections to the proposed tunnels eg Cammeray is 20 lanes wide, Balgowlah is 12 lanes wide and Seaforth is six lanes wide. Tidal flow (bidirectional lanes) is recommended to reduce the width of the surface connections, particularly at the Warringah Freeway
- The absolute performance measure for the design should be an improvement of the built environment by means of reduced surface traffic in the local street network, improved amenity, improved safety and improved sustainable transport function
- Concerns regarding the suitability of existing infrastructure (including parking and connecting roads) in both the Northern Beaches and Sydney CBD to accommodate the additional vehicles as a result of the project. Requests for the project to include upgrades to local roads impacted by increased traffic accessing tunnel portals.

#### ***Response***

##### Width of surface connections

The rigorous selection process carried out to identify the preferred corridor for the project and surface connections is outlined in Chapter 4 (Project development and alternatives) of the environmental impact statement. Surface connections were developed with consideration of minimising community and environmental impacts, in addition to engineering and construction constraints.

The number of lanes present at each surface connection is a function of the existing lanes present and the requirement to accommodate entry ramp lanes and exit ramp lanes at each location. There is a large number of lanes present along the Warringah Freeway due to the volume of connections present in this road corridor, and the high volumes of daily traffic using the freeway.

##### Operational performance of local network

By providing additional motorway capacity and bypassing communities underground, the project would reduce through traffic volumes in many areas and improve amenity in these areas. As such, the project would facilitate improvements to urban amenity in the Harbour CBD and Northern Beaches by reducing through traffic in a number of urban areas and by reducing pressure on arterial roads.

No adjustments would be made to surface roads beyond those described in sections 5.2.6 and 5.3.3 of the environmental impact statement. However, through changing trip patterns and reduced demand on some routes, the project would provide the opportunity for Transport for NSW network management teams and other stakeholders, including councils, to investigate further opportunities for local road improvements and adjustments. Transport for NSW would also continue to work with stakeholders, including councils, through agreed cross organisational governance structures to investigate options to improve movement and place outcomes and leverage the strategic benefits of the program of works.

Transport for NSW will carry out a review of operational network performance 12 months and five years from the opening of the project to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections, as per environmental management measure OT1 (refer to Table D2-1 of this submissions report). The assessment will be based on future

updated traffic surveys taken during operation, utilising an appropriate methodology that follows the relevant and industry accepted guidelines current at that time.

Following the operational network performance review carried out under environmental management measure OT1, an action plan would be developed and action taken that would offer the ability to leverage further benefits or opportunities. For example, should the network perform better than expected (as confirmed through environmental management measure OT1), further opportunities for road space reallocation may be identified.

#### **C4.1.4 Surface connections at the Warringah Freeway**

##### ***Issue raised***

Submitters raised concerns and made requests regarding the surface connection at Warringah Freeway. Specific concerns and requests included:

- Concerns that the Beaches Link tunnels do not connect to and from Sydney Harbour Tunnel, only the Sydney Harbour Bridge
- Requests that the southbound exit to the Harbour Bridge and North Sydney are bifurcated to provide a direct link to the Sydney Harbour Tunnel ramps.

##### ***Response***

Upgrades to the Warringah Freeway are being carried out as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project. The reconfiguration of the Warringah Freeway Upgrade is required to interact with new infrastructure from both projects and to achieve optimised connectivity for the harbour crossings, an improvement of the bypass and access/distributor functions of the road corridor. This upgrade 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.

Consequently, the southbound exit from the Beaches Link tunnel would merge with the Warringah Freeway in an outside lane, and therefore a southbound connection from the Beaches Link tunnel to the Sydney Harbour Bridge and/or Sydney Harbour Tunnel is not feasible for the project. Northbound traffic exiting the Sydney Harbour Tunnel would be able to access the Beaches Link tunnel. The project surface connections to the Warringah Freeway, in addition to the connection directly to the Western Harbour Tunnel, are shown in Figure 5-1 of the environmental impact statement. Access arrangements upon completion of construction works at the Warringah Freeway, including connections to the Sydney Harbour Tunnel and Sydney Harbour Bridge, is shown in Figure 9-5 of the environmental impact statement.

#### **C4.1.5 Surface connections at Wakehurst Parkway**

##### ***Issue raised***

Submitters requested additional detail and raised concerns regarding the surface connections at Wakehurst Parkway. Specific requests and concerns included:

- Requests for confirmation of the dimensions of the Wakehurst Parkway tunnel portal
- Concerns that the tunnel portal is too wide. Suggestion to stagger the tunnel entrance and exit portals to reduce the width.

### ***Response***

The realignment and upgrade of Wakehurst Parkway involves ramp tunnels to and from the mainline tunnel. The ramps would consist of two lanes in each direction and the approximate size of the tunnel portal at Wakehurst Parkway would be 30 metres in width and 5.3 metres in height.

The road reservation at Wakehurst Parkway is about 80 metres wide which allows for the current configuration of the tunnel portals. Co-location of the tunnel portals allows for efficiencies in construction and for the placement of motorway facilities and ventilation outlet at Wakehurst Parkway on top of the tunnel portals minimising the need for property acquisition, vegetation clearance and subsequent impacts on surrounding bushland.

#### **C4.1.6 Surface connections at Balgowlah**

##### ***Issue raised***

Submitters raised concerns regarding the surface connections at Balgowlah including:

- Concerns that the design of the surface connections at Balgowlah was altered prior to the environmental impact statement being issued and that the community was not consulted. The surface connection at Balgowlah should be moved so that it is not near schools or residences
- Objections to the design of the surface connections on the basis that insufficient consideration has been given to the traffic impacts on feeder roads and local residential streets
- Concerns about the location of the tunnel portal and requests for the surface connections to be relocated to reduce their footprint, improve traffic outcomes and minimise impacts to public open space
- Concerns that a signalised intersection 100 metres from the tunnel entry would create a bottleneck for vehicles exiting the tunnel in a northerly direction at Balgowlah and resultant queuing may be unsafe.

##### ***Response***

The Balgowlah surface connections would link the mainline tunnels and the eastern area of the Northern Beaches peninsula, including Seaforth, Manly and Brookvale. Many different options were considered for the surface connection at Balgowlah. A summary of the key tunnel and surface road alignment options which were proposed and tested over a period of five years for the North Balgowlah/Balgowlah/Seaforth area is presented in Chapter 4 (Project development and alternatives) of the environmental impact statement. Further engineering was carried out incorporating suggestions from various stakeholders including community members and groups, through multiple community consultation sessions between 2017 and 2020. A summary of each of the nine connection alternatives assessed against the key objectives of the project for the Balgowlah area is outlined in Section 4.5.5 of the environmental impact statement.

Development of the preferred design option included consideration of issues such as: traffic and transport, environment and heritage, community, flooding, constructability and engineering, and cost. The design selection process was extensive and thorough in reaching the final selected preferred alternative of north facing tunnel ramps to the Burnt Bridge Creek Deviation, with a shortened access road to distribute traffic and connect to the new and improved open space and recreation facilities. The design selection process was progressive as it developed and adapted to incorporate important inputs from the community and key stakeholders over the period between 2017 and 2020. A summary of the evaluation of the Balgowlah connection preferred alternative is included in Table 4-19 of the environmental impact statement.

The design of the project would continue to seek opportunities to maximise achievement of the key objectives of the project. The design of the proposed surface connections at Balgowlah allows for connectivity to and from Pittwater Road/Condamine Street to be maintained, removes the requirement to alter the current alignment of the Kitchener Street bridge, and also provides connectivity for residents of Seaforth, North Balgowlah, Balgowlah and Manly via Sydney Road, to and from the tunnel. Additionally, this update in alignment has minimised impacts to Burnt Bridge Creek, maximised the provision of new and improved public open space, and reduced the need for mitigation of permanent noise and visual impacts.

Construction of the new and improved open space and recreation facilities at Balgowlah would be delivered progressively. Commencement of the staged works for the new open space and recreation facilities would be subject to completion of the consultation process described above. Residual land, primarily to the east and north of the new access road, would progressively become available through the construction period, which would facilitate re-purposing it to the new open space and recreation facilities. This would allow it to be handed over progressively for use by the community. The new open space and recreation facilities to the west of the proposed access road, between the access road and Burnt Bridge Creek Deviation, would be constructed after completion of the project and then handed over to Northern Beaches Council.

Vehicles travelling northbound and exiting the tunnel at Balgowlah would not be impacted by the traffic signals at the intersection with the new access road. A slip lane is proposed for northbound traffic as shown in Figure 5-19 of the environmental impact statement.

#### **C4.1.7 Access road at Balgowlah**

##### ***Issue raised***

Submitters raised concerns and made requests regarding the new access road at Balgowlah including:

- Concerns that details of the new access road are limited
- The revised location of the new access road and ventilation outlet at Balgowlah is not shown in the environmental impact statement
- Requests for the new access road at Balgowlah to be removed from the project, as it is perceived to not be required as traffic volumes on the Spit Bridge would be reduced through the use of the connection at Wakehurst Parkway
- Requests for the new access road to be redesigned to minimise operational traffic impacts. The new access road should be for the exclusive use of tunnel traffic and Burnt Bridge Creek Deviation traffic should not be permitted to turn into or out of the new access road
- Concerns that the new access road is not efficient, as traffic has to turn back on itself and it includes two signalised intersections. Additionally, traffic coming out of the tunnel has to cross traffic going into the tunnel
- Suggestions that the inclusion of free-flowing access slip roads, with underpass or overpass ramps, would remove the need for motorists travelling from the south into the tunnel to stop at traffic lights
- Suggestions that the signalised intersections at Sydney Road opposite Maritimo Street, the Burnt Bridge Creek Deviation, and the new access road, be removed
- Concerns that the current design of the new access road at Balgowlah impacts on the use of Balgowlah Oval and the adjacent cricket nets
- Concerns that if the new access road has two lanes, one lane would be used for parking leaving only one lane available for traffic. Additionally, it is considered that given the plan for open space

there would have to be another crossing in the middle of the new access road, which is unreasonable

- Concerns access to the BP service station on the corner of Maretimo Street and Sydney Road would be removed. Requests for traffic flows and accesses to Sydney Road, including Maretimo Street, to remain as they are currently.

### ***Response***

#### Access road to the Burnt Bridge Creek Deviation

As described in Section C4.1.6 above, the development of the preferred surface connection at Balgowlah included an extensive assessment over a number of years by a multidisciplinary team including design engineers, construction engineers, transport planners and environmental advisors, including feedback and changes made as a result of community consultation. This process looked to identify a surface connection at Balgowlah that best balanced technical, community and environmental outcomes while meeting the transport objectives.

The Balgowlah connection alternatives that were considered are outlined in Section 4.5.5 of the environmental impact statement, including assessment of each alternative against the key project objectives. The preferred alternative comprises north facing tunnel ramps onto the Burnt Bridge Creek Deviation, with a shortened access road to distribute traffic and connect to the new and improved open space and recreation facilities. The justification for selecting the Balgowlah connection preferred alternative is included in Table 4-19 of the environmental impact statement. The selected access road connection to Sydney Road improves long-term network performance by:

- Reducing pressure on the Burnt Bridge Creek Deviation/Sydney Road/Manly Road intersection and Condamine Street between the Burnt Bridge Creek Deviation and Sydney Road
- Eliminating traffic weaving inherent in many other options
- Improving traffic performance and road safety outcomes.

The new access road, motorway facility and ventilation outlet at Balgowlah are shown in Figure 5-5 and described in Table 5-2 of the environmental impact statement. The impacts of the new access road, motorway facility and ventilation outlet have been assessed in the relevant chapters of the environmental impact statement.

#### Balgowlah Oval

The existing Balgowlah Oval and cricket nets would remain operational throughout construction until a new facility (if decided through the dedicated consultation process) is commissioned as part of the new and improved open space and recreation facilities at Balgowlah, as can be seen in Figure 6-38 of the environmental impact statement. Construction of the new access road and the new and improved open space and recreation facilities would be staged so that the current access to the existing Balgowlah Oval is maintained (refer to Table 6-25 of the environmental impact statement).

Notwithstanding, the layout of the new and improved open space and recreation facilities at Balgowlah, including Balgowlah Oval, is indicative and would be subject to the dedicated consultation process described above in Section C4.1.2 and in Section A2.5 of this submissions report.

#### Access road parking and pedestrian crossing

The final design of the access road is subject to further design development. The design, which would consider requirements for operational features such as clearways, would ensure safe and efficient access to the tunnels and the dedicated new and improved open space and recreation facility carpark, and would be developed to the relevant Australian, Transport for NSW and



Austrroads standards. It is unlikely that parking on the access road would be available, due to the lane configuration of the access road. Rather, public parking would be provided at a dedicated parking area as part of the new and improved open space and recreation facilities.

The at-grade pedestrian crossing of the new access road adjacent to the new public car park within the new and improved open space and recreation facilities at Balgowlah is described in Table 5-9 of the environmental impact statement. While the project's connections to and from the Burnt Bridge Creek Deviation are key to integrating the project with the surrounding road network, the final layout of the new and improved open space and recreation facilities at Balgowlah, including shared user paths and pedestrian crossings of the new access road, are subject to further consultation with Northern Beaches Council and the community.

#### Access to BP service station

The new access road at Balgowlah would provide connectivity from the Beaches Link tunnel to and from Sydney Road via a new traffic light intersection on the Burnt Bridge Creek Deviation and a new traffic light intersection at Sydney Road/Maretimo Street, as discussed in Section 5.2.6 of the environmental impact statement.

There would be minor changes to local roads, including intersection works at Maretimo Street. The project would include widening of Sydney Road at the new intersection between the new access road, Sydney Road and Maretimo Street to allow for turning lanes and maintenance of through traffic lanes on Sydney Road. Traffic movements north-south (and vice versa) through the intersection between Maretimo Street and the access road would not be permitted.

The BP service station on the corner of Maretimo Street and Sydney Road currently has driveway access from both Sydney Road and Maretimo Street. During construction, there may be temporary adjustment to access, but access to this business would still be maintained. Transport for NSW will consult with businesses potentially impacted by construction in accordance with environmental management measures BU2 and 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, parking and address other potential impacts as they arise through the construction phase will be identified and implemented.

### **C4.1.8 Surface road works**

#### ***Issue raised***

Submitters raised concerns and made requests regarding the surface road works to be carried out by the project. Specific concerns and requests included:

- Concerns that crash barriers are not 'motorcycle friendly' and that road authorities need to consider the needs of motorcyclists before installing crash barriers
- Requests for confirmation whether the Manly Road/Burnt Bridge Creek Deviation/Sydney Road intersection would be reconfigured to allow two lanes of traffic to cross west towards Seaforth.

#### ***Response***

All barriers would be designed in accordance with all relevant design standards and guidelines including Roads and Maritime Services *Supplement to Austrroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers (2009) Version 2.0* (Roads and Maritime Services, 2016e). The project would be designed to cater for all road users.

The intersection at Manly Road/Sydney Road and the Burnt Bridge Creek Deviation would not be reconfigured to allow two lanes of traffic to cross west towards Seaforth across the Burnt Bridge Creek Deviation.

As outlined in Section C4.1.3 above, no adjustments would be made to surface roads beyond those described in sections 5.2.6 and 5.3.3 of the environmental impact statement. Adjustments to traffic movements on local roads are a matter for the relevant local council. Notwithstanding, Transport for NSW will investigate, if deemed to be required after opening, the requirement for local area traffic management measures to minimise the impact of the project on the surrounding local road network, in accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report). Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable.

#### **C4.1.9 Wakehurst Parkway surface road works**

##### ***Issue raised***

Specific concerns and requests relating to upgrades along Wakehurst Parkway include:

- Concerns regarding the proposed increase in width of Wakehurst Parkway; that it would be out of proportion with the narrow ridge it runs along, potentially impact on sensitive environments such as Manly Warringah War Memorial State Park and Garigal National Park and bring the road closer to residents than the existing alignment
- The widening of Wakehurst Parkway is considered to be unnecessary
- Requests that the design should further reduce the environmental impacts of expansion
- Requests that any widening/re-alignment of Wakehurst Parkway should be to the west of the existing road; this would utilise heavily disturbed areas and reduce negative impacts on the higher quality Manly Warringah War Memorial State Park bushland
- Requests for confirmation of the proposed noise barriers and location of bus stops during operation along Wakehurst Parkway
- Requests for confirmation of whether wildlife corridors or bridges would be provided over Wakehurst Parkway
- Requests that Figure 5-12 of the environmental impact statement should show the tunnel portals and ventilation outlets as well as the lateral dimensions
- Requests for the distance from specific residences to the ventilation outlet at Wakehurst Parkway to be provided
- Requests for further detail on what is planned for preparation, construction and operation of the proposed road widening on Wakehurst Parkway and the shared user path, and should not be left until the further design development stage. The concept of “where feasible and reasonable” is not acceptable and needs full community consultation.

##### ***Response***

###### **Width of Wakehurst Parkway**

New tunnelled connections to and from Wakehurst Parkway would provide a strategic link between the Northern Beaches Hospital Precinct and centres in the upper Northern Beaches, and key centres across Greater Sydney. These connections would greatly improve connectivity for the Northern Beaches and assist in reducing demand for the Warringah Road, Roseville Bridge and Eastern Valley Way corridors.

The road reservation is about 80 metres wide along Wakehurst Parkway. As the current Wakehurst Parkway corridor is a key arterial road link for the northern and western areas of the Northern Beaches, including Frenchs Forest, Narrabeen and Mona Vale, its widening to a dual lane road would allow connection to the proposed ramp tunnels and support increased traffic volumes.

The road reserve varies in alignment and gradient and requires the new upgraded and realigned road to traverse a varying path beside and/or over the existing road alignment.

As works along Wakehurst Parkway would be within the existing road reservation corridor, no vegetation within Garigal National Park (to the west of Wakehurst Parkway) or Manly Warringah War Memorial State Park (to the east) would be cleared. Adjustment of more of the proposed alignment to the west of the existing road would result in vegetation clearing being required within Garigal National Park.

#### Noise barriers and bus stops

The indicative location of new noise barriers and bus stops during operation are shown in Figure 5-23 and Figure 5-24 of the environmental impact statement.

#### Fauna connectivity

The project would provide new and replacement fauna crossings over and beneath Wakehurst Parkway as described in Section 5.2.11 of the environmental impact statement and Table 5.16 of Appendix S (Technical working paper: Biodiversity development assessment report).

Following exhibition of the environmental impact statement and receipt of the Department of Planning, Industry and Environment – Environment, Energy and Science Group submission on the environmental impact statement, Transport for NSW carried out further investigations and development of the design to refine the location and type of fauna underpasses. The design refinement is described in Section A4.4 of this submissions report.

The refinement has included investigating opportunities to optimise the location of fauna underpasses along Wakehurst Parkway and their dimensions, and to determine if any of the combined drainage/fauna underpasses could become dedicated fauna underpasses. This was carried out in the context of biodiversity, design and topographical constraints. These investigations resulted in some refinements to fauna underpass locations and characteristics which would potentially result in higher use by target fauna. The revised locations are outlined below:

- Three new fauna underpasses located:
  - About 715 metres north of Kirkwood Street
  - About 1000 metres north of Kirkwood Street
  - About 605 metres south of Aquatic Drive
- Three new fauna rope canopy bridges, located about 910 metres and 1370 metres north of Kirkwood Street and 885 metres south of Aquatic Drive
- Replacement of the two existing fauna rope canopy bridges at about 330 metres north of Kirkwood Street and 200 metres south of Aquatic Drive
- Retention of the existing fauna underpass north of Aquatic Drive constructed as part of the Northern Beaches Hospital road upgrade project.

Fauna exclusion fencing will be installed for the full extent of Wakehurst Parkway within the construction footprint (refer to revised environmental management measure B3 in Table D2-1 of this submissions report) to guide fauna to multiple dedicated fauna underpasses and rope canopy bridges.

#### Vertical and horizontal alignment of the project

The indicative vertical alignment of the project is shown in Figure 5-10 to Figure 5-12 of the environmental impact statement. An overview of the project alignment is provided in Figure 5-1 to

Figure 5-9 of the environmental impact statement and lateral distances can be estimated using the scale bar on these figures.

The tunnel portals are located where the tunnels connect to the surface. The tunnels would be constructed using cut and cover at the tunnel portals. Further detail of cut and cover work and the ventilation outlets at the Warringah Freeway, Gore Hill Freeway, Burnt Bridge Creek Deviation and Wakehurst Parkway are shown in Figure 5-17, Figure 5-18, Figure 5-21 and Figure 5-22 of the environmental impact statement respectively.

It is also noted that the dedicated project interactive online portal ([nswroads.work/blportal](https://nswroads.work/blportal)) includes an interactive map, which allows community members to enter their property address so as to better understand the project in direct relation to their property. This map will be updated as the project progresses. Refer to Section A2.3.6 of this submissions report for further detail on the project interactive online portal.

#### Further design development

The purpose of an environmental impact statement is to assess the potential impact of the construction and operation of a project based on a project design. Further studies would be carried out to inform further design development and should design refinements occur, as outlined in Section C4.1.1 above, these 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. Appendix E (Community consultation framework) provides the framework to engage and consult with the community and stakeholders on the project and to receive and respond to feedback during project delivery (refer to environmental management measure SE3 in Table D2-1 of this submissions report).

## **C4.2 Gore Hill Freeway Connection**

### **C4.2.1 Gore Hill Freeway**

#### ***Issue raised***

Submitters raised concerns regarding the Gore Hill Freeway Connection component, including:

- Concerns that the scale and design of the works at Gore Hill Freeway would impact lower North Shore communities including disruption during construction, for no operational benefit
- Objections to the closure of Dickson Avenue east with concerns it would negatively impact development on the Royal North Shore Hospital site and surrounds and further add to congestion on Frederick Street
- Lane Cove Tunnel is considered to be a pinch point for the current design.

#### ***Response***

#### Operational benefits for lower North Shore communities

The Beaches Link and Gore Hill Freeway Connection project would provide a new underground motorway bypass of the Military Road/Spit Road (A8) and Warringah Road (A38)/Eastern Valley Way corridors. The project would substantially improve travel times and trip reliability for many freight vehicles, public transport users and other commuters who rely on these transport links each year, reducing pressure on congested road corridors servicing the Northern Beaches and North Shore, including the congested Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors, as outlined in Section 3.6.1 of environmental impact statement.

Modelled forecast traffic demands across Middle Harbour indicate a reduction in demand on major arterial routes around northern Sydney, including a forecast decrease in daily traffic demand on Eastern Valley Way of up to 40 per cent by 2037. Reduced congestion on existing surface arterial routes is expected to improve network resilience due to the provision of new road capacity and connectivity, and reduce the attractiveness of rat-running on these roads, including Eastern Valley Way, reducing traffic through surrounding urban and residential areas.

By providing additional motorway capacity and bypassing communities underground, the project would reduce through traffic volumes in many areas. This would result in reduced noise and improved amenity in these areas. This includes reduced through traffic on Eastern Valley Way and down through Willoughby, Naremburn, Cammeray and Northbridge. This would also assist in improving the efficiency of local movements between these localities and for those travelling from these areas into and out of the Northern Beaches.

Public transport customers would also benefit substantially from the project. Existing services would benefit from reduced traffic demand on key arterial bus corridors including the Warringah Road/Eastern Valley Way corridor, by improving travel times and travel time reliability on these roads as a result of reduced traffic demand and congestion. The reduced vehicle congestion on Warringah Road between Frenchs Forest and Roseville would support the possible implementation of a proposed rapid bus service, similar in nature to that of the existing B-Line between Dee Why and Chatswood.

The project has also been developed to minimise disruption to existing traffic as far as possible during construction. The environmental management measures specified in Table D2-1 of this submissions report will be implemented to address potential impacts on traffic and other issues during construction of the project.

#### Lane Cove Tunnel

The preferred surface connection at the Gore Hill Freeway would provide a connection to the Lane Cove Tunnel in both a northbound and southbound direction. This connection would create faster, more reliable travel times for freight services, public transport and other road users between employment centres at Chatswood, Macquarie Park, and the Northern Beaches.

#### Impacts to the Royal North Shore Hospital and surrounds

The design of the project has considered a wide variety of factors, including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. 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 as per environmental management measure OT1 (refer to Table D-2 of this submissions report). Any proposed changes would be considered in line with the process outlined in Section 2.3 of the environmental impact statement.

### **C4.2.2 Pacific Highway**

#### ***Issue raised***

Submitters raised concerns and made suggestions regarding the Pacific Highway, including:

- Signalisation of the intersection of the Pacific Highway and Dickson Avenue should be avoided as the Pacific Highway already has two signalised intersections 220 metres either side of Dickson Avenue at Hotham Parade and Campbell Street

- Concerns about impact of additional lanes at Pacific Highway intersection at Northview Apartments.

### ***Response***

#### **Signalisation of the intersection of the Pacific Highway and Dickson Avenue**

Traffic signals would be provided for the Pacific Highway/Dickson Avenue intersection to increase safety and connectivity, as noted in Section 9.4.3 and shown in Figure 5-29 of the environmental impact statement. A clarification has been included in Section A5.1.4 of this submissions report to provide intersection performance results at this intersection during operation. The Pacific Highway/Dickson Avenue intersection is expected to operate at a satisfactory Level of Service (LoS) during AM (LoS B) and PM (LoS A) peak periods through to the 2037 design year.

#### **Northview apartments**

Impacts to properties are outlined in Chapter 20 (Land use and property) of the environmental impact statement. No additional lanes are proposed at the Pacific Highway intersection adjacent to the Northview Apartments and no residential properties would be acquired in the vicinity of this intersection (including the Northview Apartments).

### **C4.2.3 Operational facilities**

#### ***Issue raised***

Submitters requested that operational facilities at the Gore Hill Freeway should be located underground or remotely.

#### ***Response***

The locations of project operational infrastructure have been developed in consideration of existing land uses and future development to minimise permanent impacts. While it is possible for the permanent facilities at the Gore Hill Freeway to be wholly or partially underground, the process is very complex and expensive. For example, these facilities house extremely large fans, and the ongoing regular maintenance of these large fans would present access difficulties and would be more time consuming and challenging to ensure the heavy lifting can be managed safely.

In addition, even if placed underground, surface access provisions for regular maintenance activities would mean that substantial surface space would still be required for the facility site. As such, the operational facilities at the Gore Hill Freeway would be located above ground, as per the design assessed by the environmental impact statement.

## **C4.3 Active transport**

### **C4.3.1 General**

#### ***Issue raised***

Submitters raised concerns and made requests regarding public transport and pedestrian and cyclist infrastructure. Specific concerns, requests and suggestions include:

- Concerns that active transport links have not been developed holistically to form a network north to south
- Underpasses and overpasses along active transport routes should be provided to avoid the need for signalised intersections and keep active travelers moving
- Requests that an active transport corridor should be provided along the length of the project

- Concerns that few new active transport routes are proposed and suggestions that the project should develop safe cycling infrastructure within a five kilometre radius of the project
- The environmental impact statement states that the project would create “opportunities to enhance the local community by improving active transport (pedestrian and cyclist facilities) connections and providing new public open space and recreation facilities”. However, there is no accompanying plan outlining the details of cycling infrastructure for commuters
- Concerns that the design does not increase connectivity and improve active transport within the lower North Shore because it severs pedestrian links, enlarges gaps in the green network and reduces public recreation space
- The environmental impact statement refers to ‘shared user paths’ but these are not defined. Concerns regarding how shared user paths would separate pedestrians from cyclists and potential safety issues
- Concerns that the connection to cycle paths and bike lanes on Aquatic Drive is omitted from figures in the environmental impact statement
- Concerns that the tunnel does not provide for active transport and does not provide additional access across Middle Harbour for cyclists or pedestrians.

### ***Response***

#### Provision of active transport

As part of an integrated, multi-modal transport network, the project includes the development of new or improved active transport links in a number of locations, delivered as part of the surface road connections at Artarmon, Balgowlah, Killarney Heights and Frenchs Forest and as part of the new and improved open space and recreation facilities at Balgowlah. These links would improve connectivity between communities, open space areas, public transport nodes and the existing active transport network.

The active transport infrastructure provided by the project is described in sections 5.1.1, 5.2.8 and 5.3.5 of the environmental impact statement. Active transport infrastructure to be provided by the project as part of the Beaches Link component of the project is identified in Table 5-9 of the environmental impact statement, which includes the provision of three shared user underpasses under the Wakehurst Parkway to provide east-west connectivity. Infrastructure to be provided as part of the Gore Hill Freeway Connection component is identified in Table 5-13 of the environmental impact statement.

The potential operational impacts to active transport have been assessed in accordance with the Secretary’s environmental assessment requirements and it is concluded that overall, the project would result in improved active transport connectivity, as discussed in Chapter 9 (Operational traffic and transport) of the environmental impact statement.

By providing additional motorway capacity and bypassing communities underground, the project would also reduce through traffic volumes and improve amenity in many areas. Through changing trip patterns and reduced demand on some routes, the project would also provide the opportunity for other parts of Transport for NSW and other agencies (including councils) to explore opportunities for urban renewal and changes to transport management on key corridors. This includes working with local council and other government stakeholders to develop a place based transport plan for the lower North Shore, which would identify potential transport opportunities to respond to the changing needs of the community, including movement types and initiatives for mode shift and network operation across all transport modes. The development of the plan would consider the transport needs for the area based on transport and land use changes within the area, including their purpose, connections between centres and modal priority, eg light vehicle, freight, buses and

cyclists, and changes to the transport network as a result of major infrastructure projects currently proposed and being delivered in the area. Transport for NSW is commencing engagement with Willoughby City Council, Mosman Council, North Sydney Council and Lane Cove Council in the last quarter of 2021.

Councils may also apply for funding for cycleways under the NSW Government's Walking and Cycling Program. 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 [www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program](http://www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program).

As such, although the provision of additional active transport links is not within the project scope, the project would not preclude the development of additional active transport links.

### Shared user paths

Shared user paths are pathways constructed for active transport use including pedestrian and non-motorised transport such as bicycles, scooters and skateboards. All final cycle routes constructed by the project would be defined and signposted to indicate direction of travel, maintained while in operation, and meet the minimum requirements specified by Transport for NSW and Austroads guidelines including Austroads *Guide to Road Design Part 6A: Paths for Walking and Cycling* (Austroads, 2021), ensuring the safety of all users. This includes minimum requirements for separation of pedestrians and cyclists and other safety-related aspects of shared path design.

### Connectivity to existing active transport links near Wakehurst Parkway

Pedestrian/active transport links as part of surface road works at Frenchs Forest are shown in Figure 5-24 of the environmental impact statement. The figure focuses on those links within and adjoining Wakehurst Parkway rather than on side streets as discussed in Section C8.5 of this submissions report. Active transport connections between the Northern Beaches Hospital road upgrade project and the project along the Wakehurst Parkway at Frenchs Forest are shown in Figure B11-1 of this submissions report.

A refinement providing additional details on the interface between active transport facilities proposed by the project and with existing mountain bike trails adjacent to the Wakehurst Parkway is provided in Section A4.5 of this submissions report.

A proposed refinement of the Wakehurst Parkway shared user bridge ramps is also provided in Section A4.3 of this submissions report. Following further consultation with the NSW Department of Education (School Infrastructure) and Northern Beaches Council, it is proposed the ramps for the new shared user bridge are realigned locally to facilitate direct connectivity between Fitzpatrick Avenue East and Aquatic Drive with secondary access also provided via the bridge to the Warringah Aquatic Centre. The refined location of the bridge crossing would better suit the main travel route for connectivity to and from the proposed relocation of The Forest High School and the greater Frenchs Forest area.

Along with providing improved connectivity for a future pedestrian and cyclist corridor, the refined ramp alignments will reduce the area of Duffys Forest endangered ecological community impacted by the project. The refined ramp alignments would also avoid permanent impacts to the Jumping Jack mountain bike trail and facilitate a contiguous shared user path along Wakehurst Parkway at this locality, consistent with the project design along the rest of the Wakehurst Parkway corridor.



### Provision of active transport infrastructure across Middle Harbour

Existing pedestrian and cyclist infrastructure across the Spit Bridge would continue to provide an active transport crossing of Middle Harbour. Provision of active transport infrastructure within the Beaches Link tunnel would not be feasible due to road safety and human health considerations. Expansion of existing active transport infrastructure within the Spit Road corridor is not within the scope of the project.

#### **C4.3.2 Balgowlah**

##### ***Issue raised***

Submitters raised concerns and made requests regarding pedestrian and cyclist infrastructure in the Balgowlah area, including:

- The design indicates no shared user paths running east-west along Sydney Road at Balgowlah – submitters requested east-west shared user paths to be implemented
- Submitters questioned why the shared user path routes end where they do
- Concerns that there are no pedestrian crossings of Sydney Road provided east or west of the new access road traffic signals, which is not consistent with Transport for NSW policy to provide pedestrian crossings on all legs of a signalised intersection
- The existing bridge over Sydney Road is too narrow for large groups of schoolboys to cross at once and only offers a convenient route for some of the boys
- Concerns about impacts to the cycle path at the Burnt Bridge Creek Deviation as this is currently used by students of Northern Beaches Secondary College Balgowlah Boys Campus as an access route.

##### ***Response***

As noted above, as part of an overarching integrated transport network, the project includes the development of new or replacement active transport links in a number of locations, generally associated with surface works for the project. These links would improve connectivity between communities, open space areas, public transport nodes and the existing active transport network.

Active transport infrastructure to be provided as part of the Beaches Link component of the project is identified in Table 5-9 of the environmental impact statement. Additional pedestrian/active transport links shown on figures within Chapter 5 (Project description) of the environmental impact statement are only those immediately surrounding or impacted by the project.

The new signal controlled pedestrian crossing across the new access road opposite Maretimo Street would continue to provide east-west connectivity for pedestrians across Sydney Road and provide connectivity to the new and improved public open space and recreation facilities. The existing pedestrian bridge to the west of the intersection of Maretimo Street, Sydney Road and the new access road is considered to be close enough to the intersection (less than 120 metres) to continue to provide north-south connectivity for pedestrians crossing Sydney Road. This is considered adequate to service users from Northern Beaches Secondary College Balgowlah Boys Campus.

The pedestrian/active transport link along the Burnt Bridge Creek Deviation would be reinstated as part of the project and appropriate diversions would be provided for the duration of construction.

### C4.3.3 Seaforth, Killarney Heights and Frenchs Forest

#### *Issue raised*

Submitters requested additional detail and raised concerns regarding pedestrian and cyclist infrastructure within the area of Wakehurst Parkway, including:

- Concerns that active transport has not been incorporated into the design in the Wakehurst Parkway area
- Concerns that there is a lack of detail around the path along Wakehurst Parkway from Seaforth to Frenchs Forest. It is considered that a shared user path is only feasible if it is sufficiently wide to accommodate both pedestrian and cyclist traffic
- If a cycle path along Wakehurst Parkway would improve amenity, then such a path should be built immediately and without consideration of the project
- Along Wakehurst Parkway a shared user path beside a road with high speed traffic, noise and air pollution would provide poor amenity for pedestrians and cyclists
- The road shoulder of Wakehurst Parkway should be wide enough for riders to avoid hazards, and still allow passing traffic to comply with the minimum safe passing distance
- Concrete barriers should be installed to protect cyclists travelling on the shared user path on Wakehurst Parkway next to traffic travelling 80 kilometres per hour. Additionally, crossing points under and over the road should be implemented to improve road safety
- The fauna crossing at Wakehurst Parkway should also facilitate the crossing of mountain bikers, trail runners and bushwalkers
- Concerns that shared user underpasses beneath Wakehurst Parkway would lack surveillance and may not feel safe for pedestrian use at night
- It is unclear whether the signalised intersection at Kirkwood Street installed during construction would be retained, to allow safe access to the shared user path along Wakehurst Parkway
- Submitters suggested the following changes to the project design:
  - The Aquatic Drive crossing design should be modified to allow riders to approach the crossing from the north on a straighter alignment, additionally the crossing should have a raised pedestrian and cyclist priority crossing, similar to that used on Merlin Street at Neutral Bay
  - A signalised intersection should be included at the intersection of Warringah Road and Wakehurst Parkway with automatic engagement whenever the opposing traffic is stopped to allow pedestrian and cyclists free flowing access from east to west on the southern side of Warringah Road in connection with the new shared user path along Wakehurst Parkway
  - The shared user path along Wakehurst Parkway should be extended further south to connect with Dalwood Avenue and could include a bi-directional shared user path from Dalwood Street on the western side of Clontarf Street/Wakehurst Parkway
  - There should be a paved and protected shared user path on both sides of Wakehurst Parkway for its entire length between Dalwood Street and Warringah Road if an underpass at the southern end of Wakehurst Parkway such as near to Seaforth Oval is not provided for users to access the proposed shared user path.

## ***Response***

### **Active transport provided near Wakehurst Parkway**

As noted above, as part of an overarching integrated transport network, the project includes the development of new or replacement active transport links in a number of locations, generally associated with surface works for the project. These links would improve connectivity between communities, open space areas, public transport nodes and the existing active transport network. Pedestrian and cyclist facilities that would be provided along Wakehurst Parkway to improve the safety and connectivity of the active transport network to, from, and within the Frenchs Forest area and surrounds, are provided in Table 5-9 of the environmental impact statement. These include:

- A new shared user path along the eastern side of Wakehurst Parkway, from the northern end of Kirkwood Street at Seaforth to the intersection with Warringah Road at Frenchs Forest
- The existing pedestrian bridge across Wakehurst Parkway would be replaced with a new shared user bridge about 350 metres south of Warringah Road
- A new shared user underpass beneath Wakehurst Parkway, about 750 metres south of the intersection with Warringah Road at Frenchs Forest, to connect the bus stop on the eastern side of Wakehurst Parkway with the suburb on the western side of Wakehurst Parkway
- A new shared user underpass beneath Wakehurst Parkway, about 1150 metres north of Kirkwood Street, to connect Garigal National Park to Manly Warringah War Memorial State Park
- A new shared user underpass beneath Wakehurst Parkway, about 700 metres north of Kirkwood Street, to connect Garigal National Park and the Engravings Trail to Manly Warringah War Memorial State Park.

Currently, cyclists travelling along Wakehurst Parkway must do so on the road without physical protection from vehicle traffic. The proposed Wakehurst Parkway shared user path would be a dedicated path for cyclists and pedestrians, allowing cyclists to be physically separated from road traffic and able to travel more slowly than drivers. To provide further separation between motorists and active transport users, the design of the shared user path would include the provision of a safety barrier on the kerbline. The barrier would be a W-beam steel rail, with sections of concrete barrier where there are fill retaining walls on the outside of the shared path. Breaks would be provided in the barrier to access bus stops and vehicle fire trails. Refer to Section A5.1.8 of this submissions report for further detail. During further design development, the design would continue to be developed in accordance with relevant standards to ensure the safety and comfort of pedestrians, cyclists and drivers.

### **Wakehurst Parkway shared user underpasses**

Fauna crossings would be constructed for the use of fauna only. Connectivity for cyclists, mountain bikers and pedestrians would be facilitated by three new shared user underpasses which would be provided beneath Wakehurst Parkway. Lighting of the underpasses would be provided in accordance with relevant standards.

The built elements of the project would contribute to creating desirable public spaces by providing a high-quality experience for users and a balanced, contextually responsive approach. The principles for designing the urban elements of the project including safety in design and crime prevention through environmental design principles, which would be further developed during the further design development stage of the project, are described in Table 22-3 of the environmental impact statement.

### Kirkwood Street access

Kirkwood Street access to Wakehurst Parkway would be reinstated following construction as shown in Figure 5-20 of the environmental impact statement.

### Project design suggestions

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. However, 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.

With regards to the specific items raised by submitters:

- Since the intersection at Aquatic Drive is not signalised it is appropriate that the crossing of Aquatic Drive be remote from the intersection. The crossing treatment would be further developed during further design development
- Crossing of Wakehurst Parkway at Warringah Road requires the crossing of two slip lanes and the north-south leg. Consideration of priority at these crossings would occur in further design development, including investigation of traffic impacts
- Extension of the shared user path down to Clontarf Street is outside the scope of the project – this is a long way south of the current project footprint
- A shared user path on the western side of Wakehurst Parkway would provide little additional benefit with major environmental impact. Pedestrians/cyclists wishing to move from/to Seaforth Oval from the shared user path would be able to use the signalised crossing at Burnt Street and travel along Kirkwood Street.

### **C4.3.4 Gore Hill Freeway**

#### ***Issue raised***

Submitters raised concerns and made requests regarding pedestrian and cyclist infrastructure within the area of Gore Hill Freeway, including:

- The Gore Hill Freeway cycleway promotes an active lifestyle and is used heavily by the community and should be retained to increase support for the project. Improvements to the cycleway should be carried out as part of the project as parts are quite narrow, not particularly flat and have light poles in the middle of it at a couple of locations
- Requests to ensure safe access for cyclists on on-road bicycle routes.

#### ***Response***

As noted above, as part of an overarching integrated transport network, the project includes the development of new or upgraded active transport links in a number of locations, generally associated with surface works for the project. These links would improve connectivity between communities, open space areas, public transport modes and the existing active transport network.

The existing shared user path on the southern side of the Gore Hill Freeway would be replaced in areas directly impacted by the project west of the T1 North Shore and Western Line and T9 Northern Line, as noted in Section 9.4.3 of the environmental impact statement. Pedestrian fencing

would also be installed along the northern side of the shared user path to improve the safety of the active transport network.

Further design development of the project, including active transport infrastructure, would be carried out in accordance with relevant design standards and guidelines of Transport for NSW and other organisations such as Austroads. This includes Austroads *Guide to Road Design Part 6A: Paths for Walking and Cycling* (Austroads, 2021), to ensure the safety of all road users. The designs would be reviewed by road design subject matter experts to ensure compliance to the relevant design standards and guidelines.

## C4.4 Public transport

### *Issue raised*

Submitters made suggestions regarding public transport infrastructure, including:

- Priority bus lanes should be provided on surrounding roads to allow fast access to the tunnel
- Suggestions that B-Line type buses should travel in shared lanes rather than dedicated bus lanes, to make more efficient use of available road space.

### *Response*

The project would support the continued operation of the B-Line program along with other existing and proposed bus services by improving travel times and reliability on key routes connecting the Northern Beaches to key centres including the Spit Road/Military Road and Warringah Road/Eastern Valley Way corridors. Additionally, the reduced vehicle congestion on Warringah Road between Frenchs Forest and Roseville would support the possible implementation of a rapid bus service between Dee Why and Chatswood, similar in nature to the existing B-Line operating on Military Road/Spit Road.

The number of existing bus services likely to use the Beaches Link tunnel relative to private vehicles would not justify the reduction in tunnel capacity that would result from the creation of designated 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, therefore removing the need for priority infrastructure like dedicated bus lanes to be implemented.

Further information about the provision of priority bus infrastructure to facilitate access to the Beaches Link tunnel is discussed in Section C8.1.5 of this submissions report.

## C4.5 Open space and recreation facilities at Balgowlah

### *Issue raised*

Submitters requested additional detail and raised concerns regarding the new and improved open space and recreation facilities at Balgowlah, including:

- Concerns that the new and improved open space is not required given the facilities already available within the area
- The project description does not mention the removal of Balgowlah Golf Club and course
- Concerns that less green space than the existing Balgowlah Golf Course would be provided. Some submitters considered the term “new and improved open space and recreation facilities” to be misleading as an existing open space area would be bisected into two smaller areas

- Requests for certainty around the replacement of Balgowlah Golf Course and the implementation of proposed open space and recreation facilities at Balgowlah
- Concerns that the environmental impact statement makes assumptions and provides positioning of sport ovals, in contradiction to statements that the plans for recreation areas would be developed through a consultation process with the whole community
- Concerns that the inclusion of basketball courts would increase the ratio of impervious surfaces as the area is currently grass
- The indicative layout of the new open space does not include previous investment in new facilities at the oval, and missing from the layout in Figure 5-28 in the environmental impact statement is the recently completed new amenities block
- Since the northern part of the new and improved recreation facilities at Balgowlah, in the area that currently contains six golf greens, would be returned first to the community submitters have suggested that Balgowlah Golf Course could be used during construction as is the case for Cammeray Golf Course. Additionally, as 90 per cent of the land is to be returned for use after completion, Balgowlah Golf Course could continue as a nine hole course during operation
- Concerns that the playing fields proposed at Balgowlah are located at the southern end of the Northern Beaches Council area and users would need to travel long distances to get to them from other parts of the Northern Beaches
- Requests to retain as many trees as possible, in particular for the trees that surround the oval outside the picket fence to be retained and to be protected.

### **Response**

The project has identified an opportunity for land at Balgowlah to be re-purposed as new and improved open space and recreation facilities for the community as outlined in Section 5.2.13 of the environmental impact statement. The use of Balgowlah Golf Course for permanent infrastructure for the project is outlined in Table 20-5 and Table 20-6 of the environmental impact statement. Once construction is complete, only a small portion of the golf course would be used for project infrastructure and permanent facilities. This provides an opportunity to convert the land to an equitable public open space that is freely accessible to all members of the public and has facilities with a broader recreation use (rather than limited to use as a golf course). As such, the new public open space is considered to be 'new and improved'.

This aligns with the *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b) which estimates a current shortfall of 24 hectares of playing area, equivalent to over 24 sports fields, which is expected to increase to a shortfall of 41 hectares by 2031. It identifies that one option to address this shortfall is to re-allocate existing Northern Beaches Council or Crown land currently used for golf to sports fields. Transport for NSW's commitment to re-purpose land in the Balgowlah area as new and improved open space and recreation facilities for the community aligns with Northern Beaches Council's objective to address the shortfall.

An indicative layout for the proposed new and improved open space and recreation facilities at Balgowlah is shown Figure 5-28 of the environmental impact statement. This layout identifies what could be delivered within the available space, with consideration of the *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b) and in acknowledgement of Northern Beaches Council's ongoing work to develop their open space and recreation strategy. Through an iterative process carried out in consultation with Northern Beaches Council during development of the project design, the extent of residual open space available for active recreation has been maximised while still delivering the operational requirements of the project (ie alignment of the access road and siting of motorway facilities was configured to maximise usable open space).

As noted above, the layout provided in Figure 5-28 of the environmental impact statement is indicative only. The final layout of the new and improved open space and recreation facilities at Balgowlah will be subject to a dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). This consultation will be separate to the consultation for the environmental impact statement and is expected to commence after planning approval and in advance of construction starting. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space. An expression of interest for participation in the consultation process is expected to be issued in early 2022. This consultation would give the community and key stakeholders, including nearby schools and sporting groups, an opportunity to provide input into the final layout of the new facilities.

Significant investment to acquire residential properties at Dudley Street has facilitated the more efficient staging of the portal works, allowing for the alignment of the new access road to be adjusted away from other residential properties and for more mature trees to be retained. This has minimised the impacts to Burnt Bridge Creek. The acquisition of these properties has also facilitated an adjustment to the temporary construction support site design so as to allow new and improved open space and recreation facilities to be delivered to the community progressively and earlier than first planned.

The protection of existing vegetation as a possible screen for construction works and the early planting of proposed vegetation are outlined in environmental management measures V9 and V12 respectively (refer to Table D2-1 of this submissions report). The retention of existing vegetation would depend on the final form of the new and improved open space and recreation facilities, subject to consultation.

## **C4.6 Utilities**

### ***Issue raised***

Submitters raised concerns and made requests regarding utilities, including:

- Concerns that utilities are not fully scoped which poses a risk to the project including financial cost, delays to the project and local impacts
- Requests that overhead wires impacted by the project should be placed underground along Kirkwood Street and Judith Street to improve amenity
- Concerns about potential conflict between the project and the Northside Storage Tunnel; an assessment should be carried out with consideration of the impact of vibration, drawdown and the health impacts associated with a spill
- Cumulative impacts in relation to the presence of the Northside Storage Tunnel infrastructure have not been considered or assessed, including potential effects on project costs and schedule.

### ***Response***

#### **Project utility works**

The project would require the installation, relocation, adjustment and/or protection of utilities, particularly within and around surface connections and surface road works as outlined in Section 5.2.9 of the environmental impact statement. The utilities management strategy for the project provides a framework for utility installations, relocations, adjustments and protection (refer to Appendix D (Utilities management strategy)). The strategy provides an overview of the principles

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

Utilities investigations and consultations with utility providers have been carried out and would continue during the ongoing project development, further design development and construction phases of the project which would inform the interaction of existing utilities with temporary and permanent project infrastructure and inform further design refinement as required.

The environmental objectives for utility works include minimising the visual impact of utility works to the surrounding community and this would be considered when the project is installing or relocating facilities.

### Northside Storage Tunnel

The Northside Storage Tunnel follows a different alignment to the project although the two pieces of infrastructure would cross at three separate locations. The location where the two tunnels are at their closest is at Sailors Bay Road, near Strathallen Avenue, Northbridge where the project crosses the Scotts Creek branch of the Northside Storage Tunnel. At this location, the Northside Storage Tunnel is about 30 metres below the Beaches Link tunnels and therefore no interactions or impacts are expected. At the other two crossing locations, the distance between the two tunnels is even larger, so similarly no impacts are expected.





Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C5 – Construction work

## C5 Construction work

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## C5.1 Procurement

### *Issue raised*

Submitters raised concerns and made recommendations with respect to the procurement of the project. Specific concerns and recommendations include:

- Recommendations that the project should be built by an Australian company, with Australian workers, not a foreign entity
- Concerns and recommendations around the selection of the preferred contractor/s and the environmental conditions of the contract to ensure performance
- Concerns that the proposed contractor/s and the process for selection of the contractor/s for the project are not identified in the environmental impact statement, given that the credentials of the selected organisations would impact their ability to manage environmental and sustainability matters
- Concerns that the contractor/s would not enforce management measures during construction as there is no incentive to obey guidelines as fines are insignificant. As part of procurement, the contractor/s should be committed to all management measures with pollution bonds and large fines for breaches
- Recommendations that Transport for NSW should be responsible for monitoring contractor compliance with all conditions of consent, with appropriate penalties for breaches and public reporting of non-compliances.

### *Response*

The contractor/s for the project would be identified after project approval. Procurement of the contractor/s would be carried out in accordance with relevant NSW legislation, Transport for NSW guidelines and other NSW Government procurement policies. The selected contractor/s would be required to be highly qualified and experienced. Further information on the procurement process for Transport for NSW road projects can be found at: [roads-waterways.transport.nsw.gov.au/business-industry/partners-suppliers](https://roads-waterways.transport.nsw.gov.au/business-industry/partners-suppliers).

Should the project be approved, the Department of Planning, Industry and Environment would issue conditions of approval for the management of key issues. Transport for NSW and the appointed contractor/s 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 methodologies and protocols to be implemented to comply with these requirements would be documented in a construction environmental management plan and relevant sub-plans which would be approved by the Department of Planning, Industry and Environment prior to construction commencing.

The contractor/s would be responsible for implementing the conditions of approval, and Transport for NSW would 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 are (in part) 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.

## C5.2 Construction program and staging

### C5.2.1 Timing of construction

#### ***Issue raised***

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

- Concerns regarding delays and the timing of project construction. Some submitters consider that construction should commence immediately, others raised concerns that the project should be postponed until after the 2023 State election
- Requests for further detail on construction timeframes and site establishment works
- Concerns regarding the length of project construction, the risk of the work taking longer than predicted and the subsequent potential disruption to residents and nearby educational facilities in Cammeray, Northbridge, Willoughby, Balgowlah and North Balgowlah. Project staging should consider the impacts to residents
- Requests that construction should be delayed until, or staged after, the completion of the Western Harbour Tunnel and Warringah Freeway Upgrade project.

#### ***Response***

##### Timing of construction

The commencement of project construction is subject to several factors including the timing of any approval granted by the Department of Planning, Industry and Environment and the procurement of relevant contractor/s. An indicative construction program for the project is shown in Table 6-3 of the environmental impact statement. As a result of further planning and procurement packaging, Transport for NSW has elected to stage the project. Further details on proposed staging is provided in Section A4.9 of this submissions report. More specific construction detail would be made available once construction contracts are awarded and detailed design and construction planning is carried out by the contractor/s. The final construction program for the project, including project staging, would depend on future project procurement decisions by Transport for NSW and packaging decisions by the contractor/s.

Early works and site establishment is a fundamental part of all projects and is described in Section 6.3 of the environmental impact statement. During this period a number of works such as surveying and investigative drilling, further contamination and heritage investigations, relocation, adjustment and protection of utilities, relocation of swing moorings, installation of environmental management controls and vegetation clearing and preliminary earthworks would be required to facilitate main construction works. Indicative construction programs for each temporary construction support site, including early works and site establishment, are provided in Section 6.8.2 of the environmental impact statement.

##### Staging with Western Harbour Tunnel and Warringah Freeway Upgrade 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. If the Beaches Link and Gore Hill Freeway Connection project is approved, coordination of works or delivery of elements of the project by the Western Harbour Tunnel and Warringah Freeway Upgrade project would maximise construction efficiency and minimise ongoing disruption to the community in certain areas.

The indicative 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 CI1 (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.

Further discussion on the integration of the Western Harbour Tunnel and Warringah Freeway Upgrade with the Beaches Link and Gore Hill Freeway Connection project is provided in Section C29.1 of this submissions report.

### **C5.2.2 Construction hours**

#### ***Issue raised***

Submitters raised concerns and made requests with respect to construction hours. Specific concerns and requests include:

- Concerns that construction works are scheduled 24 hours a day and that proposed construction work hours include working during weekends and potential work at night time
- Requests for confirmation of what management measures are to be implemented to manage the direct impact of tunnelling, tunnelling support and underground activities, as tunnelling would occur 24 hours per day, seven days a week
- Details of out of hours works are considered to be unclear. Concerns that out of hours works and timing of night work may be increased as part of detailed construction planning processes as they may be conducted 'when required' and would be left to the discretion of the contractor/s
- Requests for confirmation that out of hours works would only be for one per cent of the time, equating to ten days in three years or 3.5 days per year for the Wakehurst Parkway south construction support site (BL12).

#### ***Response***

Construction hours for the project are detailed in Section 6.9.1 of the environmental impact statement. However, all construction works would be reviewed during further design development and detailed construction planning by the contractor/s. 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. The project preference is to work within standard construction hours (7am to 6pm Monday to Friday and 8am to 1pm Saturday, with no construction works on Sundays or public holidays), where feasible. However, some construction activities would need to be extended to out of hours work (refer to Table 6-35 of the environmental impact statement). These activities would include:

- Tunnelling, underground excavation and ground support, and tunnel fitout (including tunnelling support at temporary construction support sites) would be carried out 24 hours a day/seven days a week, given relatively low noise impacts and the substantial program savings that would result. Works would be carried out either within an acoustic shed or underground, reducing impacts on nearby receivers. Acoustic sheds would be designed with consideration of the activities that would occur within them and the noise management levels applicable at nearby receivers. Spoil handling outside of standard hours at the surface would be carried out within acoustic sheds. Some night time deliveries would also be required to support the tunnelling activities
- Dewatering and refill of cofferdams would be carried out 24 hours a day to minimise the time taken to complete this activity. Rock hammering, piling and dredging would be carried out during standard construction hours only

- Immersed tube tunnel installation would 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 install each of the six tunnel units
- 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. Some transport by barge to the designated offshore disposal site may also take place outside standard construction hours
- Fabrication of tunnel tube units may require some works outside of standard construction hours, as some concrete pours might need to continue into the evening period where required to ensure appropriate concrete curing and the structural integrity of the fabricated concrete unit
- Works that require lane occupancy or are immediately adjacent to or above live traffic areas (eg bridge demolition and girder lifts) or involve substantial changes to lane configurations and traffic management arrangements would be required outside standard construction hours to minimise potential safety risks to road users, construction personnel and the public, and to minimise potential disruption to the road network. These works are likely to occur in relation to the Warringah Freeway, Gore Hill Freeway, Reserve Road Artarmon, Pacific Highway (near Dickson Avenue at Artarmon), Flat Rock Drive, Burnt Bridge Creek Deviation and Sydney Road and Wakehurst Parkway.

Following the engagement of the contractor/s and further detailed design development and construction planning, affected residents would be notified of upcoming works outside of standard construction hours before the commencement of these works. An out of hours works protocol will be developed for the construction of the project, in accordance with revised environmental management measure CNV3 (refer to Table D2-1 of this submissions report). This protocol will include:

- Details of works required outside standard construction hours and justifications of why the works are required outside standard construction hours
- The noise and vibration impact assessment processes that will be followed to identify potentially affected receivers and clarify potential impacts
- Mitigation and management measures that are to be considered and implemented where appropriate to manage potential impacts associated with works outside standard construction hours
- Details of the approval process (internal and external) for works proposed outside standard construction hours.

The protocol will be prepared in consultation with Department of Planning, Industry and Environment and the NSW Environment Protection Authority and will be implemented during the duration of the construction of the project.

It is also noted that, if the project is approved, an environment protection licence would likely be required under Chapter 3 of the *Protection of the Environment Operations Act 1997* from the NSW Environment Protection Authority.

Indicative details of construction duration and working hours for the Wakehurst Parkway south construction support site (BL12) is provided in Section 5.11.1.4 of Appendix G (Technical working paper: Noise and vibration). It indicates that no works would take place outside standard hours, except for office activities and occasional vehicle arrivals and departures, however as part of early works there may be additional minor construction activities required adjacent to the temporary construction support site, such as local area road works associated with ensuring access for residents. These works would take place for relatively short periods (less than one month) and

would occur during standard hours where practicable, however some works outside standard construction hours may be required due to road congestion and road safety issues.

## C5.3 Construction activities

### C5.3.1 Earthworks

#### ***Issue raised***

Submitters raised concerns with respect to the scale and extent of earthworks in sensitive residential areas and the foreshore environment.

#### ***Response***

A summary of the project's construction methodology, including earthworks required for surface works and excavation required for the tunnels, is provided in Chapter 6 (Construction work) of the environmental impact statement. Potential risks to the environment due to project earthworks 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 *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and other measures routinely implemented on Transport for NSW projects.

Erosion and sedimentation environmental management measures would be documented in the soil and water management plan as part of the construction environmental management plan (refer to Section D1.1 of this submissions report). Environmental management measures include (refer to Table D2-1 of this submissions report):

- Erosion and sediment measures will be implemented at all construction support sites and surface road upgrades in accordance with relevant guidelines, procedures and specifications, such as *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (Department of Environment and Climate Change (DECC), 2008). A soil conservation specialist will be engaged for the duration of construction of the project to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans (refer to revised environmental management measure SG9)
- Potentially contaminated areas directed by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 1997* (refer to revised environmental management measure SG8)
- The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contamination discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013a) (refer to environmental management measure SG13).

Other mitigation and management measures for issues such as construction dust, traffic management, and noise and vibration would also be implemented to reduce potential environmental and social impacts (refer to Table D2-1 of this submissions report).

With the implementation of these environmental management measures, impacts to nearby sensitive environments and communities would be appropriately managed and minimised.

### C5.3.2 Tunnelling methods

#### ***Issue raised***

Submitters raised concerns and made recommendations regarding tunnelling methods, including:

- Concerns regarding the use of roadheaders, rock hammering and blasting as part of the tunnelling methodology
- Recommendations that the project should only permit tunnelling within acoustic sheds and that this is monitored
- The method of cut and cover construction at Burnt Bridge Creek Deviation and Wakehurst Parkway is not described within the environmental impact statement. The method adopted should be that which has the lowest noise, dust and visual impacts.

### ***Response***

#### Tunnelling methodology and options considered

The process for selection of the preferred tunnel construction methods for the project included the development and evaluation of over seven different combinations of tunnelling methods, as outlined in Section 4.5.1 of the environmental impact statement. As part of this process, roadheaders, tunnel boring machines, immersed tube tunnels, cut and cover tunnels, and the drill and blast method were considered. These options were developed and assessed by a multidisciplinary team of design, constructability, and environmental specialists with experience in delivering tunnelling projects in NSW, Australian and international 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 in particular. The benefits and risks associated with each method are well known and the assessment of alternative methods considered various technical and environmental factors.

An outline of the construction methodology for the mainline and ramp tunnels is provided in Section 6.4.2 of the environmental impact statement. While the majority of the tunnelling work for the mainline and ramp 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 and ramp tunnels, including the extent of controlled underground blasting, would be refined during further design development and construction planning for the project.

#### Use of acoustic sheds

An acoustic shed is an enclosed noise mitigation structure constructed over access declines that facilitate tunnel access for construction. Tunnel excavation at the Cammeray Golf Course (BL1), Flat Rock Drive (BL2), Punch Street (BL3), Balgowlah Golf Course (BL10) and Wakehurst Parkway east (BL13) construction support sites would be within an acoustic shed and/or underground, as described in Section 6.4.1 of the environmental impact statement.

Noisy works required to support out of hours tunnelling, including spoil handling, would also take place within the acoustic sheds, reducing impacts on nearby receivers. Acoustic sheds would be designed with consideration of the activities that would occur within them and the noise management levels applicable at nearby receivers. They would also be designed to accommodate stockpiled tunnel spoil within the shed thereby removing the requirement for spoil haulage outside of standard hours.

#### Construction at Burnt Bridge Creek Deviation and Wakehurst Parkway

Construction of cut and cover and trough structures is described in Section 6.4.3 of the environmental impact statement. The construction methodology for cut and cover construction at Burnt Bridge Creek Deviation and Wakehurst Parkway would be confirmed during further design development and detailed construction planning.



The chosen construction methodology would consider various technical and environmental factors. Should the project be approved, regardless of which construction methodology is chosen, the contractor/s must comply with the conditions of approval issued by the Department of Planning, Industry and Environment, in addition to the environmental management measures included in Table D2-1 of this submissions report, which would include requirements to manage and minimise noise, dust and visual impacts.

### **C5.3.3 Construction activities within Middle Harbour**

#### ***Issue raised***

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

- The proposed construction methodologies are high level, outdated and unsubstantiated
- Recommendations that piling activities use non-percussive piles wherever practical (screwed piles)
- Concerns that the proposed work methods and management plans within the environmental impact statement are insufficient to address significant impacts to sensitive receivers and Middle Harbour maritime waterway users. Recommendations that alternative construction methodologies be investigated
- Queries whether there is a sufficient buffer between the dredging activities and sensitive land uses in accordance with best practice guidelines. Concerns that the minimum separation distances recommended for these activities have not been met
- Requests for clarity regarding how long the cofferdams and relocated moorings area would be inaccessible to recreational users
- Recommendations that project related maritime construction movements be restricted to an agreed schedule which ensures that the sand bar at the entrance to Middle Harbour would not be disturbed
- Requests for confirmation of the timing of maritime restrictions and construction barge movements and that construction methods be optimised to minimise disruption to Middle Harbour maritime users
- Requests for a Maritime Construction Environmental Management Plan addressing location specific risks and hazards to the maritime waterway, Seaforth Bluff, Beauty Point and Clive Park
- Requests that Transport for NSW survey, investigate, monitor and control all pre-construction phase activities and all primary construction phase activities.

#### ***Response***

##### **Construction methodologies**

As described in Section C5.3.2 above, the tunnelling methodologies chosen for the project were developed and assessed by a multidisciplinary team of design, constructability, and environmental specialists with experience in delivering tunnelling projects in NSW, Australian and international contexts.

Consideration of various engineering and other factors required to construct a tunnel across Middle Harbour and different potential construction methodologies are outlined in Section 4.5.1 of the environmental impact statement. Design development for the project included a strong focus on evaluation of potential tunnelling methods for the crossing of Middle Harbour. This analysis was carried out by a multidisciplinary team including design, construction, transport planning and environmental specialists to ensure a comprehensive analysis. It included the consideration of the

roadheader method, specialised slurry shield tunnel boring machines and an immersed tube tunnel (similar to the existing Sydney Harbour Tunnel).

Immersed tube tunnels are proposed for the project to cross Middle 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 advantages of the immersed tube tunnel method are described in Table 4-4 of the environmental impact statement, and include:

- Provides the shallowest possible tunnel alignment at the Middle 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
- Lower construction and operational costs when compared to alternative methodologies
- Minimises 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 for the project's required cross section
- Takes advantage of marine logistics to minimise heavy haulage on road
- The preferred alignment avoids interfaces with substantial sensitive marine ecology at the sand bar at the entrance to Middle Harbour.

Construction methodologies for the immersed tube tunnel outlined within Section 6.4.4 of the environmental impact statement are based on international best practice. The construction methodology for the installation of the immersed tube tunnel units supporting piles would be refined during detailed construction planning. Where vibration levels are likely to be higher than the acceptable limits, the feasibility of alternative piling techniques such as vibratory piling and screw piling would be considered. However, it is likely that some impact piling for each cofferdam would be necessary to securely embed piles into the rock and ensure the piles can be connected together to provide a watertight and safe work environment. The use of impact piling will be restricted so that in any given week impact piling will be carried out over no more than either a two hour period each work day, or a six hour period on a single work day during a 5 day week, to minimise impacts as per environmental management measure CNV14 (refer to Table D2-1 of this submissions report).

The construction methodology and management measures proposed for the project would minimise and manage the generation and movement of suspended sediments due to dredging as detailed in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) and summarised below:

- Restricted working hours, thereby minimising the rate of sediment disturbance (as outlined in Table 6-35 of the environmental impact statement)
- Use of a closed environmental clamshell bucket for removal of the surface layer of sediments with elevated contaminant concentrations (in accordance with environmental management measure WQ16 (refer to Table D2-1 of this submissions report)). These buckets have been specifically designed for dredging contaminated sediments and provide three significant advantages compared to conventional open buckets, including minimisation of suspended sediment during contact with the harbour bed, minimisation of spill as the bucket is raised through the water column and precision (accurate dredging)

- Use of two 10-12 metre deep silt curtains around the entire dredging operation (one on each side of the crossing) (in accordance with environmental management measure WQ16 (refer to Table D2-1 of this submissions report))
- Use of an additional shallower silt curtain ('Moon pool'), about two to three metres deep, attached to the dredge barge within which the dredge bucket specifically operates (in accordance with environmental management measure WQ16 (refer to Table D2-1 of this submissions report) and as outlined in Section 6.4.4 of the environmental impact statement)
- Use of shallow silt curtains around ecologically sensitive areas (eg nearby seagrass and rocky reef habitat) that could be potentially impacted by dredging activities, to provide additional protection (in accordance with revised environmental management measure B31 (refer to Table D2-1 of this submissions report))
- No overflow of dredged material permitted from transport barges.

A pictorial representation of the dredging operations, including silt curtains to be implemented, are shown on Figure C16-1 of this submissions report.

The cofferdam structures would be located an appropriate distance from sensitive environments. The amount of space between the cofferdam construction area and the seagrass patches and subtidal rocky reef at the Middle Harbour south cofferdam construction support site (BL7) is sufficient for installation of the required silt curtain around the ecologically sensitive areas. Best practice management would typically see a small-scale silt curtain for sensitive marine habits set up with a two metre buffer from the habitat being protected. This buffer distance allows for any unforeseen movement of the silt curtains onto seagrass or subtidal rocky reef that could potentially occur as a consequence of vessel wash, tidal flow, or wind or waves. The final location and layout of the Middle Harbour south cofferdam construction support site (BL7) within the construction footprint would be confirmed during further design development and construction planning.

Monitoring of dredging activities will be carried out in accordance with revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report) and will include the use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites (eg seagrass habitats) to manage any potential impacts. The monitoring requirements will be documented in a dredge monitoring program developed in consultation with an appropriately qualified and experienced specialist, Department Primary Industries (Fisheries) and the NSW Environment Protection Authority prior to its implementation.

#### Maritime construction program

The indicative construction program for Middle Harbour cofferdam construction support sites (BL7 and BL8) and other activities is presented in Table 6-22 of the environmental impact statement. Moorings would likely be relocated as part of early works and site establishment and would not be reinstated until after construction is completed in 2026. Transport for NSW (inclusive of NSW Maritime) will consult with the owners and/or leaseholders and/or licence holders of jetties and moorings that require temporary relocation to determine alternative arrangements as outlined in revised environmental management CTT2 (refer to Table D2-1 of this submissions report).

The steel shell immersed tube tunnel units would be transported by sea from a location outside of Middle Harbour (either on a barge or directly towed by a tug) to the Spit West Reserve construction support site (BL9) to be completed as outlined in Section 6.4.4 of the environmental impact statement. Works to complete the units would occur at the Spit West Reserve construction support site (BL9) as the depth of the Middle Harbour entrance does not allow for the transportation of completed immersed tube tunnel units. Consequently, the construction methodology has considered

and adapted to the constraints of the area and would avoid major dredging and piling within the Middle Harbour sandbar.

### Maritime restrictions

During the construction phase, partial restrictions of Middle Harbour with maritime speed restrictions and controlled access through the site would be required. Recreational users, such as boating, sailing, rowing and kayaking would be allowed to travel through the site in a controlled manner, ensuring the safety of both the waterway user and the construction team. The community will be notified in advance of proposed maritime restrictions in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report).

It is also noted that weekends are typically the busiest period for recreation including recreational boating on Middle Harbour and this would be further considered during detailed construction planning to minimise impacts to recreational activities and residents. Construction maritime traffic activities will be scheduled to avoid times and locations of high recreational marine traffic, including near the Spit Bridge, where possible in accordance with revised environmental management measure CTT4 (refer to Table D2-1 of this submissions report). The scheduling of limited harbour closures required for tunnel unit installation 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 CTT5 (refer to Table D2-1 of this submissions report).

Consultation will be carried out with surrounding water based users of Middle Harbour including Mosman Rowing Club, 1<sup>st</sup> Northbridge Sea Scout Group, 1<sup>st</sup> Sailors Bay Sea Scouts and Northbridge Sailing Club to develop reasonable and feasible management measures to minimise construction impacts, in accordance with revised environmental management measure CTT16 (refer to Table D2-1 of this submissions report).

In addition, Transport for NSW has developed a number of new environmental management measures to assist in managing impacts to recreational users of Middle Harbour, including but not limited to new environmental management measures CTT17 to CTT21 (refer to Table D2-1 of this submissions report).

### Environmental management

If the project is approved, the Department of Planning, Industry and Environment would issue conditions of approval for the management of key issues. These would need to be adhered to by both Transport for NSW and the selected contractor/s, in addition to the environmental management measures provided in Table D2-1 of this submissions report. The methodologies and protocols to be implemented to comply with these requirements would be documented in a construction environmental management plan and relevant sub-plans which would be approved by the Department of Planning, Industry and Environment prior to construction commencing. The contractor/s would be responsible for implementing the conditions of approval, and Transport for NSW would monitor the contractor's compliance with the conditions of approval during construction.

The construction environmental management plan would include a number of sub-plans, including a plan to address maritime works and maritime traffic, which would cover hazards and risks to maritime and recreational users (refer to Section D1 of this submissions report).

The implementation of the environmental management measures and actions to be identified in the construction environmental management plan and sub-plans would assist in reducing the impact of maritime construction activities upon recreational users and communicate pre-construction and construction activities that result in restrictions to waterways and changes in berthing and moorings.

### **C5.3.4 Utilities**

#### ***Issue raised***

Submitters raised concerns that the project may impact on utilities. Specific concerns include:

- Concerns that there would be disruptions to gas or electricity supplies and that the disruption would negatively impact the education of students at Northern Beaches Secondary College Balgowlah Boys Campus and St Cecilia's Catholic School over a prolonged period
- Concerns the proposed power supply on Kirkwood Street, used to supply the project power, would require the road or footpath to be dug up. Queries how the construction would be carried out and whether there would be an impact on parking
- Concerns the proposed temporary noise barrier behind Kirkwood Street residents would be located on top of a sewerage line.

#### ***Response***

Proposed treatments for existing utilities within the construction footprint, including utilities that would need to be relocated or adjusted, are identified in Appendix D (Utilities management strategy). Utilities investigations and consultations with utility providers have been carried out and would continue during further design development and construction phases of the project, which would inform the interaction of existing utilities with temporary and permanent project infrastructure and inform further design refinement as required. Appendix D (Utilities management strategy) details how stakeholder coordination would be carried out and the environmental impact objectives for the work. These objectives seek to minimise the potential disruption of these activities to the surrounding community and environment.

Where possible, project construction would avoid impacts to residential and other sensitive receivers. Ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction works/construction support sites and sensitive social infrastructure above the tunnel alignment (eg 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 SE2 (refer to Table D2-1 of this submissions report). Should the project require disruption of any utility connections, appropriate community consultation would be carried out in accordance with the community consultation framework included in environmental management measure SE3 (refer to Table D2-1 of this submissions report).

## **C5.4 Temporary construction support sites**

### **C5.4.1 General**

#### ***Issue raised***

Submitters raised general concerns with respect to temporary construction support sites, including:

- Temporary construction support sites should not be located in areas close to residents or rich in biodiversity since urban bushland in Sydney is scarce. As such, Clive Park and Middle Harbour should not be used as temporary construction support sites
- Concerns regarding the layout, construction activities to occur, number of workers, regrading works, provision of car spaces, use of laydown areas, size of structures, site access and light impacts on nearby properties
- Submitters have objected to the location of several temporary construction support sites and in some instances requested their relocation, including:

- Cammeray Golf Course construction support site (BL1) as residents would be impacted by Western Harbour Tunnel and Warringah Freeway Upgrade project as well as the project
- Flat Rock Drive construction support site (BL2)
- Punch Street construction support site (BL3)
- The use of Middle Harbour and the location of the temporary mooring facility. It is suggested to relocate the temporary mooring facility to Sailors Bay
- Balgowlah Golf Course construction support site (BL10)
- Wakehurst Parkway south construction support site (BL12)
- Wakehurst Parkway east construction support site (BL13)
- It is considered confusing to describe the Wakehurst Parkway east construction support site (BL13) as in Killarney Heights
- Concerns regarding the use of Clive Park during construction and potential impacts to Clive Park Heritage Area
- Requests for temporary structures to be removed at the conclusion of construction.

### ***Response***

#### Locating temporary construction support sites

Temporary construction support sites are required along the project corridor to support both tunnelling and surface works. Construction requirements as well as environmental investigations and community and stakeholder feedback were used to inform the identification and configurations of temporary construction support sites, as outlined in Section 4.5.7 of the environmental impact statement. Locating temporary 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:

- Locating the temporary construction support sites as close as possible to project construction areas
- Avoiding sensitive environments and community locations where possible
- Avoiding material impacts on heritage sites or items
- Maximising opportunities for direct access to motorways and arterial roads or water transport opportunities for construction traffic, and avoiding the need to use local residential streets if possible
- Minimising direct and indirect property impacts and acquisition requirements, particularly in residential areas.

In urban environments, it is difficult to achieve all of these requirements. Transport for NSW understands the importance of minimising impacts on local communities, and the primary driver for the location of temporary construction support sites was to minimise environmental and community impacts, while being suitably located to facilitate the construction of the project.

A summary of the project's temporary construction support sites, including indicative site layout, site access and construction activities to be carried at each site, is provided in Section 6.8 of the environmental impact assessment. Detailed construction planning would confirm the layout, including number of car parking spaces to be provided, and activities to be carried out at temporary construction support sites. Refer to Section A5.1.1 of this submissions report for further details regarding construction worker parking.

Further detail is provided on the selection of Cammeray Golf Course, Middle Harbour and Wakehurst Parkway east construction support sites below. Discussion on Flat Rock Drive construction support site (BL2) is provided in Section C5.4.2 below.

#### Cammeray Golf Course construction support site (BL1)

Impacts to land within Cammeray Golf Course would initially result from the establishment of infrastructure required to support construction of the Western Harbour Tunnel and Warringah Freeway Upgrade project. Part of the site would be later adjusted to support the establishment of the Cammeray Golf Course construction support site (BL1). The Warringah Freeway Upgrade component of the Western Harbour Tunnel and Warringah Freeway Upgrade project would provide the structural works for the cut and cover and trough structures for the Beaches Link ramps to and from the Warringah Freeway. This would allow maximum use of the road corridor by the Warringah Freeway Upgrade contractor/s and minimise disruption. The subsequent continued use of Cammeray Golf Course as a temporary construction support site by the project would remove the need for additional site establishment works. The site is required to complete the excavation and fitout (including pavement works to tie-in to the Warringah Freeway Upgrade) of the trough and cut and cover structures connecting Beaches Link mainline tunnels and the Warringah Freeway.

As discussed in Section C5.2.1 above, cumulative impacts will be managed through multi-party engagement and cooperation, which 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 C11 (refer to Table D2-1 of this submissions report).

#### Middle Harbour

The location of the cofferdams within Middle Harbour is subject to the alignment of the mainline tunnel. The mainline tunnel alignment options were developed and assessed by a multidisciplinary team including design engineers, construction engineers, transport planners and environmental advisors with five preferred corridor alternatives shortlisted as outlined in Section 4.4 of the environmental impact statement. It would not be possible to move the location of the cofferdams without changing the alignment of the tunnel. There is still some uncertainty surrounding the location of both cofferdams as outlined within Table 28-2 of the environmental impact statement. The final location and layout of the Middle Harbour cofferdam construction support sites (BL7 and BL8) would be confirmed during further design development and construction planning, with consideration of geotechnical conditions, the final construction methodologies for the project and in accordance with the conditions of approval.

It would not be feasible to use Sailors Bay as a temporary mooring facility as this bay is limited in space to manoeuvre the large, completed units and would require the transportation of the first four completed immersed tube tunnel units through the Middle Harbour construction zone for storage which may result in delays to construction works.

#### Wakehurst Parkway east construction support site (BL13)

Details of further evaluative investigations carried out for the Wakehurst Parkway east construction support site (BL13) including further community consultation are outlined in Section 4.5.7 of the environmental impact. The current siting of the temporary construction support site was identified as the preferred location, as it:

- Avoids impact to the operation of Seaforth Oval
- Minimises potential impacts on the nearby community precinct
- Uses land owned by the NSW Government

- Allows tunnelling to occur in both a northerly and southerly direction (reducing construction duration).

Transport for NSW can confirm that the Wakehurst Parkway east construction support site (BL13) is within Killarney Heights as per the NSW Planning Portal ePlanning Spatial Viewer. The locality of all temporary construction support sites are able to be seen in Figure 6-23 to Figure 6-29 of the environmental impact statement

### Clive Park

The project does not intend to use Clive Park as a temporary construction support site. The construction methodology includes cofferdams to allow the construction of the interface structures to be offshore, so as to avoid direct impact on foreshore heritage items including the Harbour Foreshore at Seaforth and heritage items at Clive Park (eg Clive Park tidal pool and Clive Park Aboriginal heritage items), and has minimised temporary and permanent impacts to the Middle Harbour shoreline. An overview of the location of temporary construction support sites used by the project is presented in Figure 6-1 of the environmental impact statement.

The tunnel alignment under Clive Park would be about 50 metres below ground level as indicated in Figure 5-10 in the environmental impact statement, and no surface accesses, permanent or temporary, are proposed. It is noted that there is a chamber offset from the driven tunnel shown in Figure 6-26 of the environmental impact statement in the vicinity of Clive Park. This chamber is not a tunnel connection or for access during construction – rather it is for an underground high voltage substation.

Further information on non-Aboriginal heritage sites and Aboriginal cultural heritage sites at Clive Park is provided in sections C13.2 and C14.2.2 respectively of this submissions report.

### Temporary structures

All temporary structures required for construction and not required for the operation of the project would be removed from temporary construction support sites. Land subject to temporary use would be rehabilitated in accordance with environmental management measure LP5 (refer to Table D2-1 of this submissions report) and in agreement with the landowner.

## **C5.4.2 Flat Rock Drive construction support site (BL2)**

### ***Issue raised***

Submitters raised general concerns and made recommendations with respect to the Flat Rock Drive construction support site (BL2), including:

- Concerns regarding the justification for the location of the temporary construction support site due to site-based impacts
- The previously proposed temporary construction support site at Artarmon is considered to be a more appropriate site as it is not within a residential area
- The Flat Rock Drive construction support site (BL2) should be moved, with suggested alternative locations include the western side of Flat Rock Drive (eg baseball field), Artarmon industrial area or North Balgowlah
- Temporary construction support sites should not be located in areas close to residents and rich in biodiversity since urban bushland in Sydney is scarce. Subsequently Flat Rock Reserve should not be used as a temporary construction support site



- Recommendations that an alternate entry and exit to the Flat Rock Drive construction support site (BL2) should be provided from Small Street to give trucks access to Willoughby Road/Warringah Freeway
- Recommendations that a slip lane northbound for unladen trucks to enter the Flat Rock Drive construction support site (BL2) and a slip lane southbound for laden trucks to depart should be considered
- Requests for an investigation as to whether there is a sufficient buffer between excavation of landfill and sensitive land uses in accordance with best practice guidelines. Concerns that the minimum separation distances recommended for these activities have not been met
- All landfill exposed by tunnelling at the Flat Rock Drive construction support site (BL2) should be capped at the end of tunnelling and crushed sandstone reinstated as a contoured base for re-establishment of locally indigenous vegetation and habitat.

### ***Response***

#### **Site location**

The general process carried out by the project to select temporary construction support sites is described above in Section C5.4.1; additional context for the selection of the Flat Rock Drive construction support site (BL2) is provided below. Due to the highly urbanised nature of the suburbs between Naremburn and Middle Harbour, and the depth of the tunnel through this area, limited viable intermediate tunnelling sites were considered to be suitable for the project. Multiple sites were considered, and two sites were shortlisted as options to support tunnel construction from Flat Rock Drive:

- On the Flat Rock Baseball Diamond located on the western side of Flat Rock Drive
- Within part of Flat Rock Reserve on the eastern side of Flat Rock Drive in land that was revegetated post 1998.

Other alternative sites as well as potential additional intermediate tunnelling sites to improve tunnelling efficiency were considered unfavourable as they would have required haulage of spoil on local streets (some of which are narrow), caused local amenity impacts and resulted in the acquisition of a substantial number of private residential and/or commercial properties.

The Flat Rock Reserve option was identified as the preferred location for this temporary construction support site, primarily because it avoids direct impacts to the local operational recreation facilities of Willoughby Recreation Centre, netball courts, the baseball diamond and other recreation spaces on the western side of Flat Rock Drive, which are in high demand for local community use.

Additionally, the preferred site would provide direct arterial road access, avoiding haulage through local streets and town centres and direct impacts to private properties. The size of the preferred site would allow the construction of an access decline and the ability to tunnel in three different directions, reducing the number of required intermediate tunnelling sites overall.

Further discussion on the selection of the preferred location of Flat Rock Drive construction support site (BL2) is provided in Section 2 (Flat Rock Drive temporary construction support site (BL2) options analysis) of the preferred infrastructure report. This includes discussion on the necessity of the Flat Rock Drive construction support site (BL2) to the overall project, and the stakeholder and community engagement activities that have occurred in the selection of the preferred location. A comparative assessment of Flat Rock Reserve option and Flat Rock Baseball Diamond option is also provided within Section 2 (Flat Rock Drive temporary construction support site (BL2) options analysis) of the preferred infrastructure report. The outcomes of the comparative assessment

confirm the Flat Rock Reserve option continues to be the preferred option for the Flat Rock Drive construction support site (BL2) for the following reasons:

- Reduced impact to the community as there would be no impact to organised sporting facilities within Bicentennial Reserve and informal recreation at Flat Rock Reserve will still be feasible throughout construction of the project
- Reduced risk of contamination impacts with the Flat Rock Reserve option. There would also be a lower human health risk associated with the exposure of potential release of landfill gases with the Flat Rock Reserve option compared to the Flat Rock Baseball Diamond option
- The Flat Rock Reserve option would require less land to be temporarily leased from Willoughby City Council.

#### Impacts to biodiversity

The majority of vegetation that would be impacted at the Flat Rock Drive construction support site (BL2) consists of native revegetation that has been planted over the last 23 years as part of the progressive rehabilitation of a former landfill site (refer to Section 3.4.1.1 of Appendix S (Technical working paper: Biodiversity development assessment report)). The site has avoided impacting the remnant vegetation and the southern part of the site also includes a large area of cleared, mown exotic grassland. A number of environmental management measures will apply to the establishment and operation of Flat Rock Drive construction support site (BL2) to minimise and manage impacts to biodiversity (eg environmental management measures B1, B11, B12, B16 and revised environmental management measures B6 and B14, refer to Table D2-1 of this submissions report).

At the end of construction, the impacted portion of Flat Rock Reserve will be rehabilitated in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report):

Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community. The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.

#### Access to the temporary construction support site

It would not be favourable to provide access to Flat Rock Drive construction support site (BL2) via Small Street as it is preferred to minimise heavy vehicle movements on local roads. Small Street is used extensively by the local community to access the local recreation and sports facility on the west side of Flat Rock Drive and Willoughby City Council has requested that the project avoid access via Small Street. During site establishment, some light vehicles may use Small Street for access to the site, but during construction, access would be via Flat Rock Drive only.

Safe access to the Flat Rock Drive construction support site (BL2) would be controlled by traffic lights, with a new right hand turn lane be provided northbound for construction traffic to safely enter the site. However, the provision of a slip lane southbound is not considered necessary from a safety perspective. It is further noted with that the provision of a southbound slip lane would also likely require additional vegetation clearance and widening of the existing shared path underpass including associated significant earthworks.

#### Management of excavated materials

Further investigations of potentially contaminated areas including at Willoughby Leisure Centre and Bicentennial Reserve, Willoughby and Flat Rock Reserve, Northbridge directly affected by the project will be carried out and managed in accordance with the requirements of guidance endorsed

under section 105 of the *Contaminated Land Management Act 1997*, as per revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). The Remediation Action Plan will be prepared in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) in the event site remediation is warranted. Additionally, ground gas investigations will be carried out in Flat Rock Reserve to further assess the potential presence of landfill gas in accordance with revised environmental management measure SG15 (refer to Table D2-1 of this submissions report).

The management of spoil and excavated materials would depend on its composition, and whether it is considered to be suitable or unsuitable for reuse. Potential reuse for spoil generated by the project is described in Section 24.3.3 of the environmental impact statement. Further investigations will be carried out at the Flat Rock Drive construction support site (BL2) to determine the feasibility of encapsulation of contaminated materials on site, in accordance with environmental management measure WM9 (refer to Table D2-1 of this submissions report). Where contaminated soils and other materials are to be encapsulated on-site, encapsulation will be designed in accordance with the requirements detailed in the *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (Australian and New Zealand Environment and Conservation Council (ANZECC), 1999).

### **C5.4.3 Open space**

#### ***Issue raised***

Submitters raised concerns and made requests regarding open space, including:

- Requests that construction sheds at the Cammeray Golf Course construction support site (BL1) be placed underground to minimise the loss of green space
- It is unclear when the Balgowlah Oval would be inaccessible during construction works
- Objections to the location of the access road from Sydney Road during construction, as the access road is close to the existing Balgowlah Oval and cricket nets and concerned this would make the oval unsafe and unusable.

#### ***Response***

##### **Cammeray Golf Course**

The access decline at the Cammeray Golf Course construction support site (BL1) would be constructed within an acoustic shed to minimise tunnelling impacts on local residents and the community and facilitate 24 hour tunnelling activities.

It would not be feasible to locate the acoustic shed underground, given the extent of groundworks that would need to occur to facilitate the approach, potential health and safety impacts for construction workers and the additional cost. The Cammeray Golf Course construction support site (BL1) has been designed and developed to minimise impacts to the golf course and allow for a reconfigured nine-hole golf course to operate throughout construction and operation.

##### **Balgowlah Oval**

The existing Balgowlah Oval would remain operational throughout construction until a new facility is commissioned; it would not form part of the Balgowlah Golf Course construction support site (BL10), as shown in Figure 6-38 of the environmental impact statement. Construction of the new access road and the new and improved open space and recreation facilities would be staged, including maintaining the current access to the existing Balgowlah Oval during construction until a new facility is operational.

The layout of the new and improved open space and recreation facilities at Balgowlah Oval, as shown in Figure 5-28 of the environmental impact statement, is indicative and would be subject to the dedicated consultation process required by revised environmental management measure LP4 (refer to Table D2-1 of this submissions report).

Vehicle movements to and from the Balgowlah Golf Course construction support site (BL10) will be managed to ensure pedestrian, cyclist and road user safety, in accordance with environmental management measure CTT9 (refer to Table D2-1 of this submissions report).

#### **C5.4.4 Access to Middle Harbour construction support sites**

##### ***Issue raised***

Submitters requested that construction vehicles be prohibited from accessing the Middle Harbour south cofferdam construction support site (BL7) from Sailors Bay Road.

##### ***Response***

The Middle Harbour south cofferdam construction support site (BL7) would only be accessed via marine vessel and barge movements within Middle Harbour. As such, the site would not be accessible via road, including via Sailors Bay Road (except in the unlikely event of an emergency on site at the southern cofferdam).



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C6 – Stakeholder and community engagement

## C6 Stakeholder and community engagement

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## C6.1 Environmental impact statement

### ***Issue raised***

Submitters raised concerns about the accessibility of the environmental impact statement documents. Specific concerns and requests include:

- Concerns that some submitters had difficulty accessing the environmental impact statement documents online and that copies were not made available at libraries for review
- Concerns that given the length of the environmental impact statement, the document was difficult to read on a screen, and members of the community were unable to effectively navigate the document and provide meaningful comment
- Concerns that the environmental impact statement was highly technical and difficult for members of the community to understand and comment on
- Requests that the environmental impact statement is re-exhibited for community consideration once made more accessible and with clearer subject headings
- Concerns that the environmental impact statement is repetitive.

### ***Response***

#### Accessibility and navigation of the electronic environmental impact statement

As noted in Section A1.5 of this submission report, the environmental impact statement was placed on public exhibition on 9 December 2020, with an exhibition closing date of 1 March 2021. This equated to a total exhibition period of 61 days, noting that the period between 20 December 2020 and 10 January 2021 (inclusive) was not included within the 61 days as part of the official exhibition period.

Electronic copies of the environmental impact statement were available to view and download from:

- The Department of Planning, Industry and Environment's Major Projects website: [www.planningportal.nsw.gov.au/major-projects/project/10456](http://www.planningportal.nsw.gov.au/major-projects/project/10456)
- The project's interactive online portal: [nswroads.work/blportal](http://nswroads.work/blportal).

To assist with online accessibility of the environmental impact statement, the document was provided in parts (larger files including multiple chapters in one document) or individual chapters (smaller file size). Large technical working papers (appendices to the environmental impact statement) were broken into parts to reduce file size.

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 were 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 project's interactive online portal also had a dedicated [documents section](#) which broke down the environmental impact statement chapters into clear headings and included a summary of what each chapter detailed, along with a relevant thumbnail picture.

In addition, Transport for NSW also prepared a *Community guide to the environmental impact statement* which was also available through the project's interactive online portal. This document was provided as an overview to support the more detailed descriptions and assessments provided in the full environmental impact statement. This guide was created as a community friendly

document to summarise the full environmental impact statement in a concise and easy to read manner.

#### Availability of physical copies of the environmental impact statement

Physical copies of the environmental impact statement are typically displayed at local councils and libraries during the exhibition period of environmental impact statements. However, given the COVID-19 restrictions, physical copies of this environmental impact statement (along with copies of the *Community guide to the environmental impact statement*) were instead distributed to local councils and electorate offices. The individual COVID-19 policies of each of the local councils or electorate offices determined whether they were displayed or not.

Section A2.3.4 of this submissions report provides details on which offices received a printed copy of the environmental impact statement and which locations chose to display this printed copy. It should be noted that in the instances the environmental impact statement was displayed, it may not have been displayed for the whole exhibition period. In particular, due to the Public Health (COVID-19 Northern Beaches) Order 2020 stay-at-home advisory issued in December 2020, the Northern Beaches Council was closed for a period of time.

#### Accessibility, 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 the potential impacts. With a project as large and complex as the Beaches Link and Gore Hill Freeway Connection, the level of required assessment is substantial, resulting in a large environmental impact statement. The Beaches Link and Gore Hill Freeway Connection project environmental impact statement complexity and length is consistent with other recent projects, including the Western Harbour Tunnel and Warringah Freeway Upgrade project.

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 working papers, through to the main document chapters and the executive summary.

To assist community accessibility of the environmental impact statement, a number of community engagement tools were developed and implemented for the exhibition period, including:

- *Community guide to the environmental impact statement* – prepared to further help the reader to navigate and understand the environmental impact statement and provided as a separate online resource. Details of how to view the full environmental impact statement were also included in the community guide and readers were encouraged to make a submission to the Department of Planning, Industry and Environment
- The project's interactive online portal – developed to help readers navigate information contained in the environmental impact statement and made available from the start of exhibition of the environmental impact statement. The interactive online portal featured a virtual information room, interactive map, animations/videos (including recordings of virtual community information sessions – see next point) and before/after slides. Further detail on the project's interactive online portal is provided in Section A2.3.6 of this submissions report
- Virtual community information sessions – twelve virtual information sessions were held during the exhibition of the environmental impact statement to provide the community with an overview



of the environmental impact statement and address any questions and concerns. These sessions were attended by the project team, including technical leads, engineers, environment and planning personnel and specialists in traffic, noise, vibration, air quality and human health. Recordings of these sessions were made available on the project's interactive online portal. Further detail on the virtual community information sessions is provided in Section A2.3.7 of this submissions report

- Project factsheets – a total of 16 factsheets were created to summarise specific details of the environmental impact statement including the temporary construction support sites in each area, air quality, traffic/transport, biodiversity and noise and vibration. The factsheets were available to view and download from the project's interactive online portal and links were also sent to stakeholders via email where relevant
- A frequently asked questions document was developed to address key topics and concerns from the environmental impact statement. This document is available to view and download from the project's interactive online portal and this was progressively updated as more enquiries were received from the community and in response to issues raised during the online information sessions.

In addition to the above, the project phone number and email were available prior to and during the environmental impact statement exhibition period as channels for the community and stakeholders to find out more information and ask questions.

While the environmental impact statement will not be re-exhibited, Transport for NSW is continuing to consult with the community and stakeholders as described in Section 7.5 of the environmental impact statement. This includes publishing information relating to the processes and activities associated with the project, providing appropriate avenues for providing comment or raising concerns and ensuring that the community is aware of these avenues. Further details on engagement which has occurred with stakeholders and the community since the end of the exhibition period is provided in Section A2.4 of this submissions report.

Appendix E (Community consultation framework) provides the framework to engage and consult with community and stakeholders on the project and to receive and respond to feedback during project development, delivery and operation, in accordance with environmental management measure SE3 in Table D2-1 of this submissions report.

#### Repetition in the environmental impact statement

With a project as large and complex as the Beaches Link and Gore Hill Freeway Connection, the level of required assessment and detail is substantial. Therefore, some detail is repeated more than once in the environmental impact statement, to ensure that important contextual information is easily and readily available to the reader without having to cross-reference.

## **C6.2 Engagement during environmental impact statement preparation**

### **C6.2.1 Consideration of previous community feedback**

#### ***Issue raised***

Submitters raised concerns about the provision for and consideration of community feedback prior to the exhibition of the environmental impact statement, including:

- Insufficient opportunity for the community to provide feedback on design aspects of the project, including ventilation outlet locations and the recent changes to the connection to and from Burnt Bridge Creek Deviation

- A lack of consideration was given to concerns raised by the community prior to the exhibition of the environmental impact statement.

### ***Response***

#### Provision for community feedback on project design

An extensive community engagement process has been carried out for the project before exhibition of the environmental impact statement as described in Section 7.2 of the environmental impact statement and summarised in Section A2.2 of this submissions report. This included two rounds of formal public consultation for the Western Harbour Tunnel and Beaches Link program of works:

- Between April and June 2017 following the announcement of the concept design
- Between July and December 2018 following the publishing of the proposed reference design.

The detail on the community engagement activities carried out for each of these periods is provided in Table 7-5 and Table 7-6 of the environmental impact statement respectively.

Given the community engagement activities carried out in 2017 and 2018, there has been substantial opportunity for the community to provide feedback on design aspects of the project.

Specific to the community feedback on design aspects relating to air quality, including the location and operation of tunnel ventilation system, Table 7-7 of the environmental impact statement provides the number of comments received on this topic during 2017 and 2018 consultation periods. In total, 5797 comments were received. Design refinements which were made in response to feedback, including consideration of feedback regarding ventilation outlet locations and ramps, are detailed in Table 7-9 of the environmental impact statement.

The design of the connection to and from Burnt Bridge Creek Deviation and the Balgowlah access road continued to be refined from the design provided in the 2019 community update. The design as detailed in Chapter 5 (Project description) of the environmental impact statement was refined beyond the design provided in the 2019 community update, so as to:

- Increase the amount of public open space that can be returned (and returned earlier during project delivery)
- Reduce construction staging on Burnt Bridge Creek Deviation
- Shorten the new access road and remove the need to demolish and replace the existing Kitchener Street bridge thereby improving traffic and transport outcomes
- Reduce impacts to Burnt Bridge Creek
- Reduce flood impact risks during construction and operation
- Reduce impacts on existing utilities such as sewer and stormwater
- Reduce potential impacts on the local Grey-headed Flying-fox colony
- Eliminate low cover tunnelling under properties in Hope Street.

Community feedback on the recent design changes to the connection to and from Burnt Bridge Creek Deviation and the Balgowlah access road and response to this feedback is provided in sections C4.1.6 and C4.1.7 of this submissions report.

#### Consideration of community feedback

The environmental impact statement process has provided the opportunity to comment on the project and the alternatives which were considered. Feedback received during preparation and prior to the exhibition of the environmental impact statement is summarised in Section 7.3 of the environmental impact statement. 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. A summary of specific project refinements that have occurred as a result of community and stakeholder feedback is provided in Table 7-9 of the environmental impact statement.

Feedback collated during the environmental impact statement exhibition period has been considered and responded to in this submissions report. Using this feedback, the Secretary of the Department of Planning, Industry and Environment will prepare an assessment report for the Minister for Planning and Public Spaces, who will then decide whether to approve the project and, if approved, identify a set of conditions of approval for Transport for NSW to adhere to during construction and operation of the project.

### **C6.2.2 Engagement and consultation process**

#### ***Issue raised***

Submitters raised concerns about the process of engagement and consultation carried out prior to the exhibition of the environmental impact statement, including:

- There was insufficient community consultation prior to the exhibition of the environmental impact statement and engagement activities were carried out to inform rather than to consult and engage with stakeholders and the community
- There was a lack of consultation with directly and indirectly impacted residents
- There was a lack of consultation with some recreational and sporting groups, including Balgowlah Golf Club, Bike North, Bicycle NSW, Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group and 1<sup>st</sup> Sailors Bay Sea Scouts
- Consultation regarding the location of the Flat Rock Drive construction support site (BL2) did not occur with general users of Flat Rock Reserve and community groups
- Questions whether consultation with Northern Beaches Council was carried out on how local traffic issues resulting from the project would be resolved
- Door knock and pamphlet drop activities took place during work hours when residents were not home to participate, limiting the opportunity for face-to-face engagement.

#### ***Response***

##### Consultation to date and purpose of engagement activities

Community and stakeholder engagement has been an integral component in the development of the project and the Western Harbour Tunnel and Beaches Link program of works more widely. The engagement process has proactively informed and engaged stakeholders and community members during project development. This approach aimed to increase public understanding of the project, encourage participation in the development process and promote the benefits of the project to local communities and stakeholders. The project has benefited from the input of local knowledge, insight, experience, goals and priorities and learnings from other major infrastructure projects, which has helped to identify issues, develop potential mitigation strategies and realise opportunities to improve project outcomes.

Extensive engagement and consultation has been carried out with the community throughout the project's development prior to the exhibition of the environmental impact statement in accordance with the Secretary's environmental assessment requirements, as described above. Engagement activities carried out to date for the project prior to the exhibition of the environmental impact statement is outlined in Section 7.2.6 of the environmental impact statement and summarised in Section A2.2 of this submissions report.

The engagement and consultation process for the project is described in Section 7.1 of the environmental impact statement and was guided by the engagement objectives listed in Section 7.1.1 of the environmental impact statement.

The two-way consultation and communication tools used as part of the project leading up to exhibition of the environmental impact statement are detailed in Section 7.1.4 of the environmental impact statement. This has included:

- General program information and feedback channels (including the program website, email address and 1800 number; letterbox drops; online community engagement map; program updates to email subscribers; feedback forms and ministerial enquiries)
- Hosted events (community feedback sessions and pop-up information displays)
- Resident, stakeholder and street meetings
- Door knocking impacted community members
- Notifications of early investigation work
- Newspaper advertisements, media releases and Facebook posts.

These tools provided a range of opportunities for the community to be engaged and consulted, provide feedback and be involved throughout the project's development.

#### Engagement and consultation with directly and indirectly impacted residents

Directly impacted residents are those whose property may be directly impacted by construction activities carried out for the project and may be affected by property acquisition. Engagement and consultation with directly impacted landowners and residents has been carried out since March 2017 as described in Section 7.2.5 of the environmental impact statement. As part of this consultation, a Personal Manager - Acquisition has been assigned to each directly impacted landowner and resident.

Transport for NSW allocates a Personal Manager - Acquisition who supports and engages directly with residential and commercial landowners who may be affected by property acquisition for the project. The Personal Manager - Acquisitions is in regular contact with these individuals to provide updates on the project, progress on the acquisition process and respond to questions and queries. Should acquisition for the project be confirmed for a particular property, the Personal Manager - Acquisitions will work with the affected landowners and residents to offer assistance and support throughout the acquisition and relocation process in accordance with environmental management measure LP3 (refer to Table D2-1 of this submissions report).

Consultation with indirectly impacted residents was carried out as part of broader community engagement for the project as described in Section 7.2.6 of the environmental impact statement and outlined in the response above. Activities carried out as part of this engagement included, but were not limited to, community feedback sessions, pop-up information displays, door knocks and letterbox drops.

#### Engagement and consultation with community and interest groups

Engagement and consultation have occurred and will continue to be carried out with a number of community and interest groups through activities such as briefings, meetings, presentations and workshops.

The list of community and interest groups which were consulted prior to the environmental impact statement exhibition is provided in Section 7.2.6 of the environmental impact statement and includes but is not limited to Balgowlah Golf Club and Northbridge Sailing Club. Engagement with community

groups and residents which occurred during and following exhibition of the environmental impact statement is outlined in Section A2.3.7 and Section A2.4.1 of this submissions report, respectively. This has included but is not limited to engagement with Bike North, Bicycle NSW, Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group and 1<sup>st</sup> Sailors Bay Sea Scouts. Further detail on consultation with community and interest groups is provided in Section A2.3.7 of the submissions report.

#### Consultation regarding Flat Rock Drive construction support site (BL2)

Between 26 July and 1 December 2018 Transport for NSW conducted an extensive community engagement program for the proposed reference design for the Western Harbour Tunnel and Beaches Link projects. The engagement program sought feedback on a variety of issues including preference between two mid-tunnel temporary construction support site options on Flat Rock Drive, including Flat Rock Drive construction support site (BL2), as described in Section 6.8.2 of the environmental impact statement.

This engagement program included:

- 20 community engagement sessions attended by more than 2600 people across nine locations
- Six shopping centre pop-up display sessions
- 35 meetings with local precinct committees, schools and school parents and citizens' (P&C) associations, resident groups, special interest groups and sporting associations
- Around 400,000 letterbox drops and more than 3890 direct door knocks.

Refer to Table 7-6 of the environmental impact statement for further details.

In total, the project received over 2186 pieces of feedback on the two mid-tunnel temporary construction support site options on Flat Rock Drive.

Given the extent of the engagement activities and feedback received, it is considered that adequate opportunity was provided for general users of Flat Rock Reserve and community groups to offer feedback.

Further detail on engagement activities and feedback received regarding the two mid-tunnel temporary construction support sites on Flat Rock Drive, including Flat Rock Drive construction support site (BL2), is provided in Section 2 (Flat Rock Drive temporary construction support site (BL2) options analysis) of the preferred infrastructure report.

#### Consultation with Northern Beaches Council

Consultation with Northern Beaches Council has been ongoing as part of project development and planning. Consultation activities carried out with Northern Beaches Council prior to exhibition of the environmental impact statement and engagement topics are detailed in Table 7-3 of the environmental impact statement. Topics discussed with Northern Beaches Council include but are not limited to project design and discussion of feedback from the local community. Engagement with Northern Beaches Council will continue through the next phases of the project, in accordance with Appendix E (Community consultation framework), including discussion on traffic and transport issues.

Refer to Section C8 of this submissions report for further discussion on operational traffic issues and Section B11 of this submissions report for the response to Northern Beaches Council's submission on the environmental impact statement.

### Timing of engagement activities

While every opportunity is made to carry out door knocking and letter box drops when residents are home to facilitate face to face engagement, it is not always possible. If a resident was not at home, a contact card was left with contact details of the project for the resident to get in touch.

In light of COVID-19 impacting the working habits of the community, the team found that during door knocking activities for the environmental impact statement, the majority of residents have been home and the team were able to have lengthy conversations with residents to respond to questions they had.

A number of other community engagement activities were carried out during the 2017 and 2018 consultation periods that maximised the opportunity for face-to-face engagement, including community feedback sessions attended by the project team and technical specialists and pop-up information displays at major shopping centres in proximity to the project. Further detail on these engagement activities is provided in Table 7-5 and Table 7-6 of the environmental impact statement. As discussed above, the project email address and 1800 phone number were also available during preparation of the environmental impact statement.

## **C6.3 Engagement during environmental impact statement exhibition**

### ***Issue raised***

Submitters raised concerns regarding consultation and engagement carried out during exhibition of the environmental impact statement, including:

- Virtual information sessions were inefficient, not held at convenient times and submitters had difficulty logging in
- Staff answering the project phone number during the exhibition period had limited knowledge of the project and could not answer technical questions
- Transport for NSW did not follow up on enquiries during the exhibition period
- Concerns that issues raised during exhibition of the environmental impact statement may not be considered
- Elements of the project were visually misrepresented in engagement material.

### ***Response***

#### Virtual information sessions

The environmental impact statement was exhibited during the global COVID-19 pandemic, which presented a unique set of challenges for any face-to-face engagement. In addition, during the exhibition period the Public Health (COVID-19 Northern Beaches) Order 2020 stay-at-home advisory was issued in December 2020. As such, the engagement strategy was adapted to focus predominately on digital engagement tools such as the online environmental impact statement and community guide, the project's interactive online portal and virtual information sessions.

Twelve virtual information sessions were held during the exhibition of environmental impact statement, attended by the project team and technical specialists. The aim of the virtual information 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. Questions were answered by the project team both via the chat function in the virtual information sessions and live on camera by the technical specialists.

Where relevant, questions which could not be immediately answered were taken on notice and a response was emailed or a follow up phone call was provided. In addition, the team updated the FAQs document progressively which was made available (and is still available) on the project's interactive online portal following the virtual information sessions to provide more responses to the most popular questions from the sessions.

Following the first round of virtual information sessions in January 2021, the second round of virtual information sessions in February 2021 were refined based on community feedback to include more time for questions and answers, and less time on formal presentations. In addition, the first round of sessions provided a valuable insight that the community wanted key topics/concerns including air quality, noise and vibration, traffic and biodiversity impacts to be addressed in more detail. As such, the second round of sessions included additional slides providing more details on these topics and the sessions were opened with some discussion on commonly asked questions as a starting point. Based on the feedback from the first round of sessions, a dedicated air quality session was organised to address air quality concerns, with air quality specialists, including a representative from the Office of the NSW Chief Scientist and Engineer in attendance.

Further detail on the virtual information sessions is provided in Section A2.3.7 of this submissions report, including the dates and number of attendees at each of the session. Session timing was late afternoon and/or evening to avoid normal business hours and to provide more opportunity for community attendance. The session timing for each project location information session was rotated between later afternoon and evening to provide the community with the best opportunity of attending at least one session.

Transport for NSW acknowledges two instances of technical issues experienced while running the virtual information sessions:

- 19 January 2021/Northbridge/Willoughby: some stakeholders who had registered to attend the event were sent the incorrect link due to a technical issue. During the session, the project team realised that these stakeholders did not have the correct link and sent the correct link through while the session was in progress
- 9 February 2021/Air Quality: an incorrect link was sent to stakeholders who had registered to attend the event. This was rectified within half an hour of the session start time and the finish time was extended so that the session time remained the same (ie it was not cut short due to the delayed re-start time).

Recordings of the virtual information sessions were published to the project's interactive online portal and made available to the public during the exhibition period to ensure the community had access to these discussions, even if they were not able to attend (for example due to technical issues or unavailability). The recorded sessions were viewed over 3700 times during the exhibition period.

### Enquiries management

The project phone number is maintained by Transport for NSW's communication and stakeholder engagement staff who have a high-level understanding of the project and can provide guidance as to how to navigate the environmental impact statement document. Where questions are not able to be readily responded to by the communication and stakeholder engagement staff, advice is sought from the project team or relevant technical specialist to respond to the enquiry.

Where a follow up email or phone call is required, this is typically provided within five business days of the initial contact where possible. However, due to the volume of enquiries received during the environmental impact statement exhibition period and especially after the virtual information

sessions, this timeframe was not always achievable. All community enquires made during the exhibition of the environmental impact statement were followed up as required.

The project phone number (1800 931 189) and email ([whtbl@transport.nsw.gov.au](mailto:whtbl@transport.nsw.gov.au)) remain available as channels for the community and stakeholders to find out more information and ask further questions.

#### Consideration of issues raised during exhibition of the environmental impact statement

Submissions in response to the environmental impact statement were received and accepted by the Department of Planning, Industry and Environment during the public exhibition period and provided to Transport for NSW following the end of the exhibition period. On 11 March 2021, the Secretary of the Department of Planning, Industry and Environment requested Transport for NSW to prepare this submissions report to address the issues identified in the submissions from the community, interest groups and government agencies. An overview of the submissions received, and a summary of issues, is provided in Section A3.2 of this submissions report.

Each submission was examined in detail to identify and understand the issues raised. Part B of this submissions report provides responses to submissions provided by government agencies, including councils. Part C of this submissions report provides responses to issues raised by the community and interest groups.

For the community and interest group submissions, the content of each submission was reviewed and categorised based on key issues. The issues raised in each submission were extracted and collated and have been presented as a summary of the issues raised by individual submissions. This means that while the exact wording of a particular submission may not be presented in the summary of the issue, the intent of each individual issue raised has been addressed and corresponding responses to the issues have been provided. Where similar issues have been raised in different submissions, only one response has been provided. Refer to Section A3.2 of this submissions report for further detail on this process.

#### Accuracy of engagement material

The figures and diagrams provided in the environmental impact statement are based on the project concept design and are indicative only.

Artist impressions and photomontages were produced for the environmental impact statement and provide a representation of the project design features based on the current concept. The visual representations, as well as the maps and graphics in the environmental impact statement, are indicative at this stage and subject to further design development and construction planning.

## **C6.4 Future engagement**

### **C6.4.1 Requests for issue or location-based community reference groups**

#### ***Issue raised***

Submitters requested the formation of several issue or location-based community reference groups and/or to be included in such group. Specific requests included:

- Establishment of a community reference group for the new and improved open space and recreation facilities at Balgowlah and for additional stakeholder groups, such as the Balgowlah Suns Junior AFL Club and AFL NSW/ACT to be included as part of the community reference group



- For a consultation group to be established that includes the community and other stakeholders to work collaboratively on the rehabilitation of Flat Rock Reserve
- Establishment of a maritime working group or similar to address concerns with construction works in and surrounding Middle Harbour
- Establishment of working groups with local schools including Northern Beaches Secondary College Balgowlah Boys Campus, St Cecilia's Catholic Primary School and Manly West Primary School
- Establishment of a mountain bike community working group to address concerns with the upgrade and realignment of Wakehurst Parkway.

### ***Response***

#### Open space and recreation facilities at Balgowlah community reference group

A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input into the final layout of the new and improved open space and recreation facilities at Balgowlah. This consultation will be separate to the consultation for the environmental impact statement. This process is expected to commence after planning approval and well in advance of construction starting. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space. The dedicated consultation process will be carried out in accordance with revised environment management measure LP4 (refer to Table D2-1 of this submissions report).

An expression of interest for participation in the consultation process is expected to be issued in early 2022. Stakeholder groups such as Balgowlah Suns Junior AFL Club and AFL NSW/ACT are able to nominate themselves to be considered as part of the community reference group.

#### Flat Rock Reserve consultation group

At the end of construction, the impacted portion of Flat Rock Reserve used as part of Flat Rock Drive construction support site (BL2) would be rehabilitated in consultation with Willoughby City Council and the community.

Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report). The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.

At this stage of the project, Transport for NSW is not proposing to form a Flat Rock Reserve consultation group. However, consultation will be carried out in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report) and Transport for NSW will provide community and interest groups an opportunity to be involved.

#### Maritime working group

Regarding the construction of the Middle Harbour crossing and potential impacts to recreational users, community groups and clubs, the community will be notified in advance of proposed maritime restrictions in Middle Harbour through appropriate media and other appropriate forms of community liaison in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report).

At this stage of the project, Transport for NSW is not proposing to form a maritime working group or similar to address concerns with construction works in and surrounding Middle Harbour. However, consultation will continue to be carried out with surrounding water-based users of Middle Harbour, including Mosman Rowing Club, Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group and 1<sup>st</sup> Sailors Bay Sea Scouts, to develop reasonable and feasible management measures to minimise construction impacts (refer to revised environmental management measure CTT16 provided in Table D2-1 of this submissions report).

#### Working groups with local schools

Transport for NSW has carried out extensive engagement with surrounding local schools, including Northern Beaches Secondary College Balgowlah Boys Campus and St Cecilia's Catholic Primary School since 2017, as described in Section 7.2.6 of the environmental impact statement. In addition, engagement with a number of schools has continued during exhibition of the environmental impact statement, including St Cecilia's Catholic Primary School and Seaforth Public School (refer to Section A2.3.7 of this submissions report). Northern Beaches Secondary College Balgowlah Boys Campus were contacted via email and phone during the exhibition of the environmental impact statement and offered a meeting.

A community communication strategy based on Appendix E (Community consultation framework) would be prepared to provide further details about community and stakeholder involvement during design, construction and the project opening phase. At this stage of the project, Transport for NSW is not proposing to form consultative working groups with local schools. However, Table 6-1 of Appendix E (Community consultation framework) includes a full list of local schools, including Northern Beaches Secondary College Balgowlah Boys Campus and St Cecilia's Catholic Primary School, which would continue to be engaged as part of the community communication strategy. Timing for consultation including communication tools and activities would be determined and included in the community communication strategy.

Ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction works/construction support sites and sensitive social infrastructure above the tunnel alignment (for example schools) about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measure SE2 (refer to Table D2-1 of this submissions report).

It is noted that Manly West Primary School is unlikely to be impacted by the project given their distance from the project.

#### Mountain bike community working group

During and following the exhibition of the environmental impact statement, mountain bike community groups such as TrailCare, Garigal Gorillas Mountain Bike Club, and Manly Warringah Mountain Bike club have been engaged on a number of occasions as documented in Section A2.3.7 of the submissions report. Transport for NSW also met with Northern Beaches Council representatives on 2 March and 19 May 2021 to discuss the mountain bike trails, new connectivity opportunities provided between Garigal National Park and Manly Warringah War Memorial State Park and the realignments of trails required during construction and operation of the project.

Based on community and bike interest group feedback and concerns raised in submissions on the environmental impact statement, in addition to further engagement with bike groups, Transport for NSW has carried out further targeted investigations to determine potential project impacts on mountain bike trails, and more accurately map where these active transport facilities are located. Further discussion and detail on the potential impacts to the mountain bike trail network adjacent to

Wakehurst Parkway and how impacts would be managed is provided in Section A4.5 of this submissions report.

At this stage of the project, Transport for NSW is not proposing to form a mountain bike community working group. However, Transport for NSW would continue to consult with Northern Beaches Council and relevant mountain bike community groups during further design development regarding potential impacts to the Manly Warringah War Memorial State Park mountain bike trail network adjacent to Wakehurst Parkway.

#### **C6.4.2 Future engagement activities**

##### ***Issue raised***

Submitters requested additional and ongoing consultation and transparent provision of information to interested stakeholders, residents, and members of the wider community. Specific requests include:

- Further consultation with Aboriginal, educational, sporting, recreational and other community groups as the project progresses to reduce and minimise impacts where possible and to be identified as key stakeholders for the project
- For Transport for NSW to engage appropriately qualified and briefed experts to establish a consultation process during construction to minimise short and long-term adverse impacts of the project and ensure effective communication with the community
- The appointment of dedicated liaison officers for directly impacted communities
- Consultation with the community and councils regarding potential solutions for parking issues during the construction phase
- Consultation regarding scheduling of nightworks to be carried out with the community
- Consultation on the number, type, positioning and ongoing operation of air, soil, surface water and groundwater monitoring stations for the project, including reporting of alerts and monitoring data
- Clarification of noise level measurements and units and requests for a noise specialist to visit residential areas to demonstrate the different noise levels that residents could potentially experience throughout construction.

##### ***Response***

#### **Further consultation and establishment of a consultation process during construction**

Transport for NSW aims to engage in an open, proactive and transparent community engagement and consultation process prior to and during construction of the project. Appendix E (Community consultation framework) provides the framework to engage and consult with the community and stakeholders, address issues raised in submissions on the project and to receive and respond to feedback during project development, delivery and operation, in accordance with environmental management measure SE3 (refer to Table D2-1 of this submissions report).

Should the project be approved, a community communication strategy would be developed in accordance with Appendix E (Community consultation framework). Construction contractor/s would be engaged to carry out further design development and construction. Together with Transport for NSW, the construction contractor/s would be responsible for communication and engagement and a detailed communication and engagement strategy would be developed and implemented. The construction contractor/s would be required to engage suitably qualified and experienced community relations personnel for the duration of construction work. This team would work in collaboration with the project's community and stakeholder team to ensure all community issues and concerns are

addressed comprehensively. The community communication strategy would describe in detail Transport for NSW's liaison and engagement process with stakeholders and consultation activities for the project development, delivery and operation.

Communication tools and activities for informing and consulting with stakeholders would be flexible, to suit the nature and scale of each stakeholder's interests and issues, and to reflect any restrictions on face-to-face engagement, as outlined in Section 6 of Appendix E (Community consultation framework). The community communication strategy would outline the application of communication tools to assist in community and stakeholder engagement activities, as well as the timing for consultation. Mechanisms for distributing information and seeking feedback from the community and stakeholders are discussed in Section 5 and proposed methods of engagement with different stakeholders are listed in Table 6-1 of Appendix E (Community consultation framework). The method of communication would be based on the level of information being provided and the timeframe for the delivery of information. Timing for consultation would be determined and included in the community communication strategy.

It should be noted that the list of stakeholders provided in Table 6-1 of Appendix E (Community consultation framework) will continue to evolve as the project progresses and further issues and stakeholders are identified.

#### Dedicated liaison officers

As discussed in the above response, mechanisms for distributing information and seeking feedback from the community and stakeholders are discussed in Section 5 and proposed methods of engagement with different stakeholders are listed in Table 6-1 of Appendix E (Community consultation framework).

While appointment of dedicated liaison officers for directly impacted communities has not been identified as part of the comprehensive range of communication tools to assist in community and stakeholder engagement activities, the processes and tools described are sufficient to ensure the directly impacted community and stakeholders would be well-informed, and to facilitate two-way communication.

#### Consultation regarding parking impacts during construction

Impacts resulting from on- and off-street parking changes during construction will be minimised where reasonable and feasible. This will be through tailored and complimentary supply and demand management strategies which will be determined during detailed construction planning, and potential impacts will be managed in accordance with revised environmental management measure CTT11 (refer to Table D2-1 of this submissions report). Depending on the location, this may include working with relevant council(s) to introduce appropriate parking restrictions or appropriate residential parking schemes.

Further detail on the impacts of parking during construction are provided in Section C7.8 of this submissions report.

#### Consultation regarding scheduling of nightworks

Some aspects of the project's construction, such as out of hours works, would require specific communications and/or management strategies due to the nature or duration of the potential impact and/or stakeholder group. Any such strategies would be guided by Appendix E (Community consultation framework) and managed through the community communication strategy. Indicative communications and management strategies for construction activities including out of hours work, is outlined in Section 7.1 of Appendix E (Community consultation framework). These communication

and management strategies would be further developed prior to construction as part of the community communication strategy as described in the above responses.

#### Community consultation on management and monitoring requirements for the project

Should the project be approved, the construction contractor/s would be responsible for compliance with the conditions of approval, overseen by 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 (in particular environmental management measures provided in Table D2-1 of this submissions report), as compliance requirements.

As detailed in Section D1 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, who would be responsible for their implementation, and how the performance of these measures would be monitored. The construction environmental management plan and associated sub plans listed in Table D1-1 of this submissions report would be developed in consultation with relevant stakeholders as determined by the Department of Planning, Industry and Environment. Given the technical nature of the requirements included in the construction environmental management plan and associated sub plans, it is not appropriate to develop them in consultation with the community.

Notwithstanding, and consistent with typical conditions of approval, Transport for NSW and/or the construction contractor/s would be required to publish current copies of the final version of each document required by the conditions of the approval on the project website. This would likely include, but not be limited to, the construction environmental management plan and associated sub plans, any audit and/or compliance tracking reports, and monitoring reports prepared as part of construction of the project.

#### Noise levels and requests for a noise specialist to demonstrate different noise levels

Decibels (dB) are a unit used to measure the intensity of noise which uses a base 10 logarithmic scale. The A-weighted decibel (dB(A)) is generally used for the purposes of environmental noise impact assessment as it has been adjusted to account for the varying sensitivity of the human ear to different frequencies of sound, as highlighted in Section A.2.2 of Annexure A of Appendix G (Technical working paper: Noise and vibration).

To assist in the interpretation of the noise levels, a summary of noise levels, in the context of comparable activities, resulting from proposed construction activities is provided in Figure 10-1 of the environmental impact statement. In terms of sound perception, a change of 1 dB(A) or 2 dB(A) is difficult for most people to detect, a 3 dB(A) to 5 dB(A) change corresponds to a small but noticeable change in loudness, and an increase of 10 dB(A) is perceived as a doubling of loudness, as outlined in Table 10-2 of the environmental impact statement.

The request for a noise specialist to visit residential areas to demonstrate the different noise levels that residents would likely experience throughout construction has been noted. At this stage there is no plan for noise specialists to visit residential areas.

## **C6.5 Complaints handling during construction**

### ***Issue raised***

Submitters requested the establishment of a complaints procedure and site specific 24-hour construction hotlines and websites for the receipt of complaints and breach reports from members of the public.

### ***Response***

A complaints management system would be developed and implemented before the start of construction activities for the project, as outlined in Section 3 of Appendix E (Community consultation framework). Transport for NSW would ensure a number of different complaint mechanisms are provided to cater to different needs and preferences. This would include ensuring the following mediums are established and maintained to receive and address community enquiries and complaints for the duration of construction:

- A toll-free 24-hour telephone number(s) through which complaints and enquiries can be registered
- A postal address to which written complaints and enquires may be sent
- An email address to which electronic complaints and enquiries may be transmitted
- A mediation system for complaints unable to be resolved
- A mechanism for community members to make enquiries in common community languages of the area.

Details of how to make a complaint would be included in all communications materials such as community updates, notifications, advertisements and the project website. The toll-free project hotline would operate 24/7 during construction and continue for 12 months after the project opens.

A complaints and enquiry register would be established to record the details, response and outcome of complaints and enquiries received. All complaints would be investigated and an appropriate response would be provided to the complainant. In addition, and as described in Section 7.5.4 of the environmental impact statement, a Community Complaints Commissioner (an independent specialist) would oversee the complaints management system and follow up on any complaint where the public is not satisfied with the response.

The complaints management system would be maintained during construction and for 12 months after the project is completed.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C7 – Construction traffic and transport

## C7 Construction traffic and transport

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## C7.1 Assessment approach and methodology

### ***Issue raised***

Submitters raised concerns about the methodology of the construction traffic and transport assessment. Specific requests, concerns and comments included:

- The impact of construction traffic on local roads has been inadequately assessed and underestimated
- Concerns that construction vehicle movements have been added to current data in the traffic model and then deemed insignificant
- The assessment should demonstrate the impact of construction traffic on typical travel times
- The assessment does not account for the effects of additional slow-moving heavy vehicles on Spit Road due to construction
- Concerns that the traffic assessment study area did not include local streets at Nareburn, Northbridge, Cammeray, Mosman and Manly Vale
- Concerns that haulage routes for spoil have not yet been decided and therefore the assessment of potential heavy vehicle impacts is incomplete
- Requests that “occasional deliveries” outside standard construction hours is clarified
- Concerns that pedestrian and cycle surveys in Appendix F (Technical working paper: Traffic and transport) were undertaken in July 2017 and have not been updated with respect to COVID-19.

### ***Response***

#### Construction traffic modelling approach

The construction traffic and transport assessment has been prepared to address the Secretary’s environmental assessment requirements. A summary of the results is provided in Chapter 8 (Construction traffic and transport) of the environmental impact statement while the detailed assessment report is included in Appendix F (Technical working paper: Traffic and transport). An overview of the construction modelling approach used in the assessment of the project is outlined in Section 8.2 of the environmental impact statement.

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). Traffic modelling has followed the processes and procedures detailed in the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013b), in addition to other Transport for NSW, Austroads and NSW Government guidelines, including acceptance of typical assumptions and limitations. The modelling approach developed by Transport for NSW has been independently reviewed by internal and external subject matter experts, and is considered to be appropriate and fit for purpose for the project.

The construction traffic and transport assessment included an assessment of how construction of the project would affect the performance of the road network. This took into consideration peak construction activity vehicle movements generated by each of the temporary construction support sites, in addition to the proposed access routes to and from each site (sections 5.2.2, 5.3.2, 5.4.2 and 5.5.2 of Appendix F (Technical working paper: Traffic and transport)). A quantitative assessment of the performance of the road network during construction has been completed through the use of traffic modelling and analysis as described in Section 8.2.3 of the environmental impact assessment. Project construction traffic peak volumes were added to the background traffic

volumes to gauge the level of impact in terms of increased traffic delays/travel times at the most materially impacted locations.

The construction traffic and transport assessment focused on the impacts during peak construction activities, which is a conservative assumption used to identify the greatest potential impact of the project. For example, the assessment of road network performance was based on the highest potential construction site traffic movements expected per hour. Peak construction activities are likely to be generally through the middle third of the construction program. Therefore, for periods outside the peak, hourly construction traffic movements and consequent impacts would generally be lower than the peak site traffic numbers used in the assessment.

#### Heavy vehicle traffic on Spit Road

Impacts to Spit Road during construction have been considered in terms of intersection performance and maximum queue lengths at the Spit Road/Parriwi Road/Spit West Reserve car park/Spit West Reserve construction support site (BL9) access, in addition to mid-block performance (refer to Section 5.4 of Appendix F (Technical working paper: Traffic and transport)). It is acknowledged that Spit Road would carry higher traffic volumes during construction, although the increase would be relatively small given its function as a State Road which currently accommodates large volumes of traffic including heavy vehicles. Detailed traffic management plans would be developed to ensure that these impacts would be appropriately mitigated (refer to Part D of this submissions report for further discussion on construction environmental management plans). The Spit Road/Parriwi Road intersection, which would provide direct access to and from the Spit West Reserve construction support site (BL9), would continue to operate at a satisfactory level of service with and without construction vehicles.

Refer to Section C7.6 of this submissions report for discussion on heavy vehicle management.

#### Study area definition and description

The areas that would be expected to be most significantly impacted by construction traffic would be largely confined to the surface work sites and temporary construction support sites. These locations are analysed and documented in Chapter 8 (Construction traffic and transport) of the environmental impact statement and Appendix F (Technical working paper: Traffic and transport) in areas comprising: Warringah Freeway and surrounds, Gore Hill Freeway and Artarmon, Balgowlah and surrounds, and Frenchs Forest and surrounds.

A qualitative assessment of potential impacts to local roads, including those at Naremburn, Northbridge, Cammeray, Mosman and Manly Vale is outlined in Section 5 of Appendix F (Technical working paper: Traffic and transport).

The vast majority of roads to be used by construction vehicles are State and regional roads (refer to Table 6-39 of the environmental impact statement). As such, it is expected that there would be few direct impacts to local roads. The largest potential impact to local roads is associated with the management of construction workforce parking; this is discussed in further detail in Section C7.8 of this submissions report.

#### Spoil haulage routes

Indicative construction vehicle routes to and from the project's temporary construction support sites are provided in sections 5.2.2, 5.3.2, 5.4.2 and 5.5.2 of Appendix F (Technical working paper: Traffic and transport). The final destinations for excess spoil which cannot be reused on site is subject to several factors including the quality of spoil, commercial arrangements with waste, recycling or reuse providers, and sustainability considerations (ie where fill material is most needed). The final destinations for spoil would be planned following appointment of the construction contractor/s. Final

destinations may change during the project construction period as beneficial re-use destinations change and evolve over time. Construction haulage routes would be included in the traffic management plan (a sub-plan under the construction environmental management plan) and would be accordingly adjusted to suit the evolution of destinations during the project construction period as discussed in Section D1 of this submissions report.

### Occasional deliveries

Some deliveries to and from the temporary construction support sites and surface works areas would be needed outside of standard construction hours, including transport of over-size materials such as bridge beams and for the delivery and removal of large over mass plant and equipment. Such deliveries outside of standard construction hours would be occasional and infrequent.

### COVID-19 impacts on pedestrian and cycle surveys

The COVID-19 pandemic is an unprecedented event that is currently impacting the way people work and their travel patterns, while creating uncertainty about the future, as discussed in Section 3.1 of the environmental impact statement. Significant uncertainty still exists about the longer-term impacts of COVID-19. At this time, the duration of term impacts to transport demands and behaviours from the COVID-19 pandemic are still unknown, and current traffic conditions and travel behaviours are the result of a variety of temporary factors, including reduced public transport capacity and demand.

Transport for NSW will continue to monitor and analyse the potential long-term effects of the COVID-19 pandemic on travel demand, including changes to existing travel conditions as well as future travel behaviours and underlying economic demand drivers.

A more discussion about the effects of COVID-19 in relation to the project and traffic conditions more generally is provided in Section A5.1.17 of this submissions report.

## **C7.2 General construction traffic and transport impacts**

### ***Issue raised***

Submitters raised concerns about impacts on the road network during construction, including:

- Concerns and objections to construction traffic, including heavy vehicles, causing congestion of the local traffic network (including impacts to intersection performance) and reduced amenity for communities near the construction footprint over a five to six year construction period
- Request for councils, schools and community associations to be engaged in the preparation of the construction traffic management plan
- Suggestions that a Traffic Coordination Group be established with community representatives
- Requests for independent monitoring of construction traffic and a community reporting hotline
- Concerns about traffic using local streets to avoid construction areas (surface road works and temporary construction support sites)
- Concerns that construction traffic would damage roads used by the project.

### ***Response***

#### Performance of the road network

Proposed access routes to the project's temporary construction support sites are summarised in Table 6-39 of the environmental impact statement. Temporary construction support sites have been located to minimise heavy vehicles travelling through local streets as described in Section 4.5.7 of the environmental impact statement. The majority of temporary construction support sites have

direct access to the motorway, the arterial road network, or the harbour (for transport via barge). It is noted that the vast majority of roads to be used by construction vehicles are State and regional roads. As such, it is expected that there would be few direct impacts to local roads.

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 peak. The peak activity period is likely to be around one third of the overall construction program. The traffic and transport assessment found that some localised impacts to the local road network (ie small increases to delays and congestion) would occur at Gore Hill Freeway and Artarmon, Balgowlah and surrounds, and Frenchs Forest and surrounds, as outlined in Section 8.4 of the environmental impact statement. The performance of the Warringah Freeway and surrounding road network would not materially change and temporary impacts would be manageable.

In any particular location, throughout the indicative construction program, different construction activities would take place over different periods as shown in Table 6-3 of the environmental impact statement. As a result, potentially impacted areas are not likely to experience impacts for the entire duration of construction.

#### Preparation of a traffic management plan

Section D1 of this submissions report builds upon the environmental management plan framework in Section 28.5 of the environmental impact statement, identifying a framework for the management of key issues. Table D1-1 provides the likely sub-plans, along with the relevant guidelines and/or requirements of each plan, which would support the implementation of the construction environmental management plan. One of the construction environmental management plan sub-plans would be a traffic management plan.

The traffic management plan would be prepared in accordance with *Traffic control at work sites Technical Manual* (Transport for NSW, 2020g), Australian Standard AS 1742.3.-2019 *Manual of uniform traffic control devices – Part 3: Traffic control for works on roads* (Standards Australia, 2019b), and any other relevant standard, guide or manual. The content and purpose of the traffic management plan would be developed in consultation with relevant stakeholders as determined by the Department of Planning, Industry and the Environment.

The traffic management plan for the project would include:

- Monitoring and inspection requirements
- Compliance records
- Driver certification requirements.

Environmental management measures have been developed to minimise impacts to the community. The traffic management plan would incorporate relevant construction traffic and transport environmental management measures provided in Table D2-1 of this submissions report. These measures, which aim to avoid and minimise impacts on the local road network, include:

- Ongoing consultation, as relevant to the location, will be carried out with Greater Sydney Operations, the Port Authority of NSW, local councils, emergency services and bus operators to minimise traffic and transport impacts (refer to environmental management measure CTT6)
- The community will be notified in advance of proposed transport network changes, and maritime restrictions through appropriate media and other appropriate forms of community liaison (refer to environmental management measure CTT7)
- Construction road traffic will be managed to minimise impacts of movements during peak periods where feasible and reasonable (refer to environmental management measure CTT8)

- Vehicle movements to and from construction sites will be managed to ensure pedestrian, cyclist and road user 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 (refer to environmental management measure CTT9)
- Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by variable message signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes (refer to environmental management measure CTT10)
- Truck marshalling areas will be identified and used where required, to minimise potential queueing, to ensure associated road user safety and minimise traffic and access disruptions in the vicinity of construction support sites and access points to construction sites (refer to revised environmental management measure CTT13)
- Activities requiring temporary partial road closures will be carried out outside of peak periods and/or during night time to minimise the impact of these activities on the road network where feasible and reasonable (refer to environmental management measure CTT14).

All measures will be designed and deployed in accordance with relevant standards and guidelines (including Austroads, Australian Standards and applicable Transport for NSW standards), and review and approval of detailed traffic management plans would be carried out by relevant stakeholders and subject matter experts.

### Community engagement

Ongoing consultation as relevant to the location will be carried out with Greater Sydney Operations, the Port Authority of NSW, local councils, emergency services and bus operators to minimise traffic and transport impacts in accordance with environmental management measure CTT6 (refer to Table D2-1 of this submissions report). Traffic management arrangements would be determined through the Traffic Control Group process in consultation with the relevant council, where relevant.

The community will be notified in advance of proposed transport network changes and maritime restrictions through appropriate media and other appropriate forms of community liaison in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report). Further, a traffic and transport liaison group would be established, including representatives from appropriate councils and other transport stakeholder groups to discuss traffic management, pedestrian management and road safety during construction, as outlined in Section 7.1 of Appendix E (Community consultation framework).

In addition, Transport for NSW would ensure several different complaint mechanisms are provided. This would include a toll-free 24 hour telephone number(s) through which complaints and enquiries can be made.

There would be numerous obligations on the contractor/s and Transport for NSW in terms of ongoing monitoring and communication of environmental impacts during construction, including those related to construction traffic. As noted in the above response, the traffic management plan would include monitoring and inspection requirements and mechanisms for compliance records. If the project is approved, the conditions of approval would likely prescribe compliance measures for the monitoring of impacts, environmental reporting and environmental performance. The contractor/s would be responsible for implementing the conditions of approval, and Transport for NSW would monitor the contractor/s compliance with the conditions of approval during construction. Refer to Section C1.4.2 of this submissions report for further detail on compliance monitoring.

### Use of local roads to avoid construction areas

The construction traffic impact assessment carried out for the project (see Section 5 of Appendix F (Technical working paper: Traffic and transport)) included a comprehensive analysis of the likely impacts of construction on local traffic. Access routes to the temporary construction support sites are proposed which utilise the motorway network or major arterial roads rather than local roads, where practical, to minimise impacts to local roads. Overall, the assessment concluded that the project's construction would not result in a significant increase in vehicle numbers on local roads, either in terms of construction vehicles or other general traffic. Even taking into account the cumulative effect of traffic associated with construction of other projects, (assessed in Section 5.7 of Appendix F (Technical working paper: Traffic and transport)), increases in traffic and consequent congestion due to the project's construction would be relatively minor.

Construction works would require the temporary closure of only two local roads: Lambs Road, Artarmon between Punch Street and Cleg Street and the northern end of Kirkwood Street, Killarney Heights. At Artarmon, the temporary closure of Lambs Road would not impact on local traffic. At Killarney Heights, the temporary closure of Kirkwood Street, other than requiring local traffic to divert via Judith Street, would not create a shortcut that might be used for rat-running, or be a cause of increased congestion.

Changes in driver behaviour cannot be reliably predicted or quantified. However, changes in traffic around the temporary construction support sites, such as potential rat running or an increase in traffic congestion along local roads, would be further discussed with the traffic and transport liaison group, which would be established with key stakeholders as outlined in the response above.

Where impacts associate with construction traffic are predicted to occur, congestion is already occurring from the high levels of background traffic. Notwithstanding, these works would be carried out in accordance with the traffic management plan and other environmental management measures to minimise impacts to roads users, particularly during peak times.

### Damage to local roads

As discussed above, the majority of construction support sites have direct access to the motorway, the arterial road network, or the harbour (for transport via barge) and the vast majority of roads to be used by construction vehicles are State and regional roads. As such, it is expected that there would be few direct impacts to local roads. Notwithstanding, a road condition report will be prepared before any local road is used by a heavy vehicle, as required by revised environmental management measure CTT1 (refer to Table D2-1 of this submissions report). Where damage to the road network (beyond normal wear and tear) is caused by heavy vehicles the road will be restored to at least the condition it was pre-works or compensation will be offered to the road owner.

## **C7.3 Location-specific impacts**

### **C7.3.1 Warringah Freeway and surrounds**

#### ***Issue raised***

Submitters raised concerns about potential construction traffic and local road impacts in the Warringah Freeway area. Specific queries, concerns and comments include:

- Concerns about the potential cumulative traffic and transport impacts due to temporary construction support sites operating concurrently (ie Cammeray Golf Course (BL1), Flat Rock Drive (BL2) and Punch Street (BL3) construction support sites)
- Concerns Flat Rock Drive and Brook Street are not suitable for heavy vehicles

- Concerns the proposed signalised intersection for the Flat Rock Drive construction support site (BL2) would impact traffic flows and cause delays
- Concerns about resident access to and from local roads and driveways connecting to construction access routes such as Brook Street, Ernest Street and Flat Rock Drive, due to the predicted increased number of trucks using these roads
- Questions whether the traffic assessment considered weekly traffic demand peaks such as Saturday morning sport at Bicentennial Reserve
- Concerns that the description in Table 4-4 of Appendix F (Technical working paper: Traffic and transport) is incorrect, as it describes Cammeray Golf Course as a key destination for Amherst Street. However, Amherst Street is a key east/west access route to Cammeray, while Cammeray Golf Course is accessed from Park Avenue
- Concerns about construction traffic impacts along Flat Rock Drive and Brook Street at Naremburn as it is an access route for emergency vehicles to Royal North Shore Hospital and Naremburn Ambulance Station.

### ***Response***

#### Cumulative traffic impacts

The assessment of construction traffic impacts in Warringah Freeway and surrounds is provided in Section 8.4.1 of the environmental impact statement and Section 5.2 of Appendix F (Technical working paper: Traffic and transport). The assessment of construction impacts in Warringah Freeway and surrounds includes the Cammeray Golf Course (BL1) and Flat Rock Drive (BL2) construction support sites operating concurrently. Given that spoil trucks for the project would predominantly use major arterial roads, potential cumulative impacts inclusive of Punch Street construction support site (BL3) and any other overlapping projects would be minor.

The intersection and midblock performance results for the road network operating under the worst case construction traffic scenario during peak periods are summarised in Table 8-15 and Table 8-16 respectively of the environmental impact statement.

Assessment of the performance of key locations in the road network affected by construction activities indicates that the road network in the Warringah Freeway and surrounds areas would not materially change under construction conditions, and that the temporary impacts of construction on traffic operation would be manageable.

#### Access to temporary construction support sites

Access routes to temporary construction support sites are proposed to be from major arterial roads rather than local roads where feasible. Most roads to be used for construction vehicle access to the project in the Warringah Freeway area and surrounds are State or regional roads. They include Brook Street, Flat Rock Drive and Ernest Street as shown in Table 5-4, Figure 5-10 and Figure 5-11 of Appendix F (Technical working paper: Traffic and transport). As concluded in Section 5.2.4 of Appendix F (Technical working paper: Traffic and transport), changes in traffic performance on these roads during construction would be minor when compared to pre-construction conditions.

Brook Street/Flat Rock Drive is a sub-arterial road with two lanes in each direction and up to 9 per cent heavy vehicles in the AM peak. A new intersection with traffic signals would be constructed on Flat Rock Drive to provide turning access for northbound traffic to, and safe egress for traffic exiting, the Flat Rock Drive construction support site (BL2). During construction, this intersection would operate at LoS A, as noted in Table 5-6 in Appendix F (Technical working paper: Traffic and transport), with only minor delays to through traffic on Flat Rock Drive.

Vehicle access to and from temporary construction support sites, including consideration of turn paths, would continue to be developed during further design development and construction planning, and be designed in accordance with relevant Austroads guidelines, Transport for NSW standards and Australian Standards.

A traffic management plan would be prepared for the construction phase of the project. Potential impacts from construction traffic, including proposed access arrangements for temporary construction support sites, will be managed through the implementation of the environmental management measures provided in Table D2-1 of this submissions report (in particular environmental management measures CTT9 and CTT10), ensuring appropriate traffic management and safety measures are in place.

#### Construction traffic and private property access

- Construction traffic impacts at Brook Street/Flat Rock Drive and Ernest Street are addressed in Section 8.4.1 of the environmental impact statement. The forecasted overall traffic volumes during construction are not significantly different to existing traffic volumes.

As traffic volumes would not be significantly different during construction and impacts to intersections would be minor, ease of access to private property along the construction vehicle routes would not be affected. Construction traffic during peak periods will be managed to minimise impacts of movements during peak periods where feasible and reasonable in accordance with environmental management measure CTT8 (refer to Table D2-1 of this submissions report).

The community will be notified in advance of proposed transport network changes, and maritime restrictions through appropriate media and other appropriate forms of community liaison, in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report). Where impacts to private property access are unavoidable during construction, landowners or lease holders/tenants where appropriate will be consulted in advance to develop appropriate alternative access arrangements in accordance with environmental management measure LP6 (refer to Table D2-1 of this submissions report).

#### Peak traffic periods

The traffic modelling was based on the worst case peak construction activity traffic scenario (assumed to occur during the peak period of spoil removal from tunnel construction and adjacent surface road works) occurring during the AM peak (between 7am and 9am on a normal working weekday) and PM peak (between 4pm and 6pm on a normal working weekday) to demonstrate the maximum potential traffic performance impact of the project. While it is acknowledged that construction works are also scheduled to occur between 8am to 1pm on Saturdays, which may coincide with local sporting activities, the peak traffic levels during this time are lower than weekday peaks. As such, the construction traffic and transport assessment has provided a conservative assessment of traffic performance impacts.

Ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction sites and temporary construction support sites about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measure SE2 (refer to Table D2-1 of this submissions report).

#### Amherst Street

Table 4-4 of Appendix F (Technical working paper: Traffic and transport) is intended to provide an overview of key road network features within the study area. It is acknowledged that Amherst Street provides access between eastern and central parts of Cammeray and to Cammeray Golf Course, via Park Avenue. While the description of key destinations from Amherst Street was not exhaustive,



the quantitative traffic volumes and traffic patterns adopted for each key road govern the assessment and outcomes, and the description is appropriate.

#### Access for emergency vehicles

Ongoing consultation, as relevant to the location, will be carried out with Greater Sydney Operations, the Port Authority of NSW, local councils, emergency services and bus operators to minimise traffic and transport impacts in accordance with environmental management measure CTT6 (refer to Table D2-1 of this submissions report).

Flat Rock Drive and Brook Street are construction vehicle routes that would provide access to the Flat Rock Drive construction support site (BL2). However, the volume of construction traffic would represent only a minor change when compared to pre-construction conditions as discussed in Section 5.2 of Appendix F (Technical working paper: Traffic and transport). Therefore, emergency vehicles would still be able to travel along Flat Rock Drive and Brook Street as required. Should construction of the project require temporary traffic diversions, road occupation or temporary road closures, emergency vehicles would make use of alternative detour routes where required, or would proceed under traffic control as part of the site-specific construction traffic and access management controls.

### **C7.3.2 Gore Hill Freeway and Artarmon**

#### ***Issue raised***

Submitters raised concerns about potential construction traffic and local road impacts in the Gore Hill Freeway and Artarmon area. Specific concerns and requests include:

- Concerns regarding and objections to construction traffic including heavy vehicles causing congestion at Artarmon Road, Reserve Road, Butchers Lane and Barton Road at Artarmon, due to activity at the Barton Road construction support site (BL5)
- Concerns construction traffic would cause property access issues for businesses in the Artarmon industrial area, including Reserve Road, due to activity at the Punch Street (BL3) and Dickson Avenue (BL4) construction support sites
- Requests that access to the Reserve Road on-ramp to Gore Hill Freeway be maintained for residents throughout construction
- Concerns the number of light vehicles expected to use the Barton Road construction support site (BL5) has been underestimated.

#### ***Response***

#### Impacts due to construction traffic and heavy vehicles

Most heavy vehicles accessing the Gore Hill Freeway and Artarmon construction area would be travelling to and from the Punch Street construction support site (BL3), with all other sites operating as smaller support sites, generating a substantially lower number of heavy vehicle movements as described in Section 8.4.2 of the environmental impact statement. Relatively low impacts are expected on Hampden Road, Barton Road, Butchers Lane and Reserve Road north of Gore Hill Freeway given the low number of construction vehicles on these roads (fewer than 120 light vehicle and 60 heavy vehicle movements per day) as discussed in Section 8.4.2 of the environmental impact statement. No construction traffic is expected to use Artarmon Road.

A summary of the predicted construction traffic impacts in the Gore Hill Freeway and Artarmon area is provided in Section 8.4.2 of the environmental impact statement. The intersection performance results for the road network operating under the worst case construction traffic scenario during peak periods are summarised in Table 8-17 of the environmental impact statement. The midblock

performance results for the road network operating under the worst case construction traffic scenario during morning and evening peak periods are summarised in Table 8-18 of the environmental impact statement. The assessment of performance at key locations in the road network affected by construction traffic indicates that the road network may experience some localised impacts during construction. In addition, the Gore Hill Freeway/Reserve Road interchange currently operates close to capacity during peak periods and this would continue during construction. However in most locations, road performance would continue to operate satisfactorily during peak periods.

It is noted that the Gore Hill Freeway Connection works would involve complex construction staging in a constrained urban environment, including multiple complex utility adjustments, which would require careful management to minimise impacts. The contractor/s would finalise and complete plans for staging the work during further design development and construction planning in consultation with Transport for NSW.

Construction road traffic will be managed to minimise impacts of movements during peak periods where feasible and reasonable in accordance with environmental management measure CTT8 (refer to Table D2-1 of this submissions report). Management of construction traffic would be further detailed in the traffic management plan for the project. Temporary lane and road closures would generally be carried out outside of peak traffic periods and in accordance with other proposed environmental management measures, and the impacts of these closures would therefore be low.

#### Property access

Lambs Road between Punch Street and Cleg Street would be closed to traffic throughout construction as discussed in Section 8.4.2 of the environmental impact statement. Existing industrial/commercial properties currently located in this section of Lambs Road would be acquired to facilitate development of the Punch Street construction support site (BL3), as shown in Figure 6-32 of the environmental impact statement. Road access to other adjoining and nearby properties would not be affected.

Periodic short-term partial closures of Reserve Road, Hampden Road, Dickson Avenue and Punch Street would be needed during construction. Given the extensive local road network in Artarmon, vehicles would generally have multiple alternative routes available during these interim closures. Potential detour roads include Herbert Street, Carlotta Street, Campbell Street, Frederick Street and Cleg Street as outlined in Section 8.4.2 of the environmental impact statement.

Activities requiring temporary partial road closures will be carried out outside of peak periods and/or during night time to minimise the impact of these activities on the road network where feasible and reasonable, in accordance with environmental management measure CTT14 (refer to Table D2-1 of this submissions report). Any temporary road closures required would be carried out under traffic control to ensure safety and minimise disruption to the road network. Management of these day-to-day road closures and associated traffic management measures would be outlined in the traffic management plan. At locations where temporary and/or permanent road closures are required, access to private properties would be maintained or alternative arrangements made in agreement with the affected stakeholders in accordance with the requirements outlined in Appendix E (Community consultation framework).

#### Estimate of light vehicles using Barton Road construction support site (BL5)

The Barton Road construction support site (BL5) is the smallest of all the temporary construction support sites and would be primarily used for equipment laydown, car parking and site offices. Peak daily light vehicle and heavy vehicle volumes associated with spoil and waste removal, material deliveries and arrival and departure of construction personnel are summarised in Table 6-39 of the

environmental impact statement based on the indicative construction methodology and key activities proposed at the site.

### **C7.3.3 Balgowlah and surrounds**

#### ***Issue raised***

Submitters raised concerns about potential construction traffic and local road impacts in the Balgowlah area. Specific concerns and objections included:

- Concerns that Northern Beaches Council would become responsible for managing traffic congestion caused by the construction of project at Seaforth, Frenchs Forest, Manly Vale and Balgowlah
- Concerns about local traffic network congestion at Balgowlah and Manly Vale due to surface road works in Balgowlah
- Concerns about construction impacts on access to the Balgowlah Golf Course
- Concerns about potential cumulative traffic and transport impacts due to temporary construction support sites operating concurrently (ie Spit West Reserve (BL9), Balgowlah Golf Course (BL10), Kitchener Street (BL11), Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites)
- Concerns about road closures causing property access issues and congestion of the local traffic network in Balgowlah
- Concerns about traffic impacts at Spit Road due to additional openings of Spit Bridge for spoil barges, immersed tube tunnel steel shell units and specialised marine construction plant
- Objections to Sailors Bay Road at Northbridge being used by construction traffic to access Middle Harbour south cofferdam construction support site (BL7), which would cause disruption to small businesses and Northbridge Public School.

#### ***Response***

##### **Northern Beaches Council responsibility for traffic management**

Most roads forming part of construction vehicle routes are State or regional roads managed by Transport for NSW. As discussed in Section C7.2 of this submissions report, construction traffic is unlikely to have more than a minor impact on local roads. Traffic management arrangements would be determined through the Traffic Control Group process in consultation with the relevant council, where relevant. Further, access, congestion and advance notification of construction works potentially impacting these will be managed through the implementation of environmental management measures, in particular, CTT7, CTT8, CTT9 and CTT10 (refer to Table D2-1 of this submissions report).

A traffic management plan would be developed in consultation with relevant stakeholders as determined by the Department of Planning, Industry and the Environment and outlined in Section D1 of this submissions report. The traffic management plan would provide detail regarding the management of all construction-related traffic including light and heavy vehicles, construction traffic access and haulage routes, and the timing of certain types of construction traffic movements. Implementation of this plan would be the responsibility of the contractor/s and Northern Beaches Council would not be required to take responsibility for its implementation. Further, as outlined in Section 7.1 of Appendix E (Community consultation framework), a traffic and transport liaison group would be established, including representatives from appropriate councils and other transport stakeholder groups to discuss traffic management, pedestrian management and road safety during construction.

Section B11.7 of this submissions report provides further detail in the response to the Northern Beaches Council submission associated with construction traffic and transport, including management measures and strategies for the project.

### Local traffic network congestion

The assessment of construction traffic impacts at Balgowlah and surrounds is provided in Section 8.4.4 of the environmental impact statement. The performance of intersections (level of service (LoS)) within the Balgowlah and surrounds area with the introduction of construction traffic would generally remain the same as conditions without the project. The intersection Manly Road/Sydney Road/Burnt Bridge Creek Deviation would worsen from LoS C to LoS D during the PM peak. In addition, the intersection of Spit Road/Parriwi Road/Spit West Reserve car park/Spit West Reserve (BL9) construction support site access would worsen from a LoS B to LoS C also during the PM peak. The midblock performance during construction would be comparable to performance under conditions without the project at all locations, with the exception of Sydney Road east of Manly Road in the eastbound direction which would reduce from LoS C to LoS D during the PM peak. However, it is expected that Sydney Road in this location and direction would still operate with spare capacity and at a satisfactory level of service during construction.

As discussed in Section C7.2 of this submissions report, environmental management measures have been developed to minimise impacts to the community. The traffic management plan will incorporate relevant construction traffic and transport environmental management measures provided in Table D2-1 of this submissions report. These measures, which aim to avoid and minimise impacts on the local road network, include:

- Construction road traffic will be managed to minimise impacts of movements during peak periods where feasible and reasonable (refer to environmental management measure CTT8)
- Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by Variable Message Signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes (refer to environmental management measure CTT10)
- Truck marshalling areas will be identified and used where required, to minimise potential queueing, to ensure associated road user safety and minimise traffic and access disruptions in the vicinity of construction support sites and access points to construction sites (refer to revised environmental management measure CTT13)
- Activities requiring temporary partial road closures will be carried out outside of peak periods and/or during night time to minimise the impact of these activities on the road network where feasible and reasonable (refer to environmental management measure CTT14).

All measures will be designed and deployed in accordance with relevant standards and guidelines (including Austroads, Australian Standards and applicable Transport for NSW standards), and review of detailed traffic management plans would be carried out by relevant stakeholders and subject matter experts.

### Balgowlah Golf Course access

Balgowlah Golf Course construction support site (BL10) would occupy part of the golf course (about 28 per cent) for a period of up to five years. During this time the golf course would be permanently closed from the start of construction, should the project be approved.

### Cumulative construction impacts

The assessment of construction traffic impacts at Balgowlah and surrounds is provided in Section 8.4.4 of the environmental impact statement. The intersection performance results for the road network operating under the worst case construction activity traffic scenario during peak periods are summarised in Table 8-19 of the environmental impact statement. The midblock performance results for the road network operating under the worst case construction traffic scenario during peak periods are summarised in Table 8-20 of the environmental impact statement. The assessment of the performance of the road network at key locations affected by construction activities at Balgowlah and surrounds indicates that the road network may experience minor localised impacts during construction. However, in most locations it would still operate satisfactorily during peak periods.

The assessment includes Spit West Reserve (BL9), Balgowlah Golf Course (BL10) and Kitchener Street (BL11) construction support sites operating concurrently. Given that spoil trucks for the project would predominantly use major arterial roads, potential cumulative impacts inclusive of other temporary construction support sites, and any other overlapping projects, would be minor as outlined in Section 8.4.4 of the environmental impact statement.

### Maintaining property access

Activities requiring temporary partial road closures will be carried out outside of peak periods and/or during the night time to minimise the impact of these activities on the road network where feasible and reasonable, in accordance with environmental management measure CTT14 (refer to Table D2-1 of this submissions report). Any temporary road closures required would be carried out under traffic control to ensure the safety of construction personnel and the public, and minimise disruption to the road network. Management of these day-to-day road closures and associated traffic management measures would be outlined in the traffic management plan. At locations where temporary and/or permanent road closures are required, access to private properties would be maintained or alternative arrangements made in agreement with the affected stakeholders in accordance with the requirements outlined in Appendix E (Community consultation framework).

### Spit Road and Spit Bridge openings

The peak period for marine traffic would be during construction of the interface structures, where there may be up to 68 barge and workboat movements per day between the Spit West Reserve construction support site (BL9) and the Middle Harbour cofferdam construction support sites (BL7 and BL8), and the dredging works. However, the duration of these works would be relatively short as discussed in Section 5.6.3 of Appendix F (Technical working paper: Traffic and transport).

Transporting immersed tube tunnel steel shell units and specialised marine construction plant from the Outer Sydney Harbour to Middle Harbour would require access when the Spit Bridge is open. Given the length, draught, limited speed and manoeuvrability of the immersed tube tunnel units and specialised marine construction plant, special bridge opening times outside of peak traffic periods may be required to transport these units to their intended destination. This would require special arrangements and permits to be obtained. Any proposed changes to standard opening times would be advertised in advance to waterway users as part of the engagement processes outlined in Appendix E (Community Engagement framework) of the environmental impact statement.

### Impacts on Northbridge area

The Middle Harbour south (BL7) and Middle Harbour north (BL8) construction support sites are marine based and access for plant and materials would be by barge from the Spit West Reserve construction support site (BL9). Therefore, there would be no construction road traffic impacts on

Sailors Bay Road associated with these sites. In the unlikely event of an emergency at the Middle Harbour south (BL7) construction support site, access may be required via Sailors Bay Road. Potential road-related impacts from the use of Spit West Reserve construction support site (BL9) are discussed in Section 8.4.4 of the environmental impact statement.

### **C7.3.4 Frenchs Forest and surrounds**

#### ***Issue raised***

Submitters raised concerns about potential construction traffic and local road impacts in the Frenchs Forest area. Specific queries, concerns and requests included:

- Queries about proposed changes to intersection operation at Kirkwood Street and Judith Street at the Wakehurst Parkway during construction
- Concerns that the intersection of Frenchs Forest Road and Brook Road at Seaforth is not safe for large trucks to navigate
- Requests that heavy vehicles are prohibited along Sydney Road and Frenchs Forest Road through Seaforth village, residential areas and past Seaforth Public School.

#### ***Response***

##### Intersection operation at Kirkwood Street and Judith Street at the Wakehurst Parkway

During construction, Kirkwood Street would be closed to general traffic at its intersection with the Wakehurst Parkway. Vehicles that currently use Kirkwood Street would need to detour either via Judith Street or Burnt Street (or other routes) to reach the Wakehurst Parkway. Kirkwood Street would provide light construction vehicle access to the Wakehurst Parkway south construction support site (BL12). Access to the properties owned by Sydney Water and Telstra would also be slightly impacted, with vehicles required to access the properties via Judith Street and Kirkwood Street south as discussed in Section 8.4.5 of the environmental impact statement. The reduction in general traffic accessing Kirkwood Street in conjunction with only light vehicles accessing the Wakehurst Parkway south construction support site (BL12) at Kirkwood Street would result in an overall marginal improvement in the performance of the Wakehurst Parkway/Kirkwood Street intersection. The impact on diverted vehicles would be minor given that several nearby alternative local roads are available, including Judith Street and Burnt Street.

The impacts to the performance of the Wakehurst Parkway/Judith Street intersection are considered negligible, with a reduction in performance from LoS B to LoS C during the AM peak and improvement in performance from LoS D to LoS C in the PM peak.

The Wakehurst Parkway/Burnt Street intersection during construction would continue to operate at an acceptable level of service including the effects of the small volume of additional detoured vehicles generated by the changes described above.

##### Frenchs Forest Road and Sydney Road

The project does not propose spoil truck movements through Seaforth. Spoil trucks exiting the Wakehurst Parkway east construction support site (BL13) would be required to travel north on Wakehurst Parkway so as to avoid Sydney Road, minimising the impact of spoil truck movements on surrounding local roads. Spoil trucks would not be permitted to travel south through Frenchs Forest Road and Sydney Road and would therefore not impact businesses in the Seaforth Village along Sydney Road. Spoil haulage from Balgowlah Golf Course construction support site (BL10) would be directed to travel south along Manly Road/Spit Road/Military Road or north along Condamine Street/Pittwater Road so as to avoid Sydney Road west of Burnt Bridge Deviation and potential impacts to the Seaforth Village precinct.

## C7.4 Impacts to schools

### *Issue raised*

Submitters raised concerns about potential construction traffic impacts to schools. Specific concerns, requests and comments included:

- Concerns about impacts from construction traffic on schools located in the vicinity of the project, particularly during peak hours
- Requests for further details on measures that would be implemented to manage construction vehicle movements close to schools
- Requests for a curfew on truck movements during school hours
- Requests that trucks be prohibited from travelling through school zones
- Requests for appropriate induction of construction staff to inform them about the local road network and school zones
- The potential loss of parking near schools could hinder access for pick up and drop off, including at Artarmon Public School, Cammeray Public School and Northern Beaches Secondary College Balgowlah Boys Campus
- Concerns the Balgowlah Golf Course construction support site (BL10) would impact access to Northern Beaches Secondary College Balgowlah Boys Campus at Sydney Road and Maretimo Street
- The Sydney Road footbridge is used as part of the Northern Beaches Secondary College Balgowlah Boys Campus emergency evacuation plan and must be available to provide safe egress at all times.

### *Response*

#### Construction traffic near schools

Local schools have been identified in Table 6-1 of Appendix E (Community consultation framework) as key stakeholders and would continue to be engaged as part of the community communication strategy for the project. Ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction works/temporary construction support sites about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measure SE2 (refer to Table D2-1 of this submissions report)

A range of environmental management measures have been developed to minimise potential construction traffic impacts near schools (refer to Table D2-1 of this submissions report). These include:

- The community will be notified in advance of proposed transport network changes through appropriate media and other appropriate forms of community liaison (refer to environmental management measure CTT7)
- Construction road traffic will be managed to minimise impacts of movements during peak periods where feasible and reasonable (refer to environmental management measure CTT8)
- Vehicle movements to and from construction sites will be managed to ensure pedestrian, cyclist and road user 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 (refer to environmental management measure CTT9)

- Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by variable message signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes (refer to environmental management measure CTT10).

All measures will be designed and deployed in accordance with relevant standards and guidelines (including Austroads, Australian Standards and applicable Transport for NSW standards), and review of detailed traffic management plans would be carried out by relevant stakeholders and subject matter experts to ensure the safety of the community.

*QA Specification G10: Traffic Management* (Transport for NSW, 2020) requires construction personnel to be inducted on the traffic management plan, including knowledge of the relevant management measures, the local road network and school zones.

#### Loss of parking near schools

A range of management and mitigation measures would be implemented to avoid impacts on high traffic areas used by schools eg for pick-up/ drop-off and other functions. As outlined in Section C7.8 below, and further discussed in Section A5.1.1 of this submissions report, construction worker parking in local streets would be minimised through a range of complementary supply and demand initiatives, in accordance with revised environmental management measure CTT11 (refer to Table D2-1 of this submissions report). These initiatives would be tailored to suit the requirements and geographical spread of the workforce to ensure maximum take up, once the contractor/s have been engaged.

Potential parking impacts and associated management measures would be detailed in the traffic management plan.

#### Access to Northern Beaches Secondary College Balgowlah Boys Campus

Access to Northern Beaches Secondary College Balgowlah Boys Campus would be maintained throughout construction.

The Sydney Road/Maretimo Street intersection would be modified during construction, with an additional approach to allow access to the Balgowlah Golf Course construction support site (BL10) from Sydney Road as discussed in Section 8.4.4 of the environmental impact statement. Providing traffic signals at the intersection would be beneficial to vehicles performing a right turn into or out of Maretimo Street, including to and from the Northern Beaches Secondary College Balgowlah Boys Campus, which currently have to give way to multiple conflicting movements under the priority-controlled intersection arrangement. This would reduce conflict between vehicle movements and improve safety for both road users and pedestrians around the school area.

In addition, construction vehicles exiting the temporary construction support site via a right-turn would be required to give way to vehicles turning left from Maretimo Street and would not conflict with vehicles turning right. Traffic movements north-south (and vice versa) through the intersection between Maretimo Street and the Balgowlah Golf Course construction support site (BL10) (and future access road) would not be permitted.

A signalised pedestrian crossing would be provided at the new access road entrance to the Balgowlah Golf Course construction support site (BL10) off Sydney Road via the traffic signals provided at the Sydney Road/Maretimo Street/Access Road intersection. This would ensure safe passage for users of the Sydney Road pedestrian bridge, including students from the Northern Beaches Secondary College Balgowlah Boys Campus to the Balgowlah Oval.

The existing pedestrian bridge over Sydney Road would not be impacted by the project.



## C7.5 Road safety during construction

### *Issue raised*

Submitters raised concerns about road safety during construction. Specific concerns, requests and suggestions included:

- Concerns about road safety impacts from construction vehicles for pedestrians, cyclists and motorists, particularly at residential areas, aged care facilities and local roads near the project
- Concerns about road safety at key roads, intersections and pedestrian crossings including Brook Street, Slade Street, Strathallen Avenue, intersection of Ernest Street and Miller Street, intersection of Sydney Road and Maretimo Street, and multiple intersections with Reserve Road
- Concerns about safety impacts from construction vehicles accessing the temporary construction support sites, particularly Cammeray Golf Course (BL1), Flat Rock Drive (BL2), Balgowlah Golf Course (BL10), Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites
- Requests for construction traffic management measures such as marked crossings, pedestrian bridges and traffic marshals to ensure pedestrian safety near residential areas and schools, including at Flat Rock Drive
- Requests for reduced speed limits near temporary construction support sites to ensure pedestrian safety
- Concerns about safety issues for pedestrians and cyclists using existing active transport infrastructure and proposed detours, including on the existing bike route at Hampden Road at Artarmon, at Flat Rock Drive in Naremburn and in Balgowlah due to nearby temporary construction support sites and associated construction traffic
- Suggestions for construction vehicles to be clearly marked and identifiable.

### *Response*

Construction traffic represents a relatively small increase compared to background traffic volumes. In addition to project-specific rules and procedures, as for all road traffic, construction-related vehicles are required to comply with general road rules such as posted speed limits and intersection controls. Therefore, the project is unlikely to represent a significantly different safety risk compared with the existing situation.

Temporary 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 or arterial road network, or the harbour (for transport via barge). Given that pedestrian or cycle traffic would tend to use the arterial network less than local streets and not use the motorway network at all, this would limit the potential for interactions between pedestrians and cyclists and construction traffic. The proposed access points to and from the temporary construction support sites are described in Section 6.8 of the environmental impact statement. Vehicle access to and from temporary construction support sites would continue to be developed during further design development and construction planning, and be designed in accordance with relevant Austroads guidelines, Transport for NSW standards and Australian Standards.

A primary consideration during construction is the maintenance of public safety, near to and around temporary construction support sites and surface road works. Potential impacts from construction traffic including proposed access arrangements for temporary construction support sites would 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.

This includes management of vehicle movements to and from construction sites to ensure pedestrian, cyclist and road user 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, in accordance with environmental management measure CTT9 (refer to Table D2-1 of this submissions report). Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network, in accordance with environmental management measure CTT10 (refer to Table D2-1 of this submissions report). This will be supplemented by variable message signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes.

The community will be notified in advance of proposed transport network changes through appropriate media and other appropriate forms of community liaison in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report). Directional signage will be installed ahead of time and changed routes communicated ahead of time to ensure community members are prepared well in advance of the changes.

As discussed in Section C7.2, the traffic management plan would be developed prior to construction proceeding and include measures to manage public safety, including the above environmental management measures. Adherence to designated vehicle routes, speed limits, warning signage and other measures would also be incorporated to manage vehicle movements and safety.

The northern abutment work on Hampden Road would impact cyclists who currently travel on the road shoulder on either side of Hampden Road. During construction, one lane in each direction would be provided and cyclists would be required to travel on-road in mixed traffic as discussed in Section 8.4.2 of the environmental impact statement. Impacts would be mitigated by minimising the duration of work, with car parking removed on both sides of the road.

Direct impacts to existing pedestrian and cycling facilities will be minimised where reasonable and feasible. Any detours and adjustments will be designed with consideration of user safety and convenience, in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report). All temporary routes and detours for vehicles, cyclists and pedestrians will be designed in accordance with legislation and relevant standards and guidelines of Transport for NSW and other authorities.

As discussed in Section C7.2, a traffic management plan would be developed for the project. The traffic management plan would include the mandatory use of safety equipment such as flashing lights and reversing beepers. Trucks hauling spoil would likely be required to have external identification recognising the project as the source of the tunnel spoil.

## **C7.6 Heavy vehicle management**

### ***Issue raised***

Submitters raised queries and requests regarding the management of impacts from construction heavy vehicles, including:

- Concerns about amenity impacts if there were to be 24 hour truck movements
- Requests that construction vehicle movements must not occur outside of standard construction hours (7am to 6pm weekdays and 8am to 1pm Saturday)
- Requests that truck movements are restricted during peak hours
- Queries whether spoil trucks would use Sydney Harbour Tunnel or Sydney Harbour Bridge and Western Distributor

- Questions about how heavy vehicles will be prevented from using local roads and how this will be monitored
- Concerns about truck marshalling on public roads near temporary construction support sites and construction sites, particularly Cammeray Golf Course (BL1) and Flat Rock Drive (BL2) construction support sites where the roads are already perceived as constrained.

### ***Response***

#### Heavy vehicle construction hours

Standard construction hours for the project are 7am to 6pm Monday to Friday, and 8am to 1pm Saturday. Spoil haulage would be carried out during standard construction hours only. Some deliveries to and from the temporary construction support sites (being mainly concrete for tunnelling works) would be required outside of standard construction hours. These would be required on a nightly basis, however during each night, these deliveries would be relatively infrequent.

Spoil haulage routes are discussed in Section C7.1 of this submissions report. As noted in Section C7.1, the final destinations for spoil would be planned following appointment of the construction contractor/s. Final destinations may change during the project construction period as beneficial re-use destinations change and evolve over time. Construction haulage routes would be included in the traffic management plan.

Construction road traffic will be managed to minimise impacts of movements during peak periods where feasible and reasonable, as required by environmental management measure CTT8 (refer to Table D2-1 of this submissions report).

#### Construction vehicle movements and haulage routes

All temporary construction support sites have been selected to allow efficient access to and from State or regional roads and therefore minimise construction traffic on local roads where feasible. Temporary construction support sites, including access arrangements, are described in Section 6.8 of the environmental impact statement.

Outside of the traffic and transport assessment study area, most roads that form part of construction haulage routes are State or regional roads. The contribution of construction-related heavy vehicle traffic would be relatively minor compared to existing background traffic flows along most construction haulage routes, as outlined in Section 8.4 of the environmental impact statement.

Construction haulage routes would be included in the traffic management plan and would be adjusted periodically to suit the evolution of destinations during the project construction period as discussed in Section D1.1 of this submissions report.

Environmental management measures have been developed to minimise impacts to the community. Truck marshalling areas will be identified and used where required to minimise potential queuing, to ensure associated road user safety and minimise traffic and access disruptions in the vicinity of construction support sites and access points to construction sites, in accordance with environmental revised management measure CTT13 (refer to Table D2-1 of this submissions report). Vehicle movements to and from construction sites would be managed to ensure pedestrian, cyclist and road user 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 (refer to environmental management measure CTT9 in Table D2-1 of this submissions report). The traffic management plan would identify routes to be used to access the site and those for haulage. Monitoring and inspection of adherence to the proposed haulage routes would also be a requirement of the plan.

## **C7.7 Public and active transport**

### **C7.7.1 Changes to bus routes and services**

#### ***Issue raised***

Submitters raised concerns about proposed changes to bus routes, services and infrastructure during construction. Specific concerns included:

- Concerns that public transport connections (bus services) may be impacted during construction, particularly at Artarmon, Balgowlah, Cammeray and Flat Rock Drive
- Concerns about the removal of bus stops during construction.

#### ***Response***

No changes to bus services are proposed as part of the project, although some changes to travel times could be expected in some circumstances, for example due to increased traffic from construction, changes to intersections (such as introduction of traffic lights for construction support site access), removal of T2 Transit lanes or temporary, and partial or full temporary road closures at times. Impacts on bus travel times are assessed in sections 5 and 7 of Appendix F (Technical working paper: Traffic and transport) and are not expected to be material.

Minor adjustments would be required to some bus stops along Pacific Highway in Artarmon, Sydney Road at Balgowlah and along Wakehurst Parkway (shown in Figures 8-11, 8-14, 8-16 and 8-17 of the environmental impact statement). Some potential short-term adjustments to bus priority infrastructure on Burnt Bridge Creek Deviation at Balgowlah may also be required, resulting in a minor increase in bus travel times.

Any adjustments to existing bus stops will be determined in consultation with relevant stakeholders, including other divisions of Transport for NSW, and advanced notification would be provided to affected bus customers. Bus stops would be relocated as close as reasonably practicable to their existing position to minimise disruption, in accordance with revised environmental management measure CTT12 (refer to Table D2-1 of the submissions report).

### **C7.7.2 Temporary adjustment to the Gore Hill Freeway shared user path**

#### ***Issue raised***

Submitters raised concerns about temporary adjustment to the Gore Hill Freeway shared user path during construction. Specific concerns, comments and suggestions included:

- Concerns that the project understates the usage levels by pedestrians and cyclists along the Gore Hill Freeway shared user path
- Concerns about the impact of the temporary adjustment to the Gore Hill Freeway shared user path during construction which may affect the connection for cyclists commuting between neighboring suburbs such as Artarmon, Lane Cove, Naremburn, Northbridge and Willoughby
- The temporary adjustment to the Gore Hill Freeway shared user path is considered inadequate due to significantly increased travel times, difficulty in navigation and because it mixes pedestrians, cyclists and motorists potentially leading to an increased risk of accidents which potentially discourages active transport use
- Active transport impacts within the Gore Hill Freeway and Artarmon area are not adequately illustrated in Figure 8-12 of the environmental impact statement, including the proposed detour route

- The temporary adjustment to the Gore Hill Freeway shared user path should be designed in accordance with industry-standard guidelines such as the *NSW Bicycle Guidelines* (Roads and Traffic Authority, 2005)
- Suggestions that the design of the temporary adjustment to the Gore Hill Freeway shared user path be developed in consultation with the relevant stakeholders, and integrate appropriate design principles and alternative routes to increase safety and connectivity for all users.

### **Response**

Modifications to the active transport network at Artarmon would be needed during construction of the Gore Hill Freeway Connection, resulting in the temporary adjustment of the shared user path along the Gore Hill Freeway between Reserve Road and Station Street impacting up to 150 pedestrians and cyclists who currently use the shared user path during the weekday peak periods.

This information regarding current usage of the Gore Hill Freeway shared user path was based on pedestrian and cyclist surveys carried out on Tuesday 28 November 2017, Saturday 2 December 2017 and Sunday 3 December 2017 between 6am and 8pm at the shared user path next to the southern side of the Gore Hill Freeway, near Hampden Road in Artarmon. The survey results are summarised in Section 4.3.8 and Figure 4-32 to Figure 4-34 of Appendix F (Technical working paper: Traffic and transport).

Gore Hill Freeway Connection works would involve complex construction staging in a constrained urban environment, including multiple complex utility adjustments. Transport for NSW would aim to minimise the extent and duration of any detours, but until detailed design and staging design is completed, exact impacts on active transport routes are only preliminary.

At this stage of the project, it is proposed that alternative routes would divert pedestrians and cyclists via Station Street, Francis Street, Lambs Road, Cleg Street and Reserve Road, resulting in an additional travel distance of about 550 metres. It is acknowledged that Figure 8-12 of the environmental impact statement incorrectly shows the proposed detour as being via Waltham Street and Dickson Avenue. The correct route for the proposed detour, based on the current level of design and construction planning, would be as per the aforementioned text continuing along Cleg Street to Reserve Road instead of turning right along Waltham Street. A clarification is included in Table A5-13 of this submissions report acknowledging this error.

The contractor/s would finalise and complete plans for staging the work during further design development and construction planning in consultation with Transport for NSW. At this time appropriate sequencing of the work in the Gore Hill Freeway area would be confirmed, including the cut and cover work and water quality basin upgrade work in and near Punch Street which impacts the existing shared user path along the Gore Hill Freeway, finalisation of complex sewer and stormwater relocations in this constrained area, and in consideration of any interface required between contractors if the project is staged. The intention is to plan this work so as to reduce the current distance and duration of impact of the detour, including consideration of cyclist safety.

Transport for NSW is continuing to engage with key stakeholders within Transport for NSW and relevant external parties such as bike groups with respect to this proposed detour.

Detours and adjustments to existing pedestrian and cycling facilities will be designed with consideration of user safety and convenience in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report). All temporary routes and detours for vehicles, cyclists and pedestrians will be designed in accordance with legislation and relevant standards and guidelines of Transport for NSW and other authorities (eg Austroads and Australian Standards).

Detours and changes to the location of active transport infrastructure would be communicated to users in consultation with relevant stakeholders including local councils as outlined in Appendix E (Community consultation framework).

The community will be notified in advance of proposed transport network changes through appropriate media and other appropriate forms of community liaison as required by environmental management measure CTT7 (refer to Table D2-1 of this submissions report). Directional signage, barriers and/or line marking will be used as required to direct cyclists and pedestrians past construction sites and on the surrounding network in accordance with environmental management measure CTT10 (refer to Table D2-1 of this submissions report).

Further information on the management of construction traffic impacts in the Gore Hill Freeway and Artarmon area and road safety issues are provided in Section C7.3.2 and Section C7.4 respectively.

### **C7.7.3 Impact on other active transport routes and infrastructure**

#### ***Issue raised***

Submitters raised concerns about impacts to other active transport routes and infrastructure during construction. Specific queries, concerns and comments included:

- Requests for temporary active transport infrastructure, including shared path detours, to be designed based on the final designs for shared paths as much as practical
- Concerns about impacts on active transport connections during construction at Cammeray and North Sydney
- Concerns about impacts on the proposed shared use path detour at Flat Rock Drive construction support site (BL2), including disruptions to access and routes between neighbouring suburbs
- Concerns about interrupted access to shared user paths due to the Balgowlah Golf Course (BL10) and Kitchener Street (BL11) construction support sites
- Concerns about safety impacts on the shared user path at Burnt Bridge Creek Deviation near the Balgowlah Golf Course construction support site (BL10), specifically in terms of accessibility for vulnerable users (including the elderly and less mobile users)
- Requests for an alternative active transport route to be constructed through Flat Rock Gully avoiding the Flat Rock Drive construction support site (BL2) in consultation with Willoughby City Council, Bicentennial Reserve and Flat Rock Gully Committee
- Requests that any proposed cycleway detours are developed in consultation with local cycling groups, such as Bike North.

#### ***Response***

##### **Establishment of temporary active transport infrastructure**

Temporary diversions or detours for existing shared user paths would be required where the existing active transport infrastructure would be directly impacted by the project's construction works. The main areas affected would be:

- Flat Rock Reserve – shared user path parallel to Flat Rock Drive, to be temporarily diverted for establishment of the Flat Rock Drive construction support site (BL2)
- Artarmon – Gore Hill Freeway shared user path, and pedestrian footpath along the eastern side of the Reserve Road bridge, to be temporarily diverted to allow for establishment of the Punch Street (BL3) and Dickson Road (BL4) construction support sites, construction of Gore Hill

Freeway tunnel connection works, permanent motorway operation facilities, and adjustments to Reserve Road and Hampden Road bridges

- Balgowlah – shared user path adjacent to the eastern side of Burnt Bridge Creek Deviation near Kitchener Street, and Burnt Bridge Creek Deviation pedestrian/cycle underpass, which would be temporarily diverted to allow establishment of the Balgowlah Golf Course construction support site (BL10), tunnelling works, and the new access road between Burnt Bridge Creek Deviation and Sydney Road
- Frenchs Forest – shared user path adjacent to the Wakehurst Parkway north construction support site (BL14) and the shared user path bridge over Wakehurst Parkway connecting the Warringah Aquatic Centre and Bantry Bay Road, which would be demolished and replaced as part of the project.

Where existing active transport infrastructure is directly affected by a temporary construction support site, detours would be installed as part of site establishment works, which would occur prior to the main construction activities commencing as described in Section 6.3.2 of the environmental impact statement. The timing of impacts to existing active transport infrastructure by other construction works and the provision of detours would be determined by the staging of the construction works and the provision of access to work areas. In addition, in most cases the existing active transport infrastructure would be reinstated in its current position, after completion of construction work.

Where temporary detours or diversions are required, appropriate routes would be established utilising existing cycle routes and paths where possible, as discussed in Section 6.9.2 of the environmental impact statement. In all cases, detours and adjustments will be designed with consideration of user safety and convenience in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report).

### Cammeray and North Sydney

Potential impacts on the active transport network within the Warringah Freeway and surrounds (including Cammeray and North Sydney) during construction are shown in Figure 8-9 of the environmental impact statement.

The access arrangements at the Cammeray Golf Course construction support site (BL1) would be established as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project. The shared user path along Warringah Freeway near Cammeray Golf Course would be realigned to travel along the rear of the Cammeray Golf Course construction support site (BL1) until the Ernest Street/Merlin Street intersection as part of the Warringah Freeway Upgrade. Minor impacts to pedestrians and cyclists are expected given that existing connectivity would be maintained and a short additional travel distance of up to 100 metres. In addition, heavy vehicles at the Cammeray Golf Course construction support site (BL1) would be directed to access the site directly to and from the Warringah Freeway, avoiding interaction with cyclists.

Vehicle movements to and from construction sites will be managed to ensure pedestrian, cyclist and road user safety, in accordance with environmental management measure CTT9 (refer to Table D2-1 of this submissions report). Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network in accordance with environmental management measure CTT10 (refer to Table D2-1 of this submissions report). This will be supplemented by variable message signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes.

### Flat Rock Reserve

Potential impacts on active transport at Naremburn including at Flat Rock Reserve are summarised in Figure 8-10 of the environmental impact statement. The temporary adjustment of the Flat Rock Reserve shared user path (parallel to Flat Rock Drive, on the western side of the construction support site) would be required to accommodate the Flat Rock Drive construction support site (BL2) as outlined in Section 8.4.1 of the environmental impact assessment. This path would be temporarily realigned along the western perimeter of the construction support site, resulting in an additional travel distance of up to 100 metres (refer to Figure 8-10 of the environmental impact assessment).

The existing walking tracks along the eastern perimeter of the site would be largely maintained with two minor temporary diversions required. Given that existing connectivity would be maintained and the small potential increase in travel distance, impacts on pedestrians and cyclists using the shared user path are expected to be minor. Temporary relocation of pedestrian and cycle paths and bus stops would be carried out as part of site establishment work as described in Section 6.3.2 of the environmental impact statement. All detour routes would be operational before any closures to maintain connectivity during construction. Detours and adjustments to existing pedestrian and cycling facilities will be designed with consideration of user safety and convenience in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report).

Conflicts between vehicles and pedestrians and/or cyclists using the footpaths or shared user paths near the Flat Rock Drive construction support site (BL2) would be managed through traffic signals to control of movements at the site entry/exit as outlined in Section 8.4.1 of the environmental impact statement.

### Balgowlah

Impacts to the active transport network within the Balgowlah area and surrounds are described in Section 8.4.4 and shown in Figure 8-15 of the environmental impact statement.

A 50 metre temporary shared user path would be constructed within the Balgowlah Golf Course while the existing shared user path along the existing Burnt Bridge Creek Deviation is being adjusted as part of road widening works. The extension of the existing shared user underpass beneath the Burnt Bridge Creek Deviation required as part of the road widening works would be staged to maintain access for users at all times. Subject to final planning for staging of this work (which is subject to consultation with Northern Beaches Council and the community regarding the final landform of the new and improved open space and recreation facilities at Balgowlah), more short term detours may be required due to construction access restrictions as discussed in Section 8.4.4 of the environmental impact statement. A signalised pedestrian crossing would be provided at the new access road entrance to the Balgowlah Golf Course construction support site (BL10) off Sydney Road via the traffic signals provided for the Sydney Road/Maretimo Street/access road intersection.

Impacts on pedestrians and cyclists are expected to be minor given that existing connectivity would be maintained and additional travel distances via the temporary shared user path would be minimal.

All temporary routes and detours for vehicles, cyclists and pedestrians will be designed in accordance with legislation and relevant standards and guidelines of Transport for NSW and other authorities. Appropriate linemarking and signage would be used to identify diversions and, where required, traffic controllers would ensure safe passage for users in accordance with environmental management measure CTT9 (refer to Table D2-1 of this submissions report).



There are no changes proposed to active transport near the Kitchener Street construction support site (BL11). Temporary adjustment of the existing shared user path which would cross the access to this site would be carried out as part of site establishment work as described in Section 6.3.2 of the environmental impact statement.

Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network in accordance with environmental management measure CTT10. Any detours and adjustments to existing pedestrian and cycling facilities will be designed with consideration of user safety and convenience in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report).

Further discussion of potential road safety impacts and proposed management measures is provided in Section C7.5 of this submissions report.

#### Consultation with cycling groups

Direct impacts to existing pedestrian and cycling facilities would be minimised where reasonable and feasible, in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report). Ongoing consultation, as relevant to the location, will be carried out with relevant stakeholders, including cycling groups, in accordance with Appendix E (Community consultation framework).

The land on which the Flat Rock Drive construction support site (BL2) would be located would be leased from Willoughby City Council. As discussed in Section B12 of this submissions report, Transport for NSW intends to develop an Interface Agreement with Willoughby City Council. Any adjustments to active transport facilities in this area would be subject to consultation with Council as part of the Interface Agreement process.

Transport for NSW would also continue to consult with Northern Beaches Council and relevant mountain biking associations during further design development of the project regarding potential impacts to the Manly Warringah War Memorial State Park mountain bike trail network at Wakehurst Parkway (refer to Section A4.5 of this submissions report).

## **C7.8 Parking**

### ***Issue raised***

Submitters raised concerns about impacts to parking during construction. Specific requests, concerns, comments and suggestions included:

- Requests that sufficient on-site parking be provided for workers and residential parking schemes be implemented in coordination with councils to ensure that worker parking impacts on local neighborhoods are mitigated
- Concerns that the likelihood of construction workers driving to the temporary construction support sites has been underestimated and not adequately assessed
- Concerns that parking provisions for workers have been underestimated using the assumption that workers would arrive at site by public transport or a shuttle bus
- Concerns that not all temporary construction support sites are accessible by public transport
- Support for the proposed shuttle buses to transport workers between temporary construction support sites and nearby transport hubs to make construction workers' commute by public transport feasible

- Concerns about the removal of parking spaces for the Balgowlah Golf Course construction support site (BL10) and increased parking along local streets nearby
- Concerns about parking of construction workers along Kirkwood Street and Judith Street at Seaforth due to the limited number of parking spaces available at Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites
- Suggestions for worker parking to be located along the western side of Wakehurst Parkway near the intersection with Dreadnought Road at Oxford Falls.

### ***Response***

#### Construction worker parking

Where possible, the project has located and sized temporary construction support sites to balance the different constraints in each location, including consideration of accommodating worker parking, with a particular emphasis on minimising property acquisitions. As a result, for some sites not all worker parking is able to be accommodated within the temporary construction support site boundary, and/or additional demand management and supply measures would be needed.

The number of car parking spaces and tailored complementary demand management strategies at each temporary construction support site would be determined during detailed construction planning, when the contractor/s have been engaged.

Therefore, environmental management measure CTT11 has been revised to better reflect the intention to, as far as reasonably practical, minimise construction worker parking in local streets, where local existing demands are high through a range of complementary supply and demand initiatives (refer to Table D2-1 of this submissions report):

Impacts resulting from on- and off-street parking changes during construction would be minimised where reasonable and feasible. Depending on the location, options to manage construction worker parking and potential impacts to stakeholders may include:

- a) Proactively encouraging usage of public transport for workers through site induction information sessions
- b) Provision of shuttle buses from public transport hubs where appropriate
- c) Staged removal and replacement of parking
- d) Provision of alternative parking arrangements such as off-site contractor-managed parking lots
- e) Managed staff parking arrangements
- f) Working with relevant council(s) to introduce appropriate parking restrictions near to construction sites and temporary construction support sites or appropriate residential parking schemes.

These initiatives would be tailored to suit the requirements and geographical spread of the workforce to ensure maximum take up, once the contractor/s have been engaged.

The assessment conservatively assumes a relatively high usage of private vehicles by construction workers. However, lower levels of private vehicle use may be achieved with the effective implementation of revised environmental management measure CTT11 (refer to Table D2-1 of this submissions report).

Section A5.1.1 of this submissions report provides details of the broad strategies for worker parking currently under consideration for temporary construction support sites south and north of Middle Harbour. This includes encouraging the construction workforce to use public transport and to car

pool through site inductions and tool box talks. The public transport provisions available near the project to provide access to temporary construction support sites include:

- Military Road/Spit Road, the Pacific Highway, Epping Road, Eastern Valley Way, Frenchs Forest Road, Warringah Road and Condamine Street/Pittwater Road are key bus corridors near the project with multiple bus routes that would provide access to temporary construction support sites along the project
- Artarmon Station and North Sydney Station on the Sydney Trains suburban train network would provide access to construction sites at Artarmon and Cammeray respectively
- New Sydney Metro stations, which will be available from the beginning of the construction of the project, including stations at North Sydney and Crows Nest.

Other strategies include provision of shuttle buses to and from public transport centres (for sites both north and south of Middle Harbour), shuttle buses to and from any alternate additional parking site(s) to be procured by the contractor/s (for sites south of Middle Harbour) and shuttle buses provided between Balgowlah Golf Course construction support site (BL10) to and from Spit West Reserve (BL9) and Kitchener Street (BL11) construction support sites. Appendix B of this submissions report includes details on additional analysis Transport for NSW carried out of the existing parking supply and demand surrounding the proposed temporary construction support sites, which would be used to help inform the further development of parking impact mitigation strategies.

#### Worker parking at Balgowlah

Car parking areas for construction workers would be provided at the Balgowlah Golf Course construction support site (BL10). Therefore, loss of parking on nearby local streets from construction worker parking is not expected during construction. Public parking spaces would be removed from the existing Balgowlah Golf Course car park during construction. These spaces are used for both the golf course and for the nearby Balgowlah Oval. However, as the golf course would no longer be in operation during construction and temporary alternative parking would be available on Pickworth Avenue, impacts are expected to be negligible as noted in Section 8.4.4 of the environmental impact statement.

#### Worker parking at Kirkwood and Judith Streets, Seaforth

Car parking areas for site staff and construction workers would be provided at the Wakehurst Parkway south (BL12) and Wakehurst Parkway north (BL14) construction support sites, with car parking for site staff and limited parking for construction workers provided at Wakehurst Parkway east construction support site (BL13). Parking would be maximised within the constraints of the respective temporary construction support site. Additional parking would be accommodated on the road reserve within the Wakehurst Parkway Upgrade component of the project as required and suiting staging of works to support the Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites. The number of car parking spaces would be determined during further construction planning.

As noted above, complementary supply and demand strategies for construction worker parking will be implemented to minimise impacts of construction worker parking on local streets in accordance with revised environmental management measure CTT11 (refer to Table D2-1 of this submissions report) and as discussed further in Section A5.1.1 of this submissions report.

It is not anticipated that parking on the western side of the Wakehurst Parkway at the intersection of Dreadnought Road would be required.

## C7.9 Maritime traffic

### C7.9.1 General maritime traffic issues

#### ***Issue raised***

Submitters raised concerns about maritime traffic during construction. Specific queries, concerns and suggestions include:

- Concerns about safety impacts due to construction vessel movements required for material deliveries and spoil transfer
- Concerns that proposed maritime exclusion zones during construction activities at Middle Harbour have not been planned in consultation with local maritime users and may cause safety risks
- Suggestions for the proposed maritime exclusion zones between Clive Park and Seaforth Bluff to remain open on Sundays to allow sailing activities
- Suggestions for making the cofferdam and water construction area fully accessible for use outside of standard construction hours
- Suggestions for extending the cofferdams landwards to reduce encroachment into the water channel and thereby maintain a wider waterway accessible to the public during construction
- Suggestions that Transport for NSW regularly report on construction activities, waterway restrictions, changes to berthing and mooring arrangements, potential hazards and risk mitigation measures via a Maritime Communications Strategy
- Concerns that temporary relocation of yacht moorings may become permanent after construction
- Queries if owners of boat moorings in Middle Harbour have been consulted about the proposed temporary relocation of those moorings
- Queries if waterway area or foreshore area required for construction activities at Middle Harbour would be leased.

#### ***Response***

##### Maritime traffic navigation channels and exclusion zones

Marine construction vessels would be required during construction as described in Chapter 6 (Construction work) of the environmental impact statement. Figure 6-43 in the environmental impact statement shows the main routes which would be used during construction. Table 6-40 in the environmental impact statement details the indicative type and number of marine transport and construction vessels likely to be used during construction.

The disposal of dredged material from the Middle Harbour crossing to sea would require three barge movements per day at peak. An additional 48 barge movements per day at peak would be required for concrete deliveries. Prolonged periods of high marine construction activity would occur over about three months of the construction program.

Construction vessels transporting immersed tube tunnel steel shell units from the Outer Sydney Harbour to Middle Harbour would require access when the Spit Bridge is open. Items such as dredge plant, piling plant and immersion barges would require large transport vessels, and given the length, draught, limited speed and limited manoeuvrability of these, and the immersed tube tunnel steel shell units, special bridge opening times outside of peak traffic periods would be required in order to transport these items safely to their intended destination. This would require special arrangements and permits to be obtained.

Exclusion zones would be set up around the cofferdams, reducing navigation width to about 220 metres between the cofferdams. These zones would be marked by lit yellow buoys, as specified by the Harbour Master, to clearly identify the exclusion zones and maritime traffic navigation channels, facilitating the safe passage of vessels travelling within the vicinity of the cofferdams. Dredging activities and the installation of immersed tube tunnel support piles would also restrict navigational movements. The use of primary silt curtains during dredging activities would reduce navigation widths to about 100 metres. Exclusion zones and maritime traffic navigation channels would be moved as required to facilitate the staged access for works such as dredging and installation of immersed tube tunnel support piles.

A number of maritime construction environmental management measures have been revised and developed to ensure the safety of maritime users (refer to Table D2-1 of this submissions report). This includes:

- Scheduling construction marine traffic activities to avoid times and locations of high recreational marine traffic, including near the Spit Bridge, where possible (revised environmental management measure CTT4)
- All construction vessels will operate in a manner that minimises wash within Middle Harbour (revised environmental management measure CTT3)
- Advance notification of maritime restrictions to the community through media and other appropriate forms of community liaison (environmental management measure CTT7)
- A speed limit of four knots for all marine traffic between the Spit Bridge and 100 metres upstream of the Middle Harbour crossing to minimise the impact of vessel wash and reduce vessel speed to ensure the safety of mariners (new environmental management measure CTT20).

The framework for the management of key project issues is outlined in Section D1 of this submissions report. A marine works and marine traffic management plan would be produced as a sub-plan under the construction environmental management plan. The marine works and marine traffic management plan would include relevant construction environmental management measures, including those outlined above. Key issues to be addressed by this sub-plan include:

- Marine works and marine traffic management objectives
- Marine works and marine traffic management documentation including:
  - Works approval requirements
  - Exclusion zones
  - Temporary mooring locations
- Marine works and marine traffic mitigation including requirements for vessel movements and navigational restrictions.

#### Middle Harbour cofferdam construction support sites (BL7 and BL8)

The construction methodology includes cofferdams to allow for the construction of the interface structures to be offshore, so as to avoid direct impacts on foreshore heritage items including the Harbour Foreshore at Seaforth and heritage items at Clive Park (eg Clive Park tidal pool and Clive Park Aboriginal heritage items).

Cofferdams are temporary enclosures within a body of water, constructed to allow dewatering of an enclosed area. The purpose of the cofferdams is to create a relatively dry environment to allow the construction of the interface structures which would connect the driven tunnel and the immersed

tube tunnels at each end of the Middle Harbour crossing. The location and indicative layout of the cofferdams are shown in Figure 6-36 of the environmental impact statement.

The cofferdams would be about 63 metres wide and 25 metres long as described in Section 6.4.4 of the environmental impact statement. Construction of the interface structures within the cofferdams would require excavation of overlying soft sediments and rock from within the cofferdam. Therefore, in addition to potentially impacting heritage items, locating the cofferdams closer to the shore would also require a greater amount of excavation, including increased dredging in the area between the cofferdams. The final location and layout of the Middle Harbour cofferdam construction support sites (BL7 and BL8) would be confirmed during further design development and construction planning, with consideration of geotechnical conditions, the final construction methodologies for the project and in accordance with the conditions of approval, should the project be approved.

Some construction activities, including barge transport of marine sediment to the designated offshore disposal site or onshore loadout facility (refer to Section 5 (Treatment and loadout of dredged and excavated material not suitable for offshore disposal) of the preferred infrastructure report), may occur outside standard construction hours, as noted in Table 6-21 of the environmental impact statement. This may include works during weekends when recreational use of Middle Harbour is highest. To maintain the safety of the waterway therefore, it would be necessary to maintain exclusion zones around the cofferdams and the dredging site. However as discussed above, construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic, in accordance with revised environmental management measure CTT4 (refer to Table D2-1 of this submissions report).

Consultation will be carried out with recreational users of the waterway including Mosman Rowing Club, 1<sup>st</sup> Northbridge Sea Scouts Group, 1<sup>st</sup> Sailors Bay Sea Scouts and Northbridge Sailing Club, to develop reasonable and feasible management measures to reduce potential construction impacts in accordance with revised environmental management measure CTT16 (refer to Table D2-1 of this submissions report). Refer to Section C7.9.2 below for details on environmental management measures aimed at reducing impacts to maritime recreational users and clubs.

Temporary navigation channels will be maintained throughout the duration of dredging and cofferdam works, along with speed restrictions through the works area, in accordance with new environmental management measures CTT19 and CTT20 (refer to Table D2-1 of this submissions report).

#### Maritime communications strategy

Should the project be approved, a community communication strategy based on Appendix E (Community consultation framework) would be prepared to provide further details about community involvement during design, construction and the project opening phase. The community communication strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

Transport for NSW is committed to engaging with the community and stakeholders in the lead up to and during construction to identify specific concerns and implement relevant measures to help mitigate potential impacts. Transport for NSW will work closely with the appointed contractor/s to ensure the objectives and outcomes of the community communications strategy are delivered to a high level.

Transport for NSW does not intend to develop a specific Maritime Working Group; rather, maritime stakeholders would be engaged with in accordance with the community consultation strategy and the following environmental management measures (refer to Table D2-1 of this submissions report):

- Transport for NSW (inclusive of NSW Maritime) will consult with the owners and/or leaseholders and/or licence holders of jetties and moorings that require temporary relocation to determine alternative arrangements. Moorings impacted during construction will be temporarily relocated elsewhere in Middle Harbour in consultation with the lease holder(s) and coordination with the Port Authority of NSW. All efforts will be made to relocate facilities as close to their original locations as possible. Impacted mooring licence holders may be entitled to a fee waiver or fee reimbursement where appropriate (revised environmental management measure CTT2)
- Harbour closures scheduling will be carried out in consultation with Port Authority of NSW, other divisions of Transport for NSW and other relevant stakeholders (environmental management measure CTT5)
- The community will be notified in advance of proposed maritime restrictions through appropriate media and other appropriate forms of community liaison (environmental management measure CTT7)
- Consultation will be carried out with surrounding water based users of Middle Harbour including Mosman Rowing Club, 1<sup>st</sup> Northbridge Sea Scouts Group, 1<sup>st</sup> Sailors Bay Sea Scouts and Northbridge Sailing Club to develop reasonable and feasible management measures to minimise construction impacts (revised environmental management measure CTT16)
- Specific consultation will be carried out with businesses potentially impacted during construction. Consultation will aim to identify specific potential construction impacts for individual businesses (environmental management measure BU2).

#### Impacts on swing moorings and marina berths

About 45 swing moorings located in Pearl Bay would be temporarily relocated for about 48 months during construction due to the location of a casting facility off Spit West Reserve. About 10 swing moorings in Seaforth would also require temporary relocation due to the Middle Harbour north cofferdam construction support site (BL8). These moorings would be relocated just to the west of their existing locations in Middle Harbour, where possible in consultation with the lease holders, and therefore impacts on boat users due to the displaced moorings is considered to be minor as discussed in Section 8.4.3 of the environmental impact statement. Details of these alternative arrangements and the temporary relocation of moorings are subject to further design development and planning.

Deliveries of immersed tube tunnel units between the temporary construction support sites may require five swing moorings west of Bradys Point to be temporarily relocated. If required, arrangements would be agreed in consultation with the lease holders. Impacts on any additional relocated moorings would be limited to a relatively small change to their location. The location of the Middle Harbour north cofferdam construction support site (BL8) at Seaforth would also prohibit access to three private jetties. Temporary alternative berths would be provided at marinas nearby for a period of about 48 months.

Transport for NSW (inclusive of NSW Maritime) will continue to consult with the owners and/or leaseholders and/or licence holders of jetties and moorings that need temporary relocation to decide on alternative arrangements, in accordance with revised environmental management measure CTT2 (refer to Table D2-1 of this submissions report). Moorings impacted during construction will be temporarily relocated just to the west of their existing locations in Middle Harbour in consultation with the leaseholders and coordinated with the Port Authority of NSW. All efforts will be made to relocate facilities as close to their original locations as possible once construction is complete. Impacted mooring licence holders may be entitled to a fee waiver or fee reimbursement where appropriate.

Following completion of construction, relocated moorings would be returned to their pre-construction locations.

### Leasing of land and waterway areas

The Spit West Reserve construction support site (BL9) would be mainly located over the water west of Spit West Reserve at Mosman with a small land-based site located directly adjacent to it. The temporary construction support site has been reconfigured since the exhibition of the environmental impact statement which has minimised the impact on recreational areas used for organised junior sport (refer to Section 3 of the preferred infrastructure report). Notwithstanding, a lease agreement would be reached with Mosman Council for the Spit West Reserve construction support site (BL9) as noted in Table 20-3 of the environmental impact statement. Land use and property is discussed further in Section C19.5.

Transport for NSW regulates Middle Harbour on behalf of the State of NSW and would not require a lease for Middle Harbour south cofferdam (BL7), Middle Harbour north cofferdam (BL8) and the water-based component of the Spit West Reserve (BL9) construction support site.

## **C7.9.2 Impacts on maritime recreational users, community groups and clubs**

### ***Issue raised***

Submitters raised concerns about impacts to maritime recreational users during construction. Specific queries, concerns and requests included:

- Concerns about disruption to maritime and recreational users at Middle Harbour during construction
- Concerns that construction activities on Middle Harbour may affect the viability of Northbridge Sailing Club and Middle Harbour 16ft Skiff Sailing Club operations, including the temporary relocation of yacht moorings affecting the waterway between Seaforth Bluff and Castlecrag
- Requests for a detailed boating management and safety plan, particularly addressing morning training sessions at Mosman Rowing Club
- Queries about scheduling of work with regard to major public events where high boating movements will occur through Middle Harbour.

### ***Response***

#### Impacts on maritime recreational users, community groups and clubs

The project has been designed to manage potential disruptions to maritime traffic and transport in Middle Harbour. Potential disruptions to waterway users have been reduced by limiting harbour closures, minimising movement of moorings and maintaining access to the foreshore where feasible. Generally, recreational users, community groups and clubs downstream of the Spit Bridge would not be substantially impacted due to the limited construction activities and associated vessel interactions in this part of the harbour.

Upstream of the Spit Bridge, the Spit West Reserve construction support site (BL9) would be located next to Mosman Rowing Club and would be in the vicinity of construction vessel movements between the temporary construction support site, cofferdams, dredging and support piling work and the temporary mooring location. This has the potential to impact rowing club operations if not appropriately managed during construction.

As outlined in Section C7.9.1 above, a marine works and marine traffic management plan would be produced as a sub-plan under the construction environmental management plan. The marine works and marine traffic management plan would incorporate relevant construction traffic and transport



environmental management measures provided in Table D2-1 of this submissions report. This would include measures aimed at reducing impacts to maritime recreational users and clubs, including:

- Consultation will continue with surrounding water based users of Middle Harbour including Mosman Rowing Club, 1<sup>st</sup> Northbridge Sea Scout Group, 1<sup>st</sup> Sailors Bay Sea Scouts and Northbridge Sailing Club to develop reasonable and feasible management measures to reduce potential construction impacts (refer to revised environmental management measure CTT16)
- A navigation channel delineated with marker buoys will be formed on the approach to d'Albora Marina at The Spit adjacent to the Spit West Reserve construction support site (BL9) (refer to new environmental management measure CTT19)
- A speed limit of four knots for all marine traffic will be implemented between the Spit Bridge and 100 metres upstream of the Middle Harbour crossing to minimise the impact of vessel wash and reduce vessel speed to ensure the safety of mariners (refer to new environmental management measure CTT20)
- The Spit West Reserve construction support site (BL9) will not impact the land based approach or water based approach to the Mosman Rowing Club. The channel on approach to Mosman Rowing Club will be 30 metres (100 feet) wide and will be delineated with marker buoys (refer to new environmental management measure CTT21).

It is recognised that weekends are typically the busiest period for recreation including recreational boating as discussed in Table 6-21 of the environmental impact statement. Construction maritime traffic activities will be scheduled to avoid times and locations of high recreational maritime traffic where feasible and reasonable in accordance with revised environmental management measure CTT4 (refer to Table D2-1 of this submissions report). The community will be notified in advance of proposed maritime restrictions through appropriate media and other appropriate forms of community liaison (refer to environmental management measure CTT7 in Table D2-1 of this submissions report).

The stakeholders consulted with during various phases of the project prior to exhibition of the environmental impact statement are outlined in Chapter 7 (Stakeholder and community engagement) and Appendix E (Community consultation framework). Part A2.4 of this submissions report provides a summary of the meetings held following exhibition of the environmental impact statement, including with: 1<sup>st</sup> Northbridge Sea Scout Group and 1<sup>st</sup> Sailors Bay Sea Scouts, Northbridge Sailing Club, Mosman Rowing Club, Seaforth Sailing Club and the Middle Harbour Amateur Sailing Club. Other stakeholders which have been consulted with include the Port Authority of NSW, relevant councils and residents/owners of marinas, swing moorings and private jetties. Feedback from these stakeholders has been received and, where possible, incorporated into the design of the project to reduce impacts and inform potential risks and issues.

#### Major public events

Construction work would have a minimal impact on special events as the temporary construction support sites and marine traffic routes would not be located near venues or locations that regularly schedule events that require traffic or public transport event plans, as discussed in Section 8.4.8 of the environmental impact statement.

Water based races within Middle Harbour held by the recreational clubs along the foreshore may be impacted by marine construction traffic, as identified in Section 8.4.3 of the environmental impact statement.

Most construction activities would be carried out during standard construction hours (7am to 6pm Monday to Friday, 8am to 1pm Saturday and no construction work on Sundays or public holidays)

as noted in Chapter 6 (Construction work) of the environmental impact statement. As such, the likelihood of construction traffic interfering with major scheduled public events is reduced, as such events usually occur on weekends and/or public holidays.

Due to the scale and complexity of the cofferdams' construction, dredging works, installation of immersed tube support piles and installation of the immersed tube tunnel units, it is not feasible to limit construction to several months of the year. To do so would prolong the construction period, resulting in increased disruption to water users and additional construction costs.

Nonetheless, ongoing communication and stakeholder engagement would be carried out with councils, government departments and event organisers, which would ensure traffic management is planned to minimise impacts to event traffic and attendee safety.

Scheduling of the Middle Harbour closures will be carried out in consultation with Port Authority NSW, other divisions of Transport for NSW and all other relevant stakeholders, in accordance with environmental management measure CTT5 (refer to Table D2-1 of this submissions report).



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C8 – Operational traffic and transport

## C8 Operational traffic and transport

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## C8.1 Adequacy and accuracy of assessment

### C8.1.1 Traffic model development

#### ***Issue raised***

Submitters raised concerns about the basis of the operational traffic and transport assessment, including the adequacy of the modelling and data used. Specific requests, queries and concerns include:

- Requests that an independent review be carried out on traffic forecasts for vehicles travelling within and beyond the project corridor
- Queries on how traffic modelling forecasts future traffic
- Requests for alternative operational road traffic modelling scenarios to include:
  - A 'Do minimum' scenario that includes the approved Western Harbour Tunnel and Warringah Freeway Upgrade project
  - A 'Do something' scenario based on various tolling regimes, as costings and placement of toll collection points is required to model traffic flow and predicting toll avoidance
- Requests for the traffic modelling to be reassessed to consider population growth and distribution forecasts, including changes as a result of the Sydney Metro West and Sydney Metro Western Sydney Airport projects
- Concerns that the traffic data for the project appears to differ from the data used in the traffic and transport assessment for the Sydney Metro City & Southwest – Chatswood to Sydenham environmental impact statement, at intersections near the Pacific Highway at Artarmon.

#### ***Response***

##### Traffic model development

A multi-tiered transport modelling approach was adopted to carry out a comprehensive assessment of the current and future performance of the road network. 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, 2013b), in addition to other Transport for NSW, Austroads and NSW Government guidelines. This includes acceptance of typical assumptions and limitations.

The multi-modal Sydney Strategic Travel Model and the road traffic assignment Sydney Motorway Planning Model were used for strategic demand forecasting for the assessment. The Sydney Motorway Planning Model 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, which are available at five-year intervals from the most recent Census year. Downstream of these modelling activities, VISSIM microsimulation modelling was used to reflect and assess detailed network capacity constraints and resultant performance implications.

The traffic and transport assessment took into consideration planned population and employment demand and growth throughout Sydney over the next 20 years and changes in traffic associated with approved, under construction and recently completed transport infrastructure projects in the Sydney metropolitan area in 2037.

An overview of the modelling methodology used in the assessment of the project is provided in Figure 9-1 and Section 9.2.2 of the environmental impact statement, with further details provided in Section 3.3 of Appendix F (Technical working paper: Traffic and transport).

The transport modelling for the Beaches Link and Gore Hill Freeway Connection project has been completed in accordance with appropriate standards and guidelines, and developed, reviewed, and endorsed by internal Transport for NSW and independent subject matter experts.

The NSW Department of Planning, Industry and Environment also carried out an independent review of traffic and transport issues. Further information from Transport for NSW required as a result of this review has been incorporated into this submissions report where relevant.

#### Operational road traffic modelling scenarios

A summary of the scenarios modelled as part of the operational traffic and transport assessment is provided in Table 9-3 of the environmental impact statement. The operational traffic and transport 'Do minimum' scenario included approved, under construction and/or recently completed motorway projects (NorthConnex and WestConnex) but without the Western Harbour Tunnel and Warringah Freeway Upgrade project, as this was not an approved project at the time modelling and assessment commenced. The 'Do something' scenario has included the Warringah Freeway Upgrade component, on the basis that the project requires this to safely and efficiently integrate with the Warringah Freeway, as noted in Section 5.1 of the environmental impact statement. The Western Harbour Tunnel component was included in the 'Do something cumulative' scenario. As such, the benefits of the project with and without the Western Harbour Tunnel can be demonstrated by comparing the 'Do something' and 'Do something cumulative' scenarios.

The performance of the Western Harbour Tunnel and Warringah Freeway Upgrade project, without the inclusion of the Beaches Link and Gore Hill Freeway Connection project, is provided in Section 9.4 of the environmental impact statement for that project (Transport for NSW, 2020k).

Tolling scenarios and implications are discussed in sections 7.2.4 and 8.2.4 of Appendix F (Technical working paper: Traffic and transport). Tolling assumptions, like other modelling assumptions, are based on the most relevant information available at the time of the assessment. It would be impractical to test a variety of additional scenarios of less relevance, as this would have exponentially expanded the assessment. Although no decision on the final tolling strategy for the project has been made, the traffic assessment and modelling carried out for the environmental impact statement assumes that tolls would apply to all north and southbound trips on all harbour crossings in the future, including two-way tolling on the Western Harbour Tunnel and Beaches Link tunnel. The differences in traffic performance including the effects of changes to toll regimes can therefore be understood by comparing the assessment outcomes for the 'Do minimum' and 'Do something' scenarios.

#### Consideration of Sydney Metro West and Sydney Metro Western Sydney Airport projects

The general approach to incorporating future population growth and the effects of approved, under construction and recently completed transport projects into the traffic model is discussed above.

With regard to the two Sydney Metro projects referenced, the environmental impact statements for Sydney Metro West and Sydney Metro Western Sydney Airport were placed on public exhibition between April and June 2020, and October and December 2020, respectively. At the time the traffic and transport assessment was carried out for the Beaches Link and Gore Hill Freeway Connection project, both Sydney Metro projects referenced were at the early stages of development and therefore were not included in the future strategic modelling.

While Sydney Metro West is aimed at transporting passengers between Parramatta and the Sydney CBD, the Beaches Link and Gore Hill Freeway Connection project would service buses, freight, commercial and many other individual journey needs with diverse origins and destinations to and from the Northern Beaches. Sydney Metro Western Sydney Airport aims to serve a mass passenger transport demand between St Mary's and the Western Sydney Aerotropolis. Both Sydney Metro projects are geographically removed from the Beaches Link and serve different transport functions, and origins and destinations; therefore their inclusion is not expected to materially affect the need for or benefits of the project. This has been demonstrated by sensitivity testing using the Sydney Motorway Planning Model and Strategic Travel Model by Transport for NSW.

#### Consistency of traffic data

The Chatswood to Sydenham environmental impact statement was prepared in 2016, four years prior to the completion of the Beaches Link and Gore Hill Freeway Connection environmental impact statement.

There are a number of factors that could contribute to differing data sets between the two projects including the base modelling year adopted for that assessment, as well as whether project-specific data was obtained for specific roads or intersections used in the assessment and the modelling approach adopted.

#### **C8.1.2 Traffic model basis and inputs**

##### ***Issue raised***

Submitters queried the accuracy of the traffic and transport assessment in determining traffic volume and movements. Specific concerns include:

- Concerns that the modelling is not current as the baseline data used is from 2016. Various submitters considered the data may over-predict or under-predict traffic levels, and therefore the Secretary's environmental assessment requirements have not been met
- Concerns that the traffic and transport assessment did not consider:
  - The origins and destinations of travellers, including the time of day they travel and preferred mode of transport
  - Induced demand (new trips)
- Concerns that the traffic assessment does not consider traffic volume changes as a result of COVID-19
- Concerns that the environmental impact statement indicates that traffic is 'back to normal' across Greater Sydney after reductions due to the COVID-19 pandemic however no reference/source is provided to support these statements
- Concerns that Willoughby City Council and North Sydney Council have modelled poorer local traffic conditions resulting from the project
- Concerns that the traffic assessment does not consider traffic implications related to tunnel closures for maintenance or how often maintenance would occur.

##### ***Response***

#### Currency of data

Data inputs into the multi-modal transport forecasting process included forecast population and employment data consistent with demographics released by the NSW Department of Planning and Environment in 2017, traffic volume counts and road travel time data, along with recently completed

and future infrastructure project lists. These inputs were used to establish existing and future transport conditions 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).

As such, it is important to note that while data collection began pre-2016, this has been an ongoing exercise and as such the model is not based solely on 2016 data. The suite of data that Transport for NSW has indicates that both the strategic traffic forecasting (Sydney Motorway Planning Model) and microsimulation traffic modelling remain fit for the purpose of long-term planning and assessment of the future road transport network.

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.

Transport for NSW considers that the assessment fulfils the Secretary's environmental assessment requirements.

### Traffic and transport assessment

#### *Origins and destinations*

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

#### *Induced demand*

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

- 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.

The Sydney Motorway Planning Model used in the traffic assessment includes the changes in traffic associated with all three of the above factors, which means that all areas of the environmental impact statement assessment, including traffic performance assessment metrics (network speeds, corridor travel times, intersection level of service etc) and operational travel benefits, considers and presents project impacts inclusive of induced demand.

As an example, Table 8-3 of Appendix F (Technical working paper: Traffic and transport) provides details of daily traffic demands at key locations. This table indicates that for the design year of 2037 the Middle Harbour screenline demand is forecast to increase from 229,500 to 239,000 vehicles per day as a result of the project, which is around four per cent of total demand.

### Changes in traffic as a result of COVID-19

The COVID-19 pandemic is an unprecedented event that is currently impacting the way people work and their travel patterns, while creating uncertainty about the future, as discussed in Section 3.1 of the environmental impact statement.



The impact of COVID-19 on the transport network has been multi-faceted, and is largely broken down into immediate and medium term impacts:

- Immediate: major reductions in public transport and car trips, reductions in public transport capacity, increased second hand car purchases, increased intrastate visitation, reduction in public transport preference, increased online shopping, and deliveries, reductions in overseas and interstate visitors
- Medium term: Reduction in overseas migration, leading to a period of decrease in NSW and Sydney population growth rates, reducing overall projected travel demand; reduced commuter trips due to more people working from home, changing spatial distribution of interpeak / daily non-commute trips.

Significant uncertainty still exists about how long the impacts of COVID-19 will last. In response to the evolving Delta outbreak of COVID-19, areas of Greater Sydney and NSW have gone into lockdown in mid-2021 to manage the spread of the virus while the vaccination program is rolled out. Once vaccination targets have been met and rules have been eased, outbreaks could continue to occur in 2021 and into the future, depending on the timing and efficacy of the vaccination program. It is not possible to accurately predict when immediate and medium term impacts would finish, or when a return to pre-pandemic travel patterns will occur. At this time, the duration of impacts to transport demands and behaviours from the COVID-19 pandemic are still unknown, and current traffic conditions and travel behaviours are the result of a variety of temporary factors, including reduced public transport capacity and demand.

While the COVID-19 pandemic presents immediate to medium-term challenges for Sydney (and NSW more broadly), the project has been developed with a long-term view to address the challenges Greater Sydney will face over the next 40 years, to enable and accommodate growth, and to deliver long-lasting benefits for road users, communities and businesses. 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. Mona Vale Road, Military Road/Spit Road and Warringah Road/Eastern Valley Way road corridors generally operate well over capacity during peak periods, as described in Chapter 3 (Strategic context and project need) of the environmental impact statement. This contributes to high levels of congestion, long and unreliable journey times and, consequently, poor accessibility to and from the region. Beaches Link would create an alternative to the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors to separate out through and by-pass traffic, reducing pressure on congested road corridors servicing the Northern Beaches and North Shore.

As such, the need for the project and other strategic transport projects to meet the demands of a growing population and economy remains critical to ensuring the future success of Sydney.

Given the immediate to medium term nature of current conditions, the modelling approach used for the environmental impact statement is considered to be the most appropriate methodology for long-term planning and was completed in accordance with appropriate standards and guidelines.

While it is difficult to fully assess the long-term impact of the event, evidence of Greater Sydney's resilience to such disruptions is already apparent. Ongoing traffic and transport monitoring shows that traffic levels on most roads in the project area returned to those levels near that of the pre-COVID-19 pandemic period in early 2021, prior to the mid-2021 lockdown (acknowledging that public transport capacity and user behaviours are still in a temporary state). It is expected that similar trends will be observed once the lockdown rules have been eased, and traffic levels will return to those levels in the pre-COVID-19 pandemic period. Transport for NSW will continue to monitor and analyse the potential long-term effects of the COVID-19 pandemic on travel demand,

including changes to existing travel conditions as well as future travel behaviours and underlying economic demand drivers.

#### Willoughby City Council and North Sydney Council traffic models

Transport for NSW has been in regular contact with both of these councils throughout the course of the environmental assessment process and particularly in regard to the traffic performance of the road network within their local government areas. No evidence has been provided by councils to substantiate the claim that the project would result in significantly different traffic and performance issues compared to those presented and assessed in the environmental impact assessment.

Refer to Section B12 and Section B14 of this submissions report for the responses to Willoughby City Council and North Sydney Council submissions to the environmental impact statement.

#### Tunnel maintenance

Tunnel closure eg for major maintenance work would be infrequent and would be advised to motorists well in advance if necessary. Managing traffic during periods of tunnel maintenance would be the responsibility of the tunnel operator and, like other Sydney road tunnels, carried out outside of peak periods, using lane possessions where necessary to manage traffic congestion while still facilitating the maintenance work. The scheduling of maintenance including the timing of any lane or tunnel closures would need to be approved by Greater Sydney Operations (part of Transport for NSW).

### **C8.1.3 Traffic modelling results**

#### ***Issue raised***

Submitters queried the accuracy of the traffic modelling results. Specific concerns and queries include:

- Concerns that traffic data presented in the environmental impact statement is misleading, including:
  - Figure E-2 of the environmental impact statement reports vehicles per day and bus passengers per day, however a vehicle count per day includes buses, cars and trucks
  - Figure 4-4 of the environmental impact statement reports average weekday trips via key transport corridors (existing conditions), however it is queried if the 'daily volume' is vehicles per day. If this were the case, adding the two figures misrepresents the volume and the 'Total' is would be a misleading statistic
- Queries why traffic volume figures are located in Appendix G (Technical working paper: Noise and vibration) and not in Appendix F (Technical working paper: Traffic and transport). Additionally, Appendix F (Technical working paper: Traffic and transport) appears to provide intersection performance, not the number of vehicles, therefore impacts of the proposal on local and arterial roads are unclear
- Concerns that the growth model is not provided in the traffic assessment so the travel time savings and congestion reductions are unable to be confirmed. Concern that the project cannot accommodate future growth as there are existing roads at capacity
- Concerns that the project benefits are based on unrealistic assumptions or overstated. Specific concerns include:
  - That the almost one hour travel time saving between Dee Why and Sydney Airport is misleading as existing travel times are much less
  - Inaccurate assumptions about public transport demand.

## ***Response***

### **Misleading data presented in figures**

Figure E-2 and Figure 4-4 of the environmental impact statement include key metrics for the Eastern Harbour City's road transport network, including vehicles and bus passengers which use the Sydney Harbour Bridge, Spit Bridge and Roseville Bridge each day. They were included in the environmental impact statement to provide a summary of the demand on road infrastructure at key locations and the role these corridors play in serving public transport customers. The metric of vehicles includes all traffic eg cars, trucks and buses and therefore it should not be combined with the metric of bus passengers to provide an indication of daily volume. It is noted that this has an immaterial impact on the traffic and transport assessment; when removing the number of buses from the "total" volume figures, this would only change the total by about one to two per cent.

It is also noted that the "AM peak" label shown in Figure E-2 of the environmental impact statement is an error. All of the metrics quoted in Figure E-2 are daily traffic volumes.

Clarifications have been provided in Section A5 of this submissions report regarding these errors. It is also noted that the existing traffic demand and daily vehicle volumes at key locations, including the Spit Bridge and Roseville Bridge, are summarised in Table 4-1 of Appendix F (Technical working paper: Traffic and transport).

### **Location of traffic volume results**

A summary of the operational traffic assessment is presented in Chapter 9 (Operational traffic and transport) of the environmental impact statement while a detailed technical paper is provided in Appendix F (Technical working paper: Traffic and transport). The traffic volume figures are shown in various tables within Section 6.2, Section 7.2 and Section 8.2 of Appendix F (Technical working paper: Traffic and transport) for the 'Do minimum', 'Do something' and 'Do something cumulative' scenarios respectively. While the operational traffic assessment does include intersection level of service metrics, information is also provided on traffic volumes (modelled daily traffic demands at key locations) as well as modelled traffic travel times for key routes. As such, critical overall network operations (eg network speeds and travel times) and the performance of individual intersections on adjacent areas is holistically illustrated.

Traffic volumes presented in Annexure D of Appendix G (Technical working paper: Noise and vibration) were used for the purposes of the operational noise assessment. This included modelled traffic demands in the years 2027 and 2037, as inputs to the noise model, and traffic survey data from the year 2017 to validate the noise model. While from a traffic and transport assessment perspective, peak AM and PM periods are of most relevance for understanding operational impacts, the noise assessment is concerned with noise levels during the more sensitive night period (from 10pm to 7am). As such, the traffic demand results presented in Appendix F compared to Appendix G have different averaging periods.

Although data may have been included in multiple locations in the environmental impact statement, the operational traffic impact assessment is considered robust.

### **Growth model and road network capacity**

As discussed in Section C8.1.1 of this submissions report, the traffic assessment used a multi-tiered modelling approach to forecast traffic patterns across Sydney. 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. 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.

It is acknowledged in Section 3.4.4 of Appendix F (Technical working paper: Traffic and transport), that the Sydney Motorway Planning Model is not able to fully reflect the effect of capacity constraints on traffic demand during the peak period and demand forecasts from Sydney Motorway Planning Model can exceed the road network capacity at specific locations during peak periods. 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 C8.1.1 above, the traffic modelling is fit for purpose and has followed appropriate guidelines.

### Project benefits

The environmental impact statement provides a balanced assessment of impacts and benefits for traffic, and more broadly across the environment and community. The project would benefit communities of the lower North Shore, the Northern Beaches and the Greater Sydney Region increasing accessibility and reducing travel times as well as being part of a broader transport strategy improving the resilience of the Harbour CBD road network. The traffic and transport assessment considers a number of operational scenarios including 'Do minimum', 'Do something' and 'Do something cumulative'. These scenarios reflect the no project, with project, and with project and other road network projects in both forecast years 2027 and 2037, and reflect the road network conditions once the project is built, both on its own and in conjunction with other proposed projects.

As stated above, the transport modelling for the Beaches Link and Gore Hill Freeway Connection project has been completed in accordance with appropriate standards and guidelines, and developed, reviewed, and endorsed by internal Transport for NSW and independent subject matter experts.

The results of the 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 30 minutes when travelling between the Northern Beaches and locations in the lower North Shore during peak periods. Figures 9-3 and 9-4 show the forecast travel times in 2027 and 2037 respectively under the 'Do minimum', 'Do something' and 'Do something cumulative' scenarios. These figures clearly demonstrate the travel time benefits achieved with the project being implemented (versus the no project scenario), while differences between the 'Do something' and 'Do something cumulative' scenarios differ depending on the location.

Change in travel times in the AM peak as a result of the program of works by 2037 is shown on Figure 3-8 of the environmental impact statement. The travel times were modelled based on the shortest time route between a particular origin and destination, rather than road specific routes. It should also be noted that the travel time savings outlined in the environmental impact statement considers forecast traffic demand in 2037 for all scenarios, as opposed to current travel times and traffic demands.

For example, modelled travel time for a journey between Dee Why and Sydney Airport during the AM peak in 2037 is 95 minutes, in the absence of the Western Harbour Tunnel and Beaches Link program of works, taking into account factors such as forecast increased traffic demand and land use growth. The modelled travel time, considering the same origin and destination during the AM peak in 2037, is 39 minutes when including the program of works. This results in a travel time saving of approximately 56 minutes.

As noted above, a multi-tiered and multi-modal transport modelling approach has been used. This includes the Sydney Motorway Planning Model which develops traffic growth forecasts on the road network including growth in future road travel, based on forecasts for future multi-modal travel demand in Sydney as produced by the Strategic Travel Model. Future growth in road travel in the

Sydney Motorway Planning Model 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 Strategic Travel Model.

#### **C8.1.4 Performance of the strategic road network**

##### ***Issue raised***

Submitters raised concerns that the traffic and transport assessment has not given adequate consideration to the performance of the broader strategic road network.

Specific concerns include that traffic impacts were not considered in key areas such as Naremburn and Willoughby, or on key roads such as High Street, Willoughby Road, Eastern Valley Way, and Pittwater Road or secondary areas such as Northbridge, Brookvale and Dee Why or Military Road. Submitters were concerned that the project does not benefit key roads such as Military Road and Warringah Road, and areas of Manly Vale, Brookvale, Dee Why, Narrabeen, Warriewood and Mona Vale.

##### ***Response***

The operational traffic and transport impacts of the project were assessed in the context of traffic changes to the broader road network, as well as a detailed analysis of local area impacts. An overview of the modelling methodology used in the assessment of the project is provided in Figure 9-1 of the environmental impact statement, with further details provided in Appendix F (Technical working: Traffic and transport).

The Sydney Motorway Planning Model forecasts strategic traffic patterns on every major road in Sydney based on demands generated by the Strategic Travel Model which forecasts travel patterns across the Sydney, Newcastle and Illawarra regions under various land use, multi-modal transport and transport pricing scenarios. The Sydney Motorway Planning Model was used to consider the benefits and impacts of the project on the surrounding network, including potential redistribution of traffic.

By providing a new underground motorway bypass of the Military Road/Spit Road (A8) and Warringah Road (A38)/Eastern Valley Way corridors, the project would significantly reduce congestion and improve travel times, trip reliability and road safety for most road users who rely on these corridors, with substantial reductions in demand forecast for these corridors. By providing additional motorway capacity and bypassing communities underground, areas in the Northern Beaches and lower North Shore would benefit from the project through improvements to road network accessibility (improved travel times on new or existing infrastructure) and/or improved local amenity from reduced traffic volumes. The project would enhance the performance and resilience of the road network by providing additional road network capacity and alternate north-south and east-west linkages to reduce congestion during peak travel periods and in the event of incidents on the road network.

Analysis of the modelled forecast traffic demands across Middle Harbour with the project in 2037 indicates that:

- Peak period traffic demand on Military Road and Spit Road would decrease by up to 11 per cent and 33 per cent respectively
- Peak period traffic demand on Warringah Road would decrease by up to 23 per cent
- Peak period traffic demand on Mona Vale Road would decrease by up to eight per cent
- Daily traffic demand on Eastern Valley Way would decrease substantially by up to 40 per cent.

It is noted that the varying percentage changes in traffic demand which are anticipated for the Military Road/Spit Road corridor are due to a variety of factors including:

- Existing traffic demands and volumes differ between Military Road and Spit Road, which consequently influences the percentage change for each road
- Military Road has alternative parallel routes whereas there are no such alternative parallel routes for Spit Road in the immediate vicinity of the Spit Bridge. Therefore reduced traffic demand for the Military Road corridor is also shared with alternative parallel routes such as Ourimbah Road and Kurraba Road
- Reduced 'rat-running' is expected for the alternative parallel routes to Military Road, with through traffic better suited to Military Road and currently 'rat-running traffic' returning to Military Road. While this offsets some of the direct demand reduction benefits to Military Road, it provides further benefits to the alternative parallel routes which traverse primarily residential areas.

Strategic traffic modelling indicates that the project, combined with the Western Harbour Tunnel and Warringah Freeway Upgrade, would deliver substantial benefits to traffic travelling on the strategic road network, with trips between strategic centres saving up to 30 minutes between the Northern Beaches and locations on the lower North Shore during peak periods. This would also assist in improving the efficiency of local movements between these localities and for those travelling from these areas into and out of the Northern Beaches.

It is acknowledged that there are some areas which would experience increased traffic (generally near the portals), however the project has been designed to efficiently accommodate the predicted traffic demand and safely accommodate forecast traffic volumes. It is also noted that the substantial broader network benefits of the project would offset any localised delays for the majority of road users. Results from the modelling are presented in Section 7 of Appendix F (Technical working paper: Traffic and transport) and Section 9.4 of the environmental impact statement.

Traffic forecasting carried out for the project does not indicate any adverse impacts in areas such as Brookvale and Dee Why. Conversely, areas such as these would benefit from improved transport connectivity, capacity, and reliability as a result of the project. Areas such as Northbridge, Naremburn and Willoughby would benefit from reduced through traffic demand using roads such as Warringah Road, Eastern Valley Way, Flat Rock Drive and Brook Street to travel to the Sydney CBD, as a proportion of trips currently using these corridors would use the project instead. This would assist in improving the efficiency of local movements between these localities and for those travelling from these areas into and out of the Northern Beaches.

Overall, the project combined with the Western Harbour Tunnel and Warringah Freeway Upgrade would not result in substantially more traffic travelling into and out of the Northern Beaches peninsula, but it would result in substantial reductions in traffic demand on Spit Road/Military Road corridor, Brook Street, Eastern Valley Way/Warringah Road with more of this traffic travelling via the Beaches Link tunnel.

### **C8.1.5 Public transport**

#### ***Issue raised***

Submitters raised concerns about how public transport was considered in the traffic and transport assessment. Specific concerns and queries include:

- Concerns that the environmental impact statement does not adequately outline:
  - Public transport plans and development for both surface roads and within the tunnel
  - Public transport system arrangements for integrating and enhancing accessibility

- Details on bus services and long term plans, such as what percentage of commuters are anticipated to be served by public transport in the tunnel
- Queries whether trips on public transport would be quicker as a result of the project
- Concerns that the traffic and transport assessment did not consider the introduction of B-Line buses, or the proposed Dee Why to Chatswood B-Line bus service
- Concerns that the response to transport policy *Sydney's Bus Future* (Transport for NSW, 2013c) is inadequate, as the project's public transport infrastructure is unclear for realising the benefits or impacts of the project.

### ***Response***

#### **Adequacy of the public transport assessment**

The Beaches Link component of the project has been designed to be a key piece of the future integrated transport network of the Northern Beaches, allowing for the future provision of express bus connections with North Sydney, the Sydney CBD, Macquarie Park, St Leonards and potentially other key centres across greater Sydney via the motorway network. Accordingly, the Beaches Link tunnels have been designed to allow use by buses, including taller double decker bus services. As such, the project provides the opportunity to supplement existing services with express buses via the Beaches Link tunnel. There would also be the opportunity for express bus services using the project to interchange with Sydney Trains and the new Sydney Metro at North Sydney and Crows Nest.

Specific public transport infrastructure connections to and from the project at Cammeray, Balgowlah and Seaforth, Killarney Heights and Frenchs Forest are outlined in Table 5-9 of the environmental impact statement for the Beaches Link component of the project and Table 5-13 for the Gore Hill Freeway Connection. Along the Warringah Freeway, bus priority infrastructure would be provided as part of the Warringah Freeway Upgrade allowing buses travelling southbound in the Beaches Link tunnel direct access to a new southbound bus lane on the Warringah Freeway. At Balgowlah, a northbound and a southbound bus lane would be maintained along the Burnt Bridge Creek Deviation as part of the realignment and widening of the road. This would be consistent with existing bus provisions in this area and would assist in prioritising public transport access to the Beaches Link tunnels. The configuration of the surface roads and ramps at the Gore Hill Freeway Connection component are designed to enable high quality bus connectivity between the Beaches Link tunnels and St Leonards, Chatswood, and strategic centres to the north west via the Lane Cove Tunnel.

As noted in Section C8.1.4 above, modelled forecast traffic demands indicate that with the project there would be substantial reductions in demand forecast for road corridors, such as the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors, improving travel times and trip reliability for most road users. The strategic travel time savings for road users with the project, for example trips between strategic centres saving up to 22 minutes when travelling across Sydney Harbour from the Northern Beaches during peak periods, would be equally applicable to bus travel.

By reducing network congestion on existing surface roads, improving network resilience and increasing reliability in peak periods, the project would make buses both within the tunnel and on the surface a more attractive transport option, supporting and encouraging a mode shift to public transport as outlined in Section 9.1.3 of the environmental impact statement.

Modelled peak hour bus travel times at surface interface areas, considering the project only, is provided in sections 7.4.5, 7.5.5, 7.6.5 and 7.7.5 of Appendix F (Technical working paper: Traffic and transport). Bus travel times would be maintained through Balgowlah and surrounds, and expected to improve in Warringah Freeway and surrounds, Gore Hill Freeway and surrounds and Frenchs Forest as a result of the project. These travel time savings, both locally and regionally,

would substantially increase 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.

The provision and operation of new bus services and commuter usage predictions is not part of the project for which approval is being sought, and would be dependent on the details of a detailed future integrated transport network plan.

#### Consideration of rapid bus transport in assessment

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 outlined in sections 2.3 and 2.4 of Appendix F (Technical working paper: Traffic and transport).

The project would support and complement the continued operation of the B-Line program along with other existing and proposed bus services by improving travel times and reliability on key routes connecting the Northern Beaches to key centres including Spit Road/Military Road corridor and Warringah Road/Eastern Valley Way. Additionally, the reduced vehicle congestion on Warringah Road between Frenchs Forest and Roseville would support and enhance the planned implementation of a rapid bus service between Dee Why and Chatswood.

#### Sydney's Bus Future

*Sydney's Bus Future* (Transport for NSW, 2013c) presents a three-stage approach to improve service outcomes, focusing on improving customer experience, integrating bus services across Sydney and serving future growth.

By reducing network congestion on existing surface roads, improving network resilience and increasing reliability in peak periods, the project would make bus routes to and from the Northern Beaches a more attractive transport option with higher capacity and higher speeds, supporting and encouraging a mode shift to public transport.

## **C8.2 Performance of the local road network**

### ***Issue raised***

Submitters queried the future road network performance surrounding the project. Specific queries and concerns include:

- Concerns that the project increases vehicle reliance, resulting in local road congestion and increased travel times, and does not provide a long term solution to congestion issues
- Concerns that rat running would occur as cars and trucks avoid local congestion and/or tolls
- Concerns that the project would increase traffic in areas including in Lane Cove (in particular Longueville Road), Artarmon (in particular the Pacific Highway), and Sydney CBD
- Concerns that the project would not achieve the objectives of reducing local or main road congestion as:
  - The 10 per cent reduction of traffic on Military Road would be short term
  - Several local intersections are predicted to worsen
- Concerns that the project would not reduce traffic on the Spit Road/Military Road corridor due to toll avoidance
- The widening of the Wakehurst Parkway is not required due to the upgrade of the Warringah Road intersection, and requests to carry out further traffic modelling to demonstrate demand



- Concerns that traffic congestion would occur near the tunnel portals if there is no traffic management plan.

### ***Response***

#### Long term solution to congestion

The existing Middle Harbour crossings have limited capacity and experience high levels of congestion in peak periods, resulting in unreliable travel times for a significant number of trips. Furthermore, the limited number of alternate routes for crossing Middle Harbour makes these corridors critical to the performance of the broader motorway and arterial road network, including for freight, buses and private vehicles servicing the Northern Beaches region. This contributes to high levels of congestion, long and unreliable travel times and, consequently, poor accessibility to and from the region.

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 multi-modal transport needs of Sydney. The project has been designed to efficiently accommodate predicted traffic demand, and the benefits of the project would apply equally to all road users, including private vehicles, freight and public transport. The array of journey patterns and trip purposes within Sydney, and the dispersed nature of origin and destination points for an individual journey, means that an integrated transport network is required to service the needs of a very diverse range of origins, destinations and journey purposes. Because of the generally low density of development within the Northern Beaches and the variety of trip origins and destinations, additional road capacity, as part of an integrated long term transport solution to congestion issues, would best meet the identified project needs and objectives.

By reducing network congestion, the project would result in improved network speeds, resilience and reliability, particularly in peak periods, and would make bus routes into and out of the Northern Beaches a more attractive transport option, supporting and encouraging a mode shift to public transport. The project would also create the opportunity for new express bus routes to be developed in response to diverse travel demands and future development. Under the 'Do something' scenario, as well as providing a new, motorways standard connection between the Northern Beaches and lower North Shore, the project would result in substantial reductions in traffic demand on the existing crossings into and out of the Northern Beaches peninsula, with the largest reductions in traffic demands being on the Spit Road/Military Road corridor.

The program of works would support faster and more reliable travel times for journeys between the Northern Beaches region and key centres across Sydney, as discussed in the response above.

#### Rat running on local roads

Rat running can be generally characterised as traffic using lower-order roads to avoid congestion on arterial roads. The project is expected to reduce rat running by substantially reducing existing traffic volumes and levels of congestion on key arterial roads. The project would also provide for a separation of through traffic and local traffic, which would lead to reduced through traffic using local streets to avoid congestion.

The project would result in most heavy vehicle trips travelling to and from the Northern Beaches transferring to the Beaches Link tunnel, with the largest proportional reductions in traffic volumes being on the Spit Road/Military Road corridor. While the project would not generally increase the heavy vehicle demand travelling into and out of the Northern Beaches peninsula, it would substantially reduce the travel times of these freight trips and increase their productivity.

Toll avoidance can be generally characterised as the potential impact of traffic diverting from currently non-tolled roads as a result of introducing a toll. As such, this is not expected to be an impact for the Beaches Link tunnel, as currently un-tolled surface roads would remain un-tolled once the project is operational. The decision to apply a toll to a road is a NSW Government decision and is not made at the project level. Although no decision on the final tolling strategy has yet been made for the project, the traffic and transport assessment assumptions include two-way tolling for the project tunnels. Tolling scenario assumptions considered in the traffic and transport modelling are described in Section 7.2.4 and Section 8.2.4 of Appendix F (Technical working paper: Traffic and transport).

Where required, Transport for NSW will investigate local area traffic management measures to minimise any unexpected impacts of the project on the surrounding local road network, in accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report).

#### Redistribution of traffic on the broader road network

A summary of the forecast traffic differences with and without the project at key locations surrounding the project (including Artarmon) for 2037 is presented in Annexure B of Appendix F (Technical working paper: Traffic and transport). Although there are predicted to be slight increases in traffic volumes on some sections of roads close to the project eg Longueville Road in Lane Cove and Pacific Highway at Artarmon, other sections of these roads will benefit from greater reductions in traffic volumes.

Network performance measures for the Gore Hill Freeway and Artarmon study area indicate that the network integration works associated with the project would facilitate additional traffic travelling through the corridor while maintaining a similar level of overall network performance. Consequently, although the project would result in changed traffic volumes and patterns, where necessary, it provides the infrastructure to efficiently accommodate these changes, for example the Gore Hill Freeway, Connection as demonstrated in the traffic and transport assessment for the project.

#### Achievement of objectives to reduce local or arterial road congestion

The project objectives for the Beaches Link and Gore Hill Freeway Connection project are outlined in Section 3.4 of the environmental impact statement.

The Beaches Link and Gore Hill Freeway Connection project seeks to improve transport functionality, urban amenity and safety in local centres by reducing congestion, through traffic and 'rat runs', including reducing traffic volumes and congestion on the Military Road/Spit Road corridor. The project would support the objectives in the *Military Road Corridor Planning Study Stage 1* (North Sydney Council, 2021) through a reduction in traffic volumes and congestion along the Military Road/Spit Road corridor, enhancing the connectivity and amenity of Military Road. This also aligns with the *Mosman Local Strategic Planning Statement* (Mosman Council, 2020), which identifies the planning priority of reimagining the Military Road/Spit Road corridor to improve function, amenity and accessibility in response to the Western Harbour Tunnel and Beaches Link program of works.

The project creates an opportunity to reimagine Military Road and how this movement corridor services the lower North Shore and Northern Beaches. As the project design is further developed it would seek to maintain opportunities for the Military Road/Spit Road corridor identified under the *Military Road Corridor Planning Study Stage 1* (North Sydney Council, 2021) and the *Mosman Local Strategic Planning Statement* (Mosman Council, 2020).

The project would enable other divisions of Transport for NSW and other agencies (including relevant councils) to explore opportunities for urban renewal, public transport, active transport and changes to transport management on key corridors, including the Military Road/Spit Road corridor. This includes working with local councils and other government stakeholders to develop a place based transport plan for the lower North Shore, which would identify potential transport opportunities to respond to the changing needs of the community, including movement types, and initiatives for mode shift and network operation across all transport modes. Transport for NSW will commence engagement with Willoughby City Council, Mosman Council, North Sydney Council and Lane Cove Council on this plan in the last quarter of 2021. Transport for NSW will also investigate alternative uses for road space, with initiatives aiming to contribute to the development of 'Successful Places', one of the six outcomes for NSW in the *Future Transport Strategy 2056* (NSW Government, 2018).

Transport for NSW recognise that the implementation of a major infrastructure project such as Beaches Link may result in some intersections operating at a similar or decreased level of service due to forecast changes in traffic volumes and patterns, with limited scope for road widenings due to the constrained urban nature of the project area. However, measuring local intersection performance as a single assessment criterion, does not present a complete picture of local road network traffic operations or indeed, the benefits of a major infrastructure project. Changes at individual locations should therefore not be considered in isolation. Rather, project benefits and impacts should be considered holistically through metrics such as network speeds and corridor travel times.

Further traffic analysis and modelling of key local areas requested by the Department of Planning, Industry and Environment, has also been carried out for the preferred infrastructure report (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report). The assessment confirms that the project is not expected to adversely impact the performance of the Gore Hill Freeway and Artarmon area, or the Balgowlah and surrounds area local road network. Refined modelling of the Warringah Freeway and surrounds area and Frenchs Forest and surrounds area indicates that the impacts presented in the environmental impact statement can be further mitigated by network management and the optimisation of traffic signal operations. However, this analysis also illustrates that road network upgrades and management alone is not expected to be able to fully mitigate impacts, which would require complementary public transport and other demand management initiatives through other established forums and processes beyond the scope of the project.

Notwithstanding, Transport for NSW will carry out a review of operational network performance 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, as per environmental management measure OT1 in Table D2-1 of this submissions report. Where required, additional feasible and reasonable mitigation measures will be identified in consultation with the Department of Planning, Industry and Environment and Northern Beaches Council to manage any unexpected additional traffic performance impacts identified during the review of operational network performance.

Furthermore, Transport for NSW will also investigate options to mitigate potential localised network issues identified in accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report). Where required, Transport for NSW will investigate local area traffic management measures to minimise any unexpected impacts of the project on the surrounding local road network. Such measures would be determined in consultation with relevant councils and implemented where feasible and reasonable.

### Proposed widening of Wakehurst Parkway

The Wakehurst Parkway would be realigned to allow connection of the ramp tunnels with the surface, and widened between the ramp trough structure and Warringah Road to provide additional capacity to support increased demand and changes in traffic patterns as a result of the project. Modelled network performance in the Frenchs Forest and surrounds study area, including traffic demand, is provided in Section 7.7 of Appendix F (Technical working paper: Traffic and transport). As stated above in Section C8.1.1 of this submissions report, the transport modelling for the Beaches Link and Gore Hill Freeway Connection project has been completed in accordance with appropriate standards and guidelines, and developed, reviewed, and endorsed by internal Transport for NSW and independent subject matter experts.

Further details on the realignment and widening of the Wakehurst Parkway are provided in Table 5-8 of the environmental impact statement.

### Traffic management plan

The location and design of the tunnel portals and accompanying surface road upgrades considers and reflects expected traffic volumes and patterns, and therefore congestion or performance issues near the tunnel portals are not expected.

Transport for NSW will carry out a review of operational network performance 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, as per environmental management measure OT1 in Table D2-1 of this submissions report. Where required, additional feasible and reasonable mitigation measures will be identified in consultation with the Department of Planning, Industry and Environment and the relevant council to manage any unexpected additional traffic performance impacts identified during the review of operational network performance.

Transport for NSW will also investigate options to mitigate potential localised network issues identified in accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report). Where required, Transport for NSW will investigate local area traffic management measures to minimise any unexpected impacts of the project on the surrounding local road network. Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable.

## **C8.3 Warringah Freeway and surrounds**

### **C8.3.1 Traffic changes to the Warringah Freeway and surrounds**

#### ***Issue raised***

Submitters raised the following concerns regarding traffic changes to the Warringah Freeway and surrounding areas:

- Concerns that the widening of the Warringah Freeway and inclusion of additional traffic lanes would become confusing for motorists to navigate
- Concerns that the reconfiguration of the Warringah Freeway would limit the flexibility to access exits at Northbridge, Cammeray or Willoughby
- Concerns that the reduced access to the Warringah Freeway and the Sydney Harbour Tunnel would result in an increase in congestion, traffic, rat running and commute times in:
  - Areas of North Sydney, Cammeray, Naremburn, Willoughby, Northbridge, Cremorne, Cremorne Point, and Neutral Bay

- Streets including Berry Street, Miller Street, Falcon Street, Pacific Highway (south of Falcon Street), Willoughby Road, Brook Street and streets off Flat Rock Drive
- Concerns that the project would result in a number of intersections with poor level of service including Ben Boyd Road and Military Road, Amherst Street and West Street, and Miller Street and Falcon Street
- Concerns that the Berry Street change of access to the Warringah Freeway would fragment North Sydney, making it a less attractive urban centre
- Concerns about access to properties on Ernest Street and Anzac Park Public School
- Concerns that future public and active transport would be compromised as a result of increased traffic in neighbourhoods near North Sydney.

### ***Response***

#### Navigating the Warringah Freeway

The Warringah Freeway Upgrade would be delivered as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, which received planning approval in January 2021. The upgraded Warringah Freeway would simplify traffic flow and improve wayfinding as described in Section 9.4.2 of the environmental impact statement. An overview of these connections and their associated access arrangements is provided in Figure 9-5 of the environmental impact statement and Section 7.4.4 of Appendix F (Technical working paper: Traffic and transport). A community communication fact sheet was also released in March 2020 to help the community understand the new Warringah Freeway access arrangements provided by the Western Harbour Tunnel and Warringah Freeway Upgrade project. This visual aid can be accessed at the following link: [nswroads.work/whtportal-WFaccess](https://nswroads.work/whtportal-WFaccess).

The number of lanes present at each surface connection is a function of the existing lanes present and the requirement to accommodate on ramps and off ramps at each location. There is a large number of lanes present along the Warringah Freeway due to the volume of connections present in this road corridor.

Access from Northbridge, Cammeray or Willoughby would be maintained as part of the project. Connections between the upgraded Warringah Freeway and the arterial road network would be provided at all existing interchange locations, as described in Section 9.4.2 of the environmental impact statement. However, some changes to existing Warringah Freeway access would occur as part of the Warringah Freeway Upgrade at Falcon Street, Miller Street, Brook Street, Berry Street and Alfred Street North.

#### Traffic increases

Assessment of the project's impacts on the Warringah Freeway and surrounds area is outlined in Section 9.4.2 of the environmental impact statement, and discussed in more detail in sections 7.4 and 8.4 of Appendix F (Technical working paper: Traffic and transport).

The project is expected to reduce traffic demand on existing corridors which provide connectivity between the lower North Shore and Northern Beaches such as Military Road (Neutral Bay) and Miller Street (Cammeray), and consequently improve travel times and reliability on these routes.

In combination with the Western Harbour Tunnel and Warringah Freeway Upgrade project, the project would generally improve network performance for roads within and near North Sydney. The proposed network integration works and resulting improved 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 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 (see next response for further details).

While there is the potential for some localised delays at some intersections at peak times and some localised increases in travel times for trips within North Sydney and surrounds, this would be offset by the substantial travel time benefits provided by the project at the broader network level, particularly for trips which utilise the enhanced future motorway network.

Further traffic analysis and modelling of the Warringah Freeway and surrounds area has also been carried out for the preferred infrastructure report. This analysis (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report) indicates that the level of performance presented in the environmental impact statement can be further improved by network management and the optimisation of traffic signal operations. However, this analysis also illustrates that road network upgrades and management alone is not expected to be able to fully mitigate impacts, which would require complementary public transport and other demand management initiatives through other established forums and processes beyond the scope of the project (for example the North Sydney Integrated Traffic Program, as discussed further below).

#### Intersection performance

The modelled intersection performance for the Warringah Freeway and surrounds area for the 'Do something' and 'Do something cumulative' scenarios is shown in Table 9-6 of the environmental impact statement.

The environmental impact statement traffic modelling indicates that the intersections of Ben Boyd Road and Military Road, Amherst Street and West Street and Miller Street and Falcon Street have the potential to experience longer delays as a result of the project, however are expected to improve in the 'Do something cumulative' scenario (ie with the introduction of the Western Harbour Tunnel). While there would be some localised delays at some intersections at peak times, these would be offset by the substantial travel time benefits provided by the project at the broader network level.

The proposed road network integration works and resultant traffic performance in the North Sydney area have been developed in the context of the growing North Sydney CBD environment and existing physical constraints. 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 or in other areas. The proposed works are considered to provide an equitable outcome from the perspective of maintaining 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 (North Sydney Program), 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.

Notwithstanding this, as noted above, further assessment was requested by the Department of Planning, Industry and Environment for particular locations where the environmental impact statement indicated potential localised intersection traffic performance impacts (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report), specifically including Amhurst Street, West Street, and Miller Street. The refined operational traffic modelling (which considered further network management and optimisation of traffic signal operations) for the 2037 'Do something' and 2037 'Do something cumulative' scenarios in the morning and evening peaks generally indicates an improvement to overall road network

performance compared to the 2037 'Do minimum' scenario, and that in most cases the performance of intersections in focus would be maintained or improved with the project, with a few exceptions where residual impacts to isolated intersection delay are reported.

Transport for NSW would continue to investigate further opportunities to provide additional benefits or mitigate residual impacts within the Warringah Freeway and surrounds study through the Western Harbour Tunnel and Beaches Link program and/or other relevant processes such as the North Sydney Program. Given the context of this complex, constrained, urban area, additional mitigations would focus on multi-modal strategies to reduce private vehicle demand rather than seek to deliver further road capacity upgrades.

Transport for NSW will carry out a review of operational network performance 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. Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project in accordance with environmental management measures OT1 and OT2 (refer to Table D2-1 of this submissions report).

#### North Sydney urban centre fragmentation

The detailed transport modelling and assessment carried out by Transport for NSW does not show that the project would result in significant additional traffic and performance issues in the North Sydney CBD.

The scope of works proposed on Berry Street as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project includes a pedestrian 'scramble' crossing at the intersection of Miller Street and Berry Street to improve pedestrian movement safety and capacity, and the removal of the existing kerb build outs on the southern side of Berry Street. The removal of the kerb build outs and refinement of existing peak period clearway provisions on the southern side of Berry Street would enable traffic performance to be maintained in combination with the proposed pedestrian movement improvements. It is noted that outside of peak traffic periods (ie for the majority of time during weekdays and throughout weekends) the existing operation of Berry Street – two traffic lanes and two parking lanes – would be unaltered by the Western Harbour Tunnel and Beaches Link program of works.

As noted above, further refinements to movement and place outcomes within the North Sydney CBD may occur as part of works associated with the North Sydney Program.

#### Ernest Street properties and Anzac Park Public School access

Access to properties on Ernest Street and Anzac Park Public School would not be affected during the project's operation.

The project would connect directly via an on ramp and off ramp to the Warringah Freeway at Cammeray, north of the Ernest Street Bridge. The project would also connect to the Western Harbour Tunnel via a direct underground connection.

#### Future public and active transport

The project would result in a more resilient road network that can accommodate future growth in key road transport customers, while at the same time providing new facilities for active transport and public transport, improving amenity and road safety and promoting walking, cycling and public transport access to and within the North Sydney CBD. It is also noted that reduced traffic demand on existing corridors connecting to and from North Sydney CBD, such as Military Road, would also generally improve the speed, amenity, and safety for all users of these corridors. In the event that

road transport demand is lower or demands otherwise differ as land use and transport developments mature, the project would also provide flexibility to adjust the future transport network in response to customer needs.

Transport for NSW would continue to work with North Sydney Council and key stakeholders through agreed governance structures such as the North Sydney Program, to investigate options to improve movement and place outcomes, further leveraging the strategic benefits of the Western Harbour Tunnel and Beaches Link program of works.

### **C8.3.2 Traffic calming measures at Naremburn, Cammeray and Northbridge**

#### ***Issue raised***

Submitters requested a number of traffic management and calming features including:

- Traffic calming measures on local streets at Naremburn, Cammeray and Northbridge to reduce traffic, rat running, and increase safety, including signals or keep clear zones on Brook Street, and the intersections of Grafton Avenue, Slade Street and Rhodes Avenue, and to prioritise the safe egress and ingress of local traffic rather than through traffic
- Installation of speed cameras on Flat Rock Drive and Brook Street
- Traffic monitoring at Flat Rock Drive, Brook Street, Sailors Bay Road and Alpha Road
- Pedestrian crossings at the Rosalind Street and Miller Street intersection at Cammeray, and at the Sailors Bay Road and Flat Rock Drive intersection at Northbridge
- Restricted access to Lytton Street for westbound traffic turning left on Ernest Street.

#### ***Response***

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts.

Modelled forecast traffic demands across Middle Harbour indicate reduction in demand on major arterial routes around northern Sydney, including a forecast decrease in daily traffic demand on Eastern Valley Way of up to 40 per cent by 2037. Reduced congestion on existing surface arterial routes is expected to improve network resilience due to the provision of new road capacity and connectivity, and reduce the attractiveness of rat-running on these roads, including Eastern Valley Way, reducing traffic through surrounding urban and residential areas. By providing additional motorway capacity and bypassing communities underground, the project would reduce through traffic volumes in many areas. This would result in reduced noise and improved amenity in these areas. This includes reduced through traffic on Eastern Valley Way and down through Naremburn, Cammeray and Northbridge. As such, the proposed traffic calming measures proposed are considered to be out of scope of the project.

Notwithstanding, Transport for NSW will carry out a review of operational network performance 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 in accordance with environmental management measures OT1 (refer to Table D2-1 of this submissions report). Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network after opening. Such measures will be determined in consultation with relevant councils in accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report).



## C8.4 Gore Hill Freeway and Artarmon traffic impacts

### ***Issue raised***

Submitters raised concerns about impacts to the Gore Hill and Artarmon area. Specific concerns include:

- Concerns that traffic would increase in local streets at Artarmon including near Artarmon Village and at the Artarmon industrial area; concerns that the project would create bottlenecks at Artarmon Road, Mowbray Road and Elizabeth Street as these are currently at capacity
- Concerns that the removal of transit lanes would impact bus services, discourage carpooling and as a result, increase travel times
- Concerns that the proposed cul-de-sac on Punch Street would restrict access via Lambs Road to the Gore Hill Freeway and surrounding streets, resulting in an increase of traffic on Herbert Street and difficulty in accessing properties particularly for heavy vehicles
- Concerns regarding the Dickson Avenue intersection with Reserve Road, including:
  - Overall intersection performance would decrease
  - Travel times and traffic congestion would increase on Reserve Road and surrounding local streets due to the Dickson Avenue cul-de-sac
  - Relating to properties on Waltham Street accessing Reserve Road, vehicles would be required to detour via Cleg Street, Herbert Street, and Frederick Street, and this alternative is already congested. Suggestions to reopen Cleg Street to Reserve Road and make Taylor Lane one way eastbound
  - The impact of closing Dickson Avenue to Waltham Street and its knock-ons for local congestion
- Traffic on Reserve Road and connecting roads would worsen, which would not be mitigated by the proposed traffic changes on Reserve Road Concerns that the environmental management measures proposed are inadequate to improve the performance of the Reserve Road/Gore Hill Freeway intersection and additional measures are required.

### ***Response***

#### Impacts to Artarmon local centre

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. The proposed design is also cognisant the highly constrained urban nature of this area, including spatial constraints and property impacts.

Assessment of the project's impacts on the Artarmon local road network is provided in Section 9.4.3 of the environmental impact statement. Network performance measures for the Gore Hill Freeway and Artarmon study area indicate that the peak period traffic demand travelling through the corridor would increase by up to 13 per cent in 2037 while maintaining a similar level of overall network performance. Whilst the introduction of the project would increase demand in the area, average travel speeds would increase by up to 19 per cent in the AM peak and would not change substantially during the PM peak. As a result of the additional regional connectivity from the Artarmon area added by the Western Harbour Tunnel and Beaches Link program of works, only localised residual impacts to traffic through the Artarmon area are expected.

A summary of the forecast traffic differences with and without the project at key locations surrounding the project for 2037 is presented in Annexure B of Appendix F (Technical working paper: Traffic and transport). Annexure B demonstrates that there is not predicted to be any material change to traffic volumes north of the Reserve Road interchange/through Artarmon local centre as a result of the project.

As such, traffic forecasting and modelling indicates an acceptable level of traffic performance in the area as a result of the proposed project integration works, and does not suggest that further local road network modifications are required to mitigate project-related impacts.

Additional intersection performance information (average delay) provided as part of the preferred infrastructure report further confirms that the project (and broader Western Harbour Tunnel and Beaches Link program of works) is not expected to adversely impact the performance of the Reserve Road corridor between Barton Road and Dickson Avenue in particular (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report).

Notwithstanding the above, Transport for NSW will carry out a review of operational network performance 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. Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project in accordance with environmental management measures OT1 and OT2 (refer to Table D2-1 of this submissions report).

#### Removal of transit lanes

The conversion of the existing eastbound T2 transit lane to general traffic lanes would provide additional capacity to the road network in the AM peak to meet forecast demand and improve the utilisation of existing pavement space, as identified in Section 9.4.3 of the environmental impact statement. Forecast bus travel times for key routes through the Gore Hill Freeway and Artarmon area indicate that the conversion of the T2 transit lanes would not have a material impact on bus travel times during the AM and PM peaks towards the Sydney CBD (Lane Cove Tunnel to Gore Hill Freeway).

#### Punch Street cul-de-sac

Changes to the local road network have been minimised where possible, however, to accommodate the Gore Hill Freeway Connection, local road changes to the existing road network are required.

Changes to local roads within the Artarmon industrial area would include the removal of the connection between Punch Street and Lambs Road, with the permanent conversion of Punch Street to a cul-de-sac, as identified in Section 5.1.2 of the environmental impact statement.

Lambs Road would connect directly onto Cleg Street at its northern end while the cul-de-sac would be installed on Punch Street at its eastern end. Vehicles would be required to use Punch Street and Herbert Street. This impact on connectivity is considered to be minor, as this would not substantially increase travel time given an additional travel distance of up to 480 metres for a small number of road users.

#### Reserve Road and Dickson Avenue changes

As noted above, the design of the project at Artarmon has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. The proposed design also accounts for the highly constrained urban nature of this area, including spatial constraints and property impacts.

The traffic and transport assessment does not indicate that the performance of the Dickson Avenue intersection would materially decrease, and also indicates that the currently proposed scope of the Reserve Road interchange upgrade would efficiently accommodate forecast traffic. Additionally, the traffic modelling does not indicate that the closure of Dickson Avenue to Waltham Street would create material traffic congestion issues. As noted above, overall, the traffic forecasting and modelling does not suggest that further local road network modifications are required to mitigate project-related impacts. Refer to Section 9.4.3 of the environmental impact statement for further discussion. Also refer to Section A5.1.4 of this submissions report for further details on operational intersection performance of the Pacific Highway/Dickson Avenue intersection.

As noted above, additional intersection performance information (average delay) provided in Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report further confirms that the project (and broader Western Harbour Tunnel and Beaches Link program of works) is not expected to adversely impact the performance of the Reserve Road corridor.

Notwithstanding this, Transport for NSW will, where required, investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network to address operational road network performance (refer to OT2 in Table D2-1 of this submissions report).

## **C8.5 Balgowlah and surrounds**

### **C8.5.1 Impacts to the local road network**

#### ***Issue raised***

Submitters raised concerns that traffic at Balgowlah and the surrounding road network would worsen as a result of the project. Specific concerns include:

- Traffic impacts at Balgowlah and surrounds were not adequately assessed, including intersection performance and traffic on local streets and at shopping precincts and schools
- Traffic would increase at Balgowlah and surrounding areas and therefore the project would not improve commuting from the Northern Beaches
- Dudley Street would be difficult to access given the proximity to two major intersections (Sydney Road/Manly Road/Burnt Bridge Creek Deviation and Sydney Road/new access road)
- Rat running would occur in streets surrounding Sydney Road, with specific mention of Frenchs Forest Road, Brook Road, Ethel Street, Upper Beach Street, Violet Street, Audrey Street, White Street, Woodbine Street, Kitchener Street and Balgowlah Road
- Increased traffic on Sydney Road would impact local trips at Balgowlah, as traffic would be redistributed to other areas particularly:
  - Local streets surrounding the Balgowlah shopping mall
  - The Kenneth Road/Balgowlah Road intersection
  - The Balgowlah Road/Pittwater Road roundabout.

#### ***Response***

Traffic impacts at Balgowlah and surrounds were assessed in Section 9.4.5 of the environmental impact statement, with further detail provided in Appendix F (Technical working paper: Traffic and transport). The operational road traffic model areas subject to assessment included local and arterial roads in the suburbs of Balgowlah, Mosman, North Balgowlah, Manly Vale and Seaforth, as shown in Figure 9-2 of the environmental impact statement. The traffic and transport assessment

has adopted a holistic network modelling approach to illustrate overall critical network operations (eg network speeds and travel times) in addition to the performance of individual intersections.

Modelling of traffic travel times in the Balgowlah and surrounds area indicates that travel times across the network and on most key routes throughout the area are expected to improve as a result of the project (refer to Section 9.4.5 of the environmental impact statement). The outcomes of the traffic modelling of the 'Do something' scenario show that while peak period traffic demand would increase by up to 15 per cent by 2037, average travel speeds would improve by 77 per cent in the AM peak and 49 per cent in the PM peak due to the shift in traffic demand to the project road network. This shift from existing surface roads to the Beaches Link tunnel, and particularly the reduction in traffic travelling through the Sydney Road, Burnt Bridge Creek Deviation, Manly Road intersection, would result in reduced congestion and improved travel times for local trips. The operation of the project would facilitate additional traffic through Balgowlah and surrounding areas at greatly reduced levels of delay, which would benefit both regional and local trips.

The potential access impacts associated with the relocation of the cul-de-sac on Dudley Street are expected to be minor given remaining properties would still be accessible from Dudley Street. Traffic on this section of Sydney Road is expected to decrease as a result of the project, and therefore access to and from Dudley Street is expected to improve.

Rat-running to access the tunnel portals is generally not expected to occur, as the Balgowlah tunnel portal has been designed to provide efficient access via Sydney Road and the new access road. Furthermore, rat-running to avoid congestion is not expected to occur; the transport assessment demonstrates surface traffic conditions are expected to materially improve as a result of the project, and hence rat running to avoid congestion is less likely to occur than compared to conditions without the project.

The project is expected to reduce traffic on Sydney Road, particularly at the critical intersection with Burnt Bridge Creek Deviation, which is aligned with the evidence base presented in the traffic and transport assessment.

Further traffic analysis and modelling of the Balgowlah and surrounds area has also been carried out for the preferred infrastructure report. This analysis (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report) provides additional detail of the benefits in the Balgowlah area presented in the environmental impact statement, confirming that the local road network is not expected to be materially adversely impacted by the project in this area.

Notwithstanding this, Transport for NSW will carry out a review of operational network performance 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. Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project in accordance with environmental management measures OT1 and OT2 (refer to Table D2-1 of this submissions report). Local area traffic management measures proposed will be determined in consultation with relevant councils during further design development.

### **C8.5.2 Traffic calming measures at Balgowlah, North Balgowlah and Seaforth**

#### ***Issue raised***

Submitters requested traffic calming measures on local streets at Balgowlah and surrounds to reduce rat running on local streets and improve safety at intersections. Specific requests were made for:

- Traffic signals at Balgowlah Road/Roseberry Street and Kenneth Road/Roseberry Street intersections
- Speed cushions (or similar) on Manning Street, Bardoo Avenue, Woodbine Street, Myrtle Street, Kitchener Street, Wanganella Street, Rickard Street, Seaview Street, Kanangra Crescent, Maretimo Street and Ethel Street
- Whether there are plans to include pedestrian safety measures at Condamine Street.

#### ***Response***

Transport for NSW notes the suggestions made in relation to traffic calming devices and pedestrian safety measures.

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. As noted in Section C8.5.2 above, the project is expected to reduce rat running by substantially reducing existing traffic volumes and levels of congestion on key arterial roads. The project would also provide separation of through traffic and local traffic which would lead to reduced volume of through traffic using local streets.

As indicated above, as per environment management measure OT1 (refer to Table D2-1 of this submissions report) at periods of 12 months and five years after opening of the project, Transport for NSW will carry out a review of operational network performance to confirm the operational impacts of the project on surrounding arterial roads and major intersections. Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network in accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report). Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable. Any proposed changes would be considered in line with the process outlined in Section 2.3 of the environmental impact statement.

### **C8.5.3 Surface connections at Balgowlah**

#### ***Issue raised***

Submitters raised comments regarding the surface connections at Balgowlah. Specific queries, concerns and requests include:

- Queries the need for the Balgowlah tunnel entrance, as residents north of Manly Vale would use the Wakehurst Parkway entrance
- Queries the design of the surface works at Burnt Bridge Creek Deviation including:
  - Whether the number of lanes on Burnt Bridge Creek Deviation could be reduced if traffic lights at the new access road were removed
  - Whether the proposed traffic signals at the new access road would increase congestion in the area and interrupt traffic flow

- Whether traffic travelling southbound would be required to stop for northbound traffic turning right into the new access road after exiting the tunnel
- Concern that the removal of access from Maretimo Street to Sydney Road would increase traffic in local streets between Wanganella Street and Woodland Street
- Queries on how the tunnel can be accessed from Freshwater and Curl Curl
- Concern that the access to the BP service station on Maretimo Street when travelling eastbound on Sydney Road would be removed.

### ***Response***

#### Surface connection at Balgowlah

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration to ensure efficient operation, while also balancing and minimising impacts.

The rigorous selection process carried out to identify the preferred corridor for the project and surface connections is outlined in Chapter 4 (Project development and alternatives) of the environmental impact statement. The options presented for the North Balgowlah/Balgowlah/Seaforth area are a summary of the key tunnel and surface road alignment options which were proposed and tested over a period of five years. Further engineering was carried out incorporating suggestions from various stakeholders including community members and groups, through multiple community consultation sessions between 2017 and 2020. Surface connections were developed with consideration of minimising community and environmental impacts, in addition to engineering and construction constraints.

The two tunnel portals are required as these would service different areas on the Northern Beaches. The Burnt Bridge Creek Deviation tunnel portal would service areas north of Spit Road including Seaforth, Balgowlah, Manly, Brookvale and Dee Why, whereas the Wakehurst Parkway tunnel portal would service areas such as Frenchs Forest, Mona Vale, Narrabeen and Terry Hills.

The number of lanes present at each surface connection is a function of the existing lanes present and the requirement to connect the tunnel portals to the existing road network. To efficiently connect the tunnel portal to Burnt Bridge Creek Deviation, this requires dual right-turn lanes into the new access road from the Beaches Link off ramp and dual left-turn lanes out of the new access road to the Beaches Link on ramp and Burnt Bridge Creek Deviation southbound.

The new intersection connecting the new access road with the Burnt Bridge Creek Deviation and the tunnel portals adjacent to the northern end of Dudley Street would be signalised. Northbound through traffic coming out of the Beaches Link tunnel onto the Burnt Bridge Creek Deviation would bypass these traffic signals. Southbound traffic on Burnt Bridge Creek Deviation would be required to stop for short periods at times for traffic to turn into and out of the new access road.

The project would also provide a new signalised intersection at the southern end of the new access road to accommodate its connection with Sydney Road. These signalised intersections are required to safely and efficiently connect the Beaches Link tunnel portals to the local road network

As discussed, modelling of traffic travel times in the Balgowlah and surrounds area indicates that travel times across the network and on most key routes throughout the area are expected to improve as a result of the project. Further, as shown in Table 9-10 in the environmental impact statement, traffic is expected to perform at an optimal level of service (LoS A) at the new access road and Burnt Bridge Creek Deviation intersection. Whilst the new access road/Burnt Bridge Creek

Deviation intersection would result in a minor delay of up to 14 seconds or less, this would be offset by major improvements to travel further south through the Sydney Road intersection and beyond.

Further traffic analysis and modelling of the Balgowlah and surrounds areas has also been carried out for the preferred infrastructure report. This analysis (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report) reiterates the significant traffic benefits for this area presented in the environmental impact statement.

Notwithstanding, Transport for NSW will carry out a review of operational network performance 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. Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project in accordance with environmental management measures OT1 and OT2 (refer to Table D2-1 of this submissions report).

Further details on surface connections at Burnt Bridge Creek Deviation are provided in Section 5.2.5 of the environmental impact statement.

#### Tunnel access points

The entry and exit portals for Beaches Link are located at Balgowlah, Killarney Heights, Cammeray and Artarmon. Road users from Freshwater and Curl Curl would be able to access the tunnel at Balgowlah via the Burnt Bridge Creek Deviation.

Further details on surface connections at Balgowlah are provided in Section 5.2.5 of the environmental impact statement. For the specific entry and exit ramps for each location, see the [How to use Beaches Link fact sheet](#).

#### Access to Maretimo Street and Sydney Road service station

As discussed in Section C4.1.7 of this submissions report, the project would include widening of Sydney Road at the new signalised intersection between the new access road, Sydney Road and Maretimo Street to allow for turning lanes and maintenance of through traffic lanes on Sydney Road (refer to Chapter 5 (Project description) of the environmental impact statement). Existing access arrangements would be maintained between Sydney Road and Maretimo Street during operation. However, there would be no new direct access across Sydney Road between the new access road and Maretimo Street.

The BP service station on the corner of Maretimo Street and Sydney Road currently has driveway access from both Sydney Road westbound and Maretimo Street. Direct access to the driveway on Sydney Road for eastbound traffic is not currently possible as there is a raised median. Eastbound traffic on Sydney Road can access the BP service station via Maretimo Street. This would not change following changes proposed by the project at the Maretimo Street intersection.

### **C8.5.4 Clarification on the responsibility of Council**

#### ***Issue raised***

Submitters requested confirmation on the operational local traffic responsibilities between Transport for NSW and the Northern Beaches Council; local infrastructure cannot support the increase in traffic generated by the project and there is no plan to improve local roads.

#### ***Response***

The impacts of predicted changes in local traffic conditions at Balgowlah and surrounds are discussed in Section C8.5.1 of this submissions report. As noted above, modelling of travel times at Balgowlah and surrounds indicates that travel times across the network and on most key routes

throughout the area are expected to improve as a result of the project (refer to Section 9.4.5 of the environmental impact statement). The project would reduce congestion on arterial road corridors and reduce associated rat running on local roads in many areas, improving safety and amenity in these local community areas. Refer to Section C8.6 below for discussion on traffic performance in the Frenchs Forest and surrounds area.

Throughout further design development and construction phases of the project, Transport for NSW would continue to proactively consult with the Northern Beaches Council on the allocation and management of project assets. This consultation would seek to ensure the orderly, efficient and effective transfer of project assets where appropriate. If the management of a project asset is transferred to the Northern Beaches Council, the scope would be agreed prior to the transfer, including the provision of any data or information to be exchanged.

Items which are outside the scope of the project would continue to be discussed through other existing forums between Transport for NSW and councils.

Notwithstanding, 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. Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project in accordance with environmental management measures OT1 and OT2 (refer to Table D2-1 of this submissions report).

## **C8.6 Frenchs Forest and surrounds**

### ***Issue raised***

Submitters raised concerns about the future performance of roads near Frenchs Forest. Specific concerns and requests include:

- Concerns that travel speed would decrease in Frenchs Forest by up to 13 per cent by 2037 and congestion would worsen for northbound traffic at the Wakehurst Parkway intersection with Warringah Road, as this intersection already experiences delays since the opening of the Warringah Road underpass
- Concerns that traffic would increase on local streets including Baringa Avenue and Lister Avenue, as traffic would avoid Judith Street to access the Wakehurst Parkway
- Requests for the northern entry of Kirkwood Street to the Wakehurst Parkway to remain permanently closed.

### ***Response***

#### **Operational traffic performance in Frenchs Forest and surrounds**

Road network performance for the Frenchs Forest and surrounds area and the benefits from the recently completed Northern Beaches Hospital road upgrade project is discussed in Section 9.4.6 of the environmental impact statement.

Under the 'Do something' scenario, the changes to traffic patterns associated with the project would generally result in increased localised delays on Warringah Road surface lanes between Forest Way and the Wakehurst Parkway and reduced travel speeds in this locality.

The potential localised increases in travel times on the key corridors of Warringah Road and Wakehurst Parkway within the area are expected to be less than five minutes during the busiest peak hours in the future. Overall, traffic modelling predicts that potentially increased localised delays at intersections would be offset by the broader improvement in connectivity and reduction in



congestion created by the project. For example, average travel time savings between key centres, eg Dee Why to and from Macquarie Park, are expected to be about 20 minutes. In this example, a net saving would still be created by the project providing new high capacity connectivity and reducing congestion on existing regional routes like Warringah Road west of Frenchs Forest. It is also noted that overall travel times for general traffic on Warringah Road and Forest Way in the Frenchs Forest area would remain generally unaffected by the project, indicating that potentially increased delays along Wakehurst Parkway and Warringah Road surface lanes would not impact east-west trips.

Notwithstanding this, further traffic analysis and modelling which has been carried out for the preferred infrastructure report (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report) indicates that the impacts presented in the environmental impact statement would not be most appropriately mitigated by road network upgrades and management alone, and that a public transport and demand management approach would be more appropriate. The Beaches Link and Gore Hill Freeway Connection project reference design scope includes road network modifications to mitigate key changes to traffic patterns and conditions in the Frenchs Forest area created by the project. Transport for NSW would continue to collaborate on options to mitigate potential localised network performance issues in the area, and further leverage the overall benefits and opportunities of the project. This underlines the importance of NSW Government and council working in collaboration to develop integrated, multi-modal transport solutions which will reduce car dependence, and consequently enable and accommodate the desired growth and improve place outcomes in Frenchs Forest and surrounds.

This approach is consistent with and reliant on the outcomes of the ongoing implementation of the *Northern Beaches Hospital Precinct Structure Plan* (Northern Beaches Council, 2017a) and accompanying plans (eg Frenchs Forest Precinct Place strategy), which highlight that future precinct development beyond Stage 1 of the development is dependent on further delivery of improved transport infrastructure and operations beyond the scope of the project and a continued modal shift from private to public transport.

Traffic modelling does not indicate any congestion at the southern end of the Wakehurst Parkway near the portals, and traffic conditions in the Seaforth area would generally improve as a result of the project. Therefore traffic diverting from Judith Street to access the Wakehurst Parkway is not expected to occur.

Furthermore, Transport for NSW will carry out a review of operational network performance 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. Where required, Transport for NSW will investigate local area traffic management measures, in consultation with relevant councils, to minimise the impact of the project in accordance with environmental management measures OT1 and OT2 (refer to Table D2-1 of this submissions report).

#### Request for the closure of Kirkwood Street

It is not considered necessary to permanently close Kirkwood Street to Wakehurst Parkway.

Kirkwood Street would be reopened at its interface with Wakehurst Parkway after construction to restore access to properties in the surrounding area.

## C8.7 Road safety

### C8.7.1 Motorist safety

#### ***Issue raised***

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

- The project does not appear to comply with relevant transport policies and guidelines including Austroads Guides, *Road Safety Plan 2021* (Transport for NSW, 2018b), and Australian Standards
- Concern the tunnel would be unsafe, particularly after accidents and breakdowns
- Concern the posted traffic speed in the tunnel may be too high for heavy vehicles on steep gradients
- Concern that more accidents would occur due to being in a confined space
- The project would put increased pressure on hospitals as a result of increased accidents
- Rat running in local streets could result in accidents
- Traffic would be required to use local streets at Balgowlah that are unsuitable or unsafe such as Wanganella Street which is narrow or Woodland Street which has many accidents
- The Wakehurst Parkway does not include street lighting, and this is unsafe when emerging from the tunnel that would be lit.

#### ***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 traffic safety measures including those related to vertical gradients, 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. A description of project features, including tunnel design, is provided in Chapter 5 (Project description) of the environmental impact statement. Tunnels would be fitted with fire and life safety systems consistent with Australian Standard *AS 4825:2011 Tunnel Fire Safety* (Standards Australia, 2011), applicable Austroads and Transport for NSW guidelines, and the outcomes of consultation with emergency services.

The posted speed limit inside the tunnel would be 80 kilometres per hour, which is consistent with other existing tunnels including the Sydney Harbour Tunnel and NorthConnex. The posted speed limit for on and off ramps would vary along their length to integrate with the surface roads and ensure safety. The project would be designed to an acceptable vertical gradient suitable for heavy vehicles to travel at the intended posted speed limit.

The project 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). Vehicles using the Beaches Link and Gore Hill Freeway Connection on the motorway network would be on a higher standard of road than urban arterial roads, and consequently benefit from a lower likelihood of crashes. The project would also reduce the number of crashes on arterial roads where traffic volumes would decrease when the project is in operation. Key existing roads that would have materially reduced daily traffic demands include Spit Road/Military Road corridor, Ourimbah Road, the Wakehurst Parkway (south of the Beaches Link portals), Eastern Valley Way/Warringah Road corridor and Boundary Street. The road safety assessment

indicates that overall crashes across the network would decrease by up to 562 crashes per year as a result of the project.

The project would provide for more direct, efficient free flow access for trucks to and from the Northern Beaches thereby substantially reducing 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.

Concerns regarding traffic safety on local roads 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. It should be noted that a reduction of rat running in local streets is expected due to the attractiveness of the tunnel for through traffic, consequently reducing congestion on existing surface routes. It should also be noted that traffic would not be required to use local streets to access the tunnel; both Burnt Bridge Creek Deviation and Sydney Road providing tunnel access to and from the Balgowlah area are State Roads. The project reduction in congestion and rat running on local roads would improve safety and amenity in these local community areas.

Notwithstanding, Transport for NSW will carry out a review of operational network performance 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 in accordance with environmental management measure OT1 (refer to Table D2-1 of this submissions report). Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network in accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report). Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable.

The project would not include the provision of street lighting on Wakehurst Parkway, however lighting would be provided for the shared user path and underpass/shared user bridge. Provision of lighting would be consistent with guidelines published by Austroads and Transport for NSW, as well as the relevant and applicable Australian Standards. Additional information on lighting impacts is discussed in Section C21.5.1 of this submissions report.

### **C8.7.2 Pedestrian and cyclist safety**

#### ***Issue raised***

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

- Potential safety risks for the community walking and cycling near the project, due to increased traffic and rat running near schools, residential streets, and sport and recreational facilities
- Road safety near schools and safety risk to students due to increased traffic, with specific mention of Northern Beaches Secondary College Balgowlah Boys Campus, St Cecilia's Catholic School, Artarmon Public School, and schools in the lower North Shore area generally
- The road design at the tunnel portal at Balgowlah would result in increased risks to pedestrians travelling to local schools such as Northern Beaches Secondary College Balgowlah Boys Campus and St Cecilia's Catholic Primary School
- Concern that the pedestrian crossing at the Sydney Road intersection with the new access road in Balgowlah is unsafe.

### ***Response***

Transport for NSW understands the concern about perceived safety risks associated with increased traffic movements on local streets following implementation of the project.

The design of the project has considered a wide variety of factors including safety, connectivity, accessibility, efficiency and reliability outcomes for all transport users. The proposed design for the project has been developed through careful consideration ensuring efficient operation, while also balancing and minimising impacts. As noted above, the tunnel has been designed to be attractive to through traffic; by providing additional motorway capacity and bypassing communities underground, the project would result in a substantial reduction in congestion (which causes rat running) on local streets and improve safety and amenity in these areas. Overall, the project would result in a number of safety improvements for pedestrians and cyclists by removing large volumes of through traffic from surface 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.

Traffic forecasting does not indicate any material adverse impact to any of the schools specifically mentioned. More generally, as noted above, the majority of the lower North Shore would benefit from a reduction in through traffic. Therefore, it is more likely a material net benefit to schools in terms of reduced exposure to road traffic across the lower North Shore would occur.

As noted above, 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.

The pedestrian crossing of the new access road at the new traffic signals at the intersection of Sydney Road would provide an appropriate level of connectivity, accessibility and safety for motorists and pedestrians. Safe crossing of Sydney Road in this area would be retained via the existing pedestrian bridge.

As noted above, further design development of the project would continue to be carried out in accordance with relevant design standards and guidelines of Transport for NSW and other organisations eg Austroads. This would include the conduct of road safety audits.

## **C8.8 Public and active transport**

### **C8.8.1 Impacts on public transport**

#### ***Issue raised***

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

- Travel times on public transport would increase as a result of the project, and specifically due to the removal of transit lanes
- The environmental impact statement does not state whether trips on public transport would be quicker as a result of the project
- Concern Transport for NSW is cancelling existing bus services on the Northern Beaches to increase private vehicle forecasts
- Commuters would be impacted by potential re-routing of buses that would terminate at North Sydney CBD rather than Sydney CBD.

## ***Response***

### **Public transport 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 30 minutes when travelling between the Northern Beaches and locations in the lower North Shore during peak periods, as noted in Section 7.1 of Appendix F (Technical working paper: Traffic and transport). These travel time savings would also substantially increase accessibility for these centres, increasing the catchment of residents who can travel to and from their place of work within the '30-minute city'.

Increasing the size of this 30-minute city catchment would not be limited to private vehicles; public transport customers would similarly benefit substantially from the project. Existing bus services would benefit from reduced traffic demand on key arterial bus corridors including Eastern Valley Way/Warringah Road and Spit Road/ Military Road corridors, while the project itself would facilitate the operation of new express buses that would provide direct high speed access between major centres on the Northern Beaches and Frenchs Forest and those in the lower North Shore, north west Sydney and Sydney CBD. The project would also increase opportunities such as the potential rapid bus services along Warringah Road from Dee Why to Chatswood.

A separate analysis of localised public transport impacts (ie bus travel times) is included for each study area in sections 7 and 8 of Appendix F (Technical working paper: Traffic and transport). In summary, with the inclusion of the project, the assessment found:

- In the Warringah Freeway and surrounds area, modelled bus travel times for key routes indicate the impacts of the project on buses would be generally positive, with travel time savings for the high-demand bus routes from Gore Hill Freeway and Military Road corridors, although in some instances there is the potential for some marginal localised increases in bus travel times through the North Sydney CBD area in peak periods
- The conversion of the existing eastbound T2 transit lane on the Gore Hill Freeway at Artarmon to general traffic lanes would not have a material impact on travel times during the AM and PM peaks
- In the Balgowlah and surrounds area, bus travel times would be maintained or improved as a result of the project, as existing bus priority in the area would be maintained and traffic congestion reduced
- In the Frenchs Forest and surrounds area, bus travel times for key routes would not be materially affected by the project. Regional and local buses that are serviced by the broader Warringah Road and Eastern Valley Way corridors would benefit from improved travel times and reliability as a result of reduced traffic demand and congestion on these roads as a result of the project.

The tunnel entrances at the Gore Hill Freeway at Artarmon also offers the opportunity for express bus services to use the Beaches Link tunnel between the Northern Beaches and strategic centres such as Macquarie Park, via the Gore Hill Freeway.

### **Changes to bus services**

The project has been designed as part of an integrated transport network with a focus on new public transport connections and improved travel times, and travel time reliability for buses to provide major benefits to public transport customers. This includes opportunities for new express bus services between the Northern Beaches, North Sydney, Sydney CBD, St Leonards and strategic centres to the south west and north west, as discussed in Section 3.4 of the environmental impact statement.

There is no plan to change, reduce, or cancel the routes of the existing bus network as part the project. The relocation of some bus stops would be required, resulting in a small increase in travel distance from an existing to a relocated bus stop. Any changes to bus stop locations would be communicated to the local community and relevant stakeholders.

It is noted that, separate to the project, Transport for NSW announced a number of Northern Beaches and lower North Shore bus service improvements in December 2020. This included more than 2000 additional weekly bus services with new services including overnight B-Line services operating between Mona Vale and the Sydney CBD, and buses operating every 10 minutes on key routes as part of the creation of an all-day frequent network operating throughout the day, seven days a week. To help reduce duplication on the network, some routes, eg Route 169, were replaced by new routes or extra services on other routes. Further detail is provided at: [transportnsw.info/news/2020/northern-beaches-lower-north-shore-bus-service-improvements](https://transportnsw.info/news/2020/northern-beaches-lower-north-shore-bus-service-improvements).

### **C8.8.2 Active transport impacts near Warringah Freeway and surrounds**

#### ***Issue raised***

Submitters suggested the project should provide continuous active transport links to the Sydney CBD from Warringah Freeway, Artarmon and surrounding areas. Specific concerns include:

- Concerns that the benefits of the project do not justify the removal of cycling access on the Warringah Freeway between Miller Street at Cammeray and Alfred Street at North Sydney
- Concerns about the removal of the pedestrian and cyclist underpass at Falcon Street Bridge (eastern side).

#### ***Response***

There would not be any alterations to active transport facilities near the Warringah Freeway as part of the project. However, it is noted that there would be some impacts as a result of the Western Harbour Tunnel and Warringah Freeway Upgrade project. As part of the Warringah Freeway Upgrade component, a new dedicated cycleway on the eastern side of Warringah Freeway between Miller Street and Falcon Street would be provided.

The Falcon Street underpass would be permanently removed as part of the Warringah Freeway Upgrade as there are existing alternative routes available for pedestrians and cyclists to access the Falcon Street user bridge, which would be maintained as part of the project.

For more details relating to active transport impacts from the Western Harbour Tunnel and Warringah Freeway Upgrade, refer to Section 9.4.9 of the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement (Transport for NSW, 2020k).

### **C8.8.3 Active transport impacts at Balgowlah and surrounds**

#### ***Issue raised***

Submitters raised concerns regarding the impact to pedestrian and cycle infrastructure, connectivity and access at Balgowlah. Specific queries, requests and concerns include:

- Queries about the need for a traffic island at the new access road intersection with Sydney Road as it would be difficult for pedestrians and cyclists to navigate
- Requests for an alternative to the signalised at grade crossings at the new access road to improve cycling efficiently and connectivity
- Concerns about the loss of the local bike path at Balgowlah as crossing at Sydney Road is dangerous

- Concerns about impact to active transport opportunities through removal of the shared user path adjacent to the existing southbound lanes of the Burnt Bridge Creek Deviation
- An automatic pedestrian detection crossing should be installed at the new access road intersection with the Burnt Bridge Creek Deviation to improve pedestrian and cyclist access.

### ***Response***

Active transport infrastructure to be provided by the project is identified in Table 5-9 of the environmental impact statement. The following pedestrian and cyclist facilities would be provided at Balgowlah:

- Realignment and reconstruction of the shared user path along the south eastern side of the Burnt Bridge Creek Deviation between the Kitchener Street bridge and Dudley Street. The realigned and reconstructed shared user path would connect with the existing shared user path at Dudley Street and extension of the existing active transport underpass beneath the Burnt Bridge Creek Deviation to the north of Dudley Street
- A new shared user path along the eastern side of the new access road between Burnt Bridge Creek Deviation and Sydney Road
- New signalised at-grade pedestrian crossings of the new access road adjacent to the:
  - Intersection with Sydney Road
  - Intersection with Burnt Bridge Creek Deviation
  - New public car park within the new and improved open space and recreation facilities at Balgowlah.

There is no proposal to permanently remove the shared user path from adjacent to the Burnt Bridge Creek Deviation southbound lanes.

As indicated above, the detailed design of the project would continue to be carried out in accordance with relevant design standards and guidelines of Transport for NSW and other relevant organisations eg Austroads.

The new signal controlled pedestrian crossing of the new access road opposite Maretimo Street would continue to provide east-west connectivity for pedestrians across Sydney Road and provide connectivity to the new and improved public open space and recreational facilities. As discussed in Section C8.7.2 above, the pedestrian crossing would provide an appropriate level of connectivity, accessibility and safety for motorists and pedestrians. The existing pedestrian bridge to the west of the intersection of Maretimo Street, Sydney Road and the new access road would continue to provide north-south connectivity for pedestrians across Sydney Road.

It is also noted that the final layout of new and improved open space and recreation facilities at Balgowlah would be subject to a dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council to give the community an opportunity to provide input into the final layout of the new and improved open space and recreation facilities at Balgowlah. This would include the final layout of shared user path routes.

## **C8.8.4 Active transport impacts at Frenchs Forest and surrounds**

### ***Issue raised***

Submitters raised concerns that active transport has not adequately been considered along Wakehurst Parkway. Specific requests and concerns about active transport include:

- Requests for further details on the design for the pedestrian and cycle ways along the Wakehurst Parkway, how it would cater for varying cycling abilities, protect users from traffic and provide adequate lighting
- Concerns that the shared user path along the Wakehurst Parkway terminates too far north
- Concerns that the existing road shoulder is narrow and contains hazards (debris) resulting in cyclists riding in road traffic lanes
- Concerns about the potential loss of single track mountain bike trails on the eastern side of the Wakehurst Parkway, due to the construction of the shared user path, and request for any loss of mountain bike tracks to be replaced
- Concerns about permanent impacts on the cycling tracks to Manly Warringah War Memorial State Park.

### ***Response***

#### **Wakehurst Parkway shared user path**

Pedestrian and cyclist facilities that would be provided along the Wakehurst Parkway to improve the safety and connectivity of the active transport network to, from, and within the Frenchs Forest and surrounding area are provided in Table 5-9 of the environmental impact statement. These include:

- A new shared user path along the eastern side of the Wakehurst Parkway, from the northern end of Kirkwood Street at Seaforth to the intersection with Warringah Road at Frenchs Forest
- The existing pedestrian bridge across the Wakehurst Parkway would be replaced with a new shared user bridge about 350 metres south of Warringah Road (refer to Section A4.3 for details of a design refinement to improve connectivity outcomes, reduce the area of Duffys Forest endangered ecological community impacted, and avoid permanent impacts to the Jumping Jack mountain bike trail)
- A new shared user underpass beneath the Wakehurst Parkway, about 750 metres south of the intersection with Warringah Road at Frenchs Forest, to connect the bus stop on the eastern side of the Wakehurst Parkway with the western side of the Wakehurst Parkway
- A new shared user underpass beneath the Wakehurst Parkway, about 1150 metres north of Kirkwood Street, to connect Garigal National Park to Manly Warringah War Memorial State Park
- A new shared user underpass beneath the Wakehurst Parkway, about 700 metres north of Kirkwood Street, to connect Garigal National Park and the Engravings Trail to Manly Warringah War Memorial State Park.

Currently, cyclists travelling along the Wakehurst Parkway must do so on the road mixed with vehicle traffic. The proposed Wakehurst Parkway shared user path would be a dedicated path for cyclists and pedestrians, designed to relevant standards and guidelines, allowing cyclists to be physically separated from road traffic. The design of the shared user path would include the provision of a safety barrier on the kerbline (refer to Section A5.1.8 of this submissions report for further information). Lighting would be provided for the shared user path and underpass/shared user bridge. Provision of lighting would be consistent with guidelines published by Austroads and Transport for NSW, as well as the relevant and applicable Australian Standards.

During further design development, the design would continue to be developed in accordance with relevant standards (including Transport for NSW and Austroads standards) to ensure the safety and comfort of pedestrians, cyclists and drivers.

#### **Impacts to mountain bike trails**



Transport for NSW are aware of the importance of the mountain bike network and the connectivity between trails in Garigal National Park (on the west of the Wakehurst Parkway) and Manly Warringah War Memorial State Park (on the east of the Wakehurst Parkway).

The project would require a temporary adjustment to some of the mountain bike tracks on either side of the Wakehurst Parkway, as identified in Section 21.4.8 of the environmental impact statement.

Since exhibition of the environmental impact statement, based on community and bike interest group feedback and concerns raised in submissions on the environmental impact statement, Transport for NSW has carried out further consultation with Northern Beaches Council and relevant mountain biking associations along with further targeted investigations to determine potential project impacts on mountain bike trails, and more accurately map where these active transport facilities are located, as outlined in Section A4.5 of this submissions report.

Transport for NSW met with Northern Beaches Council representatives on 2 March and 19 May 2021 to discuss the mountain bike trail network, new connectivity opportunities provided between Garigal National Park and Manly Warringah War Memorial State Park and the realignment of trails required during construction and operation of the project. At present, there are a number of options being explored to minimise the impacts on various mountain bike trails and these are subject to further design development and discussion with Council.

Where possible, during further design development Transport for NSW would refine the design of the project and seek to avoid or otherwise minimise impacts to the mountain bike trail network. Where impacts cannot be avoided, minor detour routes would be implemented including some staging of trail adjustments to align with construction staging of the Wakehurst Parkway upgrade works. Advanced notification of track closures would be provided at key locations. Construction of the three permanent shared user path underpasses proposed along the Wakehurst Parkway would be prioritised where feasible to facilitate enhanced connectivity. Any detours and adjustments would be designed with consideration of user safety and convenience.

Transport for NSW would continue to consult with Northern Beaches Council and relevant mountain biking associations during further design development of the project regarding potential impacts to the Manly Warringah War Memorial State Park mountain bike trail network at the Wakehurst Parkway.

## **C8.9 Parking**

### ***Issue raised***

Submitters raised concerns about the impacts to car parking as a result of the project. Specific concerns, requests and queries include:

- Concerns that car parking availability would reduce in and near the project area, including at Northbridge, St Leonards, Crows Nest, Artarmon, North Sydney and the Northern Beaches
- Concerns that the project would increase car usage to the Sydney CBD, however there is no proposal to increase parking in the Sydney CBD
- Concerns that car parking on the Northern Beaches has not been considered particularly on weekends and in summer, due to induced demand of the project. Concerned as parking is already constrained, particularly at Balgowlah, Clontarf, Manly, Freshwater, and Curl Curl
- Concerns that the project would permanently remove car and motorbike parking at the Pacific Highway intersection with Dickson Avenue; requests for motorbike parking to be reinstated
- Requests for the project to include:

- A car parking study to assess impacts to car parking across the project, the Sydney CBD and increase of vehicles on the Northern Beaches during summer and weekends as a result of the project
- Local resident car parking permits, time restricted parking, and local monitoring
- Concerns that Willoughby Road would be made a permanent clearway, resulting in the removal of car parking for residents
- Queries whether new car parking would be created to support the new and improved open space and recreation facilities at Balgowlah. Concern that if car parking is not made available via the new access road, vehicles would use local streets, reducing parking for residents including on Wanganella Street
- Concerns about traffic impacts on Brighton Street and Paris Street as a result of users of the new and improved open space and recreational facilities at Balgowlah, and that the proposed carpark would not alleviate impacts to residents.

### ***Response***

#### Parking impacts

The traffic and transport assessment contained in the environmental impact statement considered parking supply on local roads, including an analysis of permanent impacts to local road access arrangements, loss of parking spaces, and availability of comparable alternative parking in nearby locations. Operational impacts to parking are described in Section 9.4 of the environmental impact statement.

Much of the parking impacted by the construction of the project would be reinstated or reconfigured prior to operation.

It is acknowledged that car parking arrangements would be altered in North Sydney as part of the Western Harbour Tunnel Warringah Freeway Project. However, North Sydney is highly accessible by public transport and parking within North Sydney CBD is discouraged through capacity restrictions and pricing mechanisms. The design of the Western Harbour Tunnel and Beaches Link program of works has been carried out to provide opportunities for express bus services and interchange with metro and rail services, to encourage public transport patronage and mode shift from private vehicles where possible. 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: [www.sydneymetro.info/station/victoria-cross-station](http://www.sydneymetro.info/station/victoria-cross-station).

It is also acknowledged that the project would require the permanent removal of about 25 parking spaces on Lambs Road and Punch Street and 10 car parking spaces and six motorcycle spaces at the Pacific Highway/Dickson Avenue intersection at Artarmon. Given the availability of parking on surrounding streets, this impact is anticipated to be absorbed by the surrounding network (considering existing parking demand).

Notwithstanding, opportunities to reduce and/or offset the permanent loss of parking spaces in Artarmon due to the project will be investigated during further design development, in accordance with new environmental management measure OT3 (refer to Table D2-1 of this submissions report). This would include parking for cars and motorbikes.

The impacts on the demand for parking on the Northern Beaches as a result of the project is too broad to be considered within the environmental impact statement, except in those circumstances where the project permanent infrastructure or facilities would result in direct impacts. The supply of parking along local streets in the Northern Beaches would not change as a result of the project. The supply of parking and resident parking permits are matters for the relevant council to consider.

Commuter travel to strategic centres including the Sydney CBD by private vehicle is not a target market of the project, and this type of traffic is not expected to be materially increased by the project, noting there are existing parking deterrents in these areas such as restricted availability and pricing.

#### Willoughby Road clearway

There is no plan to change the existing clearway and other kerbside lane arrangements on Willoughby Road as part of the project.

#### Parking at Balgowlah open space and surrounds

The layout of the new and improved open space and recreational facilities at Balgowlah as shown in Figure 5-28 of Chapter 5 (Project description) of the environmental impact statement is indicative and would be subject to consultation with Northern Beaches Council and the community. However, it is proposed that a new car parking area suitable for users of the new and improved open space and recreation facilities would be provided. One of the design aims would be to maximise the useable area for recreation facilities so this places a realistic limit on the amount of parking which can be provided.

A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah. This process will start in advance of construction commencing. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space as required by revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). An expression of interest for participation in the consultation process is expected to be issued in early 2022.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C9 – Construction noise and vibration

## C9 Construction noise and vibration

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## C9.1 Adequacy of the assessment

### ***Issue raised***

Submitters raised concerns about the adequacy of the construction noise and vibration assessment. Specific queries, concerns and comments include:

- Concerns the Secretary's environmental assessment requirements are not addressed regarding potential impacts from the establishment of temporary construction support sites, construction fatigue and respite
- Concerns that the construction noise and vibration assessment is inadequate in scope and underestimates potential noise impacts
- Requests for an additional, independent construction noise and vibration assessment
- Queries if the construction noise assessment has considered people working from home
- Concerns that St Cecilia's Catholic Primary School has been identified as a place of worship rather than a school and should be identified as both
- Concerns that the construction noise and vibration assessment assumes Flat Rock Drive is a main road currently catering for heavy vehicle traffic, away from residential properties
- Concerns that the number of people affected is underestimated by reporting in terms of residential receivers rather than persons.

### ***Response***

#### Compliance with the Secretary's environmental assessment requirements and assessment adequacy

An assessment of the potential noise and vibration impacts associated with the construction work areas and temporary construction support sites for the project is provided in Section 10.6 of the environmental impact statement. The assessment considers each stage of construction activities at the temporary construction support sites, including early works and site establishment, and key construction activities including tunnelling and surface road works. For each area or site, the key outcomes of the assessment are presented for construction airborne noise, cumulative airborne construction noise and construction fatigue, ground-borne noise (where relevant), construction traffic noise and construction vibration. Further detail is provided in Section 5 of Appendix G (Technical working paper: Noise and vibration).

The assessment of construction noise and vibration impacts has been prepared in accordance with relevant NSW noise and vibration guidelines as required by the Secretary's environmental assessment requirements. Demonstration of how the construction and vibration noise assessment complies with the Secretary's environmental assessment requirements is provided in Table 10-1 of the environmental impact statement.

Guidelines prescribed by the NSW Government and adopted for the assessment include but are not limited to the *Interim Construction Noise Guideline* (Department of Environment and Climate Change NSW (DECC), 2009) and *Assessing Vibration: a technical guideline* (Department of Environment and Conservation (DEC), 2006c). The *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) integrates and adapts these guidelines and is the key document for providing guidance for the assessment and mitigation of construction noise and vibration on this project. Further detail on all guidelines and polices used as part of the construction

noise and vibration assessment is provided in Section 3.1 of Appendix G (Technical working paper: Noise and vibration).

The potential for construction fatigue and need for respite have been considered in the assessment of cumulative airborne construction noise for each surface works area and temporary construction support site as detailed in Section 10.6 of the environmental impact statement with further detail included in Section 5 of Appendix G (Technical working paper: Noise and vibration). Additional consideration of respite has been provided for works associated with construction of the Middle Harbour crossing as discussed in Section 10.6.8 of the environmental impact statement. The potential for construction fatigue has also been considered in Section 27.3.7 of the environmental impact statement.

In addition, the impacts of construction noise and vibration will be mitigated through the implementation of the environmental management measures detailed in Table D2-1 of this submissions report. The management of cumulative construction noise impacts and construction fatigue is specifically addressed by revised environmental management measure CNV13 (refer to Table D2-1 of this submissions report), which outlines a number of approaches that will be used, where feasible and reasonable, including coordination with other major projects in the vicinity of the project and ongoing community consultation to seek feedback on and identify key noise and vibration issues relevant to the local community so that current and future works can be managed to limit cumulative impacts. The main other major projects that will be consulted are detailed in revised environmental management measure CI2 (refer to Table D2-1 of this submissions report). The need for respite has also been identified within the environmental management measures (refer to Table D2-1 of this submissions report), and will be provided in accordance with the construction noise and vibration management plan which includes the need for ensuring appropriate respite for works outside standard construction hours (revised environment management measure CNV1), respite protocols (revised environment management measure CNV9) and restrictions associated with impact piling (environment management measure CNV14).

#### Underestimation of noise impacts

The predictions of airborne noise impacts from temporary construction support sites considered realistic worst case construction activities as required by the *Interim Construction Noise Guideline* (DECC, 2009). The realistic worst case scenario is conservative because it assumes all equipment expected to be used at a given site would be operating simultaneously, at a worst case intensity, and with a worst case orientation during a 15 minute period and at the closest possible location to an affected sensitive receiver. While the realistic worst case scenario may occur, noise levels at any one location would typically vary throughout construction as different plant and equipment is used and the activities move around the works area. Therefore, actual construction noise levels most of the time are likely to be lower than modelled within Appendix G (Technical working paper: Noise and vibration) and presented in the environmental impact statement.

The predictions of airborne noise impacts from surface road works outside temporary construction support sites (eg surface road works in the Warringah Freeway, Gore Hill Freeway Connection surface road works, Balgowlah surface road works and surface road works associated with the connection, realignment and upgrade of the Wakehurst Parkway) also considered both realistic typical and worst case construction noise impact scenarios. The realistic worst case scenarios were developed to represent the impacts from noise intensive construction activities when the loudest plant and equipment items (eg rock hammers or road saws) are being used. However as stated above, this may only occur part of the time and likely for short durations. In addition, to further mitigate this potential worst case impact the project will plan and stage the works, where feasible and reasonable, to avoid multiple noisy operations and plant working in the same area at the same

time, in accordance with revised environmental management measure CNV9 (refer to Table D2-1 of this submissions report).

Ground-borne noise impacts have been predicted based on a calculation of the three dimensional minimum slant distance from the tunnel alignment to the base of each receiver structure. The empirical algorithms used in roadheader, rock hammer and rock drill ground-borne noise and vibration modelling were developed and established to suit Sydney's geology. They were developed from measurement data obtained from various recent Sydney based tunnelling projects and have subsequently been validated on these projects. The ground-borne noise predictions and subsequent assessment are based on typical geology for the area, comprising Sydney sandstone with a varying depth of shale above. However, due to localised geological anomalies, foundation to footing interaction and the large range and variety of structures that exist (eg construction type, dimensions, materials, quality of construction, footing conditions, etc), actual ground-borne noise and vibration levels may vary from what has been predicted. Verification measurements would be carried out at first opportunity following tunnelling commencement to check and verify the predictions (see Section 4.3.1.2 of Appendix G (Technical working paper: Noise and vibration)).

Further detail about the assessment methodology for ground-borne construction noise and vibration is provided in sections 4.3 and 4.4 of Appendix G (Technical working paper: Noise and vibration), respectively.

#### Request for an independent assessment

As discussed above, the assessment of construction noise and vibration impacts has been prepared in accordance with relevant NSW noise and vibration guidelines required by the Secretary's environmental assessment requirements. The assessment approach and methodology are consistent with other major Transport for NSW motorway projects as detailed in Section 4 of Appendix G (Technical working paper: Noise and vibration). The construction noise and vibration assessment has also undergone substantial review and evaluation from Transport for NSW noise specialists and by NSW Environment Protection Authority during the exhibition of the environmental impact statement. Comments and recommendations raised by NSW Environment Protection Authority are addressed in Section B1 of this submissions report.

Should the project be approved the conditions of approval would likely require the engagement of an Acoustics Advisor who is independent of Transport for NSW and the contractor/s. The role of the Acoustics Advisor would likely include the requirement to review noise and vibration documents required to be prepared, and consider and recommend improvements that may be made to avoid or minimise adverse noise and vibration impacts. They would also regularly monitor the implementation of the construction noise and vibration management plan and other noise and vibration documents for compliance.

In addition, further assessment, and development of mitigation measures to manage construction noise and vibration impacts will be carried out through the implementation of the environmental management measures as detailed in Table D2-1 of this submissions report. Key to this will be the preparation of the construction noise and vibration management plan (revised environment management measure CNV1), detailed location and activity specific construction noise and vibration impact statements (environment management measure CNV2) and the out of hours works protocol (revised environment management measure CNV3). The construction noise and vibration management plan will be reviewed and approved by Transport for NSW and the Department of Planning, Industry and Environment and the out of hours works protocol will be developed in consultation with Department of Planning, Industry and Environment and NSW Environment Protection Authority.



### Working from home

The noise management level for commercial premises (including offices) is 70 dB(A) while the noise management level for residential receivers during standard construction hours is 10 dB(A) above background, with receivers experiencing levels above 75 dB(A) considered 'highly noise affected'. Therefore, in most cases, construction noise levels are managed more conservatively at residential receivers (including for people working at home) than at offices.

Furthermore, as noted above, the prediction of airborne noise impacts from the temporary construction support sites was a conservative assessment that considered a realistic worst case scenario. Therefore, actual construction noise levels are likely to generally be lower than those modelled within Appendix G (Technical working paper: Noise and vibration) (refer to Section 10.3.3 of the environmental impact statement).

### St Cecilia's Catholic Primary School

St Cecilia's Catholic Primary School in Balgowlah was inadvertently listed as a place of worship within the environmental impact statement and it has been clarified in Table A5-13 of this submissions report that this receiver should be listed as a school. St Cecilia's church located on the corner of Wanganella Street and White Street should be listed separately as a place of worship.

Notwithstanding, the noise management levels for non-residential receivers, set in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and provided in Table 10-4 of the environmental impact statement, indicate that the noise management level for a place of worship and classroom at schools is the same ( $L_{Aeq(15\text{minute})}$  45 dB(A)). The environmental management measures outlined in Table D2-1 of this submissions report which are relevant to schools would apply to St Cecilia's Catholic Primary School.

### Consideration of Flat Rock Drive

Flat Rock Drive and Brook Street are categorised as sub-arterial roads under the *Roads Act 1993* in accordance with the Transport for NSW *Schedule of Classified Roads and Unclassified Regional Roads* (Transport for NSW, 2017c). The existing AM and PM peak traffic volumes for Brook Street south of Merrenburn Avenue, as described in Table 8-5 of the environmental impact statement, indicate that the existing percentage of heavy vehicles ranges between two and nine per cent. To mitigate noise impacts during the night time period (10.00pm to 7.00am), where a risk of sleep disturbance was identified, heavy vehicle access to the site would likely be limited to concrete deliveries of one truck per hour. This is less than five per cent of existing heavy vehicle movements on Flat Rock Drive and Brook Street during the night time period.

The potential noise impacts due to increases in road traffic on public roads were assessed in accordance with the *NSW Road Noise Policy* (Department of Environment, Climate Change and Water (DECCW), 2011b). The *Road Noise Policy* criteria is based upon the category of road, and Flat Rock Drive and Brook Street were assessed in accordance with the requirement for a sub-arterial road.

The assessment calculated daytime (7am to 10pm) and night time (10pm to 7am) road traffic noise levels with and without the project, in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), to determine if any changes in noise levels at nearby receivers would occur. As the assessment utilised modelled road traffic volumes specifically for Flat Rock Drive and Brook Street, it has taken into account parameters such as traffic volumes and percentages of heavy vehicles that are specific to this sub-arterial road.

A minor increase in noise levels is considered to be an increase of up to 2 dB(A). The predicted road traffic noise increase due to the Flat Rock Drive construction support site (BL2) is 0.5 dB(A)

during the daytime period and less than 0.5 dB(A) during the night time period, therefore complying with the *NSW Road Noise Policy* (DECCW, 2011b) criteria. As this anticipated increase is less than 2 dB(A) it is considered minor (refer to Section 10.6.6 of the environmental impact statement).

### Estimate of people affected

Potential noise and vibration impacts are assessed for each receiver type (building) as required by the Secretary's environmental assessment requirements and the relevant guidelines as discussed above. This approach assists with defining appropriate management objectives for the sensitive receivers.

## **C9.2 Assessment methodology**

### **C9.2.1 Noise catchment areas and background noise monitoring**

#### ***Issue raised***

Submitters raised concerns about the adopted noise catchment areas and the background noise monitoring carried out. Specific queries, concerns and comments include:

- Concerns that the noise assessment areas do not extend far enough around construction activities proposed at locations such as Cammeray, Middle Harbour and Manly Vale
- Queries and concerns about how background noise levels are determined, including for ground-borne noise, and concern that background noise monitoring was not carried out at all properties
- Requests for explanation of the noise monitoring locations shown on figures in Section 10.3.2 of the environmental impact statement
- Concerns that background noise monitoring was conducted along busy roads and therefore does not represent background noise levels at receivers set back from the road
- Concerns that the noise management levels are adopted for the whole of the noise catchment area while receivers within a noise catchment area could be subject to different existing background levels
- Requests for detail about the duration of potential noise impacts per noise catchment area.

#### ***Response***

The methodology for determining the noise catchment areas and carrying out background noise monitoring is described in Section 10.3 of the environmental impact statement and Section 2 of Appendix G (Technical working paper: Noise and vibration). It was carried out in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). A land use survey was carried out to identify the receiver types and uses of buildings, to the furthest extent that could potentially be impacted by noise or vibration from the project. From this survey, noise sensitive receivers near temporary construction support sites, surface works construction sites and haulage routes were identified.

As the existing acoustic environment along the length of the project varies, noise sensitive receivers have been grouped into noise catchment areas based on areas with similar acoustic characteristics.

The project has been divided into 87 noise catchment areas. These noise catchment areas help to logically group all noise sensitive receivers to assist with the assessment of noise impacts from the project. Each noise catchment area consists of a range of receiver types and land uses.

Noise monitoring was carried out at 47 locations between June 2017 and April 2019 to establish existing background noise levels, including from traffic, within the noise catchment areas. The noise

monitoring occurred over a variety of locations with differing noise levels including residential areas, roads and near the construction footprint and support sites. Noise measurements are ideally carried out at the nearest or potentially most affected locations for either construction or traffic noise impacts along the extent of the project in accordance with the *Noise Policy for Industry* (NSW Environment Protection Authority (EPA), 2017). The noise monitoring locations and noise catchment areas relative to the project are shown in Figure 10-2 to Figure 10-5 of the environmental impact statement.

Background noise monitoring was also used to define the noise catchment area extents, along with the location of the noise catchment areas relative to key environmental noise sources. The background noise level was derived based on the time period where the lowest 10th percentile background noise level occurs, representing the quietest period of the day, evening or night assessment period, and is therefore conservative in nature.

Further details of the noise monitoring completed are provided in Section 2 and Annexure C of Appendix G (Technical working paper: Noise and vibration). Prior to the commencement of construction, additional noise monitoring may be carried out to further characterise the noise catchment area environments and confirm if shoulder periods are appropriate in accordance with revised environmental management measure CNV4 (refer to Table D2-1 of this submissions report).

As discussed above, noise catchment areas are established both as a logical grouping of receivers within similar acoustic environments and as a grouping for the purposes of assessing and reporting noise and vibration impacts. As such, some areas which have similar acoustic environments (eg influenced by similar noise levels from a nearby major road), have been broken down into smaller noise catchment areas to assist with reporting on specific noise or vibration impacts, while continuing to share the same noise monitoring location. For this reason, noise monitoring was not carried out within all noise catchment areas across the project.

The noise assessment results show the predicted construction noise levels as noise contour envelopes (refer to Annexure H.1 of Appendix G (Technical working paper: Noise and vibration)) at the assessment level height of 1.5 metres above ground level in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a). The highest noise levels that could reasonably be expected to occur, for a worst case assessment are shown in the noise contour envelopes in Annexure H.2 of Appendix G (Technical working paper: Noise and vibration). As shown by the noise contour envelopes, noise expected to occur during construction is concentrated around each temporary construction support site and does not extend beyond the perimeter of the noise catchment areas. Therefore, this shows the noise catchment areas used in the assessment extend a sufficient distance.

With regard to ground-borne noise, the assessment methodology is different to air borne noise and uses the methodology described in Section 4.3 of Appendix G (Technical working paper: Noise and vibration), with assessment against the ground-borne noise objectives set in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a). The assessment of ground-borne noise does not assess impacts against background noise levels.

The indicative construction program for all work is outlined in sections 6.2 and 6.8.2 of the environmental impact statement. Noise generated during these periods of work is expected to be temporary and intermittent. The type of noise expected in the noise catchment areas surrounding each temporary construction support site and the duration these activities may occur is detailed in Section 10.6 of the environmental impact statement, with further detail provided in Section 5 of Appendix G (Technical working paper: Noise and vibration). For noise affected receivers, standard and additional mitigation measures as detailed in Table D2-1 of this submissions report will be

implemented including environmental management measures CNV1, CNV2, CNV3, CNV8 and CNV9.

### **C9.2.2 Noise management levels and vibration screening criteria**

#### ***Issue raised***

Submitters raised concerns about noise management levels and vibration screening criteria. Specific queries, concerns and comments include:

- Requests for explanation of the adopted noise management levels (for airborne and ground-borne noise) relative to typical background noise levels
- Requests for clarification on the adopted sleep disturbance criterion in relation to typical background noise levels
- Concerns that the residences would be required to keep doors and windows closed to mitigate construction noise
- Requests for a definition of the adopted vibration screening criteria.

#### ***Response***

The construction noise and vibration assessment objectives and criteria applied to the project, including for airborne noise, sleep disturbance, ground-borne noise and vibration, are summarised in Section 10.4 of the environmental impact statement and consider recommended criteria in the guidelines, policies and standards discussed in Section 10.2.

The airborne noise management levels for residential receivers, set in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), are provided in Table 10-3 of the environmental impact statement. Construction noise impacts on residential receivers are assessed using these noise management levels, set with reference to the time of day and background noise levels (called the rating background level). The rating background level 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 EPA, 2017).

To assess sleep disturbance, the assessment used a night time sleep disturbance 'screening criterion' noise goal of rating background level + 15 dB(A) to identify the receivers where there is potential for sleep disturbance in accordance with the *Noise Policy for Industry* (NSW EPA, 2017). Where the sleep disturbance screening criterion was exceeded, further assessment was conducted to determine whether the 'awakening reaction' level of  $L_{Amax}$  65 dB(A) would be exceeded and the likely number of these events. The awakening reaction level is the level above which sleep disturbance is considered likely (refer to Section 10.4.1 of the environmental impact statement).

The ground-borne noise management levels for residential receivers, are set in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) and are provided in Table 10-5 of the environmental impact statement.

The airborne noise management levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise affected point within 30 metres of the residence. Noise levels may be higher at upper floors of the noise affected residence. As such, in this assessment all levels and facades of receiver buildings have been assessed. The difference between an internal noise level and the external noise level is assumed to be 10 dB(A), which provides a conservative assumption that windows are

open for ventilation. Buildings where windows are fixed or cannot otherwise be opened may achieve a greater noise level performance.

For assessment purposes, and in line with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), British Standard *BS 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2 – Guide to damage levels from ground borne vibration* (British Standards Institution (BSI), 1993) and German Standard *DIN 4150-3 2016 Vibration in Buildings – Part 3: Effects on Structures* (Deutsches Institut für Normung (DIN), 1999), a conservative vibration damage screening level for structurally sound structures of 7.5 mm/s (peak particle velocity) has been adopted to identify where further investigation is required. A conservative vibration damage screening level of 2.5 mm/s has also been adopted for heritage items (refer to sections 3.4.5.2 and 3.4.5.3 of Appendix G (Technical working paper: Noise and vibration)).

### **C9.2.3 Airborne construction noise modelling inputs**

#### ***Issue raised***

Submitters raised concerns that the construction noise assessment does not consider topography or wind patterns, particularly at Flat Rock Drive construction support site (BL2).

Submitters also raised concerns that the construction noise assessment does not model the loss of existing vegetation that may provide noise attenuation.

#### ***Response***

Airborne noise impacts from activities associated with the construction works were assessed by modelling the noise sources, receiver building (a receiver building represents an individual building such as house or apartment building) locations, topographical features, and possible noise mitigation measures using a computer noise model developed for this project. The noise prediction model considers a comprehensive list of parameters outlined in Section 4.2.1 of Appendix G (Technical working paper: Noise and vibration) including calculation methods presented in the international standard *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (International Organization for Standardization (ISO), 1996), which incorporates moderately adverse meteorological conditions (ie wind and temperature inversions).

The model calculates the contribution of each noise source to each identified noise sensitive receiver building location surrounding the work site and allows for the prediction of the total noise from a work area or temporary construction support site for the various stages of construction work.

Construction noise modelling was completed assuming different ground types between sources and receivers but does not consider any noise attenuation provided by vegetation, allowing for a conservative outcome. As such, any loss of existing vegetation is already considered in the modelling. There is a commonly held belief that vegetation is an effective noise barrier. However, unless there is a substantial width of vegetation the benefit is generally psychological in that if the noise source, eg traffic, is not visible it reduces the perception of noise, but does not reduce measured noise levels. While this effect alone can be a powerful mitigation tool it cannot be relied upon to reduce measured noise levels. As the model does not consider attenuation provided by vegetation (both existing and proposed) and adopted a more conservative ground absorption factor as a parameter in the model, as shown in Table 4-14 of Appendix G (Technical working paper: Noise and vibration), the assessment findings are considered quite conservative. Other conservatism within the model is discussed in Section C9.1 above.

#### **C9.2.4 Assessment of construction related water traffic noise**

##### ***Issue raised***

Submitters queried how noise from barge movements associated with Middle Harbour construction work was assessed.

##### ***Response***

The temporary construction support sites within Middle Harbour would be accessed by barges and small boats usually from the Spit West Reserve construction support site (BL9).

There are no guidelines for the assessment of noise from vessel movements in NSW as stated in Section 3.4.3 of Appendix G (Technical working paper: Noise and vibration). As such, a qualitative assessment was carried out as part of the noise and vibration assessment to consider noise from vessel movements (refer to Section 4.2.6 of Appendix G). The assessment concluded that that noise from project barge movements would not cause substantial amenity or sleep disturbance impacts as it is unlikely that barge movements would occur during the night time period.

In addition, in response to the NSW Environment Protection Authority's submission on the environmental impact statement a further quantitative assessment has been carried out based on the indicative type and number of marine transport and construction vessel movements likely to occur during construction. The methodology and results of the quantitative assessment are provided in Section B1.1.2 of this submissions report.

Based on the quantitative assessment, the noise levels from vessel movements at Middle Harbour are predicted to be under the *Interim Construction Noise Guideline* (DECC, 2009) standard construction hours noise management levels. In the absence of applicable guidelines and noise management levels and considering the predicted noise levels achieve the *Interim Construction Noise Guideline* (DECC, 2009) noise management levels, noise from construction vessel movements is unlikely to impact nearby noise sensitive receivers. Even though impacts on nearby noise sensitive receivers are unlikely a speed limit of four knots for all marine traffic will be implemented between the Spit Bridge and 100 metres upstream of the Middle Harbour crossing in accordance with new environmental management measure CTT20 (refer to Table D2-1 of this submissions report) which would further minimise potential noise impacts on nearby receivers.

#### **C9.2.5 Acoustic terminology and reporting**

##### ***Issue raised***

Submitters requested further detail on acoustic terminology and reporting within the construction noise and vibration assessment. Specific requests include:

- Requested clarification of the dB(A) noise level unit and query whether it is linear or exponential (ie is 11 dB(A) ten times more powerful than 10 dB(A) and 30 dB(A) 1000 times more powerful than 20 dB(A)?)
- Requested potential construction noise and vibration impacts be reported for each property
- Requested clarification of what constitutes 'quieter work' generally permitted outside standard work hours
- Requested a definition of 'highly noise affected' receivers.

## ***Response***

### **dB(A) noise level unit**

dB(A) stands for A-weighted decibel, a unit used to measure noise. A-weighting is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear, as the ear is less sensitive to low sound frequencies. A summary of noise levels in the context of comparable activities is shown in Figure 10-1 of the environmental impact statement to assist in the interpretation of the noise levels presented. In terms of sound perception, a change of 1 dB(A) or 2 dB(A) in the sound pressure level is difficult for most people to detect. A 3 dB(A) to 5 dB(A) change corresponds to a small but noticeable change in loudness. An increase in sound level of 10 dB(A) is perceived as a doubling of loudness. However, individuals may perceive the same sound differently as many factors can influence an individual's response. dB(A) and other common acoustic terms used throughout Chapter 10 (Construction noise and vibration) of the environmental impact statement are explained in Table 10-2 of the environmental impact statement.

### **Reporting results for each property**

Noise contours for key stages of each temporary construction support site and surface road works area are included in Annexure H.1 and H.2 of Appendix G (Technical working paper: Noise and vibration) respectively, representing the predicted construction noise levels at each receiver. The construction noise assessment predicted exceedance maps are presented in Annexure H.3, which are the highest noise levels that could reasonably be expected to occur at each receiver, for a sample of scenarios likely to generate the highest noise levels from construction works from the major work areas.

Recommended minimum working distances for vibration due to mainline and ramp tunnelling, works at temporary construction support sites and surface road works areas, are shown as contours in Annexure K and Annexure L of Appendix G (Technical working paper: Noise and vibration), representing any predicted exceedance of the screening criteria at each receiver.

As noted above, and in Section 4.2.3.2 of Appendix G (Technical working paper: Noise and vibration), these noise and vibration predictions are considered conservative and worst case, because they assume all equipment used at a site would be operating simultaneously, at a worst case intensity and anywhere within the boundaries of the site, in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a). While the conservative scenario may occur, it is unlikely as noise levels would typically vary when different plant and equipment is used and activities move around the works area, and the location of the vibration intensive equipment would be reviewed during detailed construction planning, as required by environmental management measures CNV1 and CNV7 in Table D2-1 of this submissions report.

To mitigate noise and vibration construction impacts a construction noise and vibration management plan will be prepared as a sub plan to the construction environmental management plan (refer to Section D1.1 of this submissions report). This will include the environmental management measures outlined in Table D2-1 of this submissions report and any additional measures needed to minimise potential construction noise and vibration impacts at affected receivers.

For structures where the screening level is predicted to be exceeded, a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure will be completed during further construction planning to determine the safe vibration level and approach to construction near the structure (refer to environmental management measure CNV7 in Table D2-1 of this submissions report).

### Quieter work

The proposed project construction work hours are outlined in Section 6.9.1 of the environmental impact statement. The construction activities proposed at each of the temporary construction support sites are summarised in Section 6.8 of the environmental impact statement, and in more detail in Chapter 5 of Appendix G (Technical working paper: Noise and vibration), including details of proposed out of hours work during the evening and night time periods.

Outside of standard construction hours, quieter work could include non-disruptive (low noise intensive) activities during surface construction including preparatory work, repairs or maintenance that do not generate noise in excess of the applicable noise management level at any sensitive receiver, including residential receivers. Other low noise impact activities could occur outside of standard construction hours as part of the underground tunnel activities, where surface noise levels do not exceed the applicable noise management level at any sensitive receiver. Quieter work could also include deployment of quieter or less vibration emitting plant and machinery, or smaller, less powerful machinery. It may also include works being carried out within an acoustic shed, or quieter piling techniques such as screw piling as an alternative to impact or vibratory piling.

Noise management measures in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) would be implemented during construction of the project. Appendix B of the *Construction Noise and Vibration Guideline* presents standard noise and vibration mitigation measures, identifying potentially feasible and reasonable construction noise and vibration mitigation and management measures, which are reproduced in Section 7 of Appendix J of this submissions report and Annexure G.1 of Appendix G (Technical working paper: Noise and vibration). These standard mitigation measures outline examples of quieter work practices, such as scheduling high noise generating work during standard construction hours wherever feasible and reasonable and, if out of hours work is necessary, during less sensitive time periods (usually earlier in the evening) if practicable.

### Highly noise affected receivers

A highly noise affected receiver is a receiver who would be subject to noise levels greater than 75 dB(A). The criteria for a highly noise affected receiver is defined in the *Interim Construction Noise Guideline* (DECC, 2009) and has been included Table 10-3 of environmental impact statement. Detailed location and activity specific construction noise and vibration impact statements will be prepared for works with the potential to result in highly noise affected residential receivers (ie exposed to noise levels that exceed 75 dB(A)) in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report).

## **C9.3 Airborne noise impact during construction**

### **C9.3.1 Potential airborne construction noise impacts at particular locations**

#### ***Issue raised***

Submitters raised concerns about potential airborne construction noise impacts at the following locations during both standard and out of hours work:

- Northbridge, Naremburn and Willoughby, including potential impacts on the recreational use of Flat Rock Gully, Flat Rock Baseball Diamond, Bicentennial Reserve, and the Shore playing fields, due to works at the Flat Rock Drive construction support site (BL2), particularly during initial excavation and acoustic shed construction
- Balgowlah, North Balgowlah, Seaforth and Manly Vale due to works at the Balgowlah Golf Course construction support site (BL10) and Kitchener Street construction support site (BL11),



and Balgowlah surface road works, including impacts on local schools, child care premises, Balgowlah Oval, businesses and residential receivers

- Seaforth, including potential impacts on the recreational use of Manly Dam Reserve and Garigal National Park due to works at the Wakehurst Parkway south construction support site (BL12), Wakehurst Parkway east construction support site (BL13) and Wakehurst Parkway surface road works
- Seaforth, Clontarf and Northbridge, including Clive Park and Northbridge Sailing Club, due to construction work at Middle Harbour including dredging and cofferdam wall piling
- Cammeray, North Sydney and Naremburn, including potential impacts on schools and parks due to works at Cammeray Golf Course construction support site (BL1) and Warringah Freeway surface road works
- Artarmon and Willoughby due to the Gore Hill Freeway Connection surface road works
- Artarmon due to works at the Barton Road construction support site (BL5)
- Cremorne Point.

### **Response**

An assessment of the potential noise and vibration impacts associated with surface road works, construction work areas and temporary construction support sites for the project is provided in Section 10.6 of the environmental impact statement and in more detail in Section 5 of Appendix G (Technical working paper: Noise and vibration). The assessment considers potential impacts during and outside standard construction hours, and for each stage of construction activities at each work area and temporary construction support site, including early works and site establishment, as applicable.

Noise sensitive receivers located within the noise catchment areas that were included in the assessment are shown in Annexure B.1 of Appendix G (Technical working paper: Noise and vibration). Impacts were assessed at recreational receivers including but not limited to Tunks Park and lower reaches of Flat Rock Gully, Dawson Playground, Bicentennial Reserve including Willoughby basketball and netball courts, Shore playing fields, Clive Park, Northbridge Sailing Club, Balgowlah Oval, Seaforth Oval and Wakehurst Golf Course. Cremorne Point and Manly Dam Reserve, both of which were mentioned by submitters in relation to construction noise impacts, are outside the identified noise catchment area as no construction noise impacts are likely to extend to these locations.

Following exhibition of the environmental impact statement additional modelling was carried out at the Flat Rock Baseball Diamond, as it was unintentionally excluded as a recreational receiver within noise catchment area 36.1. Results of the additional modelling are shown in Table A5-13 of this submissions report and predicts the construction noise levels at the Flat Rock Baseball Diamond to be within the noise level ranges for recreational receivers as shown in Table 5-77 of Appendix G (Technical working paper: Noise and vibration) for each construction stage at the Flat Rock Drive construction support site (BL2). These results do not change the findings of the noise and vibration assessment.

Noise impacts to schools were also assessed. Schools are typically made up of both indoor (ie classroom and teaching spaces) and external receiver types (ie external active or passive recreation areas). In accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and *Noise Policy for Industry* (NSW EPA, 2017), it has been assumed that the difference between an internal noise level and the external noise level is 10 dB, assuming windows are open for adequate ventilation. An external noise management level has been defined on this basis. Based on the noise assessment

potential noise impacts from construction works at schools would be a temporary inconvenience during the various stages.

Noise contours for key stages of work at each temporary construction support site, including Barton Road Construction support site (BL5), and surface road works areas such as Gore Hill Freeway Connection surface road works are included in Annexure H.1 and H.2 respectively of Appendix G (Technical working paper: Noise and vibration), representing the predicted construction noise levels at each receiver, and at other places such as Flat Rock Reserve and Garigal National Park. Construction noise assessment predicted exceedance maps are presented in Annexure H.3.

Noise catchment areas include sensitive receivers that have similar acoustic environments. As Flat Rock Reserve and Garigal National Park are large areas used for passive recreation, they were not included within a noise catchment area as it is difficult to carry out a single point assessment where users (typically walkers or mountain bikers) continuously traverse through these areas. However, an assessment based on nearby recreational receivers showed that construction noise would be a temporary inconvenience for users as they move through areas such as Flat Rock Reserve and Garigal National Park.

Construction noise levels and the number of impacted receivers would vary over the duration of construction. However, exceedances of noise management levels would typically be temporary and intermittent. Transport for NSW recognises that there is the potential for noise impacts to residential receivers, including during evening and night time periods where surface road works and supporting works at the temporary construction support sites are required. Surface-based activities required outside of standard construction hours to support the tunnelling activities at the temporary construction support sites would be occasional and intermittent, such as concrete deliveries. These activities will be managed through implementation of environmental management measures CNV2 and CNV3 (refer to Table D2-1 of this submissions report) in addition to the use of site specific mitigation measures, eg temporary noise barriers. Transport for NSW is committed to minimising construction noise impacts. The approaches that would be adopted by the project to mitigate noise impacts are outlined in the environmental management measures (refer to Table D2-1 of this submissions report) and in the construction noise strategy (refer to Appendix J of this submissions report).

In addition, feasible and reasonable noise treatment measures and management methods have been identified at the temporary construction support sites 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. These are outlined in Section 5 of Appendix G (Technical working paper: Noise and vibration) and include noise attenuating acoustic sheds and temporary noise barriers at several sites, including at Cammeray Golf Course construction support site (BL1), Flat Rock Drive construction support site (BL2) and Wakehurst Parkway south construction support site (BL12) (refer to Section C9.8.5 below for further detail on temporary noise barriers.)

To further mitigate construction noise from works outside standard construction hours, assessment for potential noise treatments would be proactively carried out at eligible properties directly adjacent to high out of hours work activity areas and implemented, where applicable, as early as possible in the construction program as outlined in Appendix I of this submissions report.

A construction noise and vibration management plan would be prepared in accordance with revised environmental management measure CNV1 (refer to Table D2-1 of this submissions report) and would provide further detail on the approach that would be adopted to manage construction noise. Monitoring will also be carried out periodically throughout all stages of construction to ensure the effectiveness of implemented mitigation and management measures and that noise and vibration

impacts are being appropriately managed, as required by revised environmental management measure CNV5 (refer to Table D2-1 of this submissions report).

### **C9.3.2 Potential cumulative construction noise impacts**

#### ***Issue raised***

Submitters raised concerns about potential cumulative construction noise impacts. Specific queries, concerns and comments include:

- Queries about cumulative construction noise impacts from temporary construction support sites in the same noise catchment area, particularly at Wakehurst Parkway, and potential cumulative construction noise impacts from adjacent construction activity (Western Harbour Tunnel and Warringah Freeway Upgrade)
- Concerns the construction noise assessment assumes the northern and southern cofferdam construction, immersed tube works and Middle Harbour temporary construction support sites would not be simultaneous while other sections of the environmental impact assessment show these works occurring simultaneously.

#### ***Response***

Potential cumulative airborne construction noise impacts and construction fatigue from major projects in the vicinity of the works locations associated with the project (including the Western Harbour Tunnel and Warringah Freeway Upgrade project) are considered for each area or site in Section 10.6 of the environmental impact statement. Potential cumulative airborne construction noise impacts and construction fatigue from temporary construction support sites in the same noise catchment area are also detailed for each site in Section 5 of Appendix G (Technical working paper: Noise and vibration).

Depending on the detailed construction methodologies and programs there is potential for cumulative increases in construction noise from the final stages of the Western Harbour Tunnel and Warringah Freeway Upgrade project with concurrent project works on the Warringah Freeway, and at the Cammeray Golf Course construction support site (BL1), Gore Hill Freeway Connection surface road works, Flat Rock Drive construction support site (BL2), and Punch Street construction support site (BL3). There is also potential for increased disturbance associated with works outside standard construction hours, which might be scheduled for both projects.

Proposed staging of concurrent work has been reviewed for the receivers closest to the Wakehurst Parkway south construction support site (BL12). The loudest construction stages for both standard construction hours and out of hours works have been used to calculate potential cumulative noise impacts. If noise from one site dominates noise levels at the receiver (ie greater than 5-10 dB(A) above noise from other sites), that site would typically control construction noise levels at the receiver and as such, this is not likely to increase the overall construction noise level at these receivers. If noise levels from each site are similar at a receiver, a total construction noise increase of up to 3 dB(A) is expected, noting that this would correspond to a small but noticeable change in loudness.

Where receivers are not directly adjacent to the Wakehurst Parkway south construction support site (BL12), there is potential for cumulative increases of construction noise from concurrent works at the Wakehurst Parkway east construction support site (BL13) and Wakehurst Parkway surface road works. At some receiver locations, when an individual site does not dominate construction noise levels at the receiver (ie it does not contribute more than 5 dB(A) more noise than other sites), cumulative construction noise levels could be up to 3 dB(A) higher than the noise levels predicted

for any one activity. However, even where a cumulative construction noise increase is predicted, the total construction noise level at that receiver is expected to be below the noise management level.

The indicative construction works program for all work is outlined in sections 6.2 and 6.8.2 of the environmental impact statement. The Middle Harbour crossing construction works program assessed as part of the construction noise assessment is outlined in Section 5.7 of Appendix G (Technical working paper: Noise and vibration) and shown on Table 5-103 of Appendix G. This matches the indicative program provided in Table 6-22 of the environmental impact statement. The program for the Middle Harbour crossing provided in the environmental impact statement and Appendix G (Technical working paper: Noise and vibration) shows multiple concurrent activities with the exception of the installation of the immersed tube tunnel units.

Cumulative airborne construction noise impacts would be mitigated in accordance with the environmental management measures outlined in Table D2-1 of this submissions report, including environmental management measures CNV1, CNV2, CNV3, CNV5, CNV9, CNV13, and CI2.

Where relevant, in order to avoid cumulative impacts, the project will manage construction activities with consideration of amenity of the affected receivers and will coordinate works outside standard construction hours with the Western Harbour Tunnel and Warringah Freeway Upgrade works, where feasible and reasonable, to provide affected receivers with appropriate respite, in accordance with revised environmental management measure CNV13 (refer to Table D2-1 of this submissions report).

### **C9.3.3 Working hours**

#### ***Issue raised***

Submitters raised concerns about construction hours being continuous (24 hours a day, seven days a week), out of hours work near residential areas, and the duration of project construction work (leading to construction fatigue).

Submitters raised concern that approved construction hours would be extended in the event that the project is running behind schedule.

#### ***Response***

##### **Continuous construction hours**

The need for out of hours work is discussed in Section 6.9.1 of the environmental impact statement and is detailed in Section 5.1.3 of Appendix G (Technical working paper: Noise and vibration). Works proposed to be carried out up to 24 hours per day, seven days per week only includes tunnelling, tunnelling support and underground activities. This includes underground tunnel excavation and tunnel fitout and surface-based support activities for underground tunnelling, and tunnel fitout. The indicative duration for these works at the tunnel temporary construction support sites is provided in Table 6-38 of the environmental impact statement. Any spoil handling required outside of standard construction hours at the surface would be carried out within acoustic sheds at temporary construction support sites, minimising potential noise impacts to nearby receivers. Other surface-based activities in support of the tunnelling activities which are required outside of standard construction hours, such as deliveries, will be managed through implementation of environmental management measures CNV2, CNV3 and CNV9 (refer to Table D2-1 of this submissions report).

Out of hours works would also be required for the construction of surface road works (eg works that require lane occupancy, works that are immediately adjacent to live traffic or involve substantial changes to lane configurations, works that require traffic management arrangements outside of standard construction hours to minimise impacts to road users), and to ensure the safety of both

construction personnel and the public. Transport for NSW has clarified the anticipated frequency of these works for the Gore Hill Freeway Connection surface road works in Section A5.1.10 of this submissions report.

Transport for NSW recognises there is the potential for noise impacts to residential receivers, including during evening and night time periods where surface road works and supporting works at the temporary construction support sites are required. Transport for NSW is committed to minimising construction noise impacts. The approaches which would be adopted by the project to mitigate noise impacts are outlined in the environmental management measure (refer to Table D2-1 of this submissions report) and in the construction noise strategy (refer to Appendix J of this submissions report).

In addition, to further mitigate construction noise from works outside standard construction hours, assessment for potential noise treatments would be proactively carried out at eligible properties directly adjacent to high out of hours work activity areas and implemented, where applicable, as early as possible in the construction program as outlined in the noise insulation program for the project (refer to Appendix I of this submissions report).

#### Extension of approved construction hours

The proposed construction hours for the project are described in Section 6.9.1 of the environmental impact statement. Where possible, work is proposed to be carried out within the standard construction hours in the *Interim Construction Noise Guideline* (DECC, 2009). However, out of hours work would be carried out in specific circumstances, where works pose an unacceptable risk to the public and construction personnel safety or an unacceptable impact to the performance of the road network. The proposed construction hours for various construction activities are provided in Table 6-35 of the environmental impact statement.

Works outside standard construction hours would be managed in accordance with an out of hours works protocol, which will be developed for construction in accordance with environmental management measure CNV3 (refer to Table D2-1 of this submissions report).

Construction noise and vibration from State significant infrastructure projects is regulated by the Department of Planning, Industry and Environment through project approval requirements and by the NSW Environment Protection Authority through environment protection licences. Any extension of the project's construction hours would be subject to assessment of the potential construction noise and vibration impacts including construction fatigue on affected receivers and would be subject to approval by the NSW Environment Protection Authority through the environment protection licence issued for the project.

## **C9.4 Ground-borne noise impacts during construction**

### ***Issue raised***

Submitters raised concerns about potential ground-borne construction noise impacts. Specific queries, concerns and comments include:

- Concerns about potential ground-borne noise impacts from continuous tunnelling activities, particularly at residential areas near surface connections
- Concerns about potential ground-borne noise impacts at Balgowlah, North Balgowlah, Seaforth, Clontarf, Naremburn and Northbridge including Northbridge Sailing Club
- Requests that adopted ground-borne noise objectives for community facilities are the same as for residential premises.

### **Response**

Ground-borne noise is generated by vibration which is transmitted through the ground into a structure. The resulting sound is more likely to be noticeable during the evening and night periods, when masking by airborne noise from other sources is less likely. The ground-borne noise objectives have been set in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) and are provided in Table 10-5 of the environmental impact statement.

Daytime objectives are identified for commercial premises and community centres which would be used predominantly during daytime. However, a daytime (7am to 6pm) objective is not set for residential receivers because, as stated in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), residential daytime ground-borne noise objectives would be human comfort objectives only. The *Assessing Vibration: a technical guideline* (DEC, 2006c), which informs the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) through guidance in the determination of acceptable vibration levels for human comfort, states that the range of values for human comfort is too widespread, and therefore a single daytime residential objective would not be appropriate to address the full range of human responses. In declining to set a residential daytime ground-borne noise objective, the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) also acknowledges that “humans can perceive floor vibration at levels well below those likely to cause damage to building contents or affect their operation.”

Potential construction ground-borne noise and vibration impacts were considered and mitigated during detailed project development, with design refinements in the Balgowlah/Seaforth area resulting in adjusted tunnel alignments which eliminated low cover tunnelling under multiple Hope Street residential properties, as outlined in Section 4.5.5 of the environmental impact statement. This revised tunnel portal location ensures that the tunnel excavation levels are deeper in the Seaforth area and reduce potential vibration and ground-borne noise impacts.

Assessment of this revised tunnel design for receiver buildings located above the mainline and ramp tunnels, showed that:

- No residential receivers would experience ground-borne noise levels greater than 40 dB(A) from roadheader tunnelling
- Up to 107 residential receivers could experience ground-borne noise levels between 35 and 40 dB(A) from roadheader tunnelling, which would exceed the nighttime ground-borne noise management levels, but not the evening ground-borne noise management levels. The majority of these residential receivers are within Seaforth. However, exceedances of this magnitude (ie less than 5 dB(A) above the criteria) are very small and unlikely to result in significant amenity impacts to affected sensitive receivers
- Other sensitive receiver buildings and commercial and industrial buildings are not predicted to experience ground-borne noise levels above the relevant ground-borne noise management level during roadheader tunnelling.

The number of buildings reported is based on the peak noise levels that a receiver building would be exposed to when the roadheader is at its closest point to the property. Depending on the location of the receiver and the distance to the tunnel excavation location, ground-borne noise could be audible for a number of weeks as the tunnelling approaches and then moves away. It also is noted that affected sensitive receivers might experience ground-borne noise on multiple occasions associated with excavation of each tunnel tube, and other subsurface excavations such as ventilation shafts, cross passages and niches for tunnel operational infrastructure.

Rock hammers are proposed to be used for clearing the bench of the tunnel and would follow behind the roadheader. Rock hammers might also be required for other subsurface excavations, such as niches and trenches for tunnel operational infrastructure. Table 10-8 of the environmental impact statement shows there are more receivers that could be impacted during rock hammering than roadheader tunnelling. The potentially affected receivers include 16 commercial buildings and residential receivers mainly within Seaforth and in noise catchment area 53.3 (north of Frenchs Forest Road). However, rock hammering work has more scope to be programmed outside evening and night time periods, where feasible and reasonable, to avoid ground-borne noise impacts during those more sensitive periods. Where rock hammers are required to carry out subsurface excavations that leaves exposed rock that needs ground support, there is potential that some rock hammering might be required outside standard construction hours. Such occurrences are not anticipated to be required frequently.

For affected receivers, standard and additional mitigation measures as detailed in Table D2-1 of this submissions report will be implemented including environmental management measures CNV1, CNV2, CNV3, CNV8 and CNV9.

## **C9.5 Construction traffic noise**

### ***Issue raised***

Submitters raised concerns about potential construction traffic noise impacts throughout the project area. Specific queries, concerns and comments include:

- Concerns about construction traffic noise during out of hours work at Balgowlah
- Concerns about noise from traffic using local streets through Balgowlah to avoid the Balgowlah surface road works
- Objections to out of hours work at the Barton Road construction support site (BL5) due to construction traffic noise
- Concerns that the access for the Barton Road construction support site (BL5) would encircle residences at 108 Reserve Road at Artarmon, creating excessive noise and vibration
- Concerns about increased noise from traffic passing Wenona School at North Sydney due to traffic detours during Warringah Freeway surface road works
- Requests for an alternative access to the Flat Rock Drive construction support site (BL2) to reduce construction traffic noise impacts on residents at Brook Street and Flat Rock Drive
- Concern that the construction traffic noise assessment does not consider construction traffic volumes with respect to workers and delivery vehicles accessing temporary construction support sites, or the stop-start nature of construction traffic and trucks driving and using brakes on steep hills such as at Flat Rock Drive.

### ***Response***

#### **Potential construction traffic noise impacts throughout the project area**

The project has sought to minimise night time heavy vehicle movements, including by limiting tunnel spoil haulage from temporary construction support sites to standard construction hours.

Site specific road traffic noise assessments have been carried out for each temporary construction support site and major surface road works area. Results are summarised in Section 10.6 of the environmental impact statement, and in more detail in Section 5 of Appendix G (Technical working paper: Noise and vibration).

Construction road traffic management and vehicle movements associated with the project are unlikely to increase road traffic noise levels by more than 2 dB(A). This change represents a minor impact in accordance with the *NSW Road Noise Policy* (DECCW, 2011b) that is likely to be barely perceptible. The number of maximum noise events from construction traffic that could disturb sleep are not likely to substantially increase, because the maximum number of truck movements generated by the project at night would be small compared to existing truck movements along the proposed vehicle routes.

Construction noise and vibration impacts will be managed using feasible and reasonable mitigation and management measures. Measures to avoid, minimise and mitigate potential noise impacts from construction works are provided in Table D2-1 of this submissions report. This includes environmental management measure CNV6 which requires construction vehicle movements to not occur on local roads, beyond those required for direct access to construction site, unless compliance with the relevant traffic noise criteria can be achieved, or alternative arrangements have been agreed with affected receivers.

#### Construction traffic noise at Balgowlah during out of hours work

Out of hours work activities would take place at the Balgowlah Golf Course construction support site (BL10) and for the Balgowlah surface road works at various times during construction. The noise impacts of these activities are assessed in sections 5.9 and 5.10 of Appendix G (Technical working paper: Noise and vibration), respectively.

The construction related road traffic noise assessment for the Balgowlah Golf Course construction support site (BL10) is outlined in Section 5.9.3 of Appendix G (Technical working paper: Noise and vibration). The forecasted number of vehicles accessing the temporary construction support site during the peak construction period is presented in Table 5-149 of Appendix G (Technical working paper: Noise and vibration). The site would contribute up to 22 trucks per hour (worst case) during the daytime period (7.00am to 10.00pm), and a maximum of one truck per hour (no more than four trucks in total) in the night time period (10.00pm and 7.00am). It is expected that half of all traffic movements would enter or exit via the Sydney Road intersection and the other half of the traffic movements would enter or exit via the Burnt Bridge Creek Deviation intersection.

The predicted road traffic noise increase due to the Balgowlah Golf Course construction support site (BL10) is less than 2 dB(A) during the day and night time periods. This change represents a minor impact in accordance with the *NSW Road Noise Policy* (DECCW, 2011b) that is likely to be barely perceptible.

Since the number of night period truck movements generated by the site is small compared to existing heavy vehicle numbers on Sydney Road and Burnt Bridge Creek Deviation, the number of maximum noise events that could disturb sleep are not likely to substantially increase.

Construction road traffic noise associated with the Balgowlah surface road works is assessed in Section 5.10.3 of Appendix G (Technical working paper: Noise and vibration). Traffic switching arrangements during construction would result in new traffic lanes being further from receivers to the west of the Burnt Bridge Creek Deviation, with southbound traffic relocated onto a new southbound lane about 15 metres east of the current location, while northbound traffic would switch to the existing southbound lane while works are under way along the northbound lanes. These works would require some out of hours work, mostly for short periods when traffic is switched between stages. As the new traffic lanes would be further from receivers, there would likely be an overall decrease in road traffic noise levels at all receivers nearby to the Burnt Bridge Creek Deviation, with the potential exception of the receivers to the east of Burnt Bridge Creek Deviation on Dudley Street, as a result of the planned traffic switching arrangements during the construction period.



The predicted increase in road traffic noise levels from construction vehicles as part of the Balgowlah surface road works indicates that construction traffic from these works would also have minimal impact on the surrounding road network, as overall road traffic noise levels are unlikely to increase by more than 2 dB(A).

#### Impacts from traffic avoiding or detouring from Balgowlah and Warringah Freeway surface road works

Impacts of proposed traffic management changes such as temporary traffic switching and new signalised intersections at the entrances of certain temporary construction support sites, were considered as part of the construction road traffic noise assessment for all surface road works including the Balgowlah surface roads works, as outlined in sections 3.4.2 and 4.2.5 of Appendix G (Technical working paper: Noise and vibration). Any road or lane closures would be temporary, short-term and carried out under traffic control, typically outside of peak periods to ensure safety and minimise disruption to the road network.

Results reported in Section 10.6.11 of the environmental impact statement indicate that changes in existing traffic arrangements and movements due to alterations made to facilitate construction are unlikely to increase road traffic noise levels by more than 2 dB(A). This change represents a minor impact in accordance with the *NSW Road Noise Policy* (DECCW, 2011b) that is likely to be barely perceptible.

The results are the same for Warringah Freeway surface road works, including at Wenona School, and are unlikely to increase road traffic noise levels by more than 2 dB(A), as reported in Section 10.6.3 of the environmental impact statement.

#### Barton Road construction support site (BL5)

Proposed vehicle movements and the corresponding road traffic noise assessment for all temporary construction support sites for the Gore Hill Freeway Connection surface road works, including the Barton Road construction support site (BL5), is presented in Table 5-65 of Appendix G (Technical working paper: Noise and vibration). Based on the proposed construction vehicle movements, no site is predicted to increase overall road traffic noise levels by more than 2 dB(A) at the nearest affected residential receivers. This change represents a minor impact in accordance with the *NSW Road Noise Policy* (DECCW, 2011b) that is likely to be barely perceptible. Heavy vehicle movements to and from the Barton Road construction support site (BL5) during the night period are not predicted to exceed the sleep disturbance screening levels and awakening reaction levels.

Given the above, it is not anticipated that the use of Reserve Road, Barton Road and Butchers Lane to access the Barton Road construction support site (BL5) would result in noise management level exceedances at the multi-storey residential receiver at 108 Reserve Road, Artarmon. Notwithstanding, feasible and reasonable environmental management measures will be implemented to manage potential noise levels from construction traffic including environmental management measures CNV1, CNV6 and CNV9 as described in Table D2-1 of this submissions report.

#### Flat Rock Drive construction support site (BL2)

The predicted road traffic noise increase due to activities at the Flat Rock Drive construction support site (BL2) is a minor increase of 0.5 dB(A) during daytime and less than 0.5 dB(A) for night time periods. Changes of this magnitude are considered to be a minor impact in accordance with the *NSW Road Noise Policy* (DECCW, 2011b) and are likely to be barely perceptible.

Night time heavy vehicle movements to and from this site would be limited to one vehicle per hour (no more than five trucks in total). Since the number of night time truck movements generated by

the site is insignificant compared to existing heavy vehicle numbers on Flat Rock Drive, the number of maximum noise events that could disturb sleep are not likely to substantially increase.

Further information on construction traffic noise impacts is provided in the following response on construction traffic noise assessment methodology.

#### Construction traffic noise assessment methodology

The methodology for assessing noise and vibration from construction related traffic operating on the public road network is described in detail in Section 4.2.5 of Appendix G (Technical working paper: Noise and vibration). It includes considerations for both light and heavy construction vehicles accessing the site (including deliveries and worker commuting) and for heavy vehicles travelling at low speeds when accelerating/decelerating with and without loads and noise level adjustments for heavy vehicles on grades. Results including the limitations on night time heavy vehicle movements are summarised in Section 10.6 of the environmental impact statement.

Two methodologies for the assessment of construction road traffic noise have been used depending on whether construction traffic is travelling on motorways, arterial and sub-arterial roads, or local roads.

Flat Rock Drive and Brook Street are categorised as sub-arterial roads under the *Roads Act 1993* in accordance with the Transport for NSW's *Schedule of Classified Roads and Unclassified Regional Roads* (Transport for NSW, 2017c). To mitigate noise impacts during the night time period (10.00pm to 7.00am), where a risk of sleep disturbance was identified, heavy vehicle access to the site would likely be limited to concrete deliveries of one truck per hour. This is less than five per cent of existing heavy vehicle movements on Flat Rock Drive and Brook Street during the night time period. The predicted road traffic noise increase due to the Flat Rock Drive construction support site (BL2) is a minor increase of 0.5 dB(A) during the daytime period and less than 0.5 dB(A) during the night time period, therefore complying with the *NSW Road Noise Policy* (DECCW, 2011b) criteria.

Construction heavy vehicles either entering or exiting the temporary construction support sites have the potential to add to the overall road traffic noise levels. A screening test has been carried out for the Balgowlah Golf Course construction support site (BL10) for the Sydney Road/Maretimo Street intersection and the new access road and Burnt Bridge Creek Deviation intersection to determine if the additional construction heavy vehicles would exceed *NSW Road Noise Policy* (DECCW, 2011b) requirements. It was determined that there would be less than a 2 dB(A) increase in road traffic noise, satisfying *NSW Road Noise Policy* (DECCW, 2011b) requirements.

All drivers would be required to comply with the heavy vehicle code of conduct, as stated in Section 10.6.16 of the environmental impact statement, which would include limiting compression braking. The preparation of the construction noise and vibration management plan as required by the revised environmental management measure CNV1 (refer to Table D2-1 of this submissions report) will include standard and additional mitigation from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a). As discussed in the Appendix C of the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), management of construction related traffic should as a minimum include the following controls:

- Scheduling and routing of vehicle movements
- Speed of vehicles
- Driver behaviour and avoidance of the use of engine compression brakes
- Ensuring vehicles are adequately silenced before allowing them to access the site.

In addition, the contractor/s would provide targeted training, inductions and toolbox talks on these management measures.

## **C9.6 Blasting**

### ***Issue raised***

Submitters raised concerns about potential blasting during construction. Specific queries, concerns and comments include:

- Objections to the potential impacts of blasting
- Requests for clarification of locations where blasting is proposed
- Concerns that the work hours for blasting reported in the environmental impact statement appear to be inconsistent with those recommended by the applicable guidelines and in Appendix G (Technical working paper: Noise and vibration).

### ***Response***

While the majority of the tunnelling work for the mainline and ramp tunnels would be carried out using roadheaders, controlled blasting may be used for cross passage excavation and bench removal to improve the efficiency of excavation activities and shorten the overall excavation program, as outlined in Section 6.4.2 of the environmental impact statement. Controlled blasting may also be adopted in hard rock cut areas along Wakehurst Parkway as an alternative to ripping or hammering of rock so as to minimise the duration of this activity, as described in Section 6.5.1 of the environmental impact statement. The methodology for construction of the mainline and ramp tunnels and surface road works, including the extent of controlled underground blasting, would be refined during further design development and construction planning for the project, and areas likely to require controlled blasting would be confirmed during this time.

The potential impacts of blasting on properties are described in sections 10.6.2 and 10.6.15 of the environmental impact statement. There are two main impacts from blasting:

- Overpressure travelling as an airwave causing a vibration response in structures such as buildings
- Ground vibration transmitted through the ground that surrounds the blast.

At high levels, overpressure and ground vibration have the potential to cause structural damage to building structures.

Where blasting is proposed during further construction planning, potential overpressure and ground vibration impacts will be managed through site and blast specific assessments. Blasting and associated activities will be carried out in a manner that does not generate unacceptable overpressure and vibration impacts or pose a significant risk of impact to structures and sensitive receivers (including threatened fauna and fauna habitat adjacent Wakehurst Parkway), as required by revised environmental management measure CNV12 in Table D2-1 of this submissions report. Prior to any blasting, all potentially affected sensitive receivers and features in the vicinity will be identified. Appropriate tests will be carried out at each proposed blasting location to develop site-specific laws that take into account relevant factors such as underlying geology and separation distance to sensitive receivers and features to determine appropriate charge sizes and blasting design to ensure compliance with relevant vibration and overpressure criteria. All blasting will be carried out in accordance with the specific laws. Monitoring will occur to determine compliance with the relevant criteria, and the site-specific laws will be adjusted as required based on the monitoring

results to ensure ongoing compliance. The potentially affected community will be kept informed about proposed blasting activities.

The proposed work hours for blasting are outlined in Table 6-35 of the environmental impact statement and Section 3.4.6.4 of Appendix G (Technical working paper: Noise and vibration) and are in accordance with the recommended standard construction hours of blasting as outlined in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a):

- 9.00am to 5.00pm Monday to Friday
- 9.00am to 1.00pm Saturday
- No blasting on Sunday or public holidays.

In summary, blasting will be carried out in a strictly controlled manner, and only where it has benefits in overall efficiency and impact reduction for the project.

## **C9.7 Vibration impacts during construction**

### ***Issue raised***

Submitters raised concerns about potential vibration impacts during construction. Specific queries, concerns and comments include:

- Concerns about potential property damage, including to sensitive buildings, due to construction activities including tunnelling activities
- Concerns about human discomfort due to construction activities including tunnelling activities
- Requests for piling activities in Middle Harbour to use non-percussive piles
- Concerns about sleep disturbance due to construction vibration
- Concern about vibration impacts at specific locations including Balgowlah Golf Course construction support site (BL10) and heritage features at Clive Park.

### ***Response***

#### **Property impacts due to vibration**

The potential for cosmetic damage to properties due to vibrations generated during construction activities, such as tunnelling and rock hammering, is discussed in Section 10.6 of the environmental impact statement. This includes the number of receiver buildings within the minimum working distance for cosmetic damage from vibration intensive activities for each work area and/or temporary construction support site. The locations of the receiver buildings are shown in Annexure L of Appendix G (Technical working paper: Noise and vibration).

For assessment purposes, a conservative vibration damage screening level for structurally sound structures has been adopted (refer to Section C9.2.2 above) to identify where further investigation is required. A conservative vibration damage screening level has also been adopted for heritage items. The adopted screening levels are for un-reinforced, light frame structures as outlined in Section 3.4.5.2 of Appendix G (Technical working paper: Noise and vibration) and when assessed assume the worst case scenario in terms of vibration energy frequencies from construction activities and continuous operation.

Where the screening level is predicted to be exceeded, a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure will be carried out during further construction planning. The analysis will determine the applicable safe

vibration level and approach to construction near the structure (refer to environmental management measure CNV7 in Table D2-1 of this submissions report). Appropriate mitigation and management measures such as equipment substitution and alternative methods, will also be implemented to avoid damage. Attended vibration monitoring will be carried out during vibration intensive activities in the vicinity of the works to ensure vibration levels remain below appropriate limits for that structure. Based on the vibration assessment and implementation of environmental management measure CNV7 (refer to Table D2-1 of this submissions report), structural and/or property damage impacts are not anticipated.

Pre-construction building structure condition surveys will be carried out in accordance with environmental management measure SG7 (refer to Table D2-1 of this submissions report). Any building and/or structure damage from vibration caused by the project will be repaired at no cost to the owner. In addition, an Independent Property Impact Assessment Panel, comprising geotechnical and engineering experts, will be established in accordance with environmental management measure SG5 (refer to Table D2-1 of this submissions report), to independently verify building condition survey reports, resolve any property damage disputes and establish ongoing settlement monitoring requirements.

Other environmental management measures proposed to minimise vibration impacts to property during construction are outlined in Table D2-1 of this submissions report.

#### Human comfort impacts due to vibration

Vibration is perceived by humans well below levels that could cause property damage. The potential for human discomfort due to vibrations generated during construction activities, is discussed in Section 10.6 of the environmental impact statement.

The number of receiver buildings exceeding the construction vibration screening levels for human comfort from mainline and ramp tunnelling works is provided in Table 10-9 of the environmental impact statement. Vibration impacts from the operation of roadheaders are predicted to be below the vibration limits for human comfort at all receivers.

Up to 440 receiver buildings are predicted to be exposed to construction vibration levels above the human comfort criteria in Section 10.4.4 of the environmental impact statement. The locations of the receiver buildings are shown in Annexure L of Appendix G (Technical working paper: Noise and vibration).

For the receivers predicted to be exposed to construction vibration levels above the human comfort criteria, environmental management measures CNV1, CNV2 and CNV9 will be implemented to manage vibration levels (refer to Table D2-1 of this submissions report). This will include but not be limited to, the selection and management of plant and equipment to minimise vibration impacts. In addition, monitoring of vibration impacts will be carried out periodically throughout all stages of construction to ensure that (refer to revised environmental management measure CNV5 of Table D2-1 of this submissions report):

- Vibration levels are consistent with the predictions detailed in the relevant construction noise and vibration impact statements
- Vibration impacts are being appropriately managed
- Mitigation measures are effective.

### Piling in Middle Harbour

The consideration of alternative piling methods as part of the construction of the Middle Harbour crossing is discussed in Section 5.7.5.1.1 of Appendix G (Technical working paper: Noise and vibration).

During further design development and construction planning less noise and vibration intensive piling methods, and the need to minimise potential noise and vibration impacts to adjacent sensitive receivers will be considered for the Middle Harbour crossing, in accordance with new environmental management measure CNV15 (refer to Table D2-1 of this submissions report). Less noise and vibration intensive methods, such as vibratory piling and screw piling for immersed tube tunnel support piling, will be adopted where feasible and reasonable and subject to addressing potential constructability and engineering constraints. These piling methods could also assist in reducing the airborne noise impacts on the surrounding receivers. Options would be reviewed to use best management practice impact piling equipment to ensure vibration impacts are reduced to the minimum possible.

The management of vibration impacts from cofferdam piling would also be reviewed during further design development and construction planning. Some impact piling for each cofferdam pile would be necessary to securely embed piles into the rock and ensure the piles can be connected together to provide a watertight and safe work environment. Due to the construction methods required to achieve this safe work environment, the feasibility of adopting an alternative construction methodology for cofferdam piles is not possible.

Additionally, in any given week, impact piling will be carried out over no more than either a two hour period each work day or a six hour period on a single work day, in accordance with environmental management measure CNV14 (refer to Table D2-1 of this submissions report).

### Sleep disturbance due to vibration

Consideration of the potential for sleep disturbance due to vibration is accounted for in the vibration criteria for human comfort as set out in *Assessing Vibration: a technical guideline* (DEC, 2006c) which is detailed in Section 3.4.5 of Appendix G (Technical working paper: Noise and vibration). Table 3-8 and Table 3-9 of Appendix G (Technical working paper: Noise and vibration) provide preferred and maximum levels for human comfort (for continuous, impulsive intermittent vibration) and detail criteria for residences at night time.

For the purposes of the construction vibration assessment, the recommended minimum working distances for human comfort from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) were used as provided in Table 10-6 of the environmental impact statement. As noted in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), the minimum working distances for human comfort relate to continuous vibration and for most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are allowed in accordance with *Assessing Vibration: a technical guideline* (DEC, 2006c).

Notwithstanding, detailed location and activity specific construction noise and vibration impact statements will be prepared for works with the potential to exceed relevant human response criteria for vibration in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report). Should this involve works at night time, the night time residential criteria from *Assessing Vibration: a technical guideline* (DEC, 2006c) will be used during this further assessment. Where exceedances of the criteria are predicted, feasible and reasonable mitigation and management measures will be implemented in accordance with the requirements of the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline*

(Roads and Maritime Services, 2016a). As such, the potential for sleep disturbance due to vibration would be minimised.

#### Balgowlah Golf Course construction support site (BL10)

The most vibration intensive activity at the Balgowlah Golf Course construction support site (BL10) is likely to be construction of the tunnel access decline and the use of rock hammers for site establishment and excavation works. However, the risk of annoyance at this site from vibration is considered low as piling, earth compaction works and rock hammering would occur for a limited duration only.

There is the potential for occupants of 198 receiver buildings to be exposed to vibration levels above the human response screening level (ie building occupants may feel vibration from construction) and for 37 buildings to be at risk of cosmetic damage due to vibration intensive works at the Balgowlah Golf Course construction support site (BL10), as indicated in Table 10-24 of the environmental impact statement. The majority of these receiver buildings are within noise catchment area 50.1 (in Balgowlah, east of Balgowlah Golf Course), as shown in Annexure L of Appendix G (Technical working paper: Noise and vibration) and are within a 110 metre radius of the construction footprint. Environmental management measures provided in Table D2-1 of this submissions report will be implemented to minimise vibration impacts at sensitive receivers in areas surrounding the Balgowlah Golf Course construction support site (BL10), including environmental management measures CNV1, CNV2, CNV5, CNV7 and CNV9.

#### Clive Park

The potential for vibration impacts to heritage features within Clive Park are discussed in Section 10.6.8 of the environmental impact statement. The vibration assessment did not predict minimum and maximum vibration levels at a given structure, rather it predicted the number of buildings and heritage items which would exceed the relevant vibration screening level as discussed in Table 10-21 of the environmental impact statement.

Six heritage items, including Clive Park and Tidal Pool, Clive Park 1 (Northbridge), Clive Park 2 (Northbridge, Cicada Pupa Cave), Clive Park 4 (Northbridge), Clive Park 8 (Shelter Midden WILL 170) and Clive Park (Midden WILL 169), are predicted to be within the minimum working distances for major vibration generating activities and exceed the screening level criteria as noted in Table 10-21 of the environmental impact statement. The most vibration intensive activities near Clive Park are likely to be impact piling and vibratory piling for the installation of the Middle Harbour south (BL7) cofferdam, cofferdam excavation works and immersed tube tunnel foundation works.

Potential vibration impacts will be managed through the implementation of environmental management measure CNV7 (refer to Table D2-1 of this submissions report). This will include but not be limited to a more detailed assessment specifically considering the heritage values of the items in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed. Additional environmental management measures will also be implemented for the Aboriginal heritage sites to manage any potential vibration impacts, including AH2, AH3 and AH4 (refer to Table D2-1 of this submissions report). Based on the vibration assessment and with implementation of environmental management measures, damage to heritage features is not anticipated.

Further discussion on potential construction vibration impacts to Aboriginal heritage sites within Clive Park, including the Clive Park 1 (Northbridge) rock shelter and overhang is provided in Section C14 of this submissions report.

## **C9.8 Environmental management measures**

### **C9.8.1 Effectiveness and clarity of environmental management measures**

#### ***Issue raised***

Submitters raised concerns about the level of detail and likely effectiveness of some proposed construction noise and vibration environmental management measures and made requests for additional steps and measures to be implemented prior to and during construction. Specific queries, concerns and requests include:

- Concerns that addressing construction noise and vibration impacts by a management plan post-approval is too late
- Concerns that proposed construction noise and vibration mitigation measures are not clearly defined and are ambiguous, eg respite periods and ‘noise treatment’ are not detailed and the term ‘feasible and reasonable’ is vague
- Requests that ‘feasible and reasonable’ mitigation measures be determined by an independent authority
- Requests that construction noise and vibration mitigation measures be determined and reported for each property prior to construction to ensure the project meets noise and vibration management levels, including plans for alternative accommodation
- Requests for alternative construction methods to be adopted if feasible and reasonable mitigation measures to reduce noise cannot be established
- Requests for noisy work and respite periods to be scheduled and communicated to potentially affected receivers in advance
- Requests that all relevant noise mitigation measures and consultation provisions in the Western Harbour Tunnel and Warringah Freeway Upgrade project approval be included in the conditions of approval for this project
- Requests for financial compensation due to predicted construction noise and vibration impacts.

#### ***Response***

##### **Rationale for environmental management measures and use of management plans**

Environmental management measures proposed to mitigate potential noise and vibration impacts during construction are outlined in Table D2-1 of this submissions report. These measures were prepared by a team of suitably qualified professionals, including independent technical specialists, in accordance with the Secretary’s environmental assessment requirements, relevant NSW assessment policies and legislation, and Australian and international standards and guidelines (refer to Section 3.1 of Appendix G (Technical working paper: Noise and vibration)).

The construction noise and vibration assessment has also undergone substantial review and evaluation from Transport for NSW’s noise specialists and has been reviewed by NSW Environment Protection Authority during the exhibition of the environmental impact statement. Comments and recommendations raised by NSW Environment Protection Authority are addressed in Section B1 of this submissions report.

The assessment and management approaches detailed in the environmental impact statement and Appendix G (Technical working paper: Noise and vibration) are based upon the current level of design development and construction methodology and presents a reasonable worst case assessment of construction noise and vibration.



Should the project be approved, a construction noise and vibration management plan will be prepared by the contractor/s during further design development when the construction methodology has been refined further, in accordance with revised environmental management measure CNV1 in Table D2-1 of this submissions report. It is crucial for the plan to be developed post-engagement of the contractor/s to ensure it is specific to their design and construction methodology. The construction noise and vibration management plan will identify relevant criteria and management levels in relation to noise and vibration, identify noise and vibration sensitive receivers and features in the vicinity of the project and include feasible and reasonable standard and additional mitigation measures from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), and details about when each will be applied. The construction noise and vibration management plan will be prepared as a sub-plan to the construction environmental management plan for the project (refer to Table D1-1 of this submissions report) and implemented for the duration of construction.

In addition, detailed location and activity specific construction noise and vibration impact statements will be prepared in accordance with environmental management measure CNV2 in Table D2-1 of this submissions report, to assist with designing and selecting appropriate mitigation and management measures. The efficacy of these statements is dependent on the inclusion of this detailed location and activity specific information which will be provided by the contractor/s.

It is also likely that the conditions of approval would require the engagement of an Acoustics Advisor who is independent of Transport for NSW and the contractor/s. The role of the Acoustics Advisor would likely include the requirement to review noise and vibration documents required to be prepared, and consider and recommend improvements that may be made to avoid or minimise adverse noise and vibration impacts. They would also regularly monitor the implementation of the construction noise and vibration management plan and other noise and vibration documents for compliance.

#### Definition of measures and 'feasible and reasonable'

The definition of feasible and reasonable is provided in Section 10.4.1 of the environmental impact statement. Standard feasible and reasonable construction environmental management measures recommended by the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), including the application of respite periods, are discussed in sections 6.1 and 6.2 and listed Annexure G of Appendix G (Technical working paper: Noise and vibration).

The assessment of airborne noise impacts from surface road works and the temporary construction support sites was based on a realistic worst case scenario, developed to represent the impacts from noise intensive construction activities when the loudest plant and equipment items (eg rock hammers or road saws) are being used. While the realistic worst case scenario may occur, noise levels at any one location would typically vary throughout construction as different plant and equipment is used and the activities move around the works area. In addition, through the application of the environmental management measures in Table D2-1 of this submissions report, actual construction noise levels are likely to generally be much lower than modelled. This includes planning and staging the works, where feasible and reasonable, to avoid multiple noisy operations and plant working in the same area at the same time, in accordance with revised environmental management measure CNV9 (refer to Table D2-1 of this submissions report). Following the implementation of these measures, respite periods and the provision of noise treatment would be considered to further mitigate airborne noise impacts.

Further detail on how respite periods have been considered in the construction noise and vibration assessment is provided in Section C9.1 above. The need for respite has been identified within the environmental management measures (refer to Table D2-1 of this submissions report), and details

around the provision of respite would be confirmed by the contractor/s following further construction planning including through preparing a construction noise and vibration management plan which includes the need to ensure appropriate respite is provided for works outside standard construction hours (revised environment management measure CNV1), implementation of respite protocols (revised environment management measure CNV9) and restrictions associated with impact piling (environment management measure CNV14).

Consideration for noise treatment (or at-property treatment), as defined in Section 2 of the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), is explained in Section 4.7.3 of Appendix G (Technical working paper: Noise and vibration). Transport for NSW is committed to minimising construction noise impacts. To further mitigate construction noise from works outside standard construction hours, assessment for potential noise treatments would be proactively carried out at eligible properties directly adjacent to high out of hours work activity areas and implemented, where applicable, as early as possible in the construction program as outlined in Appendix I of this submissions report.

In addition, should the project be approved the conditions of approval would likely require the engagement of an Acoustics Advisor who is independent of Transport for NSW and the contractor/s. The role of the Acoustics Advisor would likely include the requirement to review all noise and vibration documents prepared under the conditions of approval and recommend improvements that may be made to further avoid or minimise adverse noise impacts. They would also regularly monitor the implementation of the construction noise and vibration management plan and other noise and vibration documents for compliance.

#### Property-specific and additional/alternative measures

Consideration would be given to construction noise and vibration mitigation and management measures, both generally and specifically, during further design development based on the detailed construction methodology and potential impacts specific to each work location and time. These mitigation and management measures will be detailed in a construction noise and vibration management plan (refer to revised environmental management measure CNV1 of Table D2-1 of this submissions report) and the detailed location and activity specific construction noise and vibration impact statements (refer to environmental management measure CNV2 of Table D2-1 of this submissions report).

Additional environmental management measures that can be implemented when noise and vibration criteria are exceeded, are outlined in Appendix C of the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), and include measures such as offering alternative accommodation to impacted receivers under certain circumstances. Triggers for these additional environmental management measures are discussed in Section 6.10 of Appendix G (Technical working paper: Noise and vibration) and in Appendix J of this submissions report.

#### Scheduling and community notification

Scheduling and community notification requirements will be outlined in the construction noise and vibration management plan prepared in accordance with revised environmental management measure CNV1 of Table D2-1 of this submissions report and Appendix E (Community consultation framework). Notifications would be issued prior to works commencing to explain the construction activities, work hours, and potential impacts, based on the standard and additional mitigation from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a). In addition, out of hours works notifications would be used to notify the potentially impacted community and stakeholders of planned construction activities that would occur outside of standard construction hours. These notifications would be delivered to residents, and may also be emailed and made available on the project website.

### Conditions of approval

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project. Typical conditions of approval include the requirement for the project to comply with all environmental management commitments in the documentation submitted in support of the State significant infrastructure application, including this submissions report and the environmental impact statement.

In addition, noise and vibration generated during construction would be regulated under an environment protection licence as prescribed under the *Protection of the Environment Operations Act 1997*.

The project would comply with the relevant conditions of approval issued by the NSW Minister for Planning and Public Spaces, and the environment protection licence. Conditions of approval and the requirements of the environment protection licence will be considered in the preparation of the construction noise and vibration management plan required by revised environmental management measure CNV1 of Table D2-1 of this submissions report.

### Compensation

The proposed temporary construction support sites and surface road works activities have been designed to minimise noise and vibration impacts on sensitive receivers. These design considerations include the proximity of temporary construction support sites and surface road works activities to sensitive receivers, construction of acoustic sheds and temporary noise barriers, and positioning of vehicle entrances and exits to allow access directly to and from the arterial road network where possible.

Construction noise and vibration impacts would be managed using feasible and reasonable environmental management measures outlined by in Table D2-1 of this submissions report and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a), including scheduling of works, noise reduction measures for plant and equipment, and provision of respite periods or offers of alternative accommodation for sensitive receivers if appropriate.

Given the above, financial compensation is not considered required to minimise or manage noise and vibration impacts during construction. Issues relating to compensation are further discussed in Section C12.4 of this submission report.

## **C9.8.2 Location-specific measures**

### ***Issue raised***

Submitters raised concerns about the proposed construction noise and vibration environmental management measures and requested additional environmental management measures at specific locations. Specific concerns and requests include:

- Requests for construction work hours be reduced and construction noise minimised during school hours at the Cammeray Golf Course construction support site (BL1)
- Concerns that the proposed acoustic shed at the Flat Rock Drive construction support site (BL2) is not large enough to accommodate expected construction activities and truck movements and that it would not eliminate noise
- Concerns that the workshop and other construction activities proposed at the Flat Rock Drive construction support site (BL2) are not located within the proposed acoustic shed
- Requests for further noise mitigation measures at the Barton Road construction support site (BL5)

- Requests for construction noise levels to be mitigated to within the noise management levels at Balgowlah Oval
- Requests for alternative accommodation to be offered to receivers surrounding the Flat Rock Drive construction support site (BL2) during noisy periods of construction
- Requests for dilapidation assessments to be carried out for properties where predicted vibration levels are above management levels at Seaforth and Reserve Road, Artarmon.

### ***Response***

#### **Construction hours and noise levels at Cammeray Golf Course construction support site (BL1)**

An indicative program of the works associated with the establishment, use and demobilisation of the Cammeray Golf Course construction support site (BL1) is included in Table 6-10 of the environmental impact statement.

A summary of the non-residential receiver buildings predicted to experience airborne noise above the noise management levels includes:

- Up to six receivers are predicted to experience noise levels above the noise management level during access decline piling works (estimated duration less than three months). This includes a childcare receiver located in noise catchment area 28.1 (KU Cammeray Preschool) which is predicted to experience noise levels 12 dB(A) above the noise management level during access decline piling and 6 dB(A) during site rehabilitation (estimated duration 15 months)
- One educational sensitive receiver in noise catchment area 25.1 (ANZAC Park Public School) is predicted to experience noise levels up to 2 dB(A) above the noise management level during access decline piling (estimated duration less than three months)

Where noise management levels are exceeded, there is a requirement to implement feasible and reasonable noise mitigation. Measures to avoid, minimise and mitigate the potential noise impacts from works during construction are provided in Table D2-1 of this submissions report including environmental management measures CNV1 and CNV2. In addition, the project team would also work closely with sensitive receivers to tailor the noise management approach to best suit individual needs and minimise impacts wherever possible, in accordance with Appendix E (Community consultation framework).

It should be noted that by reducing construction work hours, the overall construction duration of the project would extend and therefore noise impacts would be experienced for a prolonged period.

#### **Acoustic shed at Flat Rock Drive construction support site (BL2)**

Acoustic sheds would be designed with consideration of the activities that would occur within them and the noise management levels applicable at nearby receivers.

Noise treatments and management measures proposed for the Flat Rock Drive construction support site (BL2) that were considered in construction noise modelling are detailed in Table 5-70 of Appendix G (Technical working paper: Noise and vibration) and are shown on Figure 5-11 of Appendix G. Proposed noise treatments and management measures include a temporary noise barrier along the eastern and western boundaries of the temporary construction support site, an acoustic shed, limitations on heavy vehicle movements, performance noise targets for plant (or use of an acoustic enclosure if this cannot be achieved), and temporary noise screens/mobile noise screens. In addition, site buildings, such as workshops and site offices, would be located and/or constructed in a way that blocks line of sight from the workshop activities and general noise generating activities (ie laydown or acoustic shed openings) to the receivers located south west of

the site where feasible and reasonable. Additionally, noise generating works (eg workshop related activities) would be conducted within the acoustic shed when carried out outside standard construction hours.

During the acoustic shed construction at the Flat Rock Drive construction support site (BL2), exceedances of noise management levels are predicted to be less than 10 dB(A) at around 15 residential buildings during standard construction hours. In addition, during site establishment and the road widening and modification of Flat Rock Drive exceedances of the sleep disturbance screening level as well as the awakening reaction level are predicted, however these night time works would be minimised to reduce potential impacts where possible. Once the acoustic shed is constructed and tunnelling and tunnel fitout commence, no residential receivers are predicted to be noise affected outside of standard construction hours, as indicated in Table 10-16 of the environmental impact statement. Additionally, the number of heavy vehicle movements generated by the site during night time periods would be limited to one vehicle per hour (no more than five trucks in total) and would not typically be noticeable compared to existing traffic on Flat Rock Drive.

While all construction activities cannot be performed within the proposed acoustic shed, given the above and implementation of the environmental management measures provided in Table D2-1 of this submissions report to manage construction noise, it is anticipated that noise impacts from the operation of the Flat Rock Drive construction support site (BL2) would be effectively managed.

#### Noise mitigation at temporary construction support sites

At the Balgowlah Golf Course construction support site (BL10) and Barton Road construction support site (BL5), a number of residential receiver buildings and the Balgowlah Oval are predicted to experience airborne and ground-borne noise levels above noise management levels, as discussed in Section 10.6.10 and Section 10.6.5 respectively of the environmental impact statement. However it is noted that these predicted noise and vibration levels are considered to be conservative as they represent realistic worst case impacts during the project, as discussed in Section C9.1 above.

To mitigate these predicted impacts Transport for NSW identified a number of management measures during preparation of the environmental impact statement including measures specific to the Balgowlah Golf Course construction support site (BL10) and Barton Road construction support site (BL5) in sections 5.9.1.7 and 5.4.2.3.2 respectively of Appendix G (Technical working paper: Noise and Vibration). In addition, the environmental management measure measures would be adopted by the project to further mitigate noise impacts as outlined in Table D2-1 of this submissions report and in Appendix J of this submissions report.

A construction noise and vibration management plan will be prepared for the project, as discussed in the response above (refer to revised environmental management measure CNV1 in Table D2-1 of this submissions report). The plan will identify relevant criteria and management levels in relation to noise and vibration, identify noise and vibration sensitive receivers and features in the vicinity of the project and include standard and additional mitigation from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) and detail how and when these will be applied in the project. The construction noise and vibration management plan will be implemented for the duration of construction of the project.

Detailed location and activity specific construction noise and vibration impact statements will also be prepared for the project temporary construction support sites (refer to environmental management measure CNV2 in Table D2-1 of this submissions report). The statements will consider the proposed site layouts and noise generating activities that will occur, identify potentially impacted sensitive receivers, assess predicted noise and vibration levels against the relevant criteria and management levels, and specify the feasible and reasonable mitigation and management measures

that will be implemented in accordance with the requirements of the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a).

As discussed in the response above, further consideration would be given to environmental management measures, both generally and specifically, during further design development and the preparation of the construction noise and vibration management plan, based on the detailed construction methodology and the particular potential impacts at each work location and time.

#### Alternative accommodation

The need for alternative accommodation and details around the provision of alternative accommodation are discussed in the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) and Appendix J of this submissions report, and would be further confirmed by the contractor/s following further construction planning. Typically alternative accommodation is offered to mitigate impacts from works completed outside standard construction hours, during the night time period, under specific circumstances.

The assessment of airborne noise impacts from the surface road works and temporary construction support sites was based on a realistic worst case scenario, developed to represent the impacts from noise intensive construction activities when the loudest plant and equipment items (eg rock hammers or road saws) are being used. While the realistic worst case scenario may occur, noise levels at any one location would typically vary throughout construction as different plant and equipment is used and the activities move around the works area. In addition, through the application of the environmental management measures in Table D2-1 of this submissions report, actual construction noise levels are likely to generally be much lower than modelled. These measures include planning and staging the works, where feasible and reasonable, to avoid multiple noisy operations and plant working in the same area at the same time, in accordance with revised environmental management measure CNV9 (refer to Table D2-1 of this submissions report). Following the implementation of these measures, should residential receivers still be highly noise affected (experience noise levels greater than 75 dB(A)) during construction works outside standard construction hours, the provision of respite periods, additional consultation and notification and alternative accommodation would be considered, as discussed in Section 10.4.1 of the environmental impact statement.

Outside standard construction hours, where rock hammers are required to be used for subsurface excavations, a large number of residential receivers could experience ground-borne noise levels that exceed either the night time ground-borne noise management level of 35 dB(A) or the evening ground-borne noise management level of 40 dB(A) as provided in Table 10-8 of the environmental impact statement. Such occurrences are not anticipated to be frequent.

Outside standard construction hours a residential receiver building would be highly noise affected (greater than 75 dB(A)) during road widening works at the Flat Rock Drive construction support site (BL2), as discussed in Section 10.6.6 of the environmental impact statement). However as noted above, predicted noise levels are intended to be conservative and typically represent realistic worst case impacts during the project, as discussed in Section C9.1 above. The potential for this receivers to be highly noise affected will be further assessed during the preparation of the detailed location and activity specific construction noise and vibration impact statements in accordance with environmental management measure CNV2 (refer to Table D2-1 of this submissions report). The statements will specify the feasible and reasonable mitigation and management measures that will be implemented in accordance with the requirements of the *Interim Construction Noise Guideline* (DECC, 2009) and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a).

### Building condition surveys (dilapidation assessments)

Pre-construction building structure condition surveys will be carried out in accordance with environmental management measure SG7, including at properties within the minimum working distances for cosmetic and structural damage due to vibration (refer to Table D2-1 of this submissions report).

In addition, an Independent Property Impact Assessment Panel, comprising geotechnical and engineering experts, will be established in accordance with environmental management measure SG5 (refer to Table D2-1 of this submissions report), to independently verify building condition survey reports, resolve any property damage disputes and establish ongoing settlement monitoring requirements. Any building and/or structure damage from vibration caused by the project will be repaired at no cost to the owner.

### **C9.8.3 Construction traffic, machinery and equipment**

#### ***Issue raised***

Submitters requested details about the environmental management measures proposed to mitigate noise and vibration impacts from construction traffic and construction machinery and equipment and requested additional environmental management measures be implemented to mitigate these impacts. Specific requests included:

- Requests that heavy vehicles not use local roads or idle on local roads
- Requests for clarification of the maximum allowable noise level for machinery and equipment operating at temporary construction support sites, and how that would be limited
- Requests for low noise vehicles, machinery and equipment to be used during construction, including quiet exhausts on trucks and an alternative to beeper style reversing alarms
- Requests that the use of compression brakes not be allowed along Flat Rock Drive and Brook Street
- Queries how noise from heavy vehicles traversing the inclines of Flat Rock Drive would be managed.

#### ***Response***

##### Local roads

The project has been designed to minimise noise impacts from heavy vehicle movements. Where possible, access points to temporary construction support sites and surface works and haulage routes have been configured to provide direct access to and from arterial roads and to minimise the use of local roads. 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 (refer to environmental management measure CNV6 in Table D2-1 of this submissions report).

Truck marshalling areas will be identified and used where required, to minimise potential queueing and noise disruptions in the vicinity of temporary construction support sites and access points to construction sites (refer to revised environmental management measure CTT13 in Table D2-1 of this submissions report).

All drivers would be required to comply with existing road rules and a heavy vehicle code of conduct, as stated in Section 10.6.16 of the environmental impact statement, which would include limiting idling.

#### Noise criteria for machinery and equipment

Airborne construction noise criteria established for the project are outlined in Section 10.4 of the environmental impact statement and consider recommendations provided in the guidelines, policies and standards discussed in Section 10.2 of the environmental impact statement.

Construction noise impacts on residential receivers are assessed using these noise management levels, which are set with reference to the time of day and the corresponding rating background level. The rating background level for each location was determined in accordance with the *Noise Policy for Industry* (NSW EPA, 2017), and provides a single figure for each day, evening or night assessment period.

The airborne noise management levels for residential receivers are set in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) and are provided in Table 10-3 of the environmental impact statement. Noise management levels of rating background level + 10 dB(A) (during standard construction hours) and rating background level + 5 dB(A) (outside of standard construction hours) are used to identify receivers that would be noise affected, and a noise management level of 75 dB(A) is used to identify receivers that would be highly noise affected. A night time noise management level of rating background level + 15 dB(A) is used to identify receivers where there is a potential for sleep disturbance. The level of  $L_{Amax}$  65 dB(A) is used to identify when an 'awakening reaction' is likely during night time sleep.

Plant and equipment would be selected and managed to minimise noise and vibration impacts, and portable noise barriers would be used around particularly noisy equipment (eg concrete saws and rock hammers) where they will effectively reduce noise levels at nearby receivers (refer to revised environmental management measure CNV9 in Table D2-1 of this submissions report). Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used onsite and for any out of hours work, in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a). Where noise management levels are predicted to exceed the relevant noise management levels, alternative construction techniques and equipment that are likely to generate less noise would be investigated and used where feasible and reasonable (refer to revised environmental management measure CNV9 in Table D2-1 of this submissions report). A wide range of other environmental management measures would also be implemented to minimise noise impacts from the use of plant and equipment, as outlined in Table D2-1 of this submissions report and include measures such as scheduling of potentially disruptive works during less sensitive time periods, limiting timing of noise intensive works and providing respite periods where appropriate.

#### Use of compression brakes

All drivers would be required to comply with the heavy vehicle code of conduct, as stated in Section 10.6.16 of the environmental impact statement, and the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a) which include the requirement to limit compression braking and ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's *National Stationary Exhaust Noise Test Procedures for In-Service Motor Vehicles* (2006) and standard. The construction noise and vibration management plan, as required by the revised environmental management measures CNV1 (refer to Table D2-1 of this submissions report), will include other standard and additional mitigation from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016a). As discussed in the Appendix B of the *Construction Noise and Vibration*



*Guideline* (Roads and Maritime Services, 2016a), management of construction related traffic should as a minimum include the following controls:

- Scheduling and routing of vehicle movements
- Speed of vehicles
- Driver behaviour and avoidance of the use of engine compression brakes
- Ensuring vehicles are adequately silenced before allowing them to access the site.

In addition, the contractor/s would provide targeted training, inductions and toolbox talks on these management measures.

### Flat Rock Drive

Construction road traffic noise assessments were carried out using conservative assumptions, with the methodology further discussed in Section C9.5 of this submissions report.

Construction vehicle movements along Flat Rock Drive associated with the Flat Rock Drive construction support site (BL2) are predicted to result in a minor increase in road traffic noise levels of 0.5 dB(A) during the daytime period and less than 0.5 dB(A) during the night time period, which is considered to be a minor impact, as discussed in Section 10.6.6 of the environmental impact statement.

Night time heavy vehicle movements to and from this site would likely be limited to one vehicle per hour (no more than five trucks in total per night). This is less than 5% of the existing heavy vehicle movements on Flat Rock Drive and Brook Street during the night period. Construction traffic on Flat Rock Drive is not likely to substantially increase the number of maximum noise events that could disturb sleep since the number of night truck movements generated by the temporary construction support site is insignificant compared to existing heavy vehicle numbers on Flat Rock Drive.

To further minimise noise impacts from construction vehicles on surrounding streets, mitigation and management measures will be considered during further design development and the development of the detailed location and activity specific construction noise and vibration impact statements (environmental management measure CNV2) and the construction noise and vibration management plan (revised environmental management measure CNV1) detailed in Table D2-1 of this submissions report.

### **C9.8.4 Out of hours work**

#### ***Issue raised***

Submitters made objections and requested environmental management measures in relation to construction work outside of standard construction hours. Specific issues and requests included:

- Requests that a night time curfew be implemented for construction traffic to limit noise impacts
- Requests for community involvement in determining suitable construction noise mitigation measures (eg respite periods) and conditions for out of hours work
- Requests that the list of conditions that determine when out of hours work is allowed, be made available to the public.

## **Response**

### **Out of hours and night time work**

Transport for NSW recognises there is the potential for noise and vibration impacts to residential receivers, including during evening and night time periods where surface road works and supporting works at the temporary construction support sites are required. The noise assessment also indicates that the sleep disturbance screening criterion is likely to be exceeded at various locations when night time work occurs in close proximity to some residential receivers. Given the nature of the construction works, these impacts are unavoidable. However, these predicted exceedances are considered to be conservative and worst case, as discussed in Section C9.1 above, and if they occur would be temporary and intermittent. The project would aim to minimise noise and vibration impacts through the application of standard and, if necessary, additional mitigation measures, as outlined in Section 6.10 of Appendix G (Technical working paper: Noise and vibration).

The contractor/s 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 environmental management measures in Table D2-1 and Appendix J of this submissions report, eg 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 feasible and reasonable.

As some 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, 2016a) and Appendix J of this submissions report.

An out of hours works protocol will be developed for the construction of the project in accordance with revised environmental management measure CNV3 (refer to Table D2-1 of this submissions report). This will include the details of works required outside standard construction hours and an outline of the mitigation measures that will be implemented based on predicted impacts identified through location and activity specific noise and vibration assessments. The out of hours works protocol would minimise the overall duration of noise impacts while ensuring construction of the project is completed within a reasonable timeframe. In addition, shoulder periods will be utilised where appropriate and where a road occupancy licence is approved by Greater Sydney Operations for the works (if required), to minimise potential noise impacts from construction outside standard construction hours (refer to revised environmental management measure CNV4 in Table D2-1 of this submissions report).

To further mitigate construction noise from works outside standard construction hours, assessment for potential noise treatments would be proactively carried out at eligible properties directly adjacent to high out of hours work activity areas and implemented, where applicable, as early as possible in the construction program as outlined in Appendix I of this submissions report.

Works outside standard construction hours will be regulated by the NSW Environment Protection Authority through a project environment protection licence. The NSW Environment Protection Authority typically restrict the number of nights per week on which works that are likely to generate noise levels above noise management levels can be carried out.

Transport for NSW has clarified the anticipated frequency of out of hours works for the Gore Hill Freeway Connection surface road works in Section A5.1.10 of this submissions report.

### Community consultation and conditions

Transport for NSW will continue to engage and consult with the community and stakeholders on the project and to receive and respond to feedback during project delivery in accordance with the community communication strategy as discussed in Appendix E (Community consultation framework) and required by environmental management measure SE3 (refer to Table D2-1 of this submissions report). Specific communications and management strategies will be developed for construction activities, including out of hours work and noise and vibration mitigation and management, as outlined in Section 7 of Appendix E (Community consultation framework).

Meetings would be held with stakeholders located near the temporary construction support sites and other work sites, especially residents and businesses, to understand their issues and to identify opportunities to minimise noise and vibration impacts and improve outcomes, where feasible and reasonable. The outcomes of this consultation would be taken into account in the selection of mitigation measures, in accordance with Transport for NSW's commitments in Appendix E (Community consultation framework) and could include measures such as limiting the timing of noise-intensive works, scheduling noise-intensive works to minimise potential amenity impacts and the provision of respite periods.

Out of hours works notifications will be used to notify the potentially impacted community and stakeholders of planned construction activities that would occur outside of standard construction hours. These notifications will be delivered to residents and may also be emailed and made available on the project website.

Out of hours work will be carried out in accordance with environmental management measure CNV3 (refer to Table D2-1 of this submissions report) and any requirements of the conditions of approval and the environment protection licence issued 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 requirements contained in the environment protection licence. If approved, environment protection licences for the project will be made publicly available on the NSW Environment Protection Authority website: [apps.epa.nsw.gov.au/prpoeoapp/](https://apps.epa.nsw.gov.au/prpoeoapp/) and the project approval, if approved, including the conditions of approval, will be made publicly available on the Department of Planning, Industry and Environment's Major Projects website: [www.planningportal.nsw.gov.au/major-projects/project/10456](http://www.planningportal.nsw.gov.au/major-projects/project/10456).

#### **C9.8.5 Acoustic treatments**

##### ***Issue raised***

A number of submitters raised concerns that proposed management measures would not be effective and requested additional acoustic treatment to mitigate construction noise impacts. Specific concerns and requests include:

- Requests for noise treatment including for schools and residential properties
- Queries if proposed permanent noise barriers and noise treatment at eligible properties would be established prior to construction
- Concerns that proposed noise barriers would be ineffective in certain areas, such as for properties situated above Flat Rock Drive (BL2) and Balgowlah Golf Course (BL10) construction support sites, due to topography

## ***Response***

### **Noise treatment and early implementation of operational noise mitigation**

The use of noise treatments is generally not considered to be a suitable method of construction noise mitigation based upon the intermittent and temporary nature of such noise throughout the construction period. Noise treatments are typically considered and installed to address operational road traffic noise.

Noise impacts during construction would be effectively managed through the implementation of the relevant environmental management measures as outlined in Table D2-1 of this submission report. To further mitigate construction noise from works outside standard construction hours, assessment for potential noise treatments would be proactively carried out at eligible properties directly adjacent to high out of hours work activity areas and implemented, where applicable, as early as possible in the construction program as outlined in Appendix I of this submissions report. In addition, where feasible and reasonable, noise barriers and at-property treatment (or noise treatment) proposed as part of the project to address road traffic noise will be implemented as early as possible to attenuate construction noise in accordance with revised environmental management measure CNV10 (refer to Table D2-1 of this submissions report). This would allow eligible residents along the alignment to have the benefits of noise treatments and barriers during construction as well as operation.

### **Temporary noise barriers**

Indicative locations of temporary noise barriers proposed around the Cammeray Golf Course (BL1), Flat Rock Drive (BL2), Punch Street (BL3), Balgowlah Golf Course (BL10), Wakehurst Parkway south (BL12), Wakehurst Parkway east (BL13) and Wakehurst Parkway north (BL14) construction support sites are shown in Figure 6-30, Figure 6-31, Figure 6-32, Figure 6-38, Figure 6-40, Figure 6-41 and Figure 6-42 of the environmental impact statement respectively. Indicative noise treatment measures and management methods, including noise barriers, have been identified for the temporary construction support sites 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. These noise barriers have generally been designed to mitigate airborne noise impacts associated with the delivery of concrete outside standard construction hours, however they will also provide mitigation for other works during standard construction hours.

Noise modelling carried out for the project considered attenuation from barriers and topography (natural and purpose built), including existing road noise barriers, as outlined in Section 4.2.1 of Appendix G (Technical working paper: Noise and vibration). Therefore, the proposed noise barriers at the Flat Rock Drive (BL2) and Balgowlah Golf Course (BL10) construction support sites have been designed in consideration of potential impacts on sensitive receivers in elevated positions above these sites, as described in Section 10.6.6 and Section 10.6.10 of the environmental impact statement.

## **C9.8.6 Noise and vibration monitoring**

### ***Issue raised***

Submitters raised queries and requests regarding noise and vibration monitoring including:

- Queries how construction noise and vibration will be monitored and regulated over the course of the project
- Requests that construction noise and vibration compliance be monitored by an independent authority

- Requests for real-time noise and vibration monitoring at key construction, residential and educational locations, with results publicly reported in real-time.

### ***Response***

Construction noise and vibration impacts will be monitored in accordance with the construction noise and vibration management plan, which will detail the monitoring method and locations (refer to revised environmental management measure CNV1 in Table D2-1 of this submissions report). In addition, monitoring will be completed by the contractor/s periodically throughout all stages of construction in accordance with revised environmental management measure CNV5 (refer to Table D2-1 of this submissions report), to ensure that:

- Noise and vibration 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.

Should the project be approved, the project would comply with the conditions of approval issued by the NSW Minister for Planning and Public Spaces and the environment protection licence issued by the NSW Environment Protection Authority, including any monitoring requirements. The conditions of approval would likely require the engagement of an Acoustics Advisor who is independent of Transport for NSW and the contractor/s. The role of the Acoustics Advisor would likely include regular monitoring of the implementation of the construction noise and vibration management plan and other noise and vibration documents for compliance. In addition, Transport for NSW would provide details of all complaints to regulatory authorities as required by the conditions of approval and environment protection licence.

## **C9.8.7 Compliance and complaints**

### ***Issue raised***

A number of submissions raised concern about the pathway for affected residents to report noise and vibration related issues and requested additional information about the consultation process during construction. Specific concerns and requests included:

- Requests for information about how construction noise or vibration exceedances would be responded to
- Concerns that there is no reporting process for affected residents to follow in the event of construction noise impacts
- Requests for individual consultation between residents and Transport for NSW in the event that construction noise levels cannot be limited within noise management levels.

### ***Response***

Transport for NSW is committed to proactively engaging with the community to help minimise the impact of project construction work. The project will continue to engage and consult with the community and stakeholders and to receive and respond to feedback during project delivery in accordance with the community communication strategy as discussed in Appendix E (Community consultation framework) and required by environmental management measure SE3 (refer to Table D2-1 of this submissions report). Specific communications and management strategies will be developed for construction activities and noise and vibration mitigation and management, as outlined in Section 7 of Appendix E (Community consultation framework).

Meetings would be held with stakeholders located near the temporary construction support sites and other work sites, especially residents and businesses, to understand and address their issues and to identify opportunities to minimise noise and vibration impacts and improve outcomes, where feasible and reasonable. The outcomes of this consultation would be taken into account in the selection of mitigation measures, in accordance with Transport for NSW's commitments in the community consultation framework (refer to Appendix E (Community consultation framework)) and could include measures such as limiting the timing of noise-intensive works, scheduling noise-intensive works to minimise potential amenity impacts and the provision of respite periods.

Complaints regarding noise and vibration impacts would be managed in accordance with the overarching complaints handling process for the project outlined in Section 3 of Appendix E (Community consultation framework). The complaints management system would be developed and implemented before the start of construction and would establish and maintain a range of communication mediums to receive complaints, including a toll free 24 hour project hotline. The complaints management system would be maintained during construction and for 12 months after the project is completed. A complaints and enquiry register would also be established to record the details, response and outcome of complaints and enquiries received. All complaints would be investigated and appropriate corrective actions, if required, would be taken to reduce noise and vibration impacts in a timely manner. An appropriate response would also be provided to the complainant.

Should the project be approved, the project would comply with the conditions of approval issued by the NSW Minister for Planning and Public Spaces and the environment protection licence issued by the NSW Environment Protection Authority. Where 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.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C10 – Operational noise and vibration

## C10 Operational noise and vibration

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## C10.1 Adequacy and accuracy of the assessment

### C10.1.1 Secretary's environmental assessment requirements

#### ***Issue raised***

Submitters raised concerns about the adequacy and accuracy of the operational noise and vibration assessment including:

- Concerns that the noise and vibration assessment does not address the Secretary's environmental assessment requirements under 4. Noise and Vibration – Amenity
- Concerns that the noise and vibration assessment does not address World Health Organisation noise guidelines
- Concerns that potential noise impacts related to tunnel maintenance work, including maintenance traffic and potential night work, are omitted from the assessment.

#### ***Response***

##### Secretary's environmental assessment requirements and relevant guidelines

The environmental impact statement was prepared in accordance with the provisions of Part 5, Division 5.2 of the *NSW Environmental Planning and Assessment Act 1979* to meet the Secretary's environmental assessment requirements issued by the Department of Planning, Industry and Environment dated 22 April 2020. The Secretary's environmental assessment requirements as they relate to operational noise and vibration and where these have been addressed are detailed in Table 11-1 of the environmental impact statement and Appendix A (Secretary's environmental assessment requirements checklist).

The methodology adopted for the assessment of operational noise and vibration is outlined in Section 4.6 of Appendix G (Technical working paper: Noise and vibration). The assessment has been carried out by experienced, qualified noise and vibration specialists and is considered to be an appropriate assessment of potential project operational impacts that meets current industry best management practice. The assessment considers construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines as specified in the Secretary's environmental assessment requirements. These include the *NSW Road Noise Policy* (Department of Environment, Climate Change and Water (DECCW), 2011b), *Noise Policy for Industry* (NSW Environment Protection Authority (EPA), 2017), *Noise Guide for Local Government* (NSW EPA, 2013a) and supporting Transport for NSW guidelines including the *Noise Criteria Guideline* (Roads and Maritime Services, 2015a) and *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b).

The NSW Government's approach and guideline for addressing the impacts of road traffic noise on sensitive areas is documented in the *NSW Road Noise Policy* (DECCW, 2011b). The *NSW Road Noise Policy* has been prepared through consideration and review of international criteria, assessment methodologies and studies, including those documented in the World Health Organisation guidelines for community noise and night noise (World Health Organisation (WHO), 1999 and WHO, 2009).

##### Tunnel maintenance work and night work

Maintenance work associated with operation of the project would be intermittent and comprise a variety of activities which could be carried out at various times of the day and night, depending on the activity.

The project and its environmental performance during operation would be managed under the existing Transport for NSW environmental management system for asset maintenance (or similar) prepared in accordance with the *AS/NZS ISO 14000 Environmental Management System* series and developed to be consistent with the broad environmental objectives and policies set out in the Transport for NSW environmental management system. Maintenance work would be carried out in accordance with the noise level limits specified in the environmental management system, including any project-specific operational environmental management practices and procedures, as well as any relevant conditions of approval issued by the Department of Planning, Industry and Environment. Transport for NSW would also develop and implement a stakeholder notification and engagement plan and complaints management system before the start of operational activities for the project.

### **C10.1.2 Study area and modelling methodology**

#### ***Issue raised***

Submitters raised concerns about the study area and modelling methodology. Specific concerns and comments include:

- Concerns that major roads including Eastern Valley Way, Willoughby Road, Flat Rock Drive and the full length of Military Road were not included in the modeling of potential surface level traffic noise impacts
- Concerns that the operational road traffic noise assessment does not model increased traffic volumes, altered local traffic flows, road elevation changes or loss of vegetation that provides noise attenuation
- Concerns that the project's predicted operational noise levels are underestimated
- Requests that highly impacted areas be further assessed
- Concerns that reduced commuting as a result of the COVID-19 pandemic should be adjusted for in the operational noise assessment.

#### ***Response***

##### **Study area and scope of assessment**

The assessment methodology for the operational noise assessment is included in Section 11.2 of the environmental impact statement. The assessment included consideration of the potential impacts of the project associated with both changes in traffic noise and noise from the operation of fixed facilities. In summary, the methodology incorporated:

- Identification of potentially affected noise catchment areas (NCAs) and noise sensitive receivers, development of a study area for the assessment, and background noise monitoring to determine existing noise levels. These are documented in Section 10.3 of the environmental impact statement. As the existing acoustic environment along the length of the project varies, noise sensitive receivers were grouped into 87 NCAs based on areas with similar noise characteristics
- Noise monitoring was carried out along the project extent to quantify the existing noise environments where receivers may potentially be affected by construction and operational noise levels. Noise monitoring was carried out at 47 locations between June 2017 and April 2019 to establish existing background and existing traffic noise levels within the noise catchment areas. The noise monitoring locations are shown in Figures 10-2 to 10-5 of the environmental impact statement. Noise monitoring carried out for the assessment is considered representative of the 2020 noise environment and is applicable for the purposes of the construction and operational noise assessment

- Confirmation of noise and vibration objectives with reference to *NSW Road Noise Policy* (DECCW, 2011b) and *Noise Criteria Guideline* (Roads and Maritime Services, 2015a)
- Selection and definition of the road traffic noise scenarios to be modelled and compared. Operational road traffic noise scenarios are presented in Table 11-2 of the environmental impact statement, which includes scenarios with the project ('Do something' and 'Do something cumulative') and without the project ('Do minimum')
- Calculation of road traffic noise changes for each scenario and for both the year of opening of the project and ten years after opening, in accordance with the *NSW Road Noise Policy* (DECCW, 2011b) and supported by Transport for NSW guidelines including the *Noise Criteria Guideline* (Roads and Maritime Services, 2015a) and *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b)
- Identification of environmental management measures to avoid, minimise and mitigate noise and vibration impacts during operation.

Impacts from the redistribution of traffic on other roads, including on local feeder roads, are included in the assessment of operational road traffic noise presented in Section 11.5 of the environmental impact statement.

The operational noise assessment included relevant sections of Willoughby Road, Flat Rock Drive and Military Road. Assessment of the full length of Military Road was not considered necessary as the extent of project operational noise impacts is limited to the eastern extent of NCA 23.1. Similarly, Eastern Valley Way was not considered part of the operational noise assessment study area as it is well outside the area of potential impact from the project.

The project is forecast to reduce traffic demands on the existing arterial roads into and out of the Northern Beaches peninsula, with the largest reductions in traffic demand being on the Spit Road and Military Road corridor, as discussed in Chapter 9 (Operational traffic and transport) of the environmental impact statement. In general, users of existing connections to the Northern Beaches peninsula, including Eastern Valley Way and the Spit Road/Military Road corridor, would benefit from reduced congestion and improved road safety, as a result of the project lowering daily traffic demand on existing routes by introducing a new, higher standard of road as an alternative (the project). Peak period traffic demand on Spit Road and Warringah Road would decrease substantially as a result of the project, by up to 33 per cent and 23 per cent, respectively. Daily traffic demand on Eastern Valley Way would decrease by up to 30 per cent as a result of the project. For more information on forecast changes in traffic volumes, refer to Section 9.4.1 of the environmental impact statement.

As a result of the reduced traffic demand on the Warringah Road/Eastern Valley Way and Spit Road/Military Road corridors, existing traffic noise levels would be expected to reduce. This reduced demand is inclusive of heavy vehicles which would be diverted off the local and arterial road networks and into the tunnel thereby reducing surface noise impacts.

#### Modelling approach and methodology

The noise modelling methodology is summarised in Section 11.2 of the environmental impact statement and detailed in Section 4.6.3 of Appendix G (Technical working paper: Noise and vibration). The noise modelling methodology is consistent with the requirements of the *NSW Road Noise Policy* (DECCW, 2011b).

Noise modelling was carried out using the Road Traffic Noise Module in the SoundPLAN (version 8.0) noise modelling software. This noise modelling software is recognised and accepted by both Transport for NSW and the NSW Environment Protection Authority. The road geometry is

modelled based on the road design presented in Chapter 5 (Project description) of the environmental impact statement.

Noise modelling was completed in accordance with the *Noise Model Validation Guideline* (Roads and Maritime Services, 2018b) which advises against considering any noise attenuation provided by existing or proposed vegetation as it is impermanent (not permanent). A more conservative ground absorption factor was adopted as a parameter in the model, in order to not underestimate operational noise levels.

The noise model was validated using the long-term traffic noise monitoring results and concurrent traffic classification counts. The noise model validation process provides confidence that the noise model prepared for the existing situation represents the real world as accurately as possible within the limitations of the traffic noise prediction algorithms used in the computer noise modelling software. Further details of the noise model validation are outlined in Section 4.6.4 of Appendix G (Technical working paper: Noise and vibration).

#### Further assessment of highly impacted areas

Environmental management measures for predicted noise and vibration impacts during operation are outlined in Table D2-1 of this submissions report.

The operational noise performance of the project will be reviewed during further design development and functionally appropriate operational noise mitigation (quieter pavements eg open grade asphalt, noise barriers, at-property treatments or a combination of treatments) will be confirmed in accordance with relevant guidelines, as required by environmental management measure ONV1 (refer to Table D2-1 of this submissions report).

Within 12 months of the commencement of the operation of the project, actual operational noise performance will be compared to predicted operational noise performance (as reviewed during further design development) to analyse the effectiveness of the operational road traffic noise mitigation measures in accordance with revised environmental management measure ONV2 (refer to Table D2-1 of this submissions report). Additional feasible and reasonable mitigation will be considered where any additional receivers are identified as qualifying for consideration of noise mitigation in accordance with the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b).

#### Effects of COVID-19

The COVID-19 pandemic is an unprecedented event that is currently impacting the way people work and their travel patterns, while creating uncertainty about the future, as discussed in Section 3.1 of the environmental impact statement.

Further clarification on the effect of COVID-19 on the modelling carried out for the environmental impact statement is provided in Section A5.1.17 of this submissions report.

Given the immediate to medium term nature of current conditions, the modelling approach used for the environmental impact statement is considered to be the most appropriate methodology for long-term planning and was completed in accordance with appropriate standards and guidelines.

### **C10.1.3 Noise criteria**

#### ***Issue raised***

Submitters raised concerns about the noise criteria adopted for the assessment. Specific queries and comments include:

- Queries whether the adopted criteria and predicted noise levels from operational fixed facilities are with reference to daytime or night time levels

- Requests that the noise criteria for new freeways be applied to the project
- Queries as to why sleep disturbance assessment is guided by the *NSW Road Noise Policy* (DECCW, 2011b) for construction noise and vibration and Practice Note (iii) of *Environmental Noise Management Manual* (Roads and Traffic Authority (RTA), 2001) for operational noise and vibration.

### **Response**

#### Operational facilities noise levels

The adopted criteria and predicted noise levels from operational fixed facilities are based on the night-time period as per Note 3 of Table 11-10 of the environmental impact statement.

#### Noise criteria for new freeways

Potential road traffic noise impacts on residential receivers are assessed using the assessment criteria outlined in Section 11.3.1 of the environmental impact statement.

The adopted road traffic noise criteria for residential receivers are in accordance with the *Noise Criteria Guideline* (Roads and Maritime Services, 2015a). The assessment criteria are based on the category of the road that would generate the noise (ie the project) and whether a residence may be exposed to traffic noise from a new road corridor, redeveloped or existing roads or additional traffic on existing roads. Specific methods for determining which noise criteria category is applicable are presented in the *Noise Criteria Guideline* (Roads and Maritime Services, 2015a). Where there is a transition from a new road category to a redeveloped road category, or vice versa, a transition zone is established in accordance with the guideline.

Further explanation of the adopted operational road traffic noise criteria is outlined in Section 11.3 of the environmental impact statement and Section 3.5.2 of Appendix G (Technical working paper: Noise and vibration).

#### Sleep disturbance guidelines

The assessment of sleep disturbance due to construction noise has considered Section 4.3 of the *Interim Construction Noise Guideline* (Department of Environment and Climate Change (DECC), 2009), which refers to the *NSW Environmental Criteria for Road Traffic Noise* (NSW EPA, 1999) for guidance. Since the *NSW Environmental Criteria for Road Traffic Noise* (NSW EPA, 1999) has been superseded by the *NSW Road Noise Policy* (DECCW, 2011), the *NSW Road Noise Policy* (DECCW, 2011) has been referred to.

For operational traffic noise, sleep disturbance is assessed through maximum road traffic noise levels in accordance with the protocols of Practice Note (iii) of *Environmental Noise Management Manual* (RTA, 2001), which is specific to traffic noise.

### **C10.1.4 Operational road traffic noise**

#### **Issue raised**

Submitters raised concerns about potential operational road traffic noise impacts generally. Other specific requests and concerns about operational road traffic noise include:

- Requests that noise levels do not exceed existing ambient noise levels
- Concerns regarding operational noise levels at the Northern Beaches Secondary College Balgowlah Boys Campus.

## **Response**

### Operational road traffic noise impacts

The assessment of operational road traffic noise impacting sensitive areas was based on the noise requirements and criteria stipulated in the *NSW Road Noise Policy* (DECCW, 2011b) and supported by Transport for NSW guidelines.

Modelling of operational road traffic noise was used to identify road traffic noise levels at receivers in the vicinity of the project. The findings of the operational road traffic noise assessment are outlined in Section 11.5.2 of the environmental impact statement. Overall:

- The project, in combination with other projects, is predicted to reduce traffic noise for about 61 per cent of receiver buildings within noise catchment areas surrounding the project surface road works
- Thirty-five 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 mostly imperceptible
- Four per cent of receiver buildings are predicted to experience traffic noise level increases greater than 2 dB(A).

Changes in traffic from the project and other major road projects are predicted to reduce the number of receiver buildings exceeding the *Noise Criteria Guideline* (Roads and Maritime Services, 2015a) noise criteria when compared to the 'Do minimum' scenario during the day and night periods at noise catchment areas surrounding the Warringah Freeway and Gore Hill Freeway and Artarmon. This is due to traffic being moved from the existing surface roads into the proposed tunnels.

The project is predicted to result in road traffic noise levels that exceed the criteria and increase by 2 dB(A) or more compared to the 'Do minimum' scenario during the day and night periods in certain locations in the noise catchment areas surrounding Balgowlah, North Balgowlah, Seaforth, Killarney Heights, Allambie Heights and Frenchs Forest. This is due to predicted increases in traffic volumes and redistributed traffic on local roads associated with vehicles entering and exiting the tunnel portals at Killarney Heights and Balgowlah. In the absence of additional traffic calming measures, the following local roads are predicted to be impacted:

- Traffic volumes during the night period along Wanganella Street at Balgowlah are forecast to increase noise levels by more than 2 dB(A) and result in exceedances of the road traffic noise criteria
- Traffic volumes during the night period along Judith Street at Seaforth and Woodbine Street at North Balgowlah are forecast to increase noise levels by more than 2 dB(A), which could potentially result in exceedances of the road traffic noise criteria.

Traffic calming measures within the project area in Balgowlah, North Balgowlah and Seaforth will be investigated in consultation with Northern Beaches Council to ensure impacts due to potential increased traffic noise are minimised, with the aim of limiting potential road traffic noise increases to no more than 2 dB(A) (refer to revised environmental management measure ONV3 in Table D2-1 of this submissions report).

With the exception of the Wakehurst Parkway at Frenchs Forest and certain local roads at Seaforth, North Balgowlah and Balgowlah indicated above, the majority of properties that are eligible for consideration of additional noise mitigation are due to predicted exceedances of the cumulative limit and acute noise levels, rather than increases due to the project. This indicates that existing road traffic noise levels, rather than changes due to the project, are the main driver for additional noise mitigation.

The properties that would be eligible for consideration of additional noise mitigation beyond the adoption of road design and traffic management measures are indicated in Figure 11-1 to Figure 11- 3 of the environmental impact statement. For further details, refer to Annexure N of Appendix G (Technical working paper: Noise and vibration).

The operational noise performance of the project will be reviewed during further design development as required by environmental management measure ONV1 (refer to Table D2-1 of this submission report). Functionally appropriate operational noise mitigation (quieter pavements, eg open grade asphalt, noise barriers, at-property treatments or a combination of treatments) will be confirmed in accordance with *NSW Road Noise Policy* (DECCW, 2011b), *Noise Criteria Guideline* (Roads and Maritime Services, 2015a) and *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b). Mitigation of road traffic noise is discussed in Section 11.5.3 of the environmental impact statement and Section C10.4 below.

#### Noise levels at the Northern Beaches Secondary College Balgowlah Boys Campus

The Northern Beaches Secondary College Balgowlah Boys Campus is eligible for consideration of additional noise mitigation beyond the adoption of road design and traffic management measures due to the predicted noise level following implementation of the project being 5 dB(A) or more above the cumulative limit, as shown in Figure 11-2 of the environmental impact statement.

The Northern Beaches Secondary College Balgowlah Boys Campus is also predicted to experience an increase in maximum noise levels and the number of noise events compared to the existing situation. This is due to the new traffic lights on Sydney Road impacting 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.

Functionally appropriate noise mitigation options (quieter pavements, eg open grade asphalt, noise barriers, at-property treatment or a combination of treatments) will be confirmed as part of the further design development taking into consideration community preferences (refer to environmental management measure ONV1 in Table D2-1 of this submissions report).

The Northern Beaches Secondary College Balgowlah Boys Campus has been identified as a key stakeholder in Table 6-1 of Appendix E (Community consultation framework) and would continue to be engaged throughout the project regarding operational as well as construction noise issues.

## **C10.2 Potential vibration impacts during operation of the tunnel**

### ***Issue raised***

Submitters raised concerns about potential vibration impacts during operation of the tunnel.

### ***Response***

The potential for operational ground-borne noise and tactile vibration impacts on nearby sensitive receivers from traffic on project surface roads and tunnels has been assessed and is discussed in Section 11.7 of the environmental impact statement.

Vehicles operating on a roadway are unlikely to cause a perceptible level of vibration unless there are significant road irregularities (eg potholes), particularly if the affected receiver is more than 20 metres from the roadway.

As the new and upgraded roads on the surface and in the tunnels associated with the project would be designed, constructed and maintained to avoid road irregularities, operational ground-borne noise and tactile vibration impacts from operation traffic are not expected.

## **C10.3 Noise from operational facilities and open space and recreational facilities at Balgowlah**

### ***Issue raised***

Submitters raised concerns about noise and vibration impacts from the proposed tunnel ventilation outlets at North Balgowlah.

Submitters also raised concerns about noise impacts from the proposed new and improved open space and recreational facilities at Balgowlah, especially at Pickworth Avenue.

### ***Response***

#### **Operational facilities**

Predicted operational facility noise levels have been assessed and compared with the *Noise Policy for Industry* (NSW EPA, 2017) intrusiveness and amenity criteria in Table 11-10 of the environmental impact statement. No criteria exceedances are predicted. Similarly, vibration from operational fixed facilities is not anticipated to exceed objectives given the distance between these facilities and the nearest sensitive receiver. Noise predictions and assessment of operational fixed facilities would be updated when actual types, makes and models of the plant and equipment are confirmed during further design development.

#### **Open space and recreation facilities at Balgowlah**

Noise impacts from the use of the proposed new and improved open space and recreation facilities at Balgowlah have been assessed in accordance with the *Noise Guide for Local Government* (NSW EPA, 2013a) and determined through noise modelling of typical activities associated with the facilities. The indicative layout of the facilities at Balgowlah, as provided in Figure 5-28 of the environmental impact statement, was used for the assessment, and noise predictions have been based on all the playing fields, courts, playgrounds and carpark areas operating concurrently which is a conservative assumption.

The indicative layout of these facilities at Balgowlah would comply with the noise criterion at sensitive receivers in NCA 48.1 located at Balgowlah south of Sydney Road. However, some sensitive receivers in NCA 50.1 located at Balgowlah north of Sydney Road and east of the Burnt Bridge Creek Deviation (including Pickworth Avenue) may potentially experience noise exceedances during periods where all activities at the facilities are occurring concurrently.

A dedicated consultation process, jointly led by Transport for NSW and Northern Beaches Council, is proposed to give the community an opportunity to provide input into the final layout of the new and improved open space and recreation facilities at Balgowlah. The final layout will be designed to meet intrusive noise criteria derived in accordance with the *Noise Guide for Local Government* (NSW EPA, 2013a) where feasible and reasonable, as required by revised environmental management measure ONV5 (refer to Table D2-1 of this submissions report). The final layout will be subject to further noise assessment to confirm the need for and details of any noise attenuation required.



## C10.4 Operational noise mitigation

### C10.4.1 Mitigation types and eligibility for noise mitigation

#### ***Issue raised***

Submitters raised concerns about the proposed eligibility and hierarchy of operational noise mitigation measures. Specific concerns, queries and requests include:

- Concerns that proposed operational noise environmental management measures are lacking, and request for noise mitigation measures including quieter road pavement and at-property treatment
- Queries as to which properties would be eligible for consideration of noise mitigation, the rationale for that determination, and why some properties are eligible while neighbouring properties are not
- Requests for noise barriers or at-property treatment in specific areas including existing freeways, local roads and streets, parks and schools near the project.

#### ***Response***

The environmental management measures for the project (refer to Table D2-1 of this submissions report) are considered to be appropriate and are typical for a motorway project of this scale, being consistent with other projects with a similar level of predicted impact.

The *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b) eligibility triggers were applied where a sensitive receiver may qualify for consideration of noise mitigation beyond the adoption of road design and traffic management measures. The eligibility triggers are outlined in Section 11.3.3 of the environmental impact statement.

When the eligibility triggers are exceeded, additional mitigation is considered. The mitigation options considered (in order of preference) include:

- Source controls (such as quieter noise pavements, where functionally appropriate)
- Path controls (such as noise barriers)
- At-property controls (such as architectural treatments).

The proposed locations of noise mitigation barriers are provided in Chapter 5 (Project description) of the environmental impact statement.

The locations of properties eligible for consideration of additional noise mitigation are shown in Figure 11-1 to Figure 11-3 of the environmental impact statement, with further detail provided in Annexure N of Appendix G (Technical working paper: Noise and vibration).

A number of factors are important when considering the eligibility of receivers for additional mitigation and it can be the case while one receiver may be eligible, an adjacent receiver may not. Such factors can include: changes in the distance or orientation of the façade from the noise source, differences in topography along the noise pathway and at the receiver, intermittent shielding by buildings or other obstacles, etc.

Functionally appropriate operational noise mitigation (quieter pavements eg open grade asphalt, noise barriers, at-property treatment or a combination of treatments) will be confirmed as part of further design development taking into consideration community preferences (refer to environmental management measure ONV1 in Table D2-1 of this submissions report).

The properties that are eligible for consideration for at-property treatments, with all other proposed mitigations in place, would be confirmed during further design development in accordance with the process in the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b).

#### Quieter pavements

For the purpose of operational noise assessment, quieter pavements, such as open grade asphalt or similar, were assumed to be included for sections of the Gore Hill Freeway and Burnt Bridge Creek Deviation affected by the project. The use of quieter pavements to reduce operational road traffic noise will continue to be investigated during further design development, as required by environmental management measure ONV1 (refer to Table D2-1 of this submission report).

#### Noise barriers

Noise barriers are considered where feasible and reasonable including where four or more receivers are predicted to experience noise levels that exceed the noise criteria and are closely grouped (ie facades are separated by less than 20 metres), where the barriers do not make access to properties difficult, and where they are visually acceptable.

A noise barrier analysis was completed to identify feasible and reasonable locations where barriers would potentially be provided. The analysis followed the process outlined in the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b) and guidance in the *Noise Wall Design Guideline* (Roads and Maritime Services, 2016c).

A summary of indicative noise barriers proposed as part of the project is provided in Table 11-8 of the environmental impact statement. The locations of the proposed new and existing retained noise barriers relevant to the Beaches Link and Gore Hill Freeway Connection project are provided in Chapter 5 (Project description) of the environmental impact statement.

The details of new barriers, any changes to existing barriers and the eligibility and suitability of receiver buildings for at-property treatment would be confirmed during further design development (refer to environmental management measure ONV1 in Table D2-1 of this submissions report).

#### Receiver buildings potentially eligible for at property treatment

The number of receivers to be considered for at-property treatment after the potential benefits of quieter pavements and new and existing noise barriers have been included is identified in Table 11-9 of the environmental impact statement. At-property treatments may include but are not limited to mechanical ventilation, glazing, window and door seals, sealing of vents and sealing of underfloor areas. The locations of receiver buildings identified in Table 11-9 of the environmental impact statement are shown in Annexure R of Appendix G (Technical working paper: Noise and vibration). Annexure R includes properties along the Warringah Freeway and in adjacent areas. Mitigation for road traffic noise, including at-property treatment, for the Warringah Freeway and surrounds would be carried out as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project.

For local roads within the project area in Balgowlah, North Balgowlah and Seaforth where predicted increases in traffic are likely to result in exceedances of the relevant road traffic noise criteria, traffic calming measures with the aim of limiting potential road traffic noise increases to no more than 2 dB(A) will be investigated in consultation with Northern Beaches Council and implemented, as required by revised environmental management measure ONV3 (refer to Table D2-1 of this submissions report). As already discussed above, the need for at-property treatments will be confirmed during further design development and will consider the potential impact of the proposed traffic calming measures on traffic volumes and speeds.

## C10.4.2 Noise barrier performance and location

### ***Issue raised***

Submitters raised concerns about the performance of existing noise barriers and the proposed locations of new noise barriers. Specific requests and concerns include:

- Requests for confirmation of the proposed locations of noise barriers during operation
- Requests for noise barriers at Kitchener Street properties to mitigate noise impacts during operation
- Concerns that existing noise barriers being utilised are of inadequate height where road widening is proposed or increased traffic volumes are predicted.

### ***Response***

#### Locations of proposed noise barriers

A summary of indicative noise barriers proposed as part of the project is provided in Table 11-8 of the environmental impact statement. The locations of the proposed new and existing noise barriers relevant to the Beaches Link and Gore Hill Freeway Connection project are provided in Chapter 5 (Project description) of the environmental impact statement.

The process provided in the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b) was used to identify the design barrier height for each existing barrier and new barrier proposed in the areas affected by the project. The feasibility of each barrier at the identified design height was then evaluated by considering engineering constraints, constructability constraints, land and property impacts, potential over shadowing, visual amenity and other environmental considerations in accordance with the process provided in the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b).

#### Consideration of a noise barrier at Kitchener Street

A predicted increase in traffic volumes along Kitchener Street could lead to noise impacts at some sensitive receivers. However if noise barriers were installed on Kitchener Street to mitigate predicted impacts from road traffic noise they would be required on either side of the road with gaps at each property to ensure access is maintained. These gaps in the noise barriers would result in the barriers being ineffective and would also result in substantial visual impacts to the streetscape. Therefore, traffic calming measures would be a more feasible and reasonable solution (refer Section 7.2.2 of Appendix G (Technical working paper: Noise and vibration)).

For local roads within the project area in Balgowlah, North Balgowlah and Seaforth where predicted increases in traffic are likely to result in exceedances of the relevant road traffic noise criteria, traffic calming measures with the aim of limiting potential road traffic noise increases to no more than 2 dB(A) will be investigated in consultation with Northern Beaches Council and implemented, as required by revised environmental management measure ONV3 (refer to Table D2-1 of this submissions report).

#### Noise barrier heights

The proposed new and existing barriers were assessed to confirm that they provide appropriate noise attenuation benefits. The existing barriers were found to provide appropriate attenuation at the existing heights. The proposed new and existing barriers were then assessed to identify which properties would be eligible for consideration for at-property treatment. The noise barrier analysis is presented in Table 7-7 and Annexure N of Appendix G (Technical working paper: Noise and vibration).

The details of new barriers, any changes to existing barriers and the eligibility and suitability of receiver buildings for at-property treatment will be confirmed during further design development (refer to environmental management measure ONV1 in Table D2-1 of this submissions report).

### **C10.4.3 Implementation of environmental management measures and monitoring of operational noise and vibration**

#### ***Issue raised***

Submitters raised concerns that the stated environmental management measures would not be implemented and requested real-time monitoring of noise and vibration levels during operation.

#### ***Response***

##### Implementation of environmental management measures

It is a general condition of approval by the NSW Department of Planning, Industry and Environment that the project must be carried out in accordance with all procedures, commitments, preventative actions, performance criteria and management measures set out in the environmental impact statement and this submissions report unless otherwise specified in, or required under, the Minister's conditions of approval.

Transport for NSW and the contractor/s will be responsible for implementation of all environmental management measures.

##### Operational noise and vibration monitoring

Within 12 months of the commencement of the operation of the project, actual operational noise performance will be compared to predicted operational noise performance (as reviewed during further design development) to analyse the effectiveness of the operational road traffic noise mitigation measures, as required by revised environmental management measure ONV2 (refer to Table D2-1 of this submission report). Additional feasible and reasonable mitigation will be considered where any additional receivers are identified as qualifying for consideration of noise mitigation in accordance with the *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b).

Operational ground-borne noise and tactile vibration impacts from normal traffic operations are not expected, as discussed in Section C10.2. Therefore, vibration monitoring during operation is not considered to be warranted.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C11 – Air quality

## C11 Air quality

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## C11.1 Level and quality of air quality assessment

### C11.1.1 Concern regarding adequacy of the operational air quality assessment

#### ***Issue raised***

Submitters raised concerns about the adequacy and accuracy of the operational air quality assessment. Specific concerns included:

- Concerns that particulate matter generated by vehicle tyres, braking and transmission systems has not been included in the air quality assessment and modelled air quality levels
- Concerns that the assessment underestimates the potential air quality impacts of the ventilation outlets
- Concerns that no level of air pollution should be considered 'negligible' in the air quality assessment
- Concerns that the assessment is based on scientific and medical reports (NSW Chief Scientist, committees related to the NSW Chief Scientist and the NSW Chief Medical Officer) that are deficient
- Concerns that the assessment regarding the tunnel ventilation system is generic and not location-specific
- Concerns there are inconsistencies in the air quality modelling for the community and residential, workplace and recreational receivers, since receivers next to each other have very different predicted air quality impacts, especially near the Balgowlah Golf Course
- Concerns about the accuracy and adequacy of figures provided in the operational air quality assessment, including a concern that Figure 8-17 of Appendix H (Technical working paper: Air quality) and Figure 8-20 of Appendix H (Technical working paper: Air quality) of the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement are inconsistent regarding the change in maximum 1-hour mean carbon monoxide (CO) concentration at community receivers as the 'Do something cumulative' and 'Do minimum' scenarios would be the same for both projects.

#### ***Response***

##### Particulate matter generated by vehicle tyres, braking and transmission systems

The air quality assessment includes road transport emissions from non-exhaust processes such as brake wear, tyre wear, road surface wear and resuspension of particulate matter from the road surface as discussed in Section 6.5.2 of Appendix H (Technical working paper: Air quality). Surface road emissions were included in the air quality assessment referencing data from the *Air Emissions Inventory for the Greater Metropolitan Region in New South Wales 2008 Calendar Year. Technical Report No. 1 – Consolidated Natural and Human-Made Emissions: Results* (NSW Environment Protection Authority (EPA), 2012b) which is the most comprehensive source of information on current and future air pollutant emissions in the Sydney area and is compiled periodically by the NSW Environment Protection Authority. Data from the NSW Air Emissions Inventory showing the contribution of non-exhaust processes to current and future particulate matter emissions from road transport in Sydney is shown in Figure 5-6 and Figure 5-7 of Appendix H (Technical working paper: Air quality).

##### Conservative and contemporary assessment approach

The air quality assessment, and a number of the assumptions included, adopted a conservative approach when modelling changes in the concentrations of key pollutants at community, residential,

workplace and recreational receiver locations for expected traffic and operation of the project under a number of worst case operational scenarios, as outlined in Section 12.2 of the environmental impact statement. Key assumptions which contributed to this conservative approach include:

- Traffic volumes were taken from the Sydney Motorway Planning Model, which applies typical weekday traffic data to every day of the year, which could result in the overestimation of pollutant concentrations on weekends
- The analysis presented in Annexure E of Appendix H (Technical working paper: Air quality) indicates that the NSW Environment Protection Authority emissions model may overestimate real world emissions (by up to a factor of three)
- Full portal emissions were assumed for the Sydney Harbour and the Eastern Distributor tunnels so predictions at receivers near these portals are likely to be conservative
- Conservative assumptions were made for the 1-hour mean oxides of nitrogen (NO<sub>x</sub>) to nitrogen dioxide (NO<sub>2</sub>) conversion (refer to Annexure E of Appendix H (Technical working paper: Air quality)).

Further discussion on the assumptions and the conservatism in the assessment is included in Section 8.4.10 of Appendix H (Technical working paper: Air quality). The modelled air quality impacts have been evaluated and demonstrate compliance with regulatory air quality objectives. Due to the conservative approach adopted, the assessment is expected to overestimate potential air quality impacts, not underestimate impacts. In addition, the performance of the dispersion model (Graz Lagrangian Model (GRAL)) was compared against other models, with the outcomes of this comparison showing the model generates predictions that reflect the spatial distribution of air quality concentrations near roads with reasonable accuracy (refer to Section 6.4.3 of Appendix H (Technical working paper: Air quality)). A detailed analysis of GRAL background modelling results compared to background monitoring results is presented in Annexure H of Appendix H (Technical working paper: Air quality). This analysis also notes the combination of GRAL and the background mapping approach generally provides conservative estimates.

Best practice impact assessments typically isolate the effects of the proposed project by establishing existing conditions, forecasting the effect of the project, and considering the difference between the two scenarios (before and after) as the impact of the project, or in other words, the change to existing conditions that the project may cause. This approach was used for the air quality assessment in the Beaches Link and Gore Hill Freeway Connection environmental impact statement, and environmental impact statements for the Western Harbour Tunnel and Warringah Freeway Upgrade, NorthConnex, New M4 (previously M4 East), M8 Motorway (previously New M5), M4-M5 Link, Sydney Gateway and M6 Motorway (Stage 1) projects. This approach satisfies the Department of Planning, Industry and Environment's Secretary's environmental assessment requirements and has been reviewed by other NSW Government regulators including the NSW Environment Protection Authority, the Office of the Chief Scientist and Engineer and the Advisory Committee on Tunnel Air Quality and an independent peer reviewer engaged by the Department of Planning, Industry and Environment.

The anticipated operational air quality impacts of the project are outlined in Section 12.6 of the environmental impact statement. Exceedances of ambient air quality criteria are predicted to occur both with and without the project, usually due to changes in traffic on surface roads and high background concentrations. Under expected traffic conditions, the predicted contribution of tunnel ventilation outlets to pollutant concentrations at ground level is negligible for all receivers. In this context, 'negligible' refers to something that may be undetectable in the ambient air, and a very small change relative to existing or forecast conditions. The health impacts resulting from changes in air quality as a result of the project are discussed in Chapter 13 (Human health) of the environmental impact statement.



### Scientific and medical reports

The air quality assessment includes reference to NSW, Australian and international literature, including those by the NSW Chief Scientist and Engineer, which in many cases are peer-reviewed or published by regulatory agencies. The concerns regarding the veracity of these reports are noted, however it is outside the scope of the project to provide additional peer review of these reports.

### Assessment of the tunnel ventilation system

An assessment of the tunnel ventilation system is contained in Annexure K of Appendix H (Technical working paper: Air quality). The report was prepared in line with relevant legislation, guidelines and the Secretary's environmental assessment requirements as outlined in Table 1.1 of Annexure K.

The report is specific to the Beaches Link and Gore Hill Freeway Connection project in the following respects:

- Tunnel cross-sectional area, entry and exit locations (and therefore tunnel lengths) and tunnel gradients are as per the project concept design presented in Chapter 5 (Project description) of the environmental impact statement
- Operational traffic forecasts and speeds are specific to the project from the Sydney Motorway Planning Model as discussed in Chapter 9 (Operational traffic and transport) of the environmental impact statement
- Cumulative emissions scenarios consider ventilation outlets for both the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project
- Extended journey analysis takes into account journeys involving other parts of the Sydney motorway network (Western Harbour Tunnel and Warringah Freeway Upgrade, New M4 (previously M4 East), M8 Motorway (previously New M5), M4-M5 Link and M6 Motorway (Stage 1)).

The tunnel ventilation system assessment report and the air quality assessment were reviewed by the Office of the Chief Scientist and Engineer, key regulatory agencies and the Department of Planning, Industry and Environment and their independent peer reviewer. Feedback received from the NSW Chief Scientist and Engineer confirmed that the reports adequately addressed the potential air quality impacts of the project. The statements made by the Chief Scientist and Engineer and Chief Health Officer are available on the Department of Planning, Industry and Environment's major projects website at [www.planningportal.nsw.gov.au/major-projects/project/10456](http://www.planningportal.nsw.gov.au/major-projects/project/10456).

### Differences in predicted air quality at nearby receivers

Predicted concentrations of airborne pollutants at residential, workplace and recreational receivers as a result of the project are described in Section 12.6.2 of the environmental impact statement. Contributions from each of the emissions sources are presented graphically in Figures 12-5, 12-8, 12-11, 12-14, 12-17 and 12-20 of the environmental impact statement. Total concentrations and changes due to the project are also presented for the 42 community receivers in the same section. A more in-depth analysis was presented for these 42 community receivers as they were chosen as places representative of more sensitive locations such as schools, aged care or medical facilities, preschools or childcare centres. As the main source in the model is emissions from surface roads, and the impacts from this source are predominantly close to the road itself, the predicted concentrations change rapidly within about 100 metres from the road.

Contour plots for predicted air pollutant concentrations across the wider model domain are provided in Annexure I and Annexure J of Appendix H (Technical working paper: Air quality). All the contour

plots have the same spatial scale and extent for the geographical location being presented. The scales used for the pollutant concentrations in the contour plots vary based on the metric being mapped. For example, the maximum 1-hour mean concentration, the annual mean concentration and the change in concentration for a particular pollutant have different scales as is appropriate for the magnitudes they are presenting and the criteria they are being compared to. Larger scale contour plots that provide more detail about pollutant concentrations around each tunnel ventilation outlet in the expected traffic scenarios are provided in Annexure J of Appendix H (Technical working paper: Air quality).

#### Consistency between the 'Do something cumulative' and 'Do minimum' scenarios

The 'Do something cumulative' and 'Do minimum' for the Beaches Link and Gore Hill Freeway Connection project and the Western Harbour Tunnel and Warringah Freeway Upgrade project are similar in that the 'Do something cumulative' scenario represents both projects in operation and the 'Do minimum' scenario representing neither project being in operation. However, there were some changes to the model before the Beaches Link assessment was carried out. These included minor changes to the ventilation outlet at the Burnt Bridge Creek Deviation and changes to the surface road alignment in that area. The tunnel ventilation calculations were also revised which made minor differences to the emissions for all outlets. This is likely to have led to the slight differences between Figure 8-17 of Appendix H (Technical working paper: Air quality) and Figure 8-20 of Appendix H (Technical working paper: Air quality) of the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement, but it is also noted that the values represented in these figures are very small and so minor differences look larger on the small scale used in these figures, and the values are below the relevant criteria.

#### **C11.1.2 Concern regarding general methodology of the operational air quality assessment**

##### ***Issue raised***

Submitters expressed concerns about the methodology used for the operational air quality assessment. Specific concerns included:

- Concerns that air quality modelling carried out for the operational air quality assessment is misleading, inadequate, outdated and based on incorrect methodology, assumptions and data that have not been validated
- Concerns that there was a lack of independent, peer reviewed modelling to quantify in-tunnel and discharged air quality under a range of operating conditions, including worst case scenarios
- Concerns that the NSW Chief Scientist and Engineer has not provided their views on the overall impact the project is likely to have on local air quality
- Concerns about the accuracy of air quality modelling since the Advisory Committee on Tunnel Air Quality Technical Paper *TP05: Road Tunnel Stack Emissions* (Longley, 2014) notes that a number of factors are uncertain before the tunnel opens, eg traffic flow, traffic composition, traffic speed, vehicle emission factors, ventilation system operating parameters and stack exhaust temperature
- Concerns that the operational air quality assessment does not adequately address plume dispersal by natural wind or air currents from the ventilation outlets
- Concerns that the ventilation outlet at the Burnt Bridge Creek Deviation would be sited at a low point in a valley surrounded by hills and that Longley (2014) notes that dispersion in the lee of obstructions typically requires more advanced modelling techniques and remains subject to some uncertainty
- Concerns that the potential impacts of particulate matter PM<sub>1</sub> has not been assessed or modelled

- Concerns that modelling of the cumulative air quality impacts of the two ventilation outlets at Balgowlah and Seaforth has not been carried out
- Concerns that the impacts of nitrogen dioxide levels on motorcyclists have not been considered.

### ***Response***

#### Adequacy of air quality modelling for the operational air quality assessment

The modelling process and methodology adopted for the operational air quality assessment, including the modelling of worst case scenarios, is described in detail in Section 12.2.3 of the environmental impact statement. The air quality assessment uses a modern state of the art approach to air quality modelling and has been reviewed by the Advisory Committee on Tunnel Air Quality. The review (refer to Section B3.1 of this submissions report) concluded that “Our overall conclusion of these documents is that they constitute a thorough review of high quality. They cover all of the major issues and areas that an environmental impact statement for a project of this scale should. The information presented is of suitable detail and logical in order. The choices made regarding data used and methods followed have been logical and reasonable and it is our view that the benefit of exploring alternative approaches would be questionable or marginal.”

The operational air quality assessment considered the potential air quality impacts for a range of expected traffic scenarios in 2027 and 2037, including the cumulative impacts of the project in conjunction with other major road projects, and for regulatory worst case scenarios. The seven modelled traffic scenarios are outlined in Table 12-2 of the environmental impact statement. Operational worst case scenarios for in-tunnel air quality considered scenarios where traffic flowed at variable speeds and during a breakdown or major incident, assessing the maximum theoretical increase in ambient air quality impact due to the ventilation outlets operating continuously at the proposed emission limits, as described in Section 6.4.3 of Appendix H (Technical working paper: Air quality). These operational worst case scenarios are conservative and result in emission concentrations that are much higher than those that could occur under any foreseeable operational conditions.

The modelling process involved an emissions model, a meteorological model (Graz Mesoscale Model – GRAMM) and a dispersion model (Graz Lagrangian Model (GRAL)), as shown in Figure 12-2 of the environmental impact statement. The GRAMM/GRAL modelling approach is recognised as an advanced dispersion model that has been used extensively in regulatory assessments and scientific studies in Australia and internationally. A comprehensive and detailed study of the GRAMM/GRAL models for use in Australia was carried out by Pacific Environment (2017) as discussed in Annexure H of Appendix H (Technical working paper: Air quality). The study found that “... the combination of GRAMM and GRAL can produce good average predictions which reflect the spatial distribution of concentrations near roads with reasonable accuracy. The model chain gives results that are at least as good as those produced by other models that are currently in use in Australia.” This study was also independently peer reviewed by Dr David Carslaw of the University of York, an internationally acknowledged expert in motor vehicle emissions and air pollution statistical analysis, who found “the study to be an excellent state of the art, ‘modern’ approach to air quality modelling” (Carslaw, 2017).

The Advisory Committee on Tunnel Air Quality is chaired by the NSW Chief Scientist and Engineer and consists of a range of experts and officers in fields related to road tunnels, air quality and human health. This includes senior representatives from Transport for NSW and the NSW Ministry of Health (NSW Chief Health Officer), as well as an independent air quality expert, Dr Ian Longley from the New Zealand National Institute of Water and Atmospheric Research. The NSW Environment Protection Authority, the Department of Planning, Industry and Environment and the Office of Environment and Heritage are observers to the Committee. Professor Peter Sturm, from

the Institute for Internal Combustion Engines and Thermodynamics, Graz University of Technology, Austria is a technical advisor to the Committee.

The methodology for the operational air quality assessment was independently reviewed by the Advisory Committee on Tunnel Air Quality who concluded that "...the assessment methodology is sound and represents best practice. All of the models and data used are appropriate and expertly used. We have found no significant errors nor important omissions." The statements made by the Chief Scientist and Engineer, Advisory Committee on Tunnel Air Quality and Chief Health Officer are discussed further in Section B3.2 of this submissions report and are available on the Department of Planning, Industry and the Environment's major projects website at [www.planningportal.nsw.gov.au/major-projects/project/10456](http://www.planningportal.nsw.gov.au/major-projects/project/10456).

The Department of Planning, Industry and Environment also commissioned an independent peer review of the project air quality impact assessment. The background data selected and the manner in which it has been used was found to be appropriate and sufficient.

#### Modelled operating conditions, worst case scenarios

Operational worst case scenarios for in-tunnel air quality considered scenarios where traffic flowed at variable speeds and during a breakdown or major incident as described in sections 12.2.3 and 12.6.1 of the environmental impact statement. The operational worst case scenarios are conservative and result in pollutant emission concentrations that are much higher than those that could occur under foreseeable operational conditions in the tunnel, including taking the uncertainties in Section 8.4.10 of Appendix H (Technical working paper: Air quality) into account. Predicted pollutant concentrations in the tunnel for each of the operational worst case scenarios are discussed in Section 12.6.1 of the environmental impact statement and are presented in detail in Annexure K of Appendix H (Technical working paper: Air quality).

The regulatory worst case was also assessed, as described in Section 6.4.3 of Appendix H (Technical working paper: Air quality). The regulatory worst case assessed the maximum theoretical increase in ambient air quality due to the ventilation outlets operating continuously at the proposed emission limits. The regulatory worst case was analysed for the 2037 'Do something cumulative' scenario and assessed CO, NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and total hydrocarbon emissions from the ventilation outlets only, with emissions continuously emitted at the proposed emissions limits for all 8760 hours of the year. This is analogous to both the project and the Western Harbour Tunnel operating under breakdown scenarios continuously for a full year. The regulatory worst case represents a theoretical upper bound that would never occur for periods longer than a few hours. As regulatory worst case emissions are only relevant for the ventilation outlets, these were then combined with expected traffic results from the surface roads and portals to estimate the total potential regulatory worst case impact. The modelling results for the regulatory worst case scenarios are presented in sections 8.4.8 and 8.4.9 of Appendix H (Technical working paper: Air quality) for receivers at ground level and elevated receivers respectively.

As noted above, the methodology for the operational air quality assessment was independently reviewed by the Advisory Committee on Tunnel Air Quality (refer to Section B3.2 of this submissions report) and concluded that "...the assessment methodology is sound and represents best practice. All of the models and data used are appropriate and expertly used. We have found no significant errors nor important omissions." The statements made by the Chief Scientist and Engineer, Advisory Committee on Tunnel Air Quality and Chief Health Officer are discussed further in Section B3.2 of this submissions report and are available on the Department of Planning, Industry and the Environment's major projects website at [www.planningportal.nsw.gov.au/major-projects/project/10456](http://www.planningportal.nsw.gov.au/major-projects/project/10456).

### Accuracy of modelling and uncertainty

The treatment of uncertainty in the air quality modelling is addressed in Section 6.5 of Appendix H (Technical working paper: Air quality). While the air quality assessment is considered to be conservative and encapsulates all feasible traffic scenarios, a sensitivity analysis was conducted to evaluate potential changes in air quality due to the operation of ventilation outlets and motorway facilities under the most unlikely of circumstances.

A sensitivity scenario was investigated to test whether varying the values in the expected traffic scenarios for diesel/petrol vehicle splits, traffic speeds, road gradients, hot running and cold start emissions, as well as non-exhaust particulate matter would materially affect the outcomes and conclusions of the assessment, as outlined in sections 6.5.2 and 8.4.12 of Appendix H (Technical working paper: Air quality). Sensitivity tests were also carried out for three ventilation outlet parameters: ventilation outlet temperature, ventilation outlet height and the inclusion of buildings near tunnel ventilation outlets, as outlined in sections 6.5.2 and 8.4.11 of Appendix H (Technical working paper: Air quality).

The predicted emissions from the ventilation outlets for the sensitivity scenario were higher than those predicted for the expected traffic scenarios but lower than those predicted for the regulatory worst case scenarios to varying degrees depending on the averaging period and the nearest ventilation outlet (refer to Section 8.4.12 of Appendix H (Technical working paper: Air quality)). The predicted sensitivity scenario air pollutant concentrations were slightly higher for the maximum 24 hour average air pollutant concentrations than for the annual average concentrations when expressed as a percentage of the concentrations under the regulatory worst case scenarios, indicating that predicted pollution concentrations for short-term averaging periods are slightly more sensitive than those for long-term averaging periods.

The results of the sensitivity tests of the three ventilation outlets parameters are provided in Section 8.4.11 of Appendix H (Technical working paper: Air quality). These sensitivity tests provided confidence that the following are all unlikely to represent a large source of uncertainty in the overall predictions: use of a single annual average temperature in the model, variation of the ventilation outlet height within a realistic potential range and the exclusion of buildings.

The assumptions in the air quality impact assessment that were likely to have had the most influence on the outcomes of the assessment are discussed in Section 8.4.10 of Appendix H (Technical working paper: Air quality). The discussion focusses on the implications of the assumptions made on the conservatism of the predicted air quality impacts of the project. Most of the assumptions made were considered to result in predictions that are accurate or overestimations.

As noted above, the methodology for the operational air quality assessment was independently reviewed by the Advisory Committee on Tunnel Air Quality and the Department of Planning, Industry and Environment commissioned an independent peer review of the project air quality impact assessment. Both concluded that the assessment was appropriate and sufficient and the Advisory Committee on Tunnel Air Quality noted that “The choices made regarding data used and methods followed have been logical and reasonable and the benefit of exploring alternative approaches would be questionable or marginal” (refer to Section B3.1 of this submissions report).

In addition, should the project be approved, conditions of approval would be issued and would likely require further air quality modelling to be completed during further design development, once a number of uncertainties are known, to confirm the revised modelled air quality levels are consistent with those included within Appendix H (Technical working paper: Air quality).

### Plume dispersal

Meteorology is an important factor affecting the dispersion of air pollutants and has been considered in detail in the assessment. The assessment uses local, measured meteorological data as an input to an advanced meteorological model. The model makes adjustments to the measured data to account for local terrain and land uses. It also makes detailed predictions of wind speed and wind direction at 200 metre intervals over the study area (over 22,000 locations) and at 15 heights for all 8760 hours of the year.

A detailed analysis of the meteorological data from the Bureau of Meteorology and NSW Office of Environment and Heritage weather stations within the GRAMM modelling domain is presented in Annexure F of Appendix H (Technical working paper: Air quality). The GRAMM meteorological model predicted wind fields (the three-dimensional spatial pattern of winds) which are an input to the GRAL dispersion model following alignment with meteorological observations. The GRAL dispersion model predicted ground-level air quality levels by simulating the movement of individual 'particles' emitted from an emission source in the three-dimensional wind field.

The model takes into account obstacle-influenced air flows, and is capable of accommodating complex topography with high horizontal relief.

### Topography

The air quality impact assessment used a sophisticated meteorological and dispersion model which can characterise pollutant dispersion in complex local terrain and topography, including the presence of buildings in urban areas, as discussed in Section 6.4.3 of Appendix H (Technical working paper: Air quality). Longley (2014) recognises that since the 1970s, research has increasingly focussed on dispersion in complex situations such as mountainous terrain, complex building clusters, low wind conditions and buoyant or heavy gases and that the understanding built up over the years has been incorporated into the range of atmospheric dispersion models commonly used today to assess dispersion from ventilation outlets.

Terrain data used in the air quality modelling was sourced from the Geoscience Australia Elevation Information System as discussed in Section 5.2 of Appendix H (Technical working paper: Air quality). The terrain along the project corridor is noted as varying from an elevation of about 75 metres Australian Height Datum at the southern end at the Warringah Freeway to an elevation of about 240 metres at Frenchs Forest at the northern end. The topography of the valley at Balgowlah is accurately reflected in the terrain data used in the modelling.

### Meteorological data

The model factored in 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 air quality concentration that may occur. The accumulation of pollutants under low wind speeds was also included in the assessment.

The modelling adopted conservative assumptions and included assessment of regulatory worst case scenarios in accordance with the Secretary's environmental assessment requirements. The assessment methodology, data inputs, assumptions and findings have all been subject to independent expert third party review and have been found to be adequate (refer to Section C11.1.1 above).

### Particulate matter PM<sub>1</sub>

Ultrafine particles (PM<sub>1</sub>) are a subset of PM<sub>2.5</sub>. The World Health Organisation (World Health Organisation Regional Office (WHO) Regional Office for Europe, 2013) recommends that:

“The richest set of studies provides quantitative information for PM<sub>2.5</sub>. For ultrafine particle numbers, no general risk functions have been published yet, and there are far fewer studies available. Therefore, at this time, a health impact assessment for ultrafine particles is not recommended.” And,

“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<sub>10</sub> and PM<sub>2.5</sub>.”

The air quality impact assessment is consistent with these recommendations, assessing impacts associated with PM<sub>10</sub> and PM<sub>2.5</sub>.

### Cumulative impacts

Air quality modelling for the project considered the simultaneous operation of all the elements of the project, including all four proposed ventilation outlets at the Warringah Freeway, Gore Hill Freeway, Burnt Bridge Creek Deviation and Wakehurst Parkway, with surface roads in 2027 and 2037 ('Do something' scenario). An additional 'Do something cumulative' scenario also considered a further seven ventilation outlets for other projects as identified in Table 2-1 of Appendix H (Technical working paper: Air quality). The 'Do something cumulative 2037' scenario considers the simultaneous operation of the New M4 (previously M4 East), M8 Motorway (previously New M5), M4-M5 Link, Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, Sydney Gateway and M6 Motorway (full project), as identified in Table 12-2 of the environmental impact statement.

In all of the expected traffic scenarios with the project, the predicted contribution of the ventilation outlets to pollutant concentrations is negligible for all receivers, including the 'Do something cumulative 2037' scenario, as discussed in Section 12.6.2 of the environmental impact statement.

### Nitrogen dioxide (NO<sub>2</sub>) impacts on motorcyclists

An assessment of the predicted changes in the maximum 1-hour mean and annual mean NO<sub>2</sub> concentrations as a result of the project are provided in Section 12.6.2 of the environmental impact statement. Exposure to motorcyclists would be highly dependent on route selection, travel distance and duration. Changes to air quality along these routes would not be noticeable. The project would have a minimal impact to residential, workplace and recreational receivers that have been assessed to reside, work or play immediately adjacent to the project road corridors.

Motorcyclists using tunnels have no opportunity to minimise exposures through the use of ventilation and would be exposed to NO<sub>2</sub> and particulate levels higher than passenger vehicles and trucks, as discussed in Section 6 of Appendix I (Technical working paper: Health impact assessment). 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 from using any motorway tunnel during periods of congestion. Motorcyclists have the option to use the surface road network to avoid the sub-surface roads and minimise their exposure to associated elevated vehicle emission levels within the tunnels.

### C11.1.3 Concern regarding averaging of operational air quality impacts

#### ***Issue raised***

Submitters raised concerns about the averaging of impacts in the methodology, including:

- Air quality impacts are averaged over a large area (GRAL domain) rather than focusing on air quality impacts in local areas
- Whether air quality has been modelled for all areas surrounding the ventilation outlets
- Air quality modelling reports are based on pollutant concentrations averaged over a 24-hour period rather than concentrations during peak traffic periods.

#### ***Response***

##### Large GRAL domain and local area air quality impacts

Air quality impacts were not averaged over a large area, rather air quality predictions were made at over 1.9 million discrete locations across the study area for the assessment.

The operational ambient local air quality assessment used the GRAMM-GRAL model system that consists of two main modules: a prognostic wind field model (Graz Mesoscale Model – GRAMM) and a dispersion model (Graz Lagrangian Model (GRAL)), as described in Section 12.2.3 of the environmental impact statement.

The GRAL and GRAMM domains are shown in Figure 6-2 of Appendix H (Technical working paper: Air quality). The GRAL domain for dispersion modelling extended well beyond the project itself (11.6 kilometres in the east–west direction and 16.7 kilometres in the north–south direction) to consider traffic interactions between the project, the Western Harbour Tunnel and Warringah Freeway Upgrade project and the M4-M5 Link project, as well as changes in the distribution of traffic along surface roads.

The GRAMM domain for the modelling of meteorology covered a substantial part of Sydney and was defined to cover the project, as well as the interfaces between the project and other road tunnels, with a sufficient buffer zone to minimise boundary effects in GRAL. The GRAMM domain extended 30 kilometres in the east–west direction and 30 kilometres in the north–south direction. The relatively large GRAMM and GRAL domains chosen also increased the number of meteorological and air quality monitoring stations that could be included for model evaluation purposes.

The GRAMM/GRAL model calculated predicted air pollutant concentrations and changes in pollutant concentrations at 42 community receiver and 35,484 residential, workplace and recreational receiver locations along the project corridor, including areas surrounding the ventilation outlets. Contour plots showing concentrations and changes in concentration are provided in Section 8.4.5 of Appendix H (Technical working paper: Air quality). The GRAL model was configured to provide predictions for a Cartesian grid of points with an equal spacing of 10 metres in both the horizontal and vertical directions, resulting in a total number of points in the grid of about 1.9 million. Thus, local air quality changes at a large number of discrete points within the model domain were included in facilitating the assessment of both changes in local and regional air quality.

##### Averaging periods

Averaging periods for the assessed pollutants are prescribed by the air quality standard or criteria adopted; in this case, the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016) and the *National Environment Protection (Ambient Air Quality) Measure* (National Environment Protection Council (NEPC), 2016). All pollutants were assessed against the



shortest averaging periods available for each criteria. Different averaging periods were used for some pollutants to address long-term (annual) and short-term (1-hour or 24-hour) exposure. The ambient air quality criteria and averaging periods applied to the assessment are outlined in Section 12.3.3 of the environmental impact statement.

#### **C11.1.4 Concern regarding traffic emission assumptions in operational assessment**

##### ***Issue raised***

Submitters raised concerns about the consideration of traffic emissions in the methodology used for the operational air quality assessment. Specific concerns included:

- The operational air quality assessment assumes there would be no pollution from cars in tunnels
- The operational air quality assessment does not consider traffic volumes resulting from induced demand
- The operational air quality assessment is based on the assumption that the project would reduce surface level traffic, yet submitters believe the environmental impact statement demonstrates potential increased intersection delays, toll avoidance, slower bus times and rat-running as a result of the project
- Air quality modelling has not taken into consideration the potential increase in electric vehicles, buses, hydrogen buses and decrease in petrol and diesel vehicles over time
- Air quality modelling assumes the improvement in fuel efficiency of vehicles by 2037. However, there is no indication that the Euro 6 or Euro 6 Standard would be adopted, therefore predicted emissions would be underestimated, as outlined in the sensitivity analysis of the air quality assessment
- Changes to work and commuting patterns due to the COVID-19 pandemic have not been considered in air quality modelling for the operational air quality assessment.

##### ***Response***

###### Emissions from vehicles in tunnels

The air quality impact assessment included an assessment of in-tunnel air quality, which modelled the emissions from vehicles in the tunnel using the design criteria in *Road Tunnels: Vehicle emissions and air demand for ventilation, Technical Committee D.5 Road Tunnels* (Permanent International Association of Road Congress (PIARC), 2019). Further detail on the assumptions used to model emissions from vehicles is included in Section 6.2.4 of Annexure K of Appendix H (Technical working paper: Air quality).

###### Traffic and induced demand

Data on traffic volume, composition and speed for surface roads used in the air quality assessment were provided by the network-wide Sydney Motorway Planning Model consistent with the operational traffic assessment.

The Sydney Motorway Planning Model takes into account changes in traffic associated with project-related induced demand (new trips), which equate to about 0.3 per cent of additional daily trips in the Sydney metropolitan area in 2037 for this project, as outlined in Section 9.2.2 of the environmental impact statement.

### Surface road traffic

The Sydney Motorway Planning Model was used to forecast strategic future traffic patterns for the project based on recently completed and future infrastructure projects, and population and employment growth forecasts.

The project is forecast to reduce traffic demands on the existing arterial roads into and out of the Northern Beaches peninsula and alleviate congestion on a number of arterial roads in northern Sydney that are used for these journeys, including Military Road/Spit Road, Warringah Road, Boundary Street, and Eastern Valley Way, as indicated in Section 9.4.1 and Figure 3-9 of the environmental impact statement. Reduced congestion on these surface arterial routes is also expected to reduce current rat-running on existing surface roads including Eastern Valley Way, Frenchs Forest Road and Ourimbah Road, reducing traffic through surrounding urban and residential areas.

The project when combined with the Western Harbour Tunnel and Warringah Freeway Upgrade project would not result in substantially more traffic travelling into and out of the Northern Beaches peninsula. Predicted impacts to local traffic are discussed in sections 9.4.2 to 9.4.6 of the environmental impact statement for key locations along the project corridor. Although traffic at some locations would be impacted by an increase in localised intersection delays, road users would generally benefit from substantial overall travel time savings on the broader road network. Traffic impacted at intersections that perform worse in the 'Do something cumulative' scenario compared to the 'Do minimum' scenario is therefore still anticipated to receive a substantial net benefit due to the broader connectivity and efficiency improvements.

In all the expected traffic scenarios including the project, the predicted contribution of the ventilation outlets to pollutant concentrations at ground level was negligible for all receivers, as discussed in Section 10.2.2 of Appendix H (Technical working paper: Air quality). The predicted total concentrations of all pollutants at receivers were generally dominated by the existing background contribution. For some pollutants and metrics (such as annual mean NO<sub>2</sub>) there was also predicted to be a substantial contribution from the modelled surface road traffic.

Changes in air quality as a result of the project are attributable to changes in the traffic volumes on the modelled surface road network, not by the ventilation outlets. Where traffic on surface roads is expected to reduce due to diversion to the tunnels, ambient air quality is expected to improve compared to conditions without the project.

Where increases in pollutant concentrations at receivers were predicted, these were mostly small. A very small proportion of receivers were predicted to have larger increases. However, it is likely that the predictions at these locations were overly conservative, due to the following reasons:

- Traffic volumes were taken from the Sydney Motorway Planning Model, which applies typical weekday traffic data to every day of the year, which could result in the overestimation of pollutant concentrations on weekends
- The analysis presented in Annexure E of Appendix H (Technical working paper: Air quality) indicates that the NSW Environment Protection Authority emissions model may overestimate real world emissions (by up to a factor of three)
- Full portal emissions were assumed for the Sydney Harbour and the Eastern Distributor tunnels so predictions at receivers near these portals are likely to be conservative
- Conservative assumptions were made for the 1-hour mean NO<sub>x</sub> to NO<sub>2</sub> conversion (refer to Annexure E of Appendix H (Technical working paper: Air quality)).

For some short-term air quality measures (1-hour NO<sub>2</sub>, 24-hour PM<sub>2.5</sub> and 24-hour PM<sub>10</sub>), exceedances of the criteria for ambient air quality were predicted to occur both without and with the project in the expected traffic scenarios. However, where this was the case, the total numbers of receivers with exceedances decreased slightly with the project and in the cumulative scenarios. For particulate matter, exceedances were due to high background concentrations.

#### Changes in future fleet composition

The fleet forecast for the operational air quality assessment is considered to be conservative in that it does not account for alternative-fuel and low-emission vehicle technologies (eg electric vehicles, hybrids). Greater utilisation of alternative-fuel and low-emission vehicle technologies and public transport services over personal vehicle use would likely reduce emissions from road traffic over time and result in improvements in ambient and in-tunnel air quality. Based on these considerations, the air quality assessment is likely to be conservative and predict an air quality impact which is overestimated and unlikely to occur.

#### Changes in future emission standards

Vehicle emission standards assumed in the ventilation analysis are consistent with the NSW Advisory Committee on Tunnel Air Quality *Technical Paper TP-01 Trends in Motor Vehicles and their Emissions* (Advisory Committee on Tunnel Air Quality (ACTAQ), 2018a), 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.

Although the ventilation analysis of in-tunnel air quality 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 of Appendix H (Technical working paper: Air quality), this assumption was not applied to the wider air quality assessment of the surface road network emissions which were calculated using an emission model developed by the NSW Environment Protection Authority, as discussed in Annexure C of Appendix H (Technical working paper: Air quality).

To assess the impact of a potential delay in adoption of 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 (refer to Annexure K of Appendix H (Technical working paper: Air quality)). With regard to ventilation outlets, without a transition to Euro 6 the mass emission rate of NO<sub>x</sub> through the outlet would increase.

Given the small contribution that ventilation outlets make to the total pollutant 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 ventilation outlets are not predicted to generate exceedances of the ambient air quality assessment criteria at ground level.

Further discussion regarding operational traffic modelling is provided in Chapter 9 (Operational traffic and transport) of the environmental impact statement and Section C8.1 of this submissions report. Potential future government strategies and policies are considered outside of the scope of the project.

#### Effect of COVID-19

The COVID-19 pandemic is an unprecedented event that is currently impacting the way people work and their travel patterns, while creating uncertainty about the future, as discussed in Section 3.1 of the environmental impact statement.

The impact of COVID-19 on the transport network has been multi-faceted, and is largely broken down into immediate and medium term impacts:

- Immediate: major reductions in public transport and car trips, reductions in public transport capacity, increased second hand car purchases, increased intrastate visitation, reduction in public transport preference, increased online shopping and deliveries, reductions in overseas and interstate visitors
- Medium term: Reduction in overseas migration, leading to a period of decrease in NSW and Sydney population growth rates, reducing overall projected travel demand; reduced commuter trips due to more people working from home, changing spatial distribution of interpeak / daily non-commute trips.

Significant uncertainty still exists about how long the impacts of COVID-19 will last. In response to the evolving Delta outbreak of COVID-19, areas of Greater Sydney and NSW have gone into lockdown in mid-2021 to manage the spread of the virus while the vaccination program is rolled out. Once vaccination targets have been met and rules have been eased, outbreaks could continue to occur in 2021 and into the future, depending on the timing and efficacy of the vaccination program. It is not possible to accurately predict when immediate and medium term impacts would finish, or when a return to pre-pandemic travel patterns will occur. At this time, the duration of impacts to transport demands and behaviours from the COVID-19 pandemic are still unknown, and current traffic conditions and travel behaviours are the result of a variety of temporary factors, including reduced public transport capacity and demand.

While the COVID-19 pandemic presents immediate to medium-term challenges for Sydney (and NSW more broadly), the project has been developed with a long-term view to address the challenges Greater Sydney will face over the next 40 years, to enable and accommodate growth, and to deliver long-lasting benefits for road users, communities and businesses. 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. Mona Vale Road, Military Road/Spit Road and Warringah Road/Eastern Valley Way road corridors generally operate well over capacity during peak periods, as described in Chapter 3 (Strategic context and project need) of the environmental impact statement. This contributes to high levels of congestion, long and unreliable journey times and, consequently, poor accessibility to and from the region. Beaches Link would create an alternative to the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors to separate out through and by-pass traffic, reducing pressure on congested road corridors servicing the Northern Beaches and North Shore.

As such, the need for the project and other strategic transport projects to meet the demands of a growing population and economy remains critical to ensuring the future success of Sydney.

Given the immediate to medium term nature of current conditions, the modelling approach used for the environmental impact statement is considered to be the most appropriate methodology for long-term planning and was completed in accordance with appropriate standards and guidelines.

While it is difficult to fully assess the long-term impact of the event, evidence of Greater Sydney's resilience to such disruptions is already apparent. Ongoing traffic and transport monitoring shows that traffic levels on most roads in the project area returned to those levels near that of the pre-COVID-19 pandemic period in early 2021, prior to the mid-2021 lockdown (acknowledging that public transport capacity and user behaviours are still in a temporary state). It is expected that similar trends will be observed once the lockdown rules have been eased, and traffic levels will return to those levels in the pre-COVID-19 pandemic period. Transport for NSW will continue to monitor and analyse the potential long-term effects of the COVID-19 pandemic on travel demand,

including changes to existing travel conditions as well as future travel behaviours and underlying economic demand drivers.

### **C11.1.5 Adequacy of data used to support the operational air quality assessment**

#### ***Issue raised***

Submitters raised general concerns about the air quality data collected for the air quality assessment. Specific concerns included:

- Concerns that the air quality assessment uses incorrect, outdated and insufficient data in the project corridor and thus lacks scientific evidence
- Concerns that air quality data from before, during and after construction have not been analysed
- Concerns that non-reputable companies were used to measure background air quality for the project
- Concerns that using air quality data from congested areas of Greater Sydney (eg Gore Hill Freeway) and not from the three project-specific monitoring stations would result in inaccurate background concentrations for the air quality assessment
- Concerns that background monitoring of air quality for the area around Flat Rock Gully has not been carried out for the project
- Concerns about the accuracy of the modelling of air quality due to the lack of data on tunnels longer than six kilometres with unfiltered ventilation outlets
- Concerns that background air quality data were collected during a major bushfire and a pandemic and would therefore not accurately represent forecasted changes
- Concerns that background nitrogen dioxide concentrations which were used to model emissions from the Burnt Bridge Creek Deviation ventilation outlet were provided by a monitoring station near the Gore Hill Freeway
- Concerns that data has not been collected near the project footprint to confirm background PM<sub>2.5</sub> and PM<sub>10</sub> levels meet the guidelines for both the 24-hour mean and the annual mean, including the 2025 goal set by the National Environment Protection Council (2016)
- Concerns that air quality data and the operational air quality assessment were based on the previously proposed location of the unfiltered ventilation outlet and the link road at Balgowlah
- Concerns that the air quality assessment contains inaccurate information about the direction of the prevailing winds at Seaforth and Balgowlah and sea breezes.

#### ***Response***

##### **Data used in the air quality assessment**

As noted above, the methodology and data used for the operational air quality assessment was independently reviewed by the Advisory Committee on Tunnel Air Quality who concluded that (refer to Section B3.2 of this submissions report) "...the assessment methodology is sound and represents best practice. All of the models and data used are appropriate and expertly used. We have found no significant errors nor important omissions." The statements made by the Chief Scientist and Engineer, Advisory Committee on Tunnel Air Quality and Chief Health Officer are discussed in Section B3.2 of this submissions report and are available on the Department of Planning, Industry and the Environment's major projects website at [www.planningportal.nsw.gov.au/major-projects/project/10456](http://www.planningportal.nsw.gov.au/major-projects/project/10456).

The Department of Planning, Industry and Environment also commissioned an independent peer review of the project air quality impact assessment. The background data selected and the manner in which it has been used was found to be appropriate and sufficient.

#### Sources and quantity of background data

The monitoring stations used in the air quality assessment are operated by the Department of Planning, Industry and Environment (Environment, Energy and Science) and Transport for NSW and are listed in Table D-1 of Annexure D of Appendix H (Technical working paper: Air quality). Hourly air quality data from 15 monitoring stations, measured for a period between 2004 and 2019 were used to determine appropriate background concentrations of pollutants for the project assessment. The locations of these background air quality monitoring stations are shown in Figure D-1 of Annexure D of Appendix H (Technical working paper: Air quality).

#### Accuracy of background data

Use of air quality data from locations that have greater volumes of traffic and traffic congestion than within the project area to establish background air quality would result in higher predicted air quality changes and is therefore a more conservative approach. In addition, the assessment of change in air quality, with and without the project, is independent of the background air quality levels as it only considers the differences between the two scenarios.

The performance of the dispersion model (GRAL) to predict pollutant concentrations was 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 with 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. The evaluation found that overall, the application of GRAL in the assessment is appropriate and that the results are conservative. The evaluation results suggest that the estimated concentrations ought to be conservative for most of the modelling.

#### Operational air quality monitoring

Ambient air quality monitoring would occur prior to and following the commencement of operation of the project. The ambient air quality monitoring period will likely be set by the conditions of approval and is typically required for at least 12 continuous months prior to operation and 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.

#### Locations of monitoring stations and validity of data

The approach for establishing background concentrations in the project assessment, and for combining these with model predictions, is described in Annexure D of Appendix H (Technical working paper: Air quality).

The siting and classification of air quality monitoring stations is governed, as far as practicable, by the requirements of Australian/New Zealand Standard *AS/NZS 3580.1.1:2007 – Methods for sampling and analysis of ambient air, Part 1.1: Guide to siting air monitoring equipment* (Standards Australia, 2007a).

Emissions from traffic on the surface road network were included in the modelling of the 'Do minimum' and 'Do something' scenarios using a modelled road network (refer to Section 12.2.3 of the environmental impact statement). For this reason, the influence of the surface road emissions

was removed from the background monitoring data as much as possible to ensure emissions from the surface road network were not modelled twice, as mentioned in Section 6.4.3 of Appendix H (Technical working paper: Air quality). Therefore, the location of background monitoring stations in congested areas (eg Gore Hill Freeway) would not influence pollutant concentration predictions, as the surface road emissions were removed as much as possible. This approach meant there was still some residual surface road contribution included in the background monitoring data, which introduced some conservatism to the predictions. However as noted by the Advisory Committee on Tunnel Air Quality in Section B3.4 of this submissions report, this did not impact the outcome of the assessment.

The three project-specific monitoring stations for the Beaches Link and the Western Harbour Tunnel program of works were established by Transport for NSW in 2017. In accordance with the Australian/New Zealand Standard *AS/NZS 3580.1.1:2007 – Methods for sampling and analysis of ambient air, Part 1.1: Guide to siting air monitoring equipment* (Standards Australia, 2007a), background stations used to establish background concentrations for the project were located in urban or rural areas to provide information on air quality away from specific sources of pollution such as major roads (eg Gore Hill Freeway) or industry. The locations of the stations are shown in Figure D-1 of Annexure D of Appendix H (Technical working paper: Air quality).

Given the date of deployment of the project-specific air quality monitoring stations, the time period covered was too short for this data to be included in the development of background concentrations and model evaluation for the assessment carried out for the environmental impact statement. However, the data from the project-specific monitoring stations were used to:

- Supplement the existing Department of Planning, Industry and Environment and Transport for NSW stations in Sydney
- Establish the representativeness of the data from the stations that were used to characterise air quality in the Beaches Link and Western Harbour Tunnel modelling domains
- Provide a time series of air quality data in the vicinity of the project.

Analysis of the data from the project-specific air quality monitoring stations was also completed and shows there are no significant changes to the trends, when comparing background monitoring to the background modelling year (refer to Annexure D of Appendix H (Technical working paper: Air quality)). In addition, this analysis showed that the modelled background concentrations assumed for the assessment were conservative for the areas where the monitors were located.

The project is not likely to result in any long term change to ambient air quality at Flat Rock Gully, hence it was not chosen as a representative background monitoring location for the project.

#### Data on similar length tunnels with unfiltered ventilation outlets

Modelling for the operational air quality assessment was based on a concept tunnel and ventilation system design specific to the Beaches Link tunnel. The model does not require data from similar length tunnels or with similar ventilation systems to be valid.

The modelling considered a regulatory worst case scenario as discussed in Section 6.4.3 of Appendix H (Technical working paper: Air quality). The objective of modelling this scenario is to present the maximum theoretical increase in ambient air quality due to the ventilation outlets operating continuously at the proposed emissions limits for all 8760 hours of the year. This is analogous to both the project and the Western Harbour Tunnel operating under vehicle breakdown scenarios continuously for a full year. The regulatory worst case therefore represents a theoretical upper bound that would never occur for periods longer than a few hours. Analysis of the regulatory worst case scenario predictions is provided in sections 8.4.8 and 8.4.9 of Appendix H (Technical working paper: Air quality). The regulatory worst case scenario predictions provide confidence that

emissions would not exceed the air quality criteria for the project or, where exceedances were predicted, that background concentrations were the primary cause of the exceedances.

### Background concentrations

The three project-specific monitoring stations for the Western Harbour Tunnel and Beaches Link program of works were established by Transport for NSW in 2017. One of these was at a background location, and the other two were at locations near busy roads. Given the date of deployment, the time period covered was too short for this data to be included in the development of background concentrations and model evaluation. However, analysis of this data was completed (refer to Annexure D of Appendix H (Technical working paper: Air quality)) and shows there are no significant changes to the trends, when comparing background monitoring to the background modelling year. This analysis also showed that the modelled background concentrations assumed for the assessment were conservative for the areas where the monitors were located.

The 15 monitoring stations used in the air quality assessment to define background concentrations for the air quality assessment are listed in Table D-1 and shown in Figure D-1 of Annexure D of Appendix H (Technical working paper: Air quality).

The main contributors to the predicted exceedances of PM<sub>2.5</sub> and PM<sub>10</sub> criteria were elevated background PM<sub>2.5</sub> and PM<sub>10</sub> concentrations in 2016 (the base year selected for the model) due to extreme events such as dust storms, bushfires and hazard reduction burns that occurred during that year (refer to Section 12.6.2 of the environmental impact statement). An alternative approach was also presented in the air quality assessment excluding the effect of events such as bushfires that generate extremely high background concentrations. While the air quality data from 2016 was used to determine background concentrations for the air quality assessment to coincide with the base year traffic modelling, among other reasons, significantly different pollutant concentrations are not predicted if a later year is used. A comparison of the (2016) background concentrations with data collected subsequently in 2018 showed that levels in 2018 were consistent with those from 2016 (refer to Section 5.8.2 of Appendix H (Technical working paper: Air quality)).

### Project design considered in air quality assessment

The air quality assessment carried out for the project is based on the current proposed design of the project, as described in Chapter 5 (Project description) of the environmental impact statement.

### Meteorological data

Meteorological data relevant to dispersion modelling for the air quality assessment is summarised in Section 5.5 of Appendix H (Technical working paper: Air quality). Data collected in 2016 at the Randwick and Rozelle meteorological stations operated by the Department of Planning, Industry and Environment and the Fort Denison and Manly (North Head) meteorological stations operated by the Bureau of Meteorology were chosen as reference meteorological data for modelling. The rationale for this selection is summarised in Annexure F of Appendix H (Technical working paper: Air quality).

The dispersion modelling carried out for the project used the GRAMM/GRAL system (version 18.1), as discussed in Section 6.4.3 of Appendix H (Technical working paper: Air quality). The model system consists of two main modules: a prognostic wind field model (GRAMM) and a dispersion model (GRAL itself), as indicated in Figure 6-1 of Appendix H (Technical working paper: Air quality).

The meteorological modelling method in GRAMM that was applied to the project is known as 'match-to-observations', and this is explained in Section 6.4.3 of Appendix H (Technical working paper: Air quality). The method allowed different weighting factors to be applied to meteorological stations, depending on the desired level of influence required in the modelling. The meteorological



data analysis showed that the Randwick station was the most representative of the project corridor, and this station was therefore given the highest weighting. Rozelle, Fort Denison and Manly (North Head) were given lower weightings, which is explained in Section 6.4.3 of Appendix H (Technical working paper: Air quality).

A statistical analysis was carried out to compare the predicted wind speed and wind direction data with the observations at each of the meteorological stations, as discussed in Section F.4.2 of Annexure F of Appendix H (Technical working paper: Air quality).

In their review of the air quality assessment, the Advisory Committee on Tunnel Air Quality noted that (refer to Section B3.3.3 of this submissions report) "...the environmental impact statement has given careful attention to the implication for meteorological modelling of the location of the project which may be impacted by the coast and harbour. The Advisory Committee on Tunnel Air Quality outline that the approach used to address variation in wind speed and direction due to local land sea breezes using the 'Match-to-Observations' function in the Graz Mesoscale Model (GRAMM) is highly appropriate in this situation and are comfortable that this is likely to provide the most representative results whilst retaining slight conservatism."

### **C11.1.6 Concern regarding operational assessment assumptions and inputs**

#### ***Issue raised***

Submitters raised concerns that the air quality modelling does not consider the 'wake effect' of tall buildings that would interfere with pollutant dispersion and does not consider the actual population in schools, childcare centres and apartment blocks near the ventilation outlets.

#### ***Response***

##### 'Wake effect' of buildings

Buildings generate turbulence and can create complicated air flow patterns including areas of accelerated flow and wakes, as explained in Section A.3.2 of Annexure A of Appendix H (Technical working paper: Air quality). A 'wake effect' can occur when the aerodynamic turbulence induced by nearby buildings causes a pollutant emitted from an elevated outlet to be rapidly mixed to the ground. Whether or not a plume is directly influenced by such aerodynamic turbulence depends on a number of factors including the height and speed at which the plume is released, the height of the nearest buildings and their distance from the outlet and the speed of the ambient air at the time the plume is released. If wind speeds are low, the effect the building has on the plume may be negligible.

The size of the GRAL domain and the fine grid resolution meant that building height data could not be practically included in the modelling, as described in Section 8.4.1 of Appendix H (Technical working paper: Air quality). Due to the complex nature of GRAL's prognostic building calculations, the ideal model set-up to account for the effects of buildings would be a maximum domain size of about two kilometres by two kilometres, with a maximum horizontal grid resolution of five metres. To include buildings in the project set-up, and utilising GRAL's prognostic building calculation approach, would have resulted in extremely long model run times (in the order of weeks per scenario). Moreover, the post-processing of the results at a five-metre resolution across a modelling domain of the size used here would have been impractical. An evaluation of the performance of the GRAMM/GRAL system indicated that the results of GRAL are not sensitive to settings for grid resolution and number of particles. Therefore, the inclusion of buildings and wake effects may be more important where there are many buildings within the study area and close to model sources. Since there are only a small number of tall buildings in proximity to the proposed ventilation outlets, their impact on plume dispersion is likely to be limited.

### Population in schools, childcare centres and apartment blocks

The operational ambient air quality assessment was based on the use of the GRAMM-GRAL model system as described in Section 12.2.3 of the environmental impact statement. Parameters used in the configuration of the dispersion model (GRAL) are outlined in sections 8.3 and 8.4.1 of Appendix H (Technical working paper: Air quality) and include factors such as traffic and ventilation outlet emissions, number of particles released per second and surface roughness. The concentration of an air pollutant at a sensitive receiver location is not dependent on the population at that location, and is therefore not considered in the dispersion model.

Appendix I (Technical working paper: Health impact assessment) combines the air quality assessment information with the highest resolution population data from the Australian Bureau of Statistics to calculate key health indicators that reflect varying population density across the dispersion model domain.

#### **C11.1.7 Concern regarding sensitive receivers selected for operational assessment**

##### ***Issue raised***

Submitters raised concerns about sensitive receivers selected for the operational air quality assessment. Specific queries and concerns included:

- Concerns that the operational air quality assessment is based on unsuitable receiver locations that do not represent a typical height property or representative and worst case locations
- Queries why a receiver near the intersection of Woodland Street and White Street at Balgowlah is identified as a 'top 10' residential, workplace and recreational receiver in Figure 8-14 of Appendix H (Technical working paper: Air quality), when in Figure J-33 of Annexure J of Appendix H, the same property appears to be unaffected by ventilation outlet emissions
- Concerns about the consistency and adequacy of figures provided in Appendix H (Technical working paper: Air quality), including that the top 10 receiver sites at Balgowlah include sites that are well outside the contour diagram
- Concerns about the scales used in the air quality figures and that they are inconsistent between figures and may represent a false view.

##### ***Response***

The scenarios modelled for the operational air quality assessment address the Secretary's environmental assessment requirements to assess worst case scenarios for in-tunnel and ambient air quality, including a range of ventilation and traffic scenarios, including worst case design maximum traffic flow (variable speed) and the worst case vehicle breakdown scenarios. The seven expected traffic scenarios modelled are outlined in Table 12-2 of the environmental impact statement. The regulatory worst case scenario, discussed in Section 6.4.3 of Appendix H (Technical working paper: Air quality), was also modelled to present the maximum theoretical increase in ambient air quality due to the ventilation outlets operating continuously at the proposed emissions limits for all 8760 hours of the year. The regulatory worst case therefore represents a theoretical upper bound that would never occur for periods longer than a few hours.

The GRAL model was used to calculate predicted air pollutant concentrations and changes in pollutant concentrations at 42 community receiver and 35,484 residential, workplace and recreational receiver locations along the project corridor, including in the areas surrounding the ventilation outlets. The model was also configured to provide predictions for a Cartesian grid of points with an equal spacing of 10 metres in both the horizontal and vertical directions across the entire model domain, resulting in a total number of points in the grid of about 1.9 million. Contour plots showing concentrations and changes in concentration are provided in Section 8.4.5 of

Appendix H (Technical working paper: Air quality). This combination of receivers provides very detailed coverage for predictions that are representative across the area.

The predicted pollutant concentrations were presented as the total pollutant concentration from all contributions (background, surface roads, portals and ventilation outlets), the change in the total pollutant concentration with the project, as well as the pollutant contribution from the ventilation outlets alone. Pollutant concentrations were provided for discrete receiver locations, across the entire GRAL modelling domain (as contour plots) and in the vicinity of the project ventilation outlets (as contour plots). Although the main emphasis in the assessment was on ground-level concentrations (as specified in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016), the assessment also predicted pollutant concentrations at different elevations (10 metres, 20 metres, 30 metres and 45 metres above ground level), to consider impacts at receivers in existing and future multi-storey buildings.

The air quality assessment in Appendix H (Technical working paper: Air quality) identifies the 10 residential, workplace and recreational receivers that would experience the worst air quality for each of several different scenarios. The 'top 10' receivers shown in Figure 8-14 of Appendix H (Technical working paper: Air quality) are the 10 receivers with the largest ventilation outlet contributions to 1-hour NO<sub>x</sub> levels for the regulatory worst case scenario, while Figure J-33 in Annexure J of Appendix H (Technical working paper: Air quality) relates to 1-hour NO<sub>x</sub> levels in an expected traffic scenario. These two figures are not directly comparable as they relate to different traffic scenarios. Some receivers that would be affected in the regulatory worst case scenario would not be affected in certain traffic scenarios.

#### Concerns about the consistency and adequacy of figures

The model was also run to determine where the highest, worst case impacts would be in the vicinity of each ventilation outlet. These results are presented in Section 8.4.8 of Appendix H (Technical working paper: air quality) for the regulatory worst case scenario. As noted throughout the assessment, the main source of pollution (apart from existing background levels) is from surface traffic, and so it is not unexpected that the top 10 receivers do not always congregate around the outlets.

The situation is different for elevated receivers as the modelling is of worst case emissions from the outlets only at receivers within 300 metres of each outlet. Figures for ground level and elevated receivers will therefore differ.

As noted in Section C11.1.1 above, the scales used for the different pollutant concentrations in the contour plots vary based on the metric being mapped.

#### **C11.1.8 Operational air quality assessment policy and standards**

##### ***Issue raised***

Submitters queried the policies and standards referred to in the operational air quality assessment methodology. Specific concerns and recommendations included:

- Concerns that the air quality assessment does not consider international air quality studies
- Concerns that the *National Environment Protection (Ambient Air Quality) Measure* (abbreviated as AAQ NEPM in Appendix H (Technical working paper: Air quality)) (NEPC, 2016) goal for the annual mean PM<sub>2.5</sub> is being reduced to seven µg/m<sup>3</sup> from 2025 and the ventilation outlet emissions are unlikely to meet this standard on opening

- Recommendations that the soon to be revised NO<sub>2</sub> standards for the *National Environment Protection (Ambient Air Quality) Measure* (NEPC, 2016) be applied to the project to re-assess the potential air quality impacts of the proposal.

### **Response**

#### International air quality studies

The air quality assessment has been carried out in accordance with relevant, best practice Australian and international guidelines. Key documents, guidelines and policies considered for the air quality assessment are outlined in Section 6.2 of Appendix H (Technical working paper: Air quality) and include guidance from recognised international organisations such as the World Road Association (Permanent International Association of Road Congress), New Zealand Ministry for the Environment and the World Health Organisation. Specific guidance has also been adopted from literature in the Australian context where appropriate.

It is also noted that the Office of the Chief Scientist and Engineer engaged Åke Sjödin from the Air Pollution and Abatement Strategies Unit at the IVL Swedish Environmental Research Institute to work with Ian Longley, Air Quality Scientist from the New Zealand National Institute of Water & Atmospheric Research, to review the air quality assessment of the project on behalf of the Advisory Committee on Tunnel Air Quality.

#### National Environment Protection (Ambient Air Quality) Measure

##### *PM<sub>2.5</sub> 2025 goals*

It is acknowledged that the *National Environment Protection (Ambient Air Quality) Measure* (NEPC, 2016) has set 2025 goals for PM<sub>2.5</sub> and that background air quality is predicted to be close to or above these goals irrespective of the operation of the project. Predicted changes due to the project's ventilation outlets would have very little impact on existing ambient concentrations. Discussion of changes in PM<sub>2.5</sub> relative to the NSW assessment criterion and the long term *National Environment Protection (Ambient Air Quality) Measure* goal is provided in Section 8.4.4 of Appendix H (Technical working paper: Air quality).

##### *NO<sub>2</sub> standards*

The maximum 1-hour and annual mean NO<sub>2</sub> standards of 246 µg/m<sup>3</sup> and 62 µg/m<sup>3</sup> (respectively) used in the air quality assessment were set by the NSW Environment Protection Authority in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016). The NO<sub>2</sub> criteria in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* is based on *National Environment Protection (Ambient Air Quality) Measure* standards adopted in 1998.

The latest review of the *National Environment Protection (Ambient Air Quality) Measure*, published in 2019, recommends an initial move to maximum 1-hour and annual mean NO<sub>2</sub> standards of 185 µg/m<sup>3</sup> and 39 µg/m<sup>3</sup> respectively, and then to 164 µg/m<sup>3</sup> and 31 µg/m<sup>3</sup> (respectively) by 2025. Since the air quality assessment commenced in 2017, the NO<sub>2</sub> criteria applied to the project are considered appropriate, as it was the recommended criteria at the time the assessment was commenced.

Very few sensitive receivers showed exceedances of either the annual average or 1-hour proposed NO<sub>2</sub> standards, and those that did were as a result of emissions from surface roads and not the ventilation outlets. Almost all of the residential, workplace and recreational receivers would remain below 31 µg/m<sup>3</sup> for the 2037 'Do something cumulative' scenario shown in Figure 8-27 of

Appendix H (Technical working paper: Air quality). The very few that are predicted to exceed do not exceed by much, and only then due to the contributions from surface roads.

For the 2037 'Do something cumulative' scenario, there are only three residential, workplace and recreational receivers with annual mean NO<sub>2</sub> predictions greater than 31 µg/m<sup>3</sup>, whereas for the 2037 'Do minimum' scenario (without the project), 26 residential, workplace and recreational receivers are predicted to have annual mean NO<sub>2</sub> predictions greater than 31 µg/m<sup>3</sup>. For the 2037 'Do something cumulative' scenario, the highest annual mean NO<sub>2</sub> prediction is estimated to be about 33.8 µg/m<sup>3</sup>, whereas for the 2037 'Do minimum' scenario (without the project), the highest annual mean NO<sub>2</sub> prediction is estimated to be 39.4 µg/m<sup>3</sup>.

### **C11.1.9 Request for further construction air quality assessment**

#### ***Issue raised***

Submitters requested that further assessment of construction air quality impacts be completed with a dust screening assessment which includes consultation with the community, and considers impacts on local, native and endangered flora and fauna.

#### ***Response***

A dust screening assessment was completed during the development of the environmental impact statement, with the assessment process described in Section 12.2.2 and Figure 12-1 of the environmental impact statement. Whilst the dust screening assessment did not involve consultation with potentially impacted sensitive receivers, the project would proactively engage with the community to help minimise the impact of project construction work in accordance with the community communication strategy as discussed in Appendix E (Community consultation framework) and required by environmental management measure SE3 (refer to Table D2-1 of this submissions report). The risk of dust settlement impacts, human health impacts and ecological impacts (without mitigation) from works within the five surface construction zones assessed is provided in Table 12-9 of the environmental impact statement. Without mitigation, the majority of the construction footprint is considered to be of high or medium risk for dust impacts, including from track-out activities.

Dust generated as a result of construction works is unlikely to represent a serious ongoing problem, as discussed in Section C11.2.1 below. Standard construction air quality measures to minimise dust impacts are required to be implemented by revised environmental management measure AQ1, including the implementation of dust suppression measures, stabilisation of exposed areas or stockpiles and measures to minimise dust generation during the transfer, handling and on site storage of spoil and construction materials (refer to Table D2-1 of this submissions report). Dust and air quality complaints will be managed in accordance with the overarching complaints handling process for the project as required by environmental management measure AQ3 (refer to Table D2-1 of this submissions report). All complaints would be investigated and appropriate corrective actions, if required, will be taken to reduce emissions in a timely manner.

## C11.2 Air quality impacts during construction

### C11.2.1 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 concerns, requests and recommendations included:

- Recommendations that surface construction works be designed to minimise potential air quality impacts
- Requests that the project not increase current air pollution levels during construction
- Concerns about the potential dust impacts from stockpiling outside of acoustic sheds
- Concerns that people would be forced to keep windows and doors closed to keep dust out during construction
- Concerns that dust impacts would create a burden for schools, residences and businesses to clean buildings, equipment, windows and play areas
- Concerns that potentially unacceptable high levels of dust and air pollutants would impact local communities, motorists, construction staff and wildlife during the entire construction period
- Concerns that the prevailing southerly winds would blow dust and contaminants into properties at Northbridge
- Concerns about air quality impacts during construction from toxic waste handling and storage.

#### ***Response***

Potential air quality impacts during construction of the project are assessed in Section 12.5 of the environmental impact statement and include consideration of:

- Dust generated at construction sites and temporary construction support sites
- Emissions from vehicles, plant and equipment used on construction sites and temporary construction support sites (refer to Section C11.2.2 below for further detail)
- Emissions during blasting
- Odour generated during handling and management of harbour sediments and material excavated from the former landfill site at the Flat Rock Drive construction support site (BL2).

As noted in Section C11.1.9 above, the risk of dust settlement impacts, human health impacts and ecological impacts were assessed without mitigation in Table 12-9 of the environmental impact statement. The project has been designed and the construction methodology has been developed with an appreciation of measures adopted on recent major infrastructure projects in Sydney to minimise potential air quality impacts including via stockpiling tunnel spoil within acoustic sheds and other environmental management measures outlined in Table D2-1 of this submissions report.

Stockpiling tunnel spoil within acoustic sheds would greatly reduce the potential for dust impacts to nearby sensitive receivers. Other earthworks, such as those required for establishing temporary construction support sites, carrying out surface road works, and excavation of cut and cover and trough structures may require the stockpiling of spoil on site. In addition, concrete batch plant stockpiles and pavement material stockpiles would also be required at various locations. Although these non-tunnel related material stockpiles would be located outside of acoustic sheds, they will be stabilised in accordance with revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report), and represent only a fraction of the total spoil quantities

generated for the project. Several of the temporary construction support sites that would require stockpiling of material outside of acoustic sheds are located away from residential receivers or within industrial areas which would further minimise potential amenity impacts.

Controlled underground blasting also would not result in direct emissions to the external air, as discussed in Section 12.5.3 of the environmental impact statement. The potential for impacts to sensitive receivers due to dust from surface-based blasting would depend on the location where the blasting is proposed, the blasting approach, and whether there are any sensitive receivers in the vicinity that could be impacted. Emissions to air from any blasting required at the Wakehurst Parkway would be managed to ensure safe working conditions for workers and minimise potential impacts to sensitive receivers in the vicinity.

Details on the likely contamination characteristics of spoil which would be excavated by the project and how contaminated spoil would be managed are provided in sections 16.3.5, 16.4.3 and 24.3.3 of the environmental impact statement. Wastes, including contaminated spoil, will be appropriately stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment, in accordance with revised environmental management measure WM4 (refer to Table D2-1 of this submissions report). Stockpiling requirements would be included within the construction soil and water management plan and would be in accordance with the requirements of the *Protection of the Environment Operations Act 1997* and the Protection of the Environment Operations (Waste) Regulation 2014 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.

Transport for NSW understands the importance of managing air quality during construction. Air quality impacts during construction would likely be localised, temporary and of relatively short duration, depending on the works taking place at the particular location and time. The project would seek to prevent air quality impacts through the implementation of best management practices routinely used on construction sites. Environmental management measures outlined in Table D2-1 of this submissions report will be implemented to minimise impacts and are considered sufficient to mitigate the effects of construction work on local air quality and the community and environment. These measures include adjusting or managing dust generating activities during unfavourable weather conditions, such as windy conditions, where appropriate. A construction environmental management plan would also be prepared for the project which would include an air quality management plan containing specific management measures and procedures to minimise dust generation. Dust and air quality complaints will be managed in accordance with the overarching complaints handling process for the project outlined in Section 3 of Appendix E (Community consultation framework), as required by environmental management measure AQ3 in Table D2-1 of this submissions report. All complaints will be investigated and appropriate corrective actions, if required, will be taken to reduce emissions in a timely manner.

However, even with rigorous air quality management measures in place, it is not possible to guarantee the dust environmental management measures implemented would be wholly effective all the time, as acknowledged in Section 12.5.1 of the environmental impact statement. There is still a 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.

### **C11.2.2 Air quality impacts from construction vehicles**

#### ***Issue raised***

Submitters expressed concern regarding air quality impacts from construction vehicles. Specific concerns and queries raised included:

- Concerns that the potential air quality impacts from construction worker and heavy vehicle traffic have not been adequately assessed
- Concerns about the potential air quality impacts of diesel and dust emissions from trucks idling, marshalling and transporting excavated spoil 24 hours a day, seven days a week during the entire construction period
- Questions how emissions generated by construction vehicles would be managed.

#### ***Response***

Potential air quality impacts from the use of construction vehicles are assessed in Section 12.5.2 of the environmental impact statement. The use of construction vehicles is expected to only result in localised minor increases in concentrations of airborne particulate matter, CO, NO<sub>x</sub>, sulfur dioxide (SO<sub>2</sub>) and volatile organic compounds (VOC).

Construction activities with the potential to generate emissions would be localised, temporary and of relatively short duration, depending on the works taking place at the particular location and time. As a result, any potentially impacted areas are not likely to experience continued impacts for the entire duration of construction.

A construction environmental management plan would be prepared for the project which would include an air quality management plan containing specific environmental management measures and procedures to minimise vehicle emissions. These measures would include:

- Proactively encouraging usage of public transport for workers and providing shuttle buses from public transport hubs where appropriate (refer to revised environmental management measure CTT11 in Table D2-1 of this submissions report)
- Minimising the queueing of trucks near construction support sites and access points to construction sites (refer to revised environmental management measure CTT13 in Table D2-1 of this submissions report).

To further mitigate impacts, the environmental management measure AQ1 (refer to Table D2-1 of this submissions report), has been amended to require the regular maintenance of construction vehicles and plant to ensure compliance with relevant emissions standards.

### **C11.2.3 Odour impacts during construction**

#### ***Issue raised***

Submitters identified concerns about impacts from odour during construction. Specific concerns and comments included:

- Concerns that the air quality assessment does not address the impacts of potential odour release during dredging activities at Middle Harbour on users of Middle Harbour, Clive Park beach and the surrounding foreshore
- Concerns that detailed investigations have not been carried out to confirm the presence and extent of potentially odorous materials and landfill gases within the project footprint at the Flat Rock Drive construction support site (BL2)



- It is unclear how the potential release of odour at the proposed Flat Rock Drive construction support site (BL2) would be addressed.

### ***Response***

#### **Middle Harbour dredged sediments**

The potential release of odour during dredging in Middle Harbour is discussed in Section 12.5.4 of the environmental impact statement and Section 5 (Treatment and loadout of dredged and excavated material not suitable for offshore disposal) of the preferred infrastructure report.

About 163,000 cubic metres of soft soil, sediments and rock would need to be removed from Middle Harbour during the dredging activities required for the installation of the immersed tube tunnels and associated transition structures. Dredged and excavated materials suitable for offshore disposal would be transported from Middle Harbour on split hopper barges and disposed of at a designated offshore disposal site (in accordance with legislative requirements). It is expected that about 12,000 cubic metres of sediment from the top 0-1.0 metre of the bed of the harbour may not be suitable for offshore disposal. These materials would be loaded onto hopper barges and transported to a land-based load-out facility, for transport by truck to land disposal at a licensed facility. Since public exhibition of the environmental impact statement, Transport for NSW has prepared a preferred infrastructure report which includes a description of the method for treating contaminated sediments from dredging and the identification of the associated load-out facility. The temporary load-out facility would be located within the Port of Newcastle and would be known as the Port of Newcastle construction support site (BL15), as shown in Figure 5-5 of the preferred infrastructure report.

During dredging and excavation of estuarine and marine sediments in Middle Harbour, the dredged material would be treated within the barge to make the material spadable (a consistency which allows the material to be spaded or shovelled). As part of this process, additives such as lime or absorbent polymers would be mixed into the material to assist in mitigating potential odour and to neutralise acid sulfate soils. Odour impacts associated with excavation and dredging activities within Middle Harbour have been assessed in Section 12.5.4 of the environmental impact statement. Further assessment of odour during treatment of this material at Middle Harbour has found odour impacts would be consistent with those assessed in the environmental impact statement (refer to Section 5.7 of the preferred infrastructure report).

Once the dredged material has been treated, the barges would transport the treated material to the Port of Newcastle construction support site (BL15), from where it would be loaded into sealed and covered trucks for transport to a suitably licensed waste facility. Material would remain in the barge until loadout into trucks and it is anticipated that stockpiling at the temporary construction support site would not be required.

#### **Potential odour and landfill gas at the Flat Rock Drive construction support site (BL2)**

The potential for odour and landfill gas release during excavations at the former landfill site at the Flat Rock Drive construction support site (BL2) is considered to be low. However, further site investigations will be carried out during the detailed design and construction planning phase to determine the potential to encounter odorous gases or materials during the proposed excavations at the Flat Rock Drive construction support site (BL2) and the need for any site-specific management measures (refer to environmental management measures SG15 and AQ2 in Table D2-1 of this submissions report).

Ground gas investigations will be carried out in accordance (where applicable) with the *Assessment and management of hazardous ground gases: Contaminated land guidelines* (NSW EPA, 2020b) (where applicable). If the investigations indicate that there is potential for odorous materials to be

uncovered or odorous gases to be released, the potential for off-site impacts (informed by meteorological studies and modelling as required) will be investigated. If unacceptable off-site impacts are predicted, appropriate mitigation and management measures will be identified to minimise potential impacts, with consideration of the investigation results, proposed site activities and meteorological conditions, and the identified measures will be implemented during relevant site activities. Odour monitoring will be carried out during relevant site activities and mitigation and management measures adjusted as required to minimise potential off-site impacts.

Any areas of exposed material at the Flat Rock Drive construction support site (BL2) that have the potential to generate odour will be kept to a minimum during site establishment works and while the area is uncovered, in accordance with revised environmental management measure AQ4 in Table D2-1 of this submissions report. If odorous areas are to remain uncovered at the end of the work shift, temporary cover or other suitable measures to minimise odour emissions will be implemented.

## **C11.3 Construction air quality environmental management measures**

### **C11.3.1 Adequacy of construction air quality environmental management measures**

#### ***Issue raised***

Submitters raised concerns about the adequacy of environmental management measures proposed to manage construction air quality impacts and requested further details. Specific queries, requests and concerns included:

- Questions about how the air quality environmental management measures would be developed and requests for more information on the measurement, monitoring, management and mitigation of impacts including details about complaint mechanisms
- Concerns that the proposed environmental management measures for construction air quality impacts provide minimal detail, are inadequate and would be ineffective
- Requests that an occupational health and safety specialist and the community be consulted on the appropriate environmental management measures to be applied throughout the construction period
- Concerns that potential dust impacts resulting from track-out activities would not be adequately controlled by the proposed environmental management measures.

#### ***Response***

Best practice air quality environmental management measures would be detailed prior to construction in the air quality management plan, prepared as a sub-plan to the construction environmental management plan for the project (refer to Section 28.5.1 of the environmental impact statement). The air quality management plan would also include construction air quality monitoring and inspection requirements and compliance records, as detailed in Table D1-1 of this submissions report. It is crucial for the plan to be developed post-engagement of the contractor/s to ensure it is specific to their design and construction methodology. The construction environmental management plan would be reviewed and approved by Transport for NSW and the Department of Planning, Industry and Environment, prior to the commencement of main construction work. The air quality management plan would also be supplemented by the requirements of the environment protection licence issued for the project and, should the project be approved, conditions of approval set by the Department of Planning, Industry and Environment.

Standard construction air quality measures are considered to be sufficient to minimise dust impacts, including from track-out activities, and are outlined in revised environmental management measure AQ1 in Table D2-1 of this submissions report. This environmental management measure includes

site inspections to monitor the effectiveness of implemented measures and adjusting or managing dust generating activities during unfavourable weather conditions where appropriate.

Transport for NSW aims to engage in an open, proactive and transparent community engagement and consultation process prior to and during construction of the project. Appendix E (Community consultation framework) provides the framework to engage and consult with the community on the project and to receive and respond to feedback during project delivery, in accordance with environmental management measure SE3 in Table D2-1 of this submissions report. Should the project be approved, Appendix E (Community consultation framework) would be developed into a community communication strategy. The community communication strategy would describe in detail the Transport for NSW's liaison and engagement process with stakeholders, and consultation activities for the project development and delivery.

Dust and air quality complaints will be managed in accordance with the overarching complaints handling process for the project outlined in Section 3 of Appendix E (Community consultation framework), as required by environmental management measure AQ3 in Table D2-1 of this submissions report. All complaints will be investigated and appropriate corrective actions, if required, will be taken to reduce emissions in a timely manner.

### **C11.3.2 Recommended additional environmental management measures**

#### ***Issue raised***

Submitters requested and recommended the inclusion of a number of additional environmental management measures to manage potential dust impacts during construction. Specific queries, requests, suggestions and recommendations included:

- Questions whether warnings would be issued or work stopped when air quality criteria are exceeded or during adverse weather conditions that would exacerbate air quality impacts
- Suggestions for dust suppression, including the use of water tanks and/or carts, covering and/or hosing down of construction vehicles, sprinklers, site exit controls and stabilisation of exposed areas and stockpiles
- Requests for dust fencing around the Flat Rock Drive construction support site (BL2) to minimise dust impacts on local residents
- Requests for properties near construction sites to be offered fans/air conditioning, including the installation of high capacity dust filtration units, and the upgrade of indoor halls (to accommodate student recreation if air quality during construction is poor)
- Requests for the cleaning of properties affected by dust generated by construction and questions whether alternative accommodation would be provided
- Requests that spoil not be stockpiled outside the acoustic shed at any time and that contaminated spoil be removed immediately from construction sites
- Recommendations that the project use hydrogen or electric heavy vehicles or that heavy vehicles be fitted with pollution control devices to minimise air quality impacts
- Requests that construction vehicles not be allowed to idle on residential streets or idle while marshalling
- Requests that environmental management measures be detailed in the construction environmental management plan and regularly reviewed/monitored by a working group which includes representatives from schools near the temporary construction support sites
- Requests for specific conditions of approval to mitigate construction dust impacts and that suitable deterrent penalties be applied when construction air quality criteria are exceeded.

### ***Response***

Best practice construction air quality environmental management measures would be detailed prior to construction in the air quality management plan, the preparation of which is addressed in Section C11.3.1 above.

#### **Dust management measures**

As noted above, standard construction air quality measures would be implemented to minimise dust impacts, as required by revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report). These standard measures include:

- Dust suppression and/or management measures, including the use of water tanks and/or carts, sprinklers, site exit controls (eg wheel washing systems and rumble grids), stabilisation of exposed areas or stockpiles, and surface treatments where appropriate
- Selection of construction equipment and/or materials handling techniques that minimise the potential for dust generation
- Management measures to minimise dust generation during the transfer, handling and on site storage of spoil and construction materials (such as sand, aggregates or fine materials) (eg the covering of vehicle loads)
- Adjustment or management of dust generating activities during unfavourable weather conditions, where appropriate
- Minimisation of exposed areas during construction
- Internal project communication protocols to ensure dust-generating activities in the same area are coordinated and mitigated to manage cumulative dust impacts of the project
- Site inspections to monitor the effectiveness of implemented measures and identify any additional measures to be implemented
- Regular maintenance of construction vehicles and plant to ensure compliance with relevant emissions standards.

These measures are considered appropriate to manage dust impacts and the cleaning of properties, installation of dust fencing, the provision of fans, air conditioning or air filtration systems, building upgrades and provision of alternative accommodation are not considered necessary to further mitigate the predicted impacts.

#### **Spoil management measures**

The management of spoil and dredged and excavated materials during construction is addressed in sections C11.2.1 and C11.2.3 above. The design of the project and preferred construction methodology has taken into consideration the waste hierarchy of the *Waste Avoidance and Resource Recovery Act 2001*, by aiming to reduce the volume of excess spoil generated and maximising the reuse of spoil, as far as practical (refer to environmental management measures WM2 and WM5 in Table D2-1 of this submissions report). The volume of spoil to be stored outside of acoustic sheds is a small fraction of the spoil quantities which would be stored either underground or within the acoustic sheds, as described in Section C11.2.1 above. Stockpiles would only be needed where the material is not able to be immediately loaded directly into trucks for removal and would be stabilised in accordance with revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report).

### Construction vehicle emission management measures

Management of air quality associated with construction vehicles and plant is addressed in Section C11.2.2 above, including an amendment to environmental management measure AQ1 (refer to Table D2-1 of this submissions report), which requires the regular maintenance of construction vehicles and plant to ensure compliance with relevant emission standards. The type of vehicles, plant and machinery used at construction ancillary facilities would be confirmed during detailed construction planning and subject to engagement of the construction contractor/s.

### Other management measures

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

Transport for NSW would ensure that compliance with environmental management measures and conditions of approval is monitored, including through independent environmental auditing. The Department of Planning, Industry and Environment compliance team carry out inspections to ensure projects approved by the Minister (or their 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.

Where 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. 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 any non-compliance.

### **C11.3.3 Monitoring of air quality during construction**

#### ***Issue raised***

Submitters raised the following concerns and requests about construction air quality monitoring:

- Concerns that the project has not proposed real time and continuous monitoring of air quality during construction and requests that air quality monitoring results be made publicly available
- Requests for conditions of approval for the project to include real-time, independent and transparent monitoring of air quality 24 hours a day, seven days a week at temporary construction support sites and at schools, pre-schools, hospitals, aged care facilities, recreational areas and sportsgrounds near the construction sites before and during construction.

#### ***Response***

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

Air quality impacts during construction works would likely be localised, temporary and of relatively short duration, depending on the works taking place at the particular location and time. Throughout all construction works, the project would aim to prevent air quality impacts through the implementation of best management practices routinely used on construction sites. Environmental management measures outlined in Table D2-1 of this submissions report would be implemented to minimise impacts and are discussed further in Section C11.3.2 above. These environmental management measures are considered appropriate to mitigate the effects of construction work on local air quality and the community and environment.

Details of air quality monitoring to be carried out during construction would be included in the air quality management plan, as detailed in Table D1-1 of this submissions report.

## **C11.4 Air quality impacts during operation**

### **C11.4.1 General air quality impacts**

#### ***Issue raised***

Submitters expressed their concerns and disagreement with the project due to the emissions that may impact air quality for the community, including residents, schools, aged care facilities, sports grounds and other community receivers. Specific queries, concerns and comments included:

- Questions why ventilation outlets are required if emissions from the outlets would be insignificant
- Concerns that air quality risks are increased by the overall length of the tunnel, the low number of ventilation outlets and that the ventilation system would concentrate and trap emissions which are currently dispersed
- The project should aim to improve existing air quality rather than contribute to and exacerbate existing air pollution
- Requests for information about the predicted CO concentrations at CR35 and at north Kirkwood Street
- Concerns about the potential impacts on air quality of removing a large number of mature native trees and recommendations for noise walls to be 'green walls' to improve air quality
- Concerns that tall buildings within the vicinity of the ventilation outlets would obstruct the dispersal of emissions and subject residents to poorer air quality, yet the air quality assessment states that air quality in these areas would be unaffected. Concerns that this would have implication on height restrictions on new residential developments near the ventilation outlets
- Concerns that the potential impacts of an emergency, involving the release of smoke or toxic air pollutants in the tunnel, and potential air quality impacts on surrounding receivers in such an event have not been assessed.

#### ***Response***

##### **Need for ventilation outlets**

Tunnel ventilation systems are required to continuously, reliably and efficiently provide a safe environment for tunnel users and communities surrounding the infrastructure, as discussed in Section 4.5.6 of the environmental impact statement. The basic objectives of tunnel ventilation systems are to:

- Maintain in-tunnel air quality
- Avoid emissions from the tunnel portals
- Manage smoke during fire incidents.

Without the assistance of mechanical ventilation, vehicle emissions can build up within the tunnels, leading to unacceptable in-tunnel air quality under some traffic scenarios. Also, without the use of ventilation outlets, traffic emissions from within the tunnel would be discharged at ground level at the tunnel portals. The use of ventilation outlets in combination with mechanical ventilation ensures that concentrated vehicle emissions from within the tunnel are dispersed effectively into the atmosphere to ensure compliance with ambient air quality criteria.

### Air quality risks and impacts

The project has been designed in such a way to manage the emissions of traffic using the tunnel to ensure compliance with relevant in-tunnel air quality standards and guidelines. All emissions from the tunnel would be via the ventilation outlets which exhaust the tunnel air at a suitable height to aid the dispersion of pollutants so the contribution is negligible at receivers.

The predicted contribution of the ventilation outlets to overall air quality concentrations is negligible for all receivers in all of the expected traffic scenarios with the project, as discussed in Section 12.6.2 of the environmental impact statement. This includes the 'Do something cumulative 2037' scenario that considered the simultaneous operation of Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, New M4 (previously M4 East), M8 Motorway (previously New M5), M4-M5 Link, Sydney Gateway and M6 Motorway, as identified in Table 12-2 of the environmental impact statement. Potential health impacts associated with changes in air quality (specifically NO<sub>2</sub> and particulates) within the local community have been assessed and are considered to be acceptable to those who reside, work or play immediately adjacent to road corridors and ventilation outlets (refer to Section 13.5.1 of the environmental impact statement). Emissions from the project's ventilation outlets are therefore not expected to result in any significant long term impacts on air quality in the areas surrounding the project or further away.

The ventilation system would be automatically controlled using real-time air velocity and air quality sensor data to ensure that in-tunnel conditions are managed effectively to comply with air quality criteria. Further, specific ventilation modes would be developed to manage breakdown, congested and emergency situations.

Emissions from the ventilation outlets and potential changes to air quality concentrations associated with changes to surface traffic volumes are addressed in sections C11.1.2 and C11.1.4 above.

### Spatial changes in air quality

Spatial changes in air quality are discussed in Section 12.6.3 of the environmental impact statement. Overall, there would be no marked redistribution of air quality impacts, and there would generally be a shift towards lower concentrations. Most notably, there would be no significant increase in pollutant concentration at receiver locations which already had high concentrations in the 'Do minimum' scenarios.

The spatial changes in air quality were assessed with respect to the annual mean PM<sub>2.5</sub> concentration, given its importance in terms of human health risks, however, the spatial changes would likely be similar for all pollutants.

The annual mean PM<sub>2.5</sub> concentration as a result of the project ('Do something 2027' scenario relative to the 'Do minimum 2027' scenario) is predicted to decrease along Military Road, Spit Road, Manly Road and Warringah Road. These reductions would be associated with reductions in surface traffic and would result in improved amenity along these built-up road corridors.

There would be increases in the PM<sub>2.5</sub> concentration along the Sydney Harbour Bridge and the Wakehurst Parkway. In the case of the Wakehurst Parkway, there would be a large increase in traffic (about 140 per cent) as a result of the project. However, the section of the Wakehurst Parkway that is affected passes through bushland, and there are no sensitive receivers close to the road. Predicted increases in pollutant concentrations along the Wakehurst Parkway are also limited to the road corridor and do not extend out to nearby receivers. There would be broadly similar changes in the 'Do something 2037' scenario.

For the 'Do something cumulative' scenarios, there would be some additional changes as a result of the Western Harbour Tunnel and Warringah Freeway Upgrade project, including reductions in the PM<sub>2.5</sub> concentration along the Western Distributor, Sydney Harbour Bridge and Warringah Freeway.

#### Predicted carbon monoxide (CO) levels

The predicted maximum 1-hour mean and the maximum rolling 8-hour mean CO concentrations at community receivers for all traffic scenarios, including the change relative to the 'Do minimum' scenario, are provided in Tables I-1 and I-8 of Annexure I of Appendix H (Technical working paper: Air quality). The CO concentrations at all of the community receiver locations are predicted to be well below the maximum 1-hour (30 mg/m<sup>3</sup>) and maximum rolling 8-hour mean (10 mg/m<sup>3</sup>) CO criteria.

#### Effects on air quality of tree removal

The design of the project has minimised tree removal in the project footprint as far as possible. If trees are to be impacted, they would be protected or pruned rather than removed where possible (refer to environmental management measures V9 and V10 in Table D2-1 of this submissions report).

A review of research on the effectiveness of vegetation in reducing air pollution was carried out as part of the *Economic Analysis to Inform the National Plan for Clean Air (Particles)* (Boulter and Kalkarni, 2013). The review found that:

- 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<sub>2.5</sub> and PM<sub>10</sub>
- 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, for example eucalyptus species, is a source of volatile organic compounds due to the oils in the leaves. Volatile organic compounds are a regulated pollutant in Australia.

The conclusion of the review advised against the use of vegetation to reduce pollution concentrations in built-up areas at short distances from busy roads. The project has been designed with consideration of this research.

#### Elevated receivers

Changes in ambient air quality at elevated receivers was assessed in Section 12.6.4 of the environmental impact statement. The modelling predicted no exceedances at any modelled height for concentrations of annual average PM<sub>10</sub> and PM<sub>2.5</sub>, annual average and maximum 1-hour average NO<sub>2</sub> and air toxics. The assessment predicted some exceedances at heights above 30 metres within 300 metres of the project's ventilation outlets for the PM<sub>2.5</sub> and PM<sub>10</sub> maximum 24-hour average concentrations, which might impact any future buildings at these heights. This would not necessarily preclude such development and further consideration at rezoning or development application stage would be required.

The NSW Environment Protection Authority impact assessment criterion for maximum 24-hour average PM<sub>10</sub> is predicted to be exceeded at one elevated existing residential, workplace and recreational receiver during the regulatory worst case scenario, as discussed in Section 10.2.5 of Appendix H (Technical working paper: Air quality). The NSW Environment Protection Authority impact assessment criterion for maximum 24-hour average PM<sub>2.5</sub> is also predicted to be exceeded



at this same receiver during the regulatory worst case scenario. Transport for NSW carried out additional modelling for this receiver which shows the exceedances of maximum 24 hour average PM<sub>10</sub> and maximum 24 hour average PM<sub>2.5</sub> are due to elevated background concentrations; it is clear that the contribution from the ventilation outlets is not the cause of the exceedance (refer to Section B1.5.4 of this submissions report for further discussion).

Transport for NSW will provide data to Northern Beaches Council, North Sydney Council, Willoughby City Council and the Department of Planning, Industry and Environment (as appropriate), detailing pollution concentrations at various heights and distances from the ventilation outlets to facilitate the planning of and assessment of new development in areas within a distance of 300 metres around the ventilation outlets which would be within a potential three-dimensional zone of affectation (buffer volume), in accordance with revised environmental management measure LP7 (refer to Table D2-1 of this submissions report).

#### Emergency conditions in the tunnel

The potential impacts of an emergency involving the release of smoke or toxic air pollutants in the tunnel have not been modelled or assessed in the environmental impact statement since assumptions made regarding the incident, eg number of vehicles involved, intensity of the fire, duration of the event, combustion material etc, may not adequately represent any type of incident.

Project design provisions to minimise traffic incidents and accidents, and the management of fire or traffic incidents within the tunnel, are described in Section 23.3.3 of the environmental impact statement. The operation of the tunnel ventilation system to manage fire and smoke in such incidents is described in Section 5.2.7 of the environmental impact statement.

The tunnel ventilation system would be designed to manage fire and smoke in the event of an incident in the tunnels and to ensure in-tunnel air quality is protective of human health. Jet fans would be used to propel the smoke downstream, and away from the stopped vehicles, to the nearest ventilation outlet or tunnel 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. The ventilation system would also be designed to prevent smoke spreading to adjoining tunnels. Air would be discharged from each ventilation outlet to the atmosphere at velocities that would achieve effective dispersion of the tunnel air. While smoke is being extracted from the tunnel, air pollutant levels may temporarily exceed the relevant guidelines at nearby residential and community receivers. Any such incident has a low expected frequency of occurrence, and would have a relatively short duration.

#### **C11.4.2 Potential particulate matter impacts**

##### ***Issue raised***

Submitters raised concerns about potential particulate matter impacts that would result from the project. Specific concerns included:

- Concerns that the ventilation outlets at the Burnt Bridge Creek Deviation and Wakehurst Parkway would potentially emit double the maximum limit of particulates recommended by the World Health Organisation within a 1.2 kilometre radius of each ventilation outlet
- Concerns that the project assumes that a reduction in surface traffic would offset the potentially high PM<sub>2.5</sub> and PM<sub>10</sub> emissions from the proposed ventilation outlets
- Concerns about potential dust impacts during operation.

## **Response**

### Predicted PM<sub>10</sub> and PM<sub>2.5</sub> levels

Background air quality levels of PM<sub>10</sub> and PM<sub>2.5</sub> presented in Appendix H (Technical working paper: Air quality) were often close to or exceeded the annual mean criteria and the maximum 24-hour average criteria in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016). These elevated background levels would be present in the community regardless of the construction and operation of the project.

The air quality assessment predicted some exceedances of annual mean and maximum 24-hour average PM<sub>10</sub> and PM<sub>2.5</sub> criteria in the 'Do something' and 'Do something cumulative' scenarios. These exceedances were predicted due to elevated background concentrations which occur during extreme events such as dust storms, bushfires and hazard reduction burns. At the same time however, the total numbers of receivers with exceedances decreased slightly with the project and in the cumulative scenarios.

Although some of the predicted maximum 24-hour average PM<sub>2.5</sub> and PM<sub>10</sub> concentrations are almost double the National Environment Protection Council criteria and/or World Health Organisation guidelines, these large exceedances are attributed to very high background concentrations.

For example, the two highest maximum 24-hour average PM<sub>10</sub> background concentrations recorded in 2016 were 121 µg/m<sup>3</sup> and 126 µg/m<sup>3</sup>, recorded on consecutive days during a hazard reduction burn that affected much of Sydney in May. There were five other days in 2016 which also recorded levels greater than 50 µg/m<sup>3</sup> (the maximum 24-hour average National Environment Protection Council criterion). When excluding the effects of extreme events such as bushfires, dust storms and hazard reduction burns, there were very few and much smaller exceedances of the air quality criteria, which represents a more realistic scenario (for example, refer to Figure 8-51 and Figure 8-52 of Appendix H (Technical working paper: Air quality)).

Where increases or exceedances of the particulate matter criteria were predicted, the contribution from ventilation outlets to the overall pollutant concentrations is negligible for all receivers as documented in Section 12.6.2 of the environmental impact statement.

The health effects of these changes in PM<sub>10</sub> and PM<sub>2.5</sub> would not be measurable and the impacts are considered to be negligible, as discussed in Chapter 13 (Human health) of the environmental impact statement.

### Ventilation outlet emissions

The air quality assessment is based on a range of traffic scenarios that correspond with a level of pollutant emissions both within and external to the tunnel. The modelling of air quality and the ventilation system performance documented in the environmental impact statement demonstrates that for a range of traffic and emissions scenarios, the project is able to comply with the relevant air quality criteria and health guidelines.

To increase confidence in the modelling carried out, the air quality assessment considered a regulatory worst case scenario as discussed in Section 6.4.3 of Appendix H (Technical working paper: Air quality). The objective of this scenario is to present the maximum theoretical increase in ambient air quality due to the ventilation outlets operating continuously at the proposed emissions limits for all 8760 hours of the year. This is analogous to both the project and the Western Harbour Tunnel operating under vehicle breakdown scenarios continuously for a full year. The regulatory worst case therefore represents a theoretical upper bound that would never occur for periods longer than a few hours. Analysis of the regulatory worst case scenario predictions indicates that emissions

would not exceed the air quality criteria for the project or, where exceedances were predicted, that background concentrations were the primary cause of the exceedances.

In all of the expected traffic scenarios with the project, the predicted contribution of the ventilation outlets to overall pollutant concentrations is negligible for all receivers, as discussed in Section 12.6.2 of the environmental impact statement.

#### Dust impacts during operation

Following completion of the project, all disturbed areas would be rehabilitated and revegetated, therefore dust impacts are not expected during operation of the project.

### **C11.4.3 Impacts of topography and weather on air quality**

#### ***Issue raised***

Submitters raised concerns about the impact of topography and weather conditions on potential air quality impacts of the project. Specific concerns included:

- Concerns that the Sydney basin would trap air pollution from the tunnel during certain weather conditions, especially in suburbs near the ventilation outlets such as Balgowlah, Balgowlah Heights, Seaforth, Clontarf, North Balgowlah, Allambie Heights and Manly Vale
- Concerns that emissions from the ventilation outlet at Balgowlah would be trapped in the valley along Burnt Bridge Creek, as smoke was during the recent bushfires, and would impact residents of Balgowlah and Manly Vale
- Concerns that the proposed ventilation outlet at Balgowlah is at a low point in a valley and that the higher surrounding areas of Seaforth, Balgowlah and North Balgowlah would be impacted by outlet emissions, including the apartments at Stockland Balgowlah and residences in Ellery Parade at Seaforth, Woodbine Street at North Balgowlah and Maretimo Street at Balgowlah.

#### ***Response***

The effects of topography and meteorology have been considered in the modelling of air quality impacts, as discussed in Section C11.1.2 above, including the effects of the broader Sydney basin and more localised peaks and valleys. Terrain data is included in the GRAMM meteorological model as discussed in Section 5.2 of Appendix H (Technical working paper: Air quality) and Section C11.1.2 above. The potential ambient air quality impacts for the project are described in Section 12.6.2 of the environmental impact statement.

In all of the expected traffic scenarios with the project, the predicted contribution of the tunnel ventilation outlets to overall air quality concentrations is negligible for all receivers, including those surrounding the ventilation outlets as discussed in Section 12.6.2 of the environmental impact statement. For some short-term air quality metrics (1-hour NO<sub>2</sub>, 24-hour PM<sub>2.5</sub> and 24-hour PM<sub>10</sub>), exceedances of the criteria were predicted to occur both with and without the project. The predicted total concentrations of all criteria pollutants at receivers were usually dominated by the existing high background concentrations. Where exceedances are predicted, the total numbers of receivers with exceedances generally decreased slightly with the project and in the cumulative scenarios. Where increases in pollutant concentrations at receivers were predicted, these were mostly small. A very small proportion of receivers were predicted to have larger increases. However, it is likely that the predictions at these locations were overly conservative. The predicted contribution of tunnel ventilation outlets to pollutant concentrations is negligible for all receivers in all of the expected traffic scenarios.

Impacts on elevated receivers in apartment buildings are addressed in Section C11.4.1 above.

Based on the findings of the air quality assessment, the siting of the ventilation outlet at Balgowlah at a low point in a valley is therefore not considered to worsen air quality.

#### **C11.4.4 Potential for cumulative impacts from the project**

##### ***Issue raised***

Submitters raised concerns about potential cumulative air quality impacts of the project. Specific concerns include:

- Concerns about the potential cumulative air quality impacts for Seaforth and North Balgowlah residents that would be exposed to emissions from the ventilation outlets at the Wakehurst Parkway and Burnt Bridge Creek Deviation as well as traffic emissions from surface roads
- Concerns about the potential cumulative air quality impacts from ventilation outlet emissions during bushfires.

##### ***Response***

###### Cumulative impact of ventilation outlet and traffic emissions

The 'Do something' scenario assessed in the air quality assessment considers the cumulative impact of emissions from all of the project ventilation outlets and expected traffic on surface roads as a result of the project. A summary of the potential operational air quality impacts is presented in Section 12.6 of the environmental impact statement and is described in sections C11.4.1 and C11.4.2 above. In all of the expected traffic scenarios with the project, the predicted contribution of the ventilation outlets to overall pollutant concentrations is negligible for all receivers, as discussed in Section 12.6.2 of the environmental impact statement.

###### Changes in air quality due to bushfires

In all of the expected traffic scenarios with the project, the predicted contribution of the ventilation outlets to overall pollutant concentrations is negligible for all receivers, as discussed in Section 12.6.2 of the environmental impact statement.

Emissions from natural sources, such as bushfires, have substantially contributed to background particulate matter concentrations, as stated in Section 5.6 of Appendix H (Technical working paper: Air quality). 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 cumulative 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.

#### **C11.4.5 Ventilation outlet locations**

##### ***Issue raised***

Submitters raised concerns relating to the location of ventilation outlets for the project. Specific requests, comments and concerns included:

- It is difficult to see where the ventilation outlets are located in the figures of the environmental impact statement
- Requests that ventilation outlets be relocated as far away as possible from the proposed new and improved public open space and recreation facilities at Balgowlah, schools and residences and as close to tunnel exit portals as is possible to save cost and energy

- Requests that potential increases in local traffic congestion, and associated impacts on ambient air quality in the project area, be considered in the location of the ventilation outlets
- Concerns that the ventilation outlet at the Wakehurst Parkway would be located at the steepest section of the tunnel with increased emissions from trucks, freight and vehicles as they ascend through the tunnel
- Objections to the ventilation outlet at Balgowlah and requested for alternative options.

### ***Response***

Tunnel ventilation outlets are proposed near the tunnel portals at Warringah Freeway at Cammeray, Gore Hill Freeway at Artarmon, Burnt Bridge Creek Deviation at Balgowlah and the Wakehurst Parkway at Killarney Heights. The locations of the proposed ventilation outlets are indicated with a symbol and text in the following figures of the environmental impact statement:

- Warringah Freeway: Figure 5-1 of the environmental impact statement
- Gore Hill Freeway: Figure 5-2 of the environmental impact statement
- Burnt Bridge Creek Deviation: Figure 5-19 of the environmental impact statement
- Wakehurst Parkway: Figure 5-20 of the environmental impact statement.

The contribution of the ventilation outlets to air quality concentrations is negligible for the expected traffic scenarios and this outcome can be achieved when the outlets are located at nearly any location through appropriate design. Therefore, the main factors when considering locations for the ventilation facilities and outlets were maintaining in-tunnel air quality, maximising operational efficiency and minimising surface disturbance, as discussed in Section 4.5.6 of the environmental impact statement. In all instances, the ventilation outlets have been co-located with other motorway facilities to reduce their combined footprint, relative to siting each of the facilities separately.

The gradient of the tunnel at the Wakehurst Parkway tunnel portal is not relevant to the ventilation outlet's location.

The air quality assessment demonstrates that the ventilation outlets in the locations chosen would operate in a manner that would result in negligible to small contributions to the local air quality during expected traffic conditions at sensitive receivers, including the new and improved public open space and recreation facilities at Balgowlah, schools and residences. The assessment considered the cumulative effect of emissions from the tunnel ventilation outlets as well as emissions from traffic on surface roads.

### **C11.4.6 Ventilation system and outlet design**

#### ***Issue raised***

Submitters raised concerns relating to the design and operation of ventilation outlets for the project. Specific queries, requests and concerns included:

- Concerns that the project would not include filtration of ventilation outlet emissions which may result in potential short and long term air quality impacts
- Concerns that the justification for not having filtration in previous tunnel projects does not apply to the project since it is much longer and would carry more traffic than NorthConnex, New M4 (previously M4 East), M8 Motorway (previously New M5), M4-M5 Link and the Western Harbour Tunnel
- Concerns that the proposed ventilation outlets would be unfiltered in order to save money and a request that the cost of providing or retrofitting filters be provided with a cost-benefit analysis that considers the cost of potential health litigation/compensation cases

- Question if filtering the ventilation outlets would reduce PM<sub>2.5</sub> emissions to acceptable levels
- Requests that the project consider filtration of ventilation outlets to reduce the climate change impact of the project
- Concerns that there has not been adequate consideration of ventilation system options, including biofiltration, and a request that alternatives, including to ventilation outlets, be considered
- Requests that consideration be given to the construction of a transverse ventilation system, which is well suited to a long-distance, heavy traffic tunnel, as it involves the delivery of fresh air into the tunnel at multiple points along its distance
- Concerns that the ventilation outlets would concentrate air pollution from the tunnel in certain locations
- Requests that ventilation outlets be designed to ensure high vertical discharge velocities that are required to assist dispersion
- Concerns that there is a lack of contingency ventilation and exhaust air discharge strategies in the event that proposed ventilation systems fail.

### ***Response***

#### Feasibility of tunnel air treatment systems including filtration

Road tunnel filtration technologies, otherwise known as ‘air treatment systems’, are intended to manage in-tunnel and ambient air quality. An explanation of why filtration is not proposed at the ventilation outlets is provided in sections 4.5.6 and 12.7.2 of the environmental impact statement. No in-tunnel filtration system is proposed for the project because the air quality assessment in Appendix H (Technical working paper: Air quality) demonstrates that the ventilation system would be effective in ensuring compliance with both in-tunnel and ambient air quality criteria. The inclusion of tunnel filtration was evaluated and found not to provide any material benefit to air quality or community health.

Very few tunnels around the world (new or under construction) are equipped with air treatment systems, including filtration (ACTAQ, 2018c). There are about 60 such tunnels in existence and in almost all cases electrostatic particle filtration systems are used. Several tunnels that have been equipped with electrostatic filters have subsequently used them very little. There are five installations of de-nitrification systems to remove NO<sub>2</sub> but only two of these systems are in use. Evidence to date suggests that the effectiveness of such controls in road tunnels is limited to specific situations. A French Government review of international tunnel air treatment, updated in December 2016 ([www.cetu.developpement-durable.gouv.fr/IMG/pdf/cetu\\_di\\_traitement\\_de\\_l\\_air-en-19\\_07\\_2017.pdf](http://www.cetu.developpement-durable.gouv.fr/IMG/pdf/cetu_di_traitement_de_l_air-en-19_07_2017.pdf)) (Centre d’Etudes des Tunnels (CETU), 2016), stated:

“...recent tunnel projects often propose the use of air treatment systems in response to concerns expressed by local populations, who have reason to be worried about changes in their environment. Before turning to systems that may effectively provide an answer to a local pollution concern, conventional ventilation techniques (using fresh airflows to dilute pollutants) should still be considered by making use of the appropriate means, ie playing on the airflows and concentrations of the discarded vitiated air, as well as on the location and configuration of discharges and any other method likely to improve the dispersion of pollution and so protect the most at-risk areas.”

“...several tunnels that have been equipped with electrostatic filters have subsequently used them very little...”

This is consistent with the Victorian Minister for Planning's recent determination for the Westgate Tunnel project which stated:

"I am not persuaded that requiring immediate installation of filtration equipment in the tunnels' ventilation systems is justified or cost-effective, or will even deliver a measurably better outcome. Unless a better environmental outcome can be expected, requiring such a measure would be an expensive gesture, distracting both investment and attention from better, and better-targeted, measures."

The NSW Government routinely reviews international best practice on tunnel ventilation systems. However, Transport for NSW is not aware of any specific government policy, either in Australia or internationally, on filtration. In November 2018, the Advisory Committee on Tunnel Air Quality, chaired by the NSW Chief Scientist and Engineer, published a review of lessons learnt from other major road tunnel projects in NSW (ACTAQ, 2018b). The review found that emissions from well designed ventilation outlets have little, if any, impact on surrounding communities and, as such, there is little health benefit in installing filtration and air treatment systems.

There are several air treatment options for mitigating the effects of tunnel operation on both in-tunnel and ambient air quality including filtration, as discussed in Section 9.2.2 of Appendix H (Technical working paper: Air quality). Where in-tunnel treatment technologies have been applied to road tunnels, these technologies have focused on the management and treatment of particulates. The Advisory Committee on Tunnel Air Quality's review of options for treating road tunnel emissions (ACTAQ, 2018b) 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. In Australia, tunnel projects therefore generally implement the primary approach of dilution of air pollution through ventilation systems (PIARC, 2008; CETU, 2016).

The tunnels would not be designed to be retrofitted with air filters as filtration is not proposed.

#### Ventilation system alternatives and outlet design

Tunnel ventilation alternatives including natural ventilation, longitudinal ventilation and transverse ventilation were considered for application to the project as discussed in Section 4.5.6 of the environmental impact statement. A longitudinal ventilation system with elevated ventilation outlets was selected as the preferred option for the project.

The effectiveness of elevated ventilation outlets in dispersing emissions is well established. 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 (previously M4 East) and M8 Motorway (previously New M5) tunnels in NSW, Clem 7, AirportlinkM7 and Legacy Way in Queensland and Eastlink in Victoria which are all operational.

Transverse ventilation systems comprise fresh air inlets along the length of one side of a tunnel, with outlets on the opposite side. Transverse ventilation has been used in the past when vehicles produced greater levels of pollutants than they do today. A transverse ventilation system is more expensive to construct because of the additional ducts that need to be excavated for each tunnel. This type of system is less effective than a longitudinal system for controlling smoke in the tunnel in case of a fire. It is also more energy intensive as more power is consumed to manage air flows.

During normal operating conditions in the Beaches Link tunnel, air would be drawn in at the entry portals and forced through the tunnels by the movement of vehicles (the piston effect), with jet fans used to assist with the movement of tunnel air, to maintain acceptable in-tunnel air quality. This air is then exhausted through elevated ventilation outlets to maximise dispersion.

The project would only emit from the ventilation outlets during normal operation, portal emissions would therefore occur only in the case of an emergency (refer to Section 5.2.7 of the environmental impact statement). Jet fans within the tunnels would direct tunnel air to the outlets to prevent portal emissions. The air pressure inside the exit portals would be maintained below atmospheric pressure to avoid the release of tunnel air from the portals. 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).

Emissions from the project's 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, should the project be approved, the conditions of approval.

#### Cost of the tunnel ventilation system

The tunnel ventilation system would be included in the capital cost of the project. Filtration of the tunnels would not be included in the capital cost of the project as it is not proposed.

#### Ventilation outlet performance

The tunnel ventilation system would operate to maintain in-tunnel air quality below regulated levels and to optimise emission rates from tunnel ventilation outlets when traffic volumes are high. At times when traffic volumes are low and therefore in-tunnel concentrations are low, emission rates from the ventilation outlets may be lower or even not required to achieve compliance either within the in-tunnel or with ambient air quality criteria.

As demonstrated in the air quality impact assessment, the proposed ventilation outlets would provide an effective means of dispersing the 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.

#### Road tunnel filtration and climate change

Vehicle emissions can be grouped into two categories:

- Greenhouse gas emissions, such as carbon dioxide, nitrous oxide and methane
- Air pollutant emissions, such as carbon monoxide, nitrogen oxides, particulate matter, volatile organic compounds and benzene.

There are two main types of road tunnel filtration technologies:

- Electrostatic precipitation (ESP) – used to remove particulate matter
- Denitrification – primarily used for the removal of nitrogen dioxide.

Road tunnel filtration technologies do not target greenhouse gas emissions from vehicles and are energy intensive, therefore the use of these technologies can cause an increase in greenhouse gas emissions and would not reduce the climate change impact of the project.

An assessment of greenhouse gas emissions generated by the project was completed in Chapter 25 (Climate change and greenhouse gas) of the environmental impact statement which found that emissions from road traffic with the project are projected to increase only slightly relative to the 'Do minimum' scenario, both in 2027 (year of project opening) and 2037 (10 years after project opening). In addition, the NSW Government is embracing the growing availability of alternative



transport such as electric and hybrid vehicles through the development of the *NSW Electric and Hybrid Vehicle Plan* (NSW Government, 2019b). Further detail on the NSW Government's strategies to drive the update of electric vehicles and transition to zero emission buses is provided in Section C28.11 of this submissions report.

### Ventilation system contingency

Emergency systems on the project are described in Section 5.2.7 of the environmental impact statement. The tunnel would be provided with a redundant power system to ensure that the jet fans and tunnel system remain operable in the event that the primary power supply fails.

The tunnel ventilation system would be designed to manage in-tunnel air quality and avoid portal emissions under all worst case traffic scenarios and to manage smoke in emergencies. In addition, redundant fans would be provided within the ventilation facilities and redundant jet fans would be provided throughout the tunnels. Redundant equipment is provided to maintain the tunnel's ventilation system capability in the event that equipment is removed for maintenance or a fan fails during operation.

The operation of the tunnels would be controlled from the Beaches Link motorway control centre located at the Gore Hill Freeway, in the Artarmon industrial estate. The motorway control centre would be continuously staffed and used to monitor and if necessary respond to conditions in the tunnels and on surface road connections. Any operational failure of the tunnel ventilation system would be managed by the motorway control centre.

### **C11.4.7 In-tunnel air quality**

#### ***Issue raised***

Submitters raised issues about the air quality within the tunnels. Specific concerns related to the following:

- Concerns that the long and steep inclines and declines of the tunnel would require heavy accelerator use and lead to increased air pollution in the tunnel
- Concerns that tunnel users would be exposed to high levels of air pollution at the tunnel entry and exit
- Concerns that air pollution concentrations would increase in the tunnel, towards the ventilation outlet at the end of the tunnel, therefore a longer tunnel would cause more air pollution
- Concerns about the levels of air pollutants in the tunnel during operation.

#### ***Response***

The project has been designed in such a way that the generation of pollutant emissions by traffic in the tunnel would be managed to meet required in-tunnel air quality criteria (refer to Section 12.3.2 of the environmental impact statement). The project design provisions to reduce pollutant emissions and concentrations within the tunnel include:

- Minimising gradients as far as reasonably practicable
- Large tunnel cross-sectional area to reduce the pollutant concentration for a given emission and to permit greater volumetric air throughput. The tunnels would have a width varying between nine to 12.5 metres and with a vertical clearance of about 5.3 metres, which would be taller than most previous tunnels constructed in NSW
- Increased height to reduce the risk of incidents involving tall vehicles blocking the tunnel and disrupting traffic. This would also reduce the risk of higher pollutant concentrations associated with flow breakdown.

The project ventilation system has been designed so that it would achieve some of the most stringent standards in the world for in-tunnel air quality and would be effective at maintaining local ambient air quality. For the ventilation outlets proposed for the project, the height, diameter and number of the outlets was primarily determined by the volume of air to be expelled (which is calculated based on tunnel width and length) and project air quality criteria.

The design and operation of the tunnel ventilation system is shown in Figure 5-26 and described in Section 5.2.7 of the environmental impact statement.

During normal operating conditions, air would be distributed throughout the tunnels by the movement of vehicles (the piston effect), ensuring distribution of air throughout the tunnel. Under worst-case scenarios of lower traffic speeds at maximum theoretical capacity and breakdown, jet fans would be used to assist with the movement of tunnel air to maintain acceptable in-tunnel air quality.

An assessment of expected in-tunnel air quality is provided in Section 12.6.1 of the environmental impact statement. The in-tunnel operational air quality limits for NO<sub>2</sub>, CO and visibility would be achieved under all expected traffic scenarios, as well as the worst case variable speed scenario (the mainline tunnels operating at theoretical maximum lane capacity over the full length of the tunnels, which is not expected to actually occur) and all breakdown or major incident scenarios.

#### **C11.4.8 Operational traffic emissions**

##### ***Issue raised***

Submitters raised concerns regarding the assessment of operational traffic emissions in the environmental impact statement. Specific concerns included:

- Concerns that the project would increase air pollution due to induced demand
- Concerns that northbound traffic in the tunnel would often be congested, resulting in ambient air quality impacts to the communities near the ventilation outlet at the Burnt Bridge Creek Deviation.

##### ***Response***

Air quality modelling for the project took into consideration changes in traffic associated with project-related induced demand (new trips), which equate to about 0.3 per cent of additional daily trips in the Sydney metropolitan area in 2037 for this project, as discussed in Section C11.1.4 above.

A summary of the potential operational air quality impacts in the expected and regulatory worst case traffic scenarios is provided in Section 12.6 of the environmental impact statement and addressed in section C11.4.1 and C11.4.2 above.

The regulatory worst case assessed the maximum theoretical increase in ambient air quality due to the ventilation outlets operating continuously at the proposed emission limits and represents the most congested scenario in the tunnel. This is analogous to both the project and the Western Harbour Tunnel operating under breakdown scenarios continuously for a full year. The regulatory worst case represents a theoretical upper bound that would never occur for periods longer than a few hours. The concentrations from the ventilation outlets in the regulatory worst case scenarios were higher than those for the expected traffic scenarios, and during the regulatory worst case scenarios it is noted:

- The maximum 1-hour CO concentration would be negligible, including taking into account the fact that CO concentrations are well below the NSW impact assessment criterion. Exceedances of the criterion due to the ventilation outlets are highly unlikely

- For PM<sub>10</sub> for the annual mean and maximum 24-hour metrics the ventilation outlet contributions would be four per cent and 16 per cent of the respective criteria. Any exceedances of the criteria would be dominated by background concentrations
- The ventilation outlet contribution would be greater for PM<sub>2.5</sub>, with the maximum contributions equating to 11 per cent and 31 per cent of the annual mean and 24-hour criteria respectively. Any exceedances of the criteria would be dominated by background concentrations
- For annual mean NO<sub>2</sub>, the maximum ventilation outlet concentrations in the regulatory worst case would be an order of magnitude higher than those in the expected traffic case, although total concentrations would still remain below the NSW air quality criterion
- A detailed analysis was conducted for 1-hour NO<sub>2</sub>. In some cases, the ventilation outlet contributions appeared to be substantial; however, as the background, surface road and tunnel portal contributions (and total NO<sub>x</sub>) increase, there is a pronounced reduction in the ventilation outlet contribution to NO<sub>2</sub>. The analysis showed that the maximum outlet contribution occurred when other contributions were low, such that overall NO<sub>2</sub> concentrations would be well below the criterion or even the predicted maximum. Exceedances of the criteria due to the ventilation outlets alone would therefore be unlikely.

Control of in-tunnel air quality, including the ventilation and monitoring systems, is addressed in Section C11.5.1 below.

## **C11.5 Operational air quality environmental management measures**

### **C11.5.1 Operational air quality monitoring**

#### ***Issue raised***

Submitters requested details and raised concerns about the management of tunnel emissions and air quality monitoring proposed during operation of the project. Specific requests and concerns included:

- Concerns over how tunnel emissions will be managed
- Requests that independent air quality monitoring be carried out near ventilation outlets and sensitive receivers in line with government guidelines for at least 5-10 years after opening
- Concerns that monitoring ambient air quality for 24 months after the tunnel opens would not allow sufficient time to validate air quality modelling and future health studies on the project
- Requests that air quality monitoring data be made publicly available on the internet and text alert notifications be sent to residents and schools if air quality criteria are exceeded
- Concerns that the project will commence ambient air quality monitoring within 12 months before operation during the peak time of construction, allowing background air quality levels to be set as benchmarks during construction when there may potentially be major dust and exhaust emissions.

#### ***Response***

##### **Management of tunnel emissions**

The project ventilation system has been designed to achieve some of the most stringent criteria in the world for in-tunnel air quality, and would be effective at maintaining local air quality. The design of the ventilation system would ensure no portal emissions during normal operation. The ventilation system would be automatically controlled using real-time air velocity and air quality sensor data to ensure that in-tunnel conditions are managed effectively in accordance with the agreed criteria.

Further, specific ventilation modes would be developed to manage breakdown, congested and emergency situations.

In addition to the operation and management of the tunnel ventilation system, there are various operational measures available to manage in-tunnel emissions and air quality. These include the following:

- Traffic management: Traffic management would be employed by tunnel operators to control exposure to vehicle-derived air pollution. Measures can include (PIARC, 2008):
  - Reducing traffic throughout
  - Lowering the allowed traffic speed
- Incident detection: Early detection of incidents and queues is essential to enable tunnel operators and the road authority to put effective traffic management in place. Monitoring via CCTV cameras is normally a vital part of the procedure for minimising congestion within tunnels and allowing timely operator response to changes in traffic flow
- Public information and advice: Traffic lights, barriers, variable message signs, radio broadcasts, public address systems (used in emergencies) and other measures can help to provide driver information and hence influence driver behaviour in tunnels
- Cleaning the tunnel regularly, as is common practice in Sydney tunnels, assists in reducing concentrations of small particles (PIARC, 2008).

Refer also to sections C11.4.6, C11.4.7 and C11.4.8 above for more information concerning the management of in-tunnel emissions.

#### In-tunnel and ambient air quality monitoring

Air quality monitoring during operation of the project is discussed in Table 5-10 of the environmental impact statement. Continuous emission monitoring would be carried out during operation of the project to monitor:

- In-tunnel air quality
- Air quality within the ventilation outlets
- Ambient air quality at representative locations for a defined period of project operation.

Air quality monitoring and ventilation for the project would be coordinated across the broader road network (including the Western Harbour Tunnel and Warringah Freeway Upgrade, and WestConnex network) to ensure:

- In-tunnel air quality remains within the specified limits for motorists and road workers
- Airflows required for safety outcomes in the event of an incident or emergency can be achieved.

Continuous emissions monitoring equipment for key pollutants (NO<sub>2</sub> 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 emission limits for the project which would be prescribed by the conditions of approval, should the project be approved, and 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 emissions monitoring equipment.

The locations of monitoring equipment within the tunnels would generally be at the beginning and end of each ventilation section, as discussed in Section 12.7.2 of the environmental impact statement. This would include, for example, monitors at each entry ramp, exit ramp, merge point and ventilation exhaust and supply point. The location of monitors would be governed by the need

to meet in-tunnel air quality criteria for all possible journeys through the tunnel system, especially for NO<sub>2</sub>. This will require sufficient, appropriately placed monitors to calculate a journey average.

Velocity monitors would also be placed in each tunnel ventilation section and at portal entry and exit points. The velocity monitors in combination with the air quality monitors would be used to modulate the ventilation within the tunnel to manage air quality and ensure net air inflow at all tunnel portals.

Continuous ambient air quality monitoring of key pollutants (particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), oxides of nitrogen (NO and NO<sub>2</sub>) and CO) would also be carried out 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 *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (Department of Environment and Conservation (DEC), 2007a), or as otherwise agreed with the NSW Environment Protection Authority. Ambient air quality monitoring would occur prior to and following the commencement of operation. The ambient air quality monitoring period will likely be set by the conditions of approval, should the project be approved, and is typically required for at least 12 continuous months prior to operation and 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 during operation on a dedicated web page as is likely to be required by the conditions of approval, should the project be approved.

The Department of Planning, Industry and Environment operates an air quality monitoring network within NSW and offers a subscription service for NSW air quality alerts on days when pollution levels are forecast to be unhealthy or very unhealthy: [www.dpie.nsw.gov.au/air-quality/air-quality-alerts](http://www.dpie.nsw.gov.au/air-quality/air-quality-alerts).

#### Ambient air quality monitoring during construction

The key pollutants of concern during operation of the project (particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), oxides of nitrogen (NO and NO<sub>2</sub>) and CO) are not of the same level of concern during construction of the project. During construction, the key pollutant of concern is dust. Therefore, continuous ambient air quality monitoring carried out at representative locations in the vicinity of the ventilation outlets prior to operation would be representative of the key pollutants of concern during operation.

### **C11.5.2 Recommended additional environmental management measures**

#### ***Issue raised***

Submitters requested additional environmental management measures for mitigating air quality during operation, including if there are exceedances of air quality criteria during operation. Specific requests and recommendations included:

- Requests that proposed environmental management measures and air quality monitoring be a central component of the environmental impact statement and included in the project cost
- Requests that emissions from the ventilation outlets meet the standards specified in the environmental impact statement
- Requests for indoor halls to be upgraded or built to accommodate student recreation when air quality is poor

- Recommendations that the environmental impact statement outlines environmental management measures that would be implemented if emissions from ventilation outlets exceed air quality criteria
- Recommendations and concerns in relation to tunnel operation:
  - Recommend closing the tunnel during periods of extremely poor air quality (eg during bushfires and back-burning), as there may be health effects associated with background levels of PM<sub>2.5</sub> and PM<sub>10</sub> even where the concentrations are below the current guidelines
  - Suggest implementing schemes that will reduce the amount of airborne pollutants from the tunnel, eg tolling vehicles with high emissions, not allowing diesel powered vehicles in the tunnels and providing subsidies to encourage the use of electric vehicles
  - Concern that private tunnel operators turn off tunnel ventilation and filtration systems to save money and a request for monitoring of this practice
  - Recommend that clear suitable deterrent penalties be applied to the tunnel operator on every occasion that air quality level limits are exceeded
- It is unclear what the enforcement power of the Beaches Link Air Quality Community Consultative Committee would be to ensure best practice, long-term air quality monitoring, particularly around all sensitive receivers during construction and operation
- Requests for any breaches/exceedances of air quality criteria to be made publicly available and investigated and that appropriate mitigation action be taken to address the underlying causes
- Requests for the formalisation and ongoing compliance monitoring of commitments made in relation to air quality, emission controls and other environmental management measures
- Requests and recommendations for conditions of approval that require:
  - Filtration of ventilation outlets in line with international best practice, and design provisions so that low cost retrofitting of filtration devices would be possible in the future should air quality monitoring demonstrate unacceptable levels of pollutants from the tunnel
  - Banning of diesel powered vehicles in the tunnel
  - Installation of fine particle and nitrogen oxide filters at ventilation outlets until Sydney's vehicle fleet comprise over 50 per cent low emission vehicles
  - Installation of air conditioning and air filtration at schools and residences to reduce air quality impacts
  - Establishment of air quality monitoring stations at schools and the preparation of a plan to identify when students should be moved indoors
  - Implementation of a warning system for residents and schools near the ventilation outlets, to tell them when there has been an accident or fire in the tunnel.

### **Response**

#### Operational air quality environmental management measures and monitoring

The Beaches Link tunnel and associated ventilation system would be built and operated in compliance with any conditions of approval set by the Department of Planning, Industry and Environment, should the project be approved. Typical conditions of approval require compliance with the environmental management commitments in the environmental documentation submitted in support of the State significant infrastructure application, including this submissions report. These and other conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

Operational air quality environmental management measures and monitoring proposed for the project are outlined in Table 5-10 of the environmental impact statement.

Transport for NSW would ensure that compliance with environmental management measures and conditions of approval is monitored through the implementation of independent environmental auditing.

The costs of implementing environmental management measures and air quality monitoring for the project as described in Chapter 5 (Project description) of the environmental impact statement and above would be included in the capital cost of the project.

#### Indoor school facilities

The air quality assessment concluded that the project is likely to result in negligible overall impacts on ambient air quality as a result of emissions from the ventilation outlets, including at all residential, workplace and recreational receivers within the modelling domain. As a result, the provision of new or upgraded indoor school facilities is not considered necessary.

#### Measures in response to operational monitoring

Monitoring of ventilation outlet emissions during operation would be regulated under an environment protection licence prescribed under the *Protection of the Environment Operations Act 1997*.

Continuous emission monitoring would be carried out during operation of the project to monitor in-tunnel air quality and air quality within the ventilation outlets. Ambient air quality monitoring would be carried out at representative locations for a defined period during operation, as described in Table 5-10 of the environmental impact statement and Section C11.5.1 above.

As noted above, Transport for NSW would ensure that compliance with environmental management measures and conditions of approval is monitored. The Department of Planning, Industry and Environment compliance team carry out inspections to ensure projects approved by the Minister (or their delegate) meet approval conditions 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.

Where 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. The issue of penalties would be at the discretion of regulatory authorities and would be reflective of the nature of the non-compliance.

The mandate of an Air Quality Community Consultative Committee would be set by conditions of approval, should the project be approved. Based on the conditions of approval for other recently approved projects, including the M6 Motorway (Stage 1) and M4-M5 Link projects, the Air Quality Community Consultative Committee would be comprised of representatives from Transport for NSW, local councils, the local community and the tunnel operator. It would be independently chaired by a chairperson appointed in consultation with the Department of Planning, Industry and Environment. The location of the ambient air quality monitors and the duration of monitoring would be informed by consultation with the committee.

#### Tunnel operation

The air quality assessment demonstrates that the tunnel ventilation outlets would make a negligible contribution to ambient air quality concentrations in all of the expected traffic scenarios, as discussed in Section 12.6.2 of the environmental impact statement.

The closure of the tunnel on days when air quality is very poor or hazardous would not contribute to improved air quality but is likely to result in traffic using alternative surface roads. The diversion of traffic from the tunnels, where the ventilation systems would facilitate effective atmospheric dispersion of the pollutants, onto the surface road network, may result in a corresponding worsening of ambient air quality in adjacent areas.

The ventilation system would be designed and operated to maintain in-tunnel air quality under all traffic scenarios, including breakdown and congested scenarios, as discussed in sections C11.4.6 and C11.4.7 above. As such, any access ban or partial restrictions on diesel vehicles, tolling vehicles with high emissions or providing subsidies to encourage the use of electric vehicles in order to maintain or improve in-tunnel air quality are not considered 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 would be broader communication, involving multiple agencies, to manage further congestion or to enable an emergency response.

## **C11.6 Further data collection, modelling and assessment**

### ***Issue raised***

Submitters requested that further data collection modelling and assessment is carried out as follows:

- Requests that a fully independent peer review of the air quality assessment be commissioned
- Requests that air quality modelling be re-assessed by an independent contractor since inconsistencies and errors were identified in the air quality impact assessment
- Recommendations that work be carried out during further design development to eliminate the areas of uncertainty outlined in Section 6.5 of Appendix H (Technical working paper: Air quality)
- Requests that air quality modelling be carried out for each possible pollutant from the ventilation outlets, covering dispersion at various heights and distances from the ventilation outlets
- Suggestions that filtration of the ventilation outlets is modelled and assessed further considering different scenarios
- Requests that a new environmental impact statement be released that includes Northern Beaches Secondary College Balgowlah Boys Campus as a sensitive receiver and that a local assessment be completed of current air particulate matter levels
- Requests that the air quality impact assessment consider emissions from traffic during peak times and existing ambient air quality data around St Cecilia's Catholic School
- Requests that ventilation outlet emissions data collected during 12 months of operation of NorthConnex be used to validate or invalidate the air quality modelling for the project
- Requests that impacts to the environment must be fully assessed with subsequent detailed plans and control measures and air quality monitors employed as a condition of approval.

### ***Response***

#### **Independent peer review**

The Department of Planning, Industry and Environment commissioned an independent peer review of the air quality assessment presented in the environmental impact statement to inform its assessment of the project. This followed a review by the Advisory Committee on Tunnel Air Quality at the request of the NSW Chief Scientist and Engineer. The independent peer reviewer concluded that the background data selected and the manner in which it was used was appropriate and



sufficient. As a consequence, further independent modelling or assessment is not considered to be necessary.

### Treatment of uncertainty

The approach to treating uncertainty in the operational air quality assessment is discussed in Section C11.1.2 above.

The sensitivity tests carried out as part of the operational air quality assessment provide confidence that the modelling outputs and assessment findings would not materially change if the parameters for which there is some uncertainty were to differ within the ranges analysed, as discussed in Section 8.4.11 of Appendix H (Technical working paper: Air quality).

### Pollutants considered in the operational air quality assessment

The Secretary's environmental assessment requirements require an assessment of impacts from potential emissions from PM<sub>10</sub> and PM<sub>2.5</sub>, CO, NO<sub>2</sub> and nitrogen oxides and volatile organic compounds. The pollutants considered in the operational air quality assessment are in accordance with these requirements, and are identified in Section 12.2.3 of the environmental impact statement and discussed in detail in sections 4.4, 4.5 and 6.4.3 of Appendix H (Technical working paper: Air quality).

Pollutants excluded from the assessment are discussed in Section 6.4.3 of Appendix H (Technical working paper: Air quality). Generally, pollutants were typically excluded from the assessment because they are either no longer considered an air quality concern eg as a result of improved fuel standards, are not relevant to road vehicle operation, or are adequately represented by a pollutant already included in the assessment.

The operational air quality modelling process involved the use of the GRAMM-GRAL model system, which models the dispersion of air pollutants at ground level as well as at different elevations, and at various distances from the ventilation outlets, across the large GRAL and GRAMM domains, as described in Section C11.1.3 above and Section 12.2.3 of the environmental impact statement. The GRAL domain for dispersion modelling extended 11.6 kilometres in the east–west direction and 16.7 kilometres in the north–south direction beyond the project and the GRAMM domain for the modelling of meteorology extended 30 kilometres in the east–west direction and 30 kilometres in the north–south direction beyond the project (refer to Figure 6-2 of Appendix H (Technical working paper: Air quality)).

The GRAL model was used to calculate predicted air pollutant concentrations and changes in pollutant concentrations at 42 community receiver and 35,484 residential, workplace and recreational receiver locations at various distances from the ventilation outlets, as shown in Figure 8-8 of Appendix H (Technical working paper: Air quality). The model was also configured to provide predictions for a Cartesian grid of points with an equal spacing of 10 metres in both the horizontal and vertical directions across the entire model domain, resulting in a total number of points in the grid of about 1.9 million. In addition, the dispersion of air pollutants was modelled at four elevated receiver heights (10 metres, 20 metres, 30 metres and 45 metres above ground level) across the model domain, to account for receivers in multi-storey buildings and future developments, as shown in Figure 8-10 of Appendix H (Technical working paper: Air quality). Thus, local air quality changes at a large number of discrete points and elevations within the model domain were included in the operational air quality assessment to facilitate the assessment of changes in local and regional air quality as a result of the project.

### Modelling for filtered ventilations outlets

The scenarios modelled for the operational air quality assessment are discussed in Section 12.2.3 of the environmental impact statement. These scenarios address the Secretary's environmental assessment requirement to assess worst case scenarios for in-tunnel and ambient air quality, including a range of ventilation scenarios and range of traffic scenarios, including worst case design maximum traffic flow scenarios (variable speed) and the worst case vehicle breakdown scenario. No scenario was modelled that involved filtered ventilation outlets as filtration of the ventilation outlets is not proposed.

### Identification and modelling of additional receivers

The methodology used to represent receivers in the operational air quality modelling of the project is described in Section 12.2.3 of the environmental impact assessment and Section 8.4.1 of Appendix H (Technical working paper: Air quality).

Receivers are defined by the NSW Environment Protection Authority as locations where people are likely to work or reside, this may include a dwelling, school, hospital, office or public recreation area (NSW EPA, 2016). Accordingly, the modelling in the air quality assessment is concerned with the location of receivers rather than the number of people at each receiver location. The modelling does not use school enrolment or population data.

Forty-two representative community receiver locations were selected along the Western Harbour Tunnel and Beaches Link program of works corridor, including areas surrounding the ventilation outlets. These community receiver locations are representative only and are not intended to comprise an exhaustive list of community receivers in the study area. The community receivers are listed in Table 8-12 and their locations shown in Figure 8-8 of Appendix H (Technical working paper: Air quality).

A total of 35,484 individual residential, workplace and recreational receivers (including the 42 community receivers) have been modelled along the Western Harbour Tunnel and Beaches Link program of works corridor. These individual residential, workplace and recreational receivers represent a range of uses in the surrounding community. The residential, workplace and recreational receivers include all other community receivers located in the study area, including those not included in the 42 representative community receivers discussed above. For example, while the Northern Beaches Secondary College Balgowlah Boys Campus was not included as a community receiver, the potential air quality impacts at that location have been predicted and are considered in the discussion of results for residential, workplace and recreational receivers.

Changes to air quality conditions at any location can be examined by reference to the contour plots for the 2037 'Do minimum' and 2037 'Do something cumulative' scenarios in Section 8.4.5 of Appendix H (Technical working paper: Air quality), the contour plots for all expected traffic scenarios in Annexure I of Appendix H (Technical working paper: Air quality), and the contour plots showing the ventilation outlet contribution only in Annexure J of Appendix H (Technical working paper: Air quality).

For this reason, further assessment of impacts at the Northern Beaches Secondary College Balgowlah Boys Campus is not considered necessary.

### St Cecilia's Catholic School

St Cecilia's Catholic Primary School was included in the list of community receivers considered in the operational air quality assessment, as indicated in Table 8-12 of Appendix H (Technical working paper: Air quality).

Potential air quality impacts at St Cecilia's Catholic Primary School were predicted for a range of expected traffic scenarios in 2027 and 2037 (outlined in Table 12-2 of the environmental impact statement), including the cumulative impacts of the project in conjunction with other major road projects, and for the regulatory worst case scenario as described in Section 12.2.3 of the environmental impact statement. The regulatory worst case scenario presents the maximum theoretical increase in ambient air quality due to the ventilation outlets operating continuously at the proposed emissions limits for all 8760 hours of the year, and therefore represents a theoretical upper bound that would never occur for periods longer than a few hours.

The modelling results for St Cecilia's Catholic Primary School (CR29) for the expected traffic and the regulatory worst case scenarios are presented in sections 8.4.5 and 8.4.8 of Appendix H (Technical working paper: Air quality). For the majority of short-term and long-term air quality measures (maximum 1-hour and annual mean NO<sub>2</sub>, maximum 1-hour and maximum rolling 8-hour mean CO and annual mean PM<sub>10</sub>), the predicted concentrations at the school were below the NSW impact assessment criteria in all of the expected traffic scenarios. Although exceedances of criteria were predicted to occur for some short-term air quality measures (maximum 24-hour and annual mean PM<sub>2.5</sub> and maximum 24-hour mean PM<sub>10</sub>) both without and with the project in the expected traffic scenarios, these were attributed to elevated background contributions in 2016 (the base year selected for the model), and not due to contributions from the ventilation outlets or the surface roads, as discussed in Section C11.1.5 above. Where increases in concentrations are predicted, these would be relatively small (less than one per cent of the criterion). In all expected traffic scenarios, the contribution of the ventilation outlets at St Cecilia's Catholic Primary School were generally negligible for all short-term and long-term air quality measures modelled. The contributions of surface roads to the predicted concentrations were also generally small.

Although the concentrations from the ventilation outlets in the regulatory worst case scenarios were higher than those for the expected traffic scenarios, exceedances of criteria were also attributed to background concentrations and not due to ventilation outlet or surface road contributions, as discussed in Section C11.4.8 above.

#### Operational air quality monitoring data from NorthConnex

Emissions data from NorthConnex is not a necessary input to the air quality modelling for the project and cannot be used to validate or invalidate the air quality modelling completed for the project. However, a detailed analysis of GRAL background modelling results was compared to background monitoring results and is presented in Annexure H of Appendix H (Technical working paper: Air quality). This comparison shows that the model generates predictions that reflect the spatial distribution of air quality concentrations near roads with reasonable accuracy. The analysis also notes the combination of GRAL and the background mapping approach generally provides conservative estimates.

#### Detailed subsequent plans, measures and monitoring

A comprehensive assessment, which has been carried out in accordance with contemporary impact assessment modelling approaches and best practice techniques, was reviewed by Advisory Committee on Tunnel Air Quality and a separate independent peer reviewer, engaged by the NSW Department of Planning, Infrastructure and Environment.

Transport for NSW have committed to a suite of environmental management measures, including monitoring of in-tunnel and ambient air quality for an agreed period. Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C12 – Human health

## C12 Human health

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## **C12.1 Adequacy of the health impact assessment**

### **C12.1.1 Adequacy of the assessment – general**

#### ***Issue raised***

Submitters raised concerns regarding the adequacy of the health impact assessment, including:

- Lack of detailed assessment of impacts on physical and mental health, children's health, and wellbeing within and near the project footprint
- The assessment was based on an incomplete project design and a best-case scenario. Suggest the assessment should be redone to account for human error and the probability of a spill of contaminated spoil and/or sediment
- The health costs projected in the assessment were based on hospital admissions only and are therefore too narrow in scope as they do not include non-hospital health costs
- The assessment is inadequate assessing only the 'perception of safety' and neglects to assess actual impacts on safety
- The precautionary principle should be applied to ensure the health of children across the project footprint
- Requests that Northbridge peninsula, Northbridge Baths and Northern Beaches Secondary College Balgowlah Boys Campus should be marked as sensitive receivers in the health impact assessment, with a specific assessment of impacts on these receivers
- Requests that an updated health risk assessment, including findings from contamination and air quality assessments, be prepared by an independent and qualified person
- Queries regarding the meaning of statements that annoyance would usually occur before physiological and other health-based impacts, and how often the annoyance impact would be expected to occur
- The health impacts of dust to school students are underestimated as the assessment equates educational premises with residential premises and does not reflect the actual number of school students
- The assessment does not fully consider cumulative road traffic noise impacts on receivers during project operation and the potential health impacts.

#### ***Response***

##### **Health impact assessment adequacy and uncertainties**

A detailed review and analysis of potential health impacts associated with the project during construction and operation such as air quality, noise and vibration, traffic and transport, property acquisition, public safety, contamination, and social wellbeing is provided in Chapter 13 (Human health) of the environmental impact statement and Appendix I (Technical working paper: Health impact assessment). The assessment of physical and mental health impacts associated with the project includes both adverse and beneficial impacts to health, including impacts to children's health and sensitive receivers within and near the project footprint.

The health impact assessment not only drew from relevant technical working papers prepared for the project but also applied risk assessment approaches in accordance with national and international best practice, as endorsed by Australian health and environmental authorities (refer to Section 2.2 of Appendix I (Technical working paper: Health impact assessment)). The supporting assessments used for the health impact assessment, such as air quality, noise and vibration and

traffic and transport, used conservative approaches in modelling to predict worst-case scenarios for the project, likely resulting in an overestimation of potential health impacts.

The use of approved methodologies to present conservative upper limit estimates means that proposed environmental management measures will be adequate to address the identified risk issues and manage uncertainties in the project, including uncertainties relating to design, spoil disposal, contaminated materials and site management. Further detail on how uncertainties would generally be addressed is provided in Section 28.3 and Table 28-3 of the environmental impact statement. Specific uncertainties related to the health impact assessment are addressed in Section 10 of Appendix I (Technical working paper: Health impact assessment).

Based on the assessment of construction contamination impacts there would be no potential to result in substantial safety risks to the community and it is unlikely that water quality would be substantially impacted by construction activities provided the proposed environmental management measures are adopted (refer to Section 13.4.2 of the environmental impact statement). Potential health impacts associated with the project, including from human error or activities that could result in traffic, noise and vibration, air or water pollution, exposure to contaminants and social change hazards across the project footprint, will be minimised through the implementation of the full range of construction and operation environmental management measures provided in Table D2-1 of this submissions report. The following sections make reference to specific environmental management measures, as relevant to the issue being discussed.

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 coordinated a scientific review of the project's impacts, including the emissions from ventilation outlets (see also Section C11 of this submissions report). The Advisory Committee on Tunnel Air Quality includes representation from the NSW Ministry of Health (the NSW Chief Health Officer). The statements from the NSW Chief Health Officer and independent air quality expert of Advisory Committee on Tunnel Air Quality are provided on the NSW Department of Planning, Industry and Environment's major project website under 'Agency Advice' accessible from [www.planningportal.nsw.gov.au/major-projects/project/10456](http://www.planningportal.nsw.gov.au/major-projects/project/10456).

The environmental impact assessment process inevitably assesses a proposal at a level of design which is not yet finalised. The design would only be progressed if the project is approved by the Minister for Planning and Public Spaces in order that ongoing design may further refine or avoid potential environmental impacts and to ensure compliance with the proposed environmental management measures and any conditions of approval granted by the Minister.

### Health costs

The Secretary's environmental assessment requirements included the requirement for an assessment of the human health risks and costs associated with the construction and operation of the proposal based on the guideline *Methodology for Valuing the Health Impacts of Changes in Particle Emissions* (NSW Environment Protection Authority (EPA), 2013b). Consideration of health costs is limited to impacts of particulate matter as there are no agreed methods available to quantify health costs for other chemical pollutants.

Although not costed, the quantification of effects, including potential mortality and asthma-related hospital admissions from the effects of NO<sub>2</sub>, are detailed in Annexure D of Appendix I (Technical working paper: Health impact assessment). The assessment of impacts on mortality and asthma emergency department admissions is based on assessments carried out by the National Environment Protection Council (Golder Associates, 2013), which is considered to be a robust method of calculating the changes in health endpoints in a standardised way.

### Perceived versus actual impacts on safety

The health impact assessment assessed actual public safety risks and hazards during construction associated with contaminants, dangerous goods, natural hazards and active transport. Road safety during construction is specifically addressed in sections 5.1.3, 5.5.4 and 5.6.2 of Appendix F (Technical working paper: Traffic and transport) and safety procedures for operation of the project, including emergency situations, are presented in Chapter 5 (Project description) of the environmental impact statement. In addition, an overview of public safety impacts during construction and operation and recommended management measures to protect road users including pedestrians and cyclists are provided in Table 8-1 and Table 8-2 of Appendix I (Technical working paper: Health impact assessment). The impacts to community perceptions of public health and safety are considered in sections 21.4 and 27.3 of the environmental impact statement.

### Precautionary principle

The means by which the project has considered and applied ecologically sustainable development principles, including the precautionary principle, across the project from planning and design to assessment, are described in Section 25.3 of the environmental impact statement. The adoption of worst case, conservative approaches in the various modelling scenarios developed for the project ensures the precautionary approach is integrated in every aspect of the impact assessment.

### Additional sensitive receivers

The environmental impact statement has assessed the air quality, noise and water quality impacts of the project on the community in the vicinity of the project, including for the suburb of Northbridge, Northbridge Baths and Northern Beaches Secondary College Balgowlah Boys Campus.

The air quality assessment model predicted air quality impacts at 35,484 individual receivers (residential, workplace and recreational receivers) in the streets/suburbs located in the study area. These individual residential, workplace and recreational receivers represent a range of land uses including residential, workplaces or recreational (open space) areas in the surrounding community, covering the suburb of Northbridge and Northern Beaches Secondary College Balgowlah Boys Campus. In addition, 42 representative community receiver locations were also selected along the project corridor for the assessment, as shown in Figure 3-2 of Appendix I (Technical working paper: Health impact assessment). These community receiver locations are representative only and are not intended to comprise an exhaustive list of community receivers in the study area. Where a receiver is not specifically listed as a community receiver, eg Northern Beaches Secondary College Balgowlah Boys Campus, potential air quality impacts at that location were predicted and considered in the discussion of results for the residential, workplace and recreational receivers.

The location and type of noise sensitive receivers near temporary construction support sites, construction sites and haulage routes were identified using a combination of aerial photography and visual inspections. These noise sensitive receivers were then grouped into noise catchment areas (NCAs) along the project alignment, with the sensitive receivers in each NCA expected to have a similar acoustic environment. The noise catchment areas are shown in Figure 10-2 to Figure 10-5 of the environmental impact statement. These figures show the suburb of Northbridge including Northbridge Baths, and the Northern Beaches Secondary College Balgowlah Boys Campus have been accounted for in NCA 39.1 and NCA 48.1 respectively. Potential health impacts relating to construction noise are assessed in Section 13.4.2 of the environmental impact statement. Further identification and/or refinement of sensitive receiver locations will be considered during preparation of the construction noise and vibration management plan required by revised environmental management measure CNV1 (refer to Table D2-1 of this submissions report).



The hydrodynamics and water quality assessment considered the potential impact of sediment plumes resulting from dredging proposed in Middle Harbour. The predicted extent of dredge plume impacts within Middle Harbour are shown in Figure 17-5 of the environmental impact statement. Deposition rates at the Middle Harbour south cofferdam (BL7) at Northbridge peninsula were predicted to remain low throughout the dredge period, despite its close location to the dredge footprint, due to the effectiveness of the deep and shallow draft silt curtains, as discussed in Section 17.4.2 of the environmental impact statement. Northbridge Baths is outside the dredge plume impact area shown in Figure 17-5 of the environmental impact statement.

Transport for NSW carried out additional impact assessment of the proposed dredging in Middle Harbour in response to community concerns raised about potential impacts to recreational areas along the harbour foreshore and this is discussed in sections C12.2.3, C16.2.3 and Appendix C2 of this submissions report. This assessment concludes that water quality impacts for recreational users of Middle Harbour are not expected, including for users of Northbridge Baths.

#### Updated assessment prepared by a qualified person

The environmental impact statement was prepared to meet the Secretary's environmental assessment requirements and accordingly, Chapter 13 (Human health) and Appendix I (Technical working paper: Health impact assessment) address all of the relevant Secretary's environmental assessment requirements. The health impact assessment itself drew upon the impact assessment findings from other parts of the environmental impact statement including Chapter 12 (Air quality) and Chapter 16 (Geology, soils and groundwater), which considered pollutants and their potential impacts on receivers during construction and operation.

The air quality impact assessment for the project, Appendix H (Technical working paper: Air quality) was reviewed by the Office of the Chief Scientist and Engineer, and the Advisory Committee on Tunnel Air Quality.

The design of the project has considered ways to minimise impacts to community health, including through the refinement of temporary construction support sites to avoid or reduce interaction with contaminants, and reduce construction impacts on receivers, particularly at Flat Rock Drive construction support site (BL2) (refer to Section 2.3 of Appendix I (Technical working paper: Health impact assessment)). Potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under Section 105 of the *Contaminated Land Management Act 1997* and revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). Where contamination is complex, an independent NSW Environment Protection Authority Accredited Site Auditor, independent of Transport for NSW and the contractor/s, will be engaged to review applicable contamination reports and evaluate the suitability of sites for a specified use as part of the project.

The health impact assessment is consistent with state, national and international guidance that is endorsed by NSW and Australian health and environmental authorities. The current health impact and risk assessments have been prepared by appropriately qualified professionals who routinely prepare these types of assessments for similar infrastructure projects and using relevant guidelines. A further independent health risk assessment is not considered necessary and is beyond the scope of the project.

#### Annoyance impacts

'Annoyance' is considered to be a health effect that can result from noise and vibration impacts during construction, often creating sounds or sensations that the community dislike or are dissatisfied with, as discussed in Section 13.4.2 of the environmental impact statement. Annoyance can also be associated with noise impacts that exceed noise guidelines/criteria and lead to sleep

disturbance for sensitive receivers during construction. The health impact assessment stated that 'annoyance' would usually occur before physiological impacts occur as noise annoyance can be the first response when short term changes in the noise environment are felt. Physiological health effects may include increased blood pressure and increased heart rate; these effects have been assessed in the health impact assessment and are discussed in Section 7.5 of Appendix I (Technical working paper: Health impact assessment).

It would be difficult to predict and quantify how often annoyances can occur as noise levels are perceived differently and some people may find certain noise levels to be acceptable while others do not. In this case, annoyance depends almost entirely on personal preferences and attitudes. With the implementation of environmental management measures, construction noise and vibration impacts will be reduced and minimised wherever possible to lessen the potential for annoyance and therefore health-based impacts on receivers.

### Student numbers in schools

Dust impacts during construction were assessed at sensitive receivers including schools in the risk assessment for construction air quality impacts (refer to Section 12.5.1 of the environmental impact statement). While some locations might not have been selected as representative community receivers, they were still assessed as residential, workplace and recreational receivers in the model. The health impact assessment allocated a risk associated with the generation of dust and impacts on human health in the adjacent community, and considered the proximity to the source area and the number and type of receivers present (refer to Section 5.3.1 of Appendix I (Technical working paper: Health impact assessment)).

The total enrolment size of schools does not alter the assessment outcome of the risk assessment, as the health impact assessment assumed maximum exposure at receiver points which is expected to be an overestimation of air quality impacts (refer to Section 10.11 of Appendix I (Technical working paper: Health impact assessment)).

The assessment was not adjusted to assume a certain number of children would be present at the site, instead the assessment considered the location and the potential risk to an individual at that location. The residential, workplace and recreational receivers are discrete receiver locations instead of individuals in a population, meaning that the assessment considered the number of receivers but not the number of individuals at each receiver 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.

### Traffic noise during operation

The health impacts associated with operational road traffic noise impacts are assessed in Section 13.5.3 of the environmental impact statement. The project is predicted to reduce traffic noise for about 59 per cent of receiver buildings within the noise catchment areas surrounding the project surface road works, which is mostly due to traffic being moved from the existing surface roads into the proposed tunnels. Thirty-seven 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. Four per cent of receiver buildings are predicted to experience increases greater than 2 dB(A) due to the project at which health impacts may be experienced if not appropriately mitigated.

Environmental management measures to address potential road traffic noise impacts during operation will principally involve the investigation of quieter pavements, and installation of noise barriers and/or at-property treatments. Indicative new noise barrier locations are shown in

Figure 5- 2, Figure 5-8 and Figure 5-9 of the environmental impact statement and receiver buildings potentially eligible for consideration of additional noise mitigation are shown in Figure 11-1, Figure 11-2 and Figure 11-3 of the environmental impact statement.

Receivers exceeding the relevant traffic noise criteria would be considered for at-property treatment, where other treatments are not feasible or reasonable. It is noted that most receivers predicted to experience exceedances of the operational road traffic noise criteria already experience exceedances (ie the reason for mitigation is existing noise levels), rather than predicted increases due to the project.

Overall however, the number of properties subject to increases in noise levels which may be of concern to health as a result of the project, is very small. Environmental management measures ONV1, ONV2 and ONV3 will be implemented to minimise potential road traffic noise impacts (refer to Table D2-1 in this submissions report).

### **C12.1.2 Adequacy of assessment – air quality**

#### ***Issue raised***

Submitters raised concerns regarding the adequacy of the health impact assessment in relation to air quality and traffic impacts, including:

- Concerns that air quality criteria measure averages and do not regulate air quality impacts which occur over a short period and may trigger health impacts
- Requests that the surface road traffic assessment and air quality assessment should inform the health impact assessment since road pollution is not limited to ventilation outlet emissions
- The assessment does not consider future health and safety impacts and lacks a forecast on potential impacts during operation of the project, particularly potential health impacts on motorists using a long tunnel network
- The assessment does not assess long term health implications that can stem from project emissions through unfiltered ventilation outlets during operation.

#### ***Response***

##### Averages in calculations

Averaging periods for the assessed pollutants are prescribed by the air quality standard or criteria adopted, and in this case, the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016) (the NSW EPA Approved Methods) and the *National Environment Protection (Ambient Air Quality) Measure* (National Environment Protection Council (NEPC), 2003). All pollutants were assessed against the shortest averaging periods available for each criterion. Different averaging periods were used for some pollutants to address long-term (annual) and short-term (1-hour or 24-hour) exposure. The ambient air quality criteria and averaging periods applied to the assessment are outlined in Section 12.3.3 of the environmental impact statement.

##### Surface road traffic and air quality to inform the health impact assessment

Air quality modelling for the project considers the simultaneous operation of all elements of the project (including emissions from all ventilation outlets and traffic on surface roads), in addition to emissions from tunnels and surface roads on the existing road network.

The health-related impacts of the project during operation are detailed in Section 13.5.1 of the environmental impact statement and are based on the traffic and air quality assessments in Chapter 9 and 12 of the environmental impact statement, respectively. The traffic and air quality

assessments considered a number of scenarios with and without the project being implemented and included traffic using the tunnel as well as on surface roads within the traffic modelling area. The scenarios considered are outlined in Table 9-3 and the traffic model area in Figure 9-2 of the environmental impact statement. Changes in traffic volumes and air quality as a result of the project were calculated through the analysis of differences between these modelled scenarios, which allowed calculation of the net effect of the project. This level of traffic and the air quality emissions directly related to the project was then used to assess the potential health impacts.

### Future health and safety impacts

The health impact assessment considers the long term health risks associated with air quality and health during operation. Health related in-tunnel air quality impacts were assessed to consider the cumulative exposure for users of the project and connected tunnel network, as well as frequent users of the tunnel network (refer to Section 13.5.2 of the environmental impact statement). The assessment evaluated health consequences for users of the tunnel, assuming the project tunnel and extended tunnel network operate in compliance with the in-tunnel air quality criteria.

The assessment found concentrations of pollutants from vehicle emissions are higher within the tunnel (compared with outside the tunnel), and with the completion of a number of tunnel projects (approved or proposed) there is the potential for exposures to occur within a network of tunnels over varying periods of time, depending on the journey. However, the tunnel and associated ventilation system would be designed to ensure that all relevant health-based in-tunnel air quality criteria would be met at all times (with windows down) for all potential operational conditions.

For individuals who regularly use tunnels for commuting or as part of their employment, there is the potential for repeated exposures to higher levels of NO<sub>2</sub> and particulates during the day. While these exposures are not likely to be additive, in terms of potential health effects, it is important that these road users should use ventilation on recirculation whenever they are using the tunnels (refer to Section 6.6 of Appendix I (Technical working paper: Health impact assessment)).

Further details on this issue are provided in Section C11.5.1 of this submissions report.

### Long term health impacts

Predicted air quality impacts from vehicle emissions during the operation phase of the project were considered in Chapter 13 (Human health) of the environmental impact statement. Air quality modelling of expected traffic movements through the tunnel were used to assess the likelihood of long term/chronic health effects in the local community.

The issue of most concern in relation to health impacts from vehicle emissions is particulate matter and specifically, fine particulate matter less than 2.5 micrometres in diameter (PM<sub>2.5</sub>) which can be ingested into the lungs.

For the regulatory worst case scenario for PM<sub>10</sub>, a hypothetical worst case scenario which assumes all the ventilation outlets operating continuously at the proposed emissions limits (and therefore unlikely to occur in the real world), the ventilation outlet contributions were four per cent and 16 per cent of the annual mean and maximum 24-hour criteria respectively. For PM<sub>2.5</sub>, the maximum outlet contributions would equate to 11 per cent and 31 per cent of the annual mean and 24-hour criteria respectively. Any exceedances of the criteria would be dominated by background concentrations of particular matter within the ambient air.

The potential incidence of health impacts associated with exposure to particulate matter is anticipated to remain unchanged as a result of the project, and no substantial health impacts are anticipated under any plausible traffic and tunnel operational scenarios. Chronic exposures over the long term to nitrogen dioxide, carbon monoxide and other compounds with incremental lifetime

carcinogenic risks have been evaluated and the health impact assessment found that there would be no chronic health risk issues predicted in the local community as a result of the project.

### **C12.1.3 Adequacy of assessment – contamination**

#### ***Issue raised***

Submitters raised concerns regarding the adequacy of the health impact assessment in relation to contamination risks, including:

- Concerns that limited sampling and testing of contaminated materials was carried out, especially as the environmental impact statement states more testing is needed to quantify the total risk of exposure
- The assessment does not properly address risks of contaminated leachate, landfill gas and odour impacts to the health of receivers and construction workers at Cammeray Golf Course construction support site (BL1) and Flat Rock Drive construction support site (BL2) and the risk of contaminants migrating
- Request for health risk assessment of contamination risks from stormwater runoff and spills.

#### ***Response***

##### Limited testing

The environmental impact statement was prepared to address the Secretary's environmental assessment requirements as outlined in various chapters, including Chapter 16 (Geology, soils and groundwater). A checklist of how each relevant contamination requirement has been addressed is provided in Table 16-1 of the environmental impact statement. A Stage 1 environmental site assessment was completed for the project to identify contaminated sites and potentially contaminated areas where further investigation is required. This included analysis of initial contamination testing carried out during groundwater monitoring in 2017/2018, which assisted in describing the existing contamination profiles of particular areas of the project footprint.

The environmental impact assessment process inevitably assesses the proposal at a stage when the design is not yet finalised. The design would only be progressed if the project is approved by the Minister for Planning and Public Spaces in order that ongoing design may further refine or avoid potential environmental impacts and to ensure compliance with any conditions of approval granted by the Minister.

The level of assessment completed for contaminated land is considered sufficient and adequate to identify and assess the key risk issues and appropriate measures to ensure satisfactory management during further design development and construction stages, in accordance with the revised environmental management measure SG8 (refer to Table D2-1 of this submissions report).

##### Addressing contamination, gas and odour risks to health

Potential contaminant exposure risks during construction, including from leachate and landfill gas to project personnel, the general public, environmental receivers and ecosystems, have been identified in Section 16.4 of the environmental impact statement.

There is a low potential for significant amounts of putrescible waste materials and landfill gases to be present beneath the proposed Flat Rock Drive construction support site (BL2) and therefore, the potential for significant odour issues during excavation is also very low (refer to Section 12.5.4 of the environmental impact statement). Additional areas of environmental interest for potential historical contamination were also identified beside the Warringah Freeway between Cammeray Golf Course

and Willoughby Road at Naremburn, Willoughby Leisure Centre and Bicentennial Reserve (refer to Section 16.4.3 of the environmental impact statement for further detail).

The potential for contaminated materials to be present at the Flat Rock Drive construction support site (BL2) and other potential areas of environmental interest in the project footprint will be further investigated as required by revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). Subject to the outcomes of the investigations, and where site remediation is warranted, a Remediation Action Plan will be prepared and implemented.

In addition, prior to excavation at these areas, further investigations will be carried out to confirm the potential to encounter odorous materials and gases and the need for any site-specific management measures, in accordance with revised environmental management measure AQ2 (refer to Table D2-1 of this submissions report). Specifically, ground (landfill) gas investigations will also be carried out in Flat Rock Reserve as required by environmental management measure SG15 (refer to Table D2-1 of this submissions report), which was revised to further minimise potential risks to air quality and health at Flat Rock Reserve following review by Transport for NSW:

Ground gas investigations will be carried out in Flat Rock Reserve to further assess the potential presence of landfill generated gas which could impact on the construction and/or operation of the project. Ground gas investigations will be carried out in accordance (where applicable) with the *Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases Assessment and management of hazardous ground gases: Contaminated land guidelines* (NSW EPA, 2012 2020). **If ground gas risks are established, appropriate design and/or management measures will be developed and implemented to remove or reduce the associated risk.**

Environmental management measures such as odour-suppressing additives, use of sealed trucks, and the development of an odour management strategy (where required) will be implemented to minimise the potential for odour during construction (refer to Section 12.5.4 of the environmental impact statement). Environmental management measures AQ1-AQ6 will be implemented to manage odour issues should they arise during construction (refer to Table D2-1 of this submissions report).

The existing groundwater monitoring program will continue throughout construction to identify changes in groundwater level and quality, in accordance with environmental management measure SG1 (refer to Table D2-1 of this submissions report), and provides a means of identifying whether contaminants are migrating as a result of the project. Environmental management measures will also be implemented and have been revised following review by Transport for NSW and in response to comments received during public exhibition, as follows:

- The groundwater monitoring program will consider additional locations for monitoring that are subject to medium and high risk of groundwater contamination during construction and operation. Where relevant, modelling/mass balance analysis will be carried out to assess potential impacts on beneficial aquifer use, the likely quality of groundwater inflows, **and migration of potential contaminant hazards** (refer to revised environmental management measure SG18)
- If the groundwater quality monitoring and associated analysis identifies potential impacts to beneficial aquifer use from the migration of contaminated groundwater, or the quality of groundwater tunnel inflows, **or migration of potential contaminant hazards**, feasible and reasonable management measures will be identified and implemented (refer to revised environmental management SG19).

### Health risk assessment of runoff and spills

Potential risks and hazards to public safety and recreational values during construction and operation of the project have been assessed in Section 8 of Appendix I (Technical working paper: Health impact assessment). This assessment included risks during construction associated with the storage, handling and transport of dangerous goods and the offsite migration of contaminants which are present in the soil, with further detail provided in Table 8-1 of Appendix I (Technical working paper: Health impact assessment). Public safety hazards and risks during operation were also assessed including the storage, handling and transport of dangerous goods, with further detail provided in Table 8-3 of Appendix I (Technical working paper: Health impact assessment). These risks will be managed through the implementation of relevant environmental management measures (refer to Table D2-1 of this submissions report), including:

- Preparation of a Remediation Action Plan, where site remediation is warranted, in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) (refer to revised environmental management measure SG8)
- Erosion and sediment control measures will be implemented at all construction support sites and surface road upgrades in accordance with the principles and requirements in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (Department of Environment and Climate Change (DECC), 2008) and relevant guidelines, procedures and specifications of Transport for NSW (refer to revised environmental management measure SG9)
- Emergency procedures, including material and washdown area bunding and appropriately sized spill containment kits, will be developed to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk of human health impacts, water quality impacts and contamination of groundwater (refer to revised environmental management measure SG20).

## **C12.2 Health impacts during construction**

### **C12.2.1 Air quality**

#### ***Issue raised***

Submitters raised concerns over potential health impacts due to a change in air quality during construction. Specific queries, comments and concerns include:

- Concerns about the impact of construction traffic emissions on the health and wellbeing of receivers, particularly increased concentrations of particulate matter and air pollution near the Balgowlah Golf Course construction support site (BL10) and Flat Rock Drive construction support site (BL2)
- Concerns that sensitive receivers and construction workers would be exposed to silica dust which exceeds exposure limits and the associated health risks
- Vegetation and bushland removal during construction does not benefit human health, as the mature trees being removed may help reduce air quality impacts
- Concerns regarding the impact of air quality exceedances on the health of sensitive receivers
- Air quality impacts over a prolonged period of construction could lead to mental health impacts for receivers, particularly for school communities and broader communities across Northern Beaches and Lower North Shore.

## ***Response***

### **Construction traffic emissions**

The potential for emissions from construction vehicles, including on-site vehicles, plant and equipment, to contribute to localised increased emissions has been considered in Section 12.5 of the environmental impact statement.

Local air quality is largely dependent on background air quality, which is more heavily influenced by regional emissions in the overall surrounding environment than local emissions. Temporary construction support sites and haulage routes have been identified with the aim of minimising the use of local roads, where possible, including access to the Balgowlah Golf Course construction support site (BL10) and Flat Rock Drive construction support site (BL2).

Any increased emissions from project-related construction vehicles near temporary construction support sites would be temporary, and would not be at sufficient levels to substantially change emissions or air quality in the local area, or impact the health of the nearest sensitive receivers. In addition, the minor emissions from these sources will be managed with in accordance with revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report). As such, health impacts are not expected from construction traffic emissions.

### **Exposure to silica and construction dust**

In 2020 the NSW Governments' Silicosis Reduction Strategy came into effect which introduced a new minimum silica workplace exposure standard and banned uncontrolled dry cutting and grinding of stone and manufactured stone. In addition, the *NSW Dust Strategy 2020-2022* (SafeWork NSW, 2020) was launched which aims to prevent occupational diseases and protect workers from hazardous dust exposure through a coordinated approach for the safe handling of hazard dust including silica. Although targeted at protecting workers, the implementation of these strategies on the project would also mitigate risks to the community.

There is potential for crystalline silica emissions to occur during tunnel excavation due to the high temperatures caused at the excavation face as discussed in Section 7 of Appendix H (Technical working paper: Air quality). Potential silica dust emissions generated during construction would be managed at source so as to minimise risks to workers and would therefore not be expected to remain airborne for an extended period nor pose health risks to the community. For construction workers, the risk of exposure to silica dust would be managed in accordance with the SafeWork NSW crystalline silica – technical fact sheet (available online at [www.safework.nsw.gov.au/resource-library/hazardous-chemicals/crystalline-silica-technical-fact-sheet](http://www.safework.nsw.gov.au/resource-library/hazardous-chemicals/crystalline-silica-technical-fact-sheet)).

Once on the surface, the handling of tunnel spoil would typically occur within an acoustic shed with haulage off site via load covered trucks, to further minimise the potential for dust emissions. As such, the risk of silica emissions and exposure in areas adjacent to temporary 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 temporary construction support sites, will be minimised through implementation of the environmental management measures including dust suppression, selection of excavation methods to minimise dust generation, and adjusting dust generation activities during unfavourable weather conditions, as per revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report).

A construction environmental management plan would be prepared for the project and would include an air quality management plan as outlined in Section 28.5.1 of the environmental impact



statement and Section D1.1 of this submissions report. This plan will include environmental management measures to minimise construction air quality impacts, as outlined in Table D1-1 of this submissions report. All relevant environmental management measures included in Table D2-1 of this submissions report will be adopted and incorporated into the air quality management plan.

Through the implementation of environmental management measures to suppress dust, it is considered unlikely that silica dust would impact on sensitive receivers surrounding temporary construction support sites.

#### Vegetation and bushland removal

The design of the project has minimised tree removal in the project footprint as far as possible. If trees are to be impacted, they will be protected and pruned rather than removed where possible (refer to revised environmental management measure V10 in Table D2-1 of this submissions report).

A review of research on the effectiveness of vegetation in reducing air pollution was carried out as part of an analysis of potential air pollution abatement measures to inform the *Economic Analysis to Inform the National Plan for Clean Air (Particles)* (Boulter and Kulkarni, 2013). The conclusion of the review advised against the use of vegetation to reduce pollution concentrations in built-up areas at short distances from busy roads, as research demonstrates that vegetation removal does not reduce air quality to any great extent. Further information on this review is provided in Section C11.4.1 of this submissions report. As such, vegetation removal is not expected to negatively affect the health of the community.

#### Consideration of air quality exceedances

The construction air quality assessment approach followed the guidance published by the United Kingdom Institute of Air Quality Management, the aim of which is to identify risks and to recommend appropriate mitigation measures. Specific assessment of potential dust deposition, elevated PM<sub>10</sub> concentrations, increased airborne particulate matter, and nitrogen oxides from vehicle exhaust were considered, and while quantitative modelling was not carried out due to highly variable construction conditions between each temporary construction support site, a qualitative assessment and alternatives to modelling were carried out.

The construction air quality assessment found that for almost all construction activities, substantial impacts on the health of receivers would be avoided through project design and the implementation of effective, industry standard mitigation and management measures, as detailed in Chapter 13 (Human health) of the environmental impact statement (which in turn draws upon the air quality assessment carried out in Chapter 12 (Air quality)). Overall, the health impact assessment concluded that construction air quality impacts are unlikely to result in any health-related impacts for receivers.

#### Prolonged air quality impacts

While it is difficult to quantify and predict particulate matter emissions from construction activities due to variable weather conditions, any effects of construction on airborne particulate matter concentrations would generally be temporary and short-lived, meaning that over the entire construction period, there would not be substantial impacts to physical health as a result of construction air quality changes.

A preliminary assessment was completed to identify areas where the project would potentially have sustained impacts to stakeholders or community members who may be susceptible to construction fatigue. During construction of the project, the community relations team would build a working relationship with the project teams for other major projects to identify stakeholders or community

members who may be susceptible to construction fatigue. The extent and impact of construction fatigue on sensitive receivers due to an extended construction duration would be assessed by identifying and assessing the extent, magnitude and intensity of impacts for stakeholder or community members (refer to Section 7.5.3 of the environmental impact statement). Community consultation and engagement activities would be carried out to support the design and construction of the project and help minimise mental health impacts including stress and anxiety for community members.

### **C12.2.2 Land-based hazards and contamination**

#### ***Issue raised***

Submitters raised concerns in relation to potential health impacts from the disturbance of potentially contaminated soils and other hazardous materials. Specific concerns and queries include:

- Concerns that the health of recreational users at downstream environments, including Manly Dam, Manly Lagoon and Manly Beach, could be impacted by contamination arising from spills, stormwater runoff from temporary construction support sites, and construction wastewater treatment plant discharge at Burnt Bridge Creek
- Construction wastewater treatment plant discharge and pollutants from construction at Burnt Bridge Creek would impact downstream environments such as Manly Lagoon and Manly Beach, which can impact human health
- Concerns about contaminated spoil being disturbed, stored and transported from temporary construction support sites, posing health hazards to local residents and recreational users across the project footprint, including at Flat Rock Drive construction support site (BL2) and Balgowlah Golf Course construction support site (BL10)
- Queries about the measures that would be used to monitor and remediate contamination at Flat Rock Drive construction support site (BL12)
- Concerns about the risk of worker exposure to petroleum vapours in soils at Balgowlah Golf Course construction support site (BL10) due to its proximity to the BP service station
- Concerns about storage of chemicals and volatile compounds posing health risks to residents in Seaforth in proximity to the Wakehurst Parkway south construction support site (BL12) and Wakehurst Parkway east construction support site (BL13)
- Requested information on the risk of asbestos dust on residents, and the management measures including testing and publication of the results
- Concerns about asbestos fibres within the floor, ceiling tiles and walls at Northern Beaches Secondary College Balgowlah Boys Campus, which could be disturbed and released during construction.

#### ***Response***

##### **Water quality impacts and wastewater treatment plant discharges**

A description of key waterways and catchments within the project study area which have the potential to be affected by the project are described in Table 17-7 of the environmental impact statement.

Manly Dam is no longer used as a source of drinking water and therefore water supplies would not be affected by the project. The freshwater lake formed by Manly Dam provides recreational opportunities for swimming, fishing, water-skiing, canoe/kayaking and boating. Manly Dam currently receives run off from Wakehurst Parkway and the runoff is collected through natural drainage lines before reaching the receiving waterways.

Burnt Bridge Creek is an urban intermittent waterway which flows through Seaforth, North Balgowlah, Balgowlah and Manly Vale into Manly Lagoon. It drains a catchment of about 380 hectares of a wide variety of land-uses including residential areas, the Balgowlah Industrial Estate, golf courses and roads. To manage the impact of stormwater pollution in Burnt Bridge Creek on downstream waterways, the Balgowlah Golf Course Stormwater Harvesting Dam was installed, resulting in reduced pollutant loads into Manly Lagoon.

The establishment of temporary construction support sites, stockpiling and earthworks may result in erosion and the mobilisation of exposed soils by stormwater runoff, leading to sedimentation in nearby waterways, particularly if this is not appropriately managed (refer to Table 17-14 of the environmental impact statement). However, as stated in Section 17.4.3 of the environmental impact statement, potential pollutant loading to receiving waters including Burnt Bridge Creek and Manly Creek is considered to be low compared with existing pollutant loading, and construction is likely to have a negligible influence on whether the NSW water quality objectives are met. Therefore, impacts to recreational activities and the health of recreational users for both these waterways and downstream water bodies are not expected. Surface water quality impacts will be managed by environmental management measures including WQ11 and WQ14 (refer to Table D2-1 of this submissions report). In addition, a soil and water management plan will be developed and implemented as part of the construction environmental management plan and include revised environmental management measures such as SG9 to manage the potential for erosion and sedimentation impacts at offsite locations (refer to Table D2-1 of this submissions report).

Impacts associated with the collection, treatment and reuse of wastewater generated during construction have been assessed in Section 17.4.3 of the environmental impact statement. Any surplus wastewater that is not reused would be treated before discharge into the local stormwater system or into a local surface watercourse. This includes wastewater collected from tunnelling activities, which would be tested and treated at construction wastewater treatment plants prior to reuse or discharge. Discharge from the wastewater treatment plants, including at Balgowlah Golf Course construction support site (BL10), will occur once the water is confirmed to be compliant with relevant discharge criteria in revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report). When the water quality criteria are met, the potential contaminant levels in discharged construction wastewater would be sufficiently low that they would not affect the health of waterways or the community use them.

The risks associated with exposure to contaminated soil, sediment or groundwater, as well as spills and accidents have been assessed for different sites in the project footprint in sections 8.1 and 8.3 of Appendix I (Technical working paper: Health impact assessment). Environmental management measures, when implemented will minimise potential impacts by meeting industry standards for the treatment and disposal of any materials. As a result, contamination levels in runoff and discharge from construction sites are expected to be sufficiently low that they would not affect the health of the community using the receiving waterways for recreation, with the implementation of environmental management measures SG8 and SG20 (refer to Table D2-1 of this submissions report).

#### Contamination in spoil and remediation

Potential impacts associated with contaminants from construction activities, including the stockpiling, storage and transport of contaminated spoil in the construction footprint, are provided in Section 16.4.3 (Geology, soils and groundwater) of the environmental impact statement. Potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under Section 105 of the *Contaminated Land Management Act 1997*, as required by revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). This includes further investigations at Flat Rock

Reserve. Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted.

The site investigations during further design development and construction planning phases will further inform contamination management including determining the feasibility of encapsulation (refer to environmental management measure WM9 (refer to Table D2-1 of this submissions report)). Where contaminated material is suitable for encapsulation it will be designed in accordance with the requirements detailed in the *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (Australian and New Zealand Environment and Conservation Council (ANZECC), 1999). Any material that is not suitable for encapsulation would be loaded into covered trucks for disposal at a suitably licensed facility.

Any contaminated material disturbed during construction would be separated from uncontaminated material on site to prevent cross contamination (refer to Section 16.4.3 of the environmental impact statement). A soil and water management plan will also be prepared and implemented prior to works commencing as part of the construction environmental management plan, including the environmental management measures contained in Table D2-1 of this submissions report. Measures to monitor surface and groundwater levels and quality may be included in the soil and water management plan in addition to those in Table D2-1 of this submissions report.

The assessment of human health risks associated with contaminants, particularly in terms of health-related impacts from the disturbance of contaminated materials, is provided in Section 13.4.3 of the environmental impact statement and Section 8.3.1 of Appendix I (Technical working paper: Health impact assessment). The assessment found that if contamination is identified during construction, measures including the development of appropriate Remediation Action Plans will be put in place to mitigate impacts to the health of the local community.

#### Hydrocarbon vapours

The BP service station at Balgowlah is listed in the NSW register of contaminated sites, along with a further six service station sites within 500 metres of the project, as detailed in Table 4-4 of Appendix M (Technical working paper: Contamination). Contamination exposure risk from service stations located near surface works and temporary construction support sites is likely to be low because contamination, if present, is likely to be a sufficient depth and distance from construction activities. Nevertheless, revised environmental management measure SG8 (refer to Table D2-1 of this submissions report) provides for further characterisation and management of any potential contamination including health impacts to construction personnel.

#### Storage of chemicals

A range of potential hazards that have the potential to affect public safety during construction were identified and their risk assessed, as outlined in Table 8-1 of Appendix I (Technical working paper: Health impact assessment). This included the handling and on-site storage of fuel and other chemicals which may result in impacts to the offsite community. The assessment in Table 8-1 found this hazard posed a low risk to public safety and is not expected to negatively affect the health of sensitive receivers nearby.

The anticipated types and quantities of dangerous goods and hazardous substances that would be stored and used within the project temporary 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).

### Addressing asbestos risk to health

The potential for contamination including asbestos is identified at a number of temporary construction support sites and other locations in Table 16-10 of the environmental impact statement. These include areas beside the Warringah Freeway between Cammeray Golf Course and Willoughby Road at Naremburn; at Punch Street, Artarmon; Willoughby Leisure Centre/Bicentennial Reserve, Willoughby; Spit West Reserve, Mosman; Balgowlah Golf Course; and along Wakehurst Parkway, between Seaforth and Frenchs Forest. A moderate level of contamination risk is identified at these sites, with the exception of the Willoughby Leisure Centre/Bicentennial Reserve, and along the Wakehurst Parkway where the risk is considered high.

Further investigation of sites for the presence of contaminated materials, including asbestos will be carried out in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). Asbestos handling, management and disposal will be carried out in accordance with relevant legislation, codes of practice and Australian standards, as required by environmental management measure SG10 (refer to Table D2-1 of this submissions report). Other relevant measures and controls include completion of a hazardous materials assessment (SG11), development of a construction waste management plan (SG12) and management of unexpected finds of contaminated material in accordance with environmental management measure SG13 (refer to Table D2-1 of this submissions report). These measures will minimise the disturbance and possible release of asbestos materials during project construction works.

The assessment of impacts from the most vibration intensive activities proposed at the Balgowlah Golf Course construction support site (BL10) and Sydney Road works are shown in Page 177 and Page 182 respectively, of Annexure L of Appendix G (Technical working paper: Noise and vibration). Construction activities have been reviewed during design development and construction planning and the minimum working distances indicate that buildings at Northern Beaches Secondary College Balgowlah Boys Campus would not be subject to cosmetic damage (for sound and unsound structures). Vibration may however be perceptible in two buildings within the Northern Beaches Secondary College Balgowlah Boys Campus near Sydney Road if plant is operating within the temporary construction support site, closest to these two buildings. Construction activities would be further reviewed during ongoing design development and construction planning, and predicted vibration levels from vibration intensive activities impacting on the two school buildings will be confirmed in consultation with a contractor/s, once appointed. If it is anticipated that vibration would be above the criteria for cosmetic damage for unsound structures at the Northern Beaches Secondary College Balgowlah Boys Campus, a contamination specialist would assess the likelihood of asbestos fibres being released and suitable measures would be determined to mitigate potential impacts to public health.

### **C12.2.3 Marine sediment and contamination**

#### ***Issue raised***

Submitters raised concerns in relation to potential health impacts from the disturbance of dredged sediments and impacts on recreational users. Specific comments and queries include:

- Concerns regarding the health impacts of contamination on recreational users, including those at Middle Harbour, as a result of construction activities such as dredging
- Requests that a 98<sup>th</sup> percentile drift and sedimentation profile for hydrodynamic and dredge plume modelling and deposition be adopted for human health risk assessment purposes
- Concerns that contamination from project construction may impact recreational uses around Middle Harbour, including impacts on the health of people who consume any caught fish

- Concerns that during and after construction potentially contaminated sediment would be deposited in areas used by the public, including children, at Clive Park beach, foreshore and the nearby bed of the harbour
- Concerns that silt curtains to control sediment from dredging activities would not guarantee safe levels of contaminated suspended sediment for recreational use in the waters of Sandy Bay and Clontarf Beach. Concerns that sediment pollution in Middle Harbour is not identified as a high health risk.

### ***Response***

#### Dredging methodology

Transport for NSW has developed an appropriate and effective dredging methodology for the project to mitigate the generation and movement of suspended sediments due to dredging, and to manage potential impacts to nearby recreational users and sensitive marine habitats.

Dredging will be carried out using a backhoe dredge with a closed environmental clamshell bucket to minimise the risk of contaminants being mobilised in the water. Dredging will also be carried out within deep-draft silt curtains 10 to 12 metres deep around the dredging works in accordance with environmental management measure WQ16 (refer to Table D2-1 of this submissions report). Further details on the environmental management measures are provided in Appendix C1 of this submissions report.

Following exhibition of the environmental impact statement, environmental management measure WQ12 (refer to Table D2-1 of this submissions report) has been updated and monitoring of dredging activities will be carried out as follows:

Monitoring during dredging activities will be carried out to validate the effectiveness of mitigation measures implemented to manage potential impacts on the water quality and sensitive marine vegetation and habitats of Middle Harbour. The use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites to manage any potential impacts, will be included in a dredge monitoring program. The dredge monitoring program will be developed in consultation with an appropriately qualified and experienced specialist, DPI Fisheries and the NSW EPA prior to its implementation.

#### Health risks of contamination on recreational users at Middle Harbour

The risks to human health from recreational exposure during proposed dredging and other construction activities in Middle Harbour are considered in Section 13.4.3 of the environmental impact statement.

In response to issues raised in various submissions, further assessment of potential recreational exposures to sediments in Middle Harbour has been carried out and is detailed in Appendix C2 of this submissions report. Locations of interest around Middle Harbour including Sailors Bay, Northbridge Park, Clive Park, Sandy Bay, The Spit, Clontarf Marina, Clontarf Baths, Clontarf Beach and Tunks Park have been assessed to evaluate whether there are any risk issues of concern for recreational exposures to sediments disturbed by the project. The assessment concludes that all maximum (or worst-case) concentrations of chemicals in water as a result of the presence of suspended sediments or dissolved phase concentrations from dredging activities are well below (at least 1000 times below) recreational water guidelines at Clive Park, which is the closest recreational swimming area to the project construction works. Concentrations in all other locations assessed (which are further away from the construction footprint) would be lower due to increased dilution or mixing in larger volumes of water.

As the assessment adopted the peak maximum concentration of suspended solids ie 100 per cent, adopting the 98<sup>th</sup>-percentile amount would reduce the risk of harm even further.

For further information refer to Appendix C2 of this submissions report.

#### Health risk from consumption of marine fauna

Sediment sampling was carried out within the proposed locations of the Middle Harbour crossing and temporary construction support sites as outlined in Section 16.3.5 of the environmental impact statement. The behaviour of sediment-bound contaminants when resuspended into the water column has been previously assessed for other construction projects where it was determined that contaminants are likely to remain bound to sediment particles and not be released into the water column. As the bioavailability of contaminants would be unlikely to increase significantly as a result of the disturbance of sediments during dredging, there is minimal potential for increased bioaccumulation of contaminants in marine fauna and the food chain. As a result, the risk of increased human exposure to contamination due to consumption of marine food is very low.

#### Sediment deposition at Clive Park and other places in Middle Harbour

Potential impacts of construction activities on water quality in and around Middle Harbour have been assessed in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement and the associated health impacts have been assessed in Section 13.4.3 of the environmental impact statement and Appendix C1 of this submissions report.

Numerical modelling was used to determine the likely movement of sediments released into the water column (known as a plume) from dredging to simulate the dispersal of suspended sediment by ambient currents in Middle Harbour, as well as the subsequent deposition of these sediments. Deposition of dredged material will be contained within the silt curtains proposed to be used during dredging activities and would be limited to a thickness of less than five millimetres. The majority of deposition would occur within and adjacent to the dredging footprint due to the low current speeds throughout the area and the use of deep draft silt curtains. Deposits would be concentrated in front of each cofferdam where most of the dredging and rehandling would occur. Low levels of sediment deposition (one to five millimetres) would mostly occur downstream of the dredge footprint due to stronger currents during the ebb tide, with some deposition reaching beyond Spit Bridge near Clontarf and Sandy Bay (refer to Figure 17-6 of the environmental impact statement).

In summary, the effects of sedimentation as a result of dredging are expected to be minor and the short term effects of turbidity and deposition would likely be less than the effects from significant rainfall events.

As discussed above, the health effects from recreational exposure to sediments suspended during dredging and other construction activities have been investigated and shown to be substantially less than the relevant water quality guideline limits for recreational exposure. In addition, the assessment conservatively assumed exposure to sediments would occur every day of the year for a lifetime, also addressing the potential for ongoing exposure associated with the deposition of sediments and disturbance during recreational activities that may occur after construction works are complete. Refer to Appendix C2 of this submissions report for further information.

As mentioned above, dredging activities will be carried out in accordance with environmental management measure WQ16 (refer to Table D2-1 of this submissions report). The use of floating silt curtain enclosures immediately around dredging plant and associated deep draft silt curtains is expected to effectively contain any mobilised sediments and minimise the risk of mobilisation of contaminated sediment in the water column.

Monitoring will be carried out during dredging activities, including real-time turbidity monitoring at both potential impact and background locations, to validate the effectiveness of mitigation measures implemented to manage potential impacts on the water quality and sensitive marine vegetation and habitats of Middle Harbour, as required by revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report).

#### **C12.2.4 Noise and vibration**

##### ***Issue raised***

Submitters raised concerns about noise and vibration impacts to health during construction, including:

- Concerns regarding health impacts associated with ground-borne noise impacts on properties and receivers at Seaforth as the NCA53.3 area is not considered for at-property noise treatment
- Concerns about extended periods of construction noise and construction traffic noise impacts on receivers, noise impacts during out of hours work, as well as cumulative noise impacts leading to physical and mental health impacts on sensitive receivers and recreational users around the construction footprint.

##### ***Response***

###### Ground borne noise

The health effects of ground-borne noise are discussed in Section 13.4.2 of the environmental impact statement and are based on the noise and vibration assessment carried out for the project (refer to Chapter 10 (Construction noise and vibration)).

Modelling of potential ground-borne noise impacts assessed a worst case scenario, which assumed tunnelling occurs immediately beneath a sensitive receiver. Excavation by roadheader would typically progress at around 20 to 30 metres per week (subject to local geology) and progress would reduce to around two to five metres a day near the tunnel portals. Ground-borne noise would typically increase as the roadheader nears a receiver and decrease as the roadheader moves way (refer to Figure 10-7 of the environmental impact statement). It is noted that receivers might experience ground-borne noise on multiple occasions, associated with excavation of different (adjacent) tunnel tubes and other subsurface elements. Ground-borne noise from excavation by the roadheader may be noticeable in some areas during the evening and during the night for one to two weeks at each affected receiver as the roadheader passes below them. Ground-borne noise from roadheader activity is predicted to exceed the night time noise criteria at about 107 residential receiver buildings.

Rock hammers are proposed to be used for clearing the bench of the tunnel and would follow behind the roadheader. Modelling shows that while more receivers could be impacted during rock hammering than roadheader tunnelling, rock hammering has more scope to be programmed outside of sensitive evening and night time periods to avoid ground-borne noise impacts, reducing the potential for associated amenity and health impacts.

While NCA53.3 is predicted to have the highest number of receivers above the night-time ground-borne noise criteria, exceedances would be short-lived and temporary. Measures to manage and mitigate potential impacts associated with ground-borne noise include preparing and implementing location and activity specific noise and vibration impact statements for subsurface tunnelling activities, as required by environmental management measure CNV2 (refer to Table D2-1 of this submissions report). The statements will consider the ground-borne noise generating activities that will occur, identify potentially impacted sensitive receivers, assess predicted ground-borne noise



levels against the relevant criteria and management levels, and specify feasible and reasonable measures that will be implemented.

Where ground-borne levels are predicted to exceed the relevant noise management levels, alternative construction techniques and equipment that are likely to generate less ground-borne noise will be investigated and used where feasible and reasonable, in accordance with environmental management measure CNV8 (refer to Table D2-1 of this submissions report).

The environmental management measures aim to reduce ground-borne noise to levels that meet the management goals, which would also be protective of health (refer to Section 7.4.1 of Appendix I (Technical working paper: Health impact assessment)).

#### Extended periods of construction and traffic noise

An assessment of potential noise and vibration impacts associated with surface road works, construction work areas and temporary construction support sites for the project is provided in Section 10.6 of the environmental impact statement and in more detail in Section 5 of Appendix G (Technical working paper: Noise and vibration). The assessment considers potential impacts during and outside standard construction hours, and for each stage of construction at each work area and temporary construction support site, including early works and site establishment as applicable. Further discussion of the anticipated noise impacts is included in Section C9.3 of this submissions report.

Noise impacts to human health were considered in relation to sleep disturbance, annoyance, hearing impairment, interference with speech and other daily activities, children's cognitive function, and cardiovascular health (refer to Section 13.4.2 of the environmental impact statement). It is anticipated that in some instances, maximum noise levels are predicted to exceed the sleep disturbance screening level and awakening reaction levels at several receivers, with the potential for annoyance and adverse health effects.

Transport for NSW is committed to minimising construction noise impacts. The approaches which will be adopted to mitigate noise impacts are outlined in the environmental management measures in Table D2-1 of this submissions report and in the Construction noise strategy (refer to Appendix J of this submissions report). This includes the development of a construction noise and vibration management plan which will include the procedures and approach for noise and vibration management and monitoring, in accordance with revised environmental management measure CNV1. To further mitigate construction noise from works outside standard construction hours, assessment of potential noise treatments would be proactively carried out at eligible properties directly adjacent work activity areas where high levels of out of hours noise are predicted. Where applicable, these would be implemented as early as possible in the construction program as outlined in Appendix I 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). This change represents a minor impact that is likely to be barely perceptible. The number of maximum noise events from construction traffic that could disturb sleep are not likely to substantially increase, because the maximum number of truck movements generated by the project at night would be small compared to existing truck movements along the proposed haulage routes. However, to further minimise the potential for noise impacts associated with construction traffic, construction vehicle movements will not occur on local roads beyond those required for direct access to construction sites, where feasible and reasonable, unless compliance with the relevant traffic noise criteria can be achieved or alternative arrangements have been agreed with affected receivers, as required by environmental management measure CNV6 (refer to Table D2-1 of this submissions report).

## **C12.2.5 Traffic, transport and access**

### ***Issue raised***

Submitters raised concerns about the health impacts from changes to traffic during construction, including:

- Health impacts on residents' quality of life, mental health and safety as a result of increased traffic during construction near the Flat Rock Drive construction support site (BL2) and Balgowlah Golf Course construction support site (BL10), and as a result of potential traffic delays on Wakehurst Parkway
- Periodic closure of Wakehurst Parkway during construction would impact a direct route for emergency vehicles to Northern Beaches Hospital.

### ***Response***

#### **Health and safety impacts of construction traffic**

The assessment of health-related social impacts during construction, including from changes in traffic, access and connectivity is provided in Section 13.4.3 of the environmental impact statement.

Changes to traffic, access and connectivity during construction have the potential to result in short-term increased levels of stress and anxiety in the local community. There would be no issues related to construction that have the potential to result in significant safety risks to the community. Traffic impacts would 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.

Temporary construction support sites and construction haulage routes have been identified to minimise the use of local roads and use higher capacity arterial roads where possible across the project footprint. Construction traffic accessing and travelling from the Flat Rock Drive construction support site (BL2) and Balgowlah Golf Course construction support site (BL10) would use the indicative routes provided in Figure 6-31 and Figure 6-38 respectively of the environmental impact statement. Modelling was carried on to assess the impacts of this construction traffic on the performance of intersections for the Flat Rock Drive construction support site (BL2) and Balgowlah Golf Course construction support site (BL10), with the results of this assessment in Section 8.4.1 and Section 8.4.4 respectively of the environmental impact statement. It found the performance of intersections would either remain the same following the introduction of construction traffic as conditions without the project or result in minor impacts.

Construction vehicle movements around temporary construction support sites will be limited to non-local roads, where feasible and reasonable, unless compliance with the relevant traffic noise criteria can be achieved, or alternative arrangements have been agreed with affected receivers as required by environmental management measure CNV6 (refer to Table D2-1 of this submissions report).

Other environmental management measures to reduce potential health and amenity impacts and maintain appropriate safety levels include CTT7, CTT8, CTT9, CTT10 and CTT15 (refer to Table D2-1 of this submissions report).

#### **Impact on emergency service vehicles access**

The existing arterial roads and the local road network are currently used by emergency services to travel to and from call-outs. Construction of the project may require temporary traffic diversions, road occupation, temporary road closures and alternative property access arrangements. Emergency vehicles would make use of alternative detour routes where required, or would proceed under traffic control as part of the site-specific construction traffic and access management controls.

Closures of the Wakehurst Parkway in both directions at the same time are not expected to be required.

Management of construction impacts will include ongoing consultation, as relevant to the location, with Greater Sydney Operations, local councils, emergency services and bus operators to minimise traffic and transport impacts, in accordance with environmental management measure CTT6 (refer to Table D2-1 of this submissions report).

### **C12.2.6 Construction fatigue**

#### ***Issue raised***

Submitters raised concerns over potential construction fatigue during the project construction period, including:

- Concerns that multiple temporary construction support sites located near Kirkwood Street, Seaforth would lead to construction fatigue for residents
- Concerns that construction activities could impact sleep and quality of life, potentially leading to health impacts such as stress and anxiety and construction fatigue for sensitive receivers and those with pre-existing conditions, particularly near the Cammeray Golf Course construction support site (BL1) and Balgowlah Golf Course construction support site (BL10)
- Concerns for construction fatigue in the Balgowlah and Seaforth areas given recent construction work near Burnt Bridge Creek Deviation associated with the Northern Beaches B-Line project.

#### ***Response***

Construction fatigue relates to receivers that experience construction impacts from a variety of projects over an extended period with few or no breaks between construction periods. It is typically related to traffic and access disruptions, noise and vibration, air quality, visual amenity and social impacts from projects that have overlapping construction phases or are carried out sequentially. The potential for construction fatigue has been assessed in Chapter 13 (Human health) of the environmental impact statement and measures to manage fatigue are included in Chapter 7 (Stakeholder and community engagement).

#### **Temporary construction support sites near Kirkwood Street**

While simultaneous construction at the Wakehurst Parkway south construction support site (BL12) and works at the nearby Wakehurst Parkway east construction support site (BL13) may result in potential cumulative construction noise and vibration impacts, the sites have different functions and generally, different activities would be carried out at each.

The Wakehurst Parkway south construction support site (BL12) would primarily support the surface works upgrade of the Wakehurst Parkway including temporary site facilities, staff offices and amenities and car parking. The Wakehurst Parkway east construction support site (BL13) is for the primary purpose of constructing a tunnel access decline and the tunnel ramps to the mainline tunnels at Seaforth. Handling and stockpiling of tunnel spoil would be carried out within an acoustic shed, and a wastewater treatment plant, temporary noise barriers, air intake, staff offices and amenities and car parking would also be located at this site.

Cumulative noise impacts from the Wakehurst Parkway south construction support site (BL12) and the Wakehurst Parkway east construction support site (BL13) are unlikely as noise generating activities would generally not occur simultaneously, and potential overlapping or cumulative impacts will be reduced through environmental management measures CNV1 and CNV13 which seek to prevent such circumstances (refer to Table D2-1 of this submissions report). While it is expected that the majority of construction activities would not be noise intensive, Table 5-180 and Table 5-198

in Appendix G (Technical working paper: Noise and vibration) show that construction fatigue may occur where residential receivers are both highly noise affected during standard working hours (during early works and site establishment at Wakehurst Parkway south construction support site (BL12)) and experience noise levels that are audible or clearly audible (during works outside of standard working hours, during early works and site establishment at Wakehurst Parkway east construction support site (BL13)).

For the remainder of longer term construction works (tunnelling, tunnel support and tunnel fitout), overall construction noise levels would be below the noise management level for all receivers. Further, as stated in Sections 4.1 and 4.2 of Appendix G (Technical working paper: Noise and vibration), all construction noise predictions are based on a worst case scenario in terms of the location of noisy activities, plant and equipment being used, and noisy activities occurring simultaneously. Where noise management levels are exceeded, further reasonable and feasible noise mitigation will be implemented, including environmental management measures CNV1 to CNV5 to minimise and monitor the potential noise impacts from construction works (refer to Table D2-1 of this submissions report).

#### Construction fatigue, health impacts and pre-existing conditions

Changes within the community, including construction fatigue, amenity and social changes have the potential to affect levels of stress and anxiety and prolonged negative stress can lead to adverse health problems. Construction fatigue can impact the health of residents during prolonged construction periods. The role of either acute or long-term environmental stress on the health of the community, in general and for specific projects, cannot be quantified, with a wide range of complex factors influencing health and wellbeing, specifically mental health. For this reason it is not possible to determine specific outcomes that may occur as a result of a specific project, or number of projects (refer to Section 9.10 of Appendix I (Technical working paper: Health impact assessment)). However, it is acknowledged that cumulative impacts may occur during construction around North Sydney and Cammeray, Artarmon, Naremburn and Willoughby (refer to Chapter 27 (Cumulative impacts) of the environmental impact statement). Cumulative impacts could be generated by interactions between the project and the Western Harbour Tunnel and Warringah Freeway Upgrade at North Sydney, Cammeray and Artarmon and the Sydney Metro City & Southwest (Chatswood to Sydenham) at Artarmon. Given that recent construction works for the Northern Beaches B-Line project were completed in 2019, this project was not considered as part of the cumulative impact assessment.

The most effective way to minimise potential health impacts associated with prolonged construction periods is to effectively manage all the individual aspects that can affect the amenity and health of the affected community, including construction noise and vibration, traffic, air quality and visual amenity. The environmental management measures that will be implemented to manage amenity and health risks for the community are presented in Table D2-1 of this submissions report and will apply to temporary construction support sites and construction activities. In addition, to minimise potential cumulative environmental, social and health impacts which may lead to construction fatigue for receivers from other ongoing and concurrent projects in proximity to the project, environmental management measures C11 and C12 (refer to Table D2-1 of this submissions report) will be implemented.

The design and construction methodology have been developed with consideration of potential construction fatigue issues and aim to mitigate many of these issues at sensitive receiver locations. In addition, during construction the extent and impact of construction fatigue would be assessed by identifying and assessing the duration, magnitude and intensity of impacts for stakeholders or community members (refer to Section 7.5.3 of the environmental impact statement). The community consultation framework presented in Chapter 7 (Stakeholder and community engagement) and

Appendix E (Community consultation framework) of the environmental impact statement has also been developed with consideration of construction fatigue and includes procedures to proactively manage this issue where possible.

Further, the Beaches Link and Gore Hill Freeway Connection project along and the other approved road tunnel projects, aim to improve infrastructure, connections and access within the urban environment. Hence on a broader scale, while requiring short-term management to minimise potential construction impacts, in the long-term these projects may assist in reducing stress and associated physiological and mental health impacts within the urban environment when open to traffic.

### **C12.2.7 Other health impacts raised**

#### ***Issue raised***

Submitters raised concerns over general health impacts during construction, including:

- Construction lighting (both flashing and still) could become a health hazard for receivers suffering from seizures and otherwise impact quality of life
- Groundwater drawdown at Burnt Bridge Creek could impact the health and wellbeing of the surrounding community and residents
- Construction impacts on the physical and mental health of community members who may be prevented from exercise and recreational activities around Middle Harbour, Northbridge, Flat Rock Gully, Seaforth and Balgowlah.

#### ***Response***

##### Construction flashing and still lighting

Night lighting impacts during construction and operation of the project are assessed in Chapter 22 (Urban design and visual amenity) of the environmental impact statement, with viewpoints from residential properties, included in the visual impact assessment of the temporary construction support sites. Generally, construction activities and equipment would use existing light and lighting structures, supplemented by temporary lighting, for night time works, surface roadworks and within temporary construction support sites.

The potential visual impact to receivers with pre-existing health conditions is not expected to be substantial (or to the extent that it may cause health hazards), as construction lighting would not be constantly flashing and would only emit a moderate lighting change. Existing vegetation would also be retained where possible to provide visual screening around the temporary construction support sites and reduce lighting impacts to surrounding receivers. Curtains would also be used around welding areas to avoid noticeable welding flash at adjacent receivers.

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 *AS4282-2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019a), as required by revised environmental management measure V6 (refer to Table D2-1 of this submissions report).

##### Groundwater drawdown

Potential construction and operational impacts associated with groundwater drawdown are assessed in Chapter 16 (Geology soils and groundwater) of the environmental impact statement. The environmental impacts associated with the predicted groundwater baseflow reductions are presented in Chapter 17 (Hydrodynamics and water quality) and Chapter 19 (Biodiversity), including consideration of both terrestrial and aquatic impacts.

In response to submissions received from regulators and the community during the public exhibition period, Transport for NSW carried out additional groundwater modelling and investigations which are summarised in Section A5.1.15 and discussed in detail in Appendix E of this submissions report. The additional modelling and investigations provide refined predictions of groundwater baseflow reductions and impacts on the terrestrial and aquatic biodiversity, water quality and social values. At Burnt Bridge Creek, while predicted baseflow reductions appear sizeable they contribute very little to streamflow and changes to streamflow after 100 years of operation of the project are predicted to be between one and three per cent which would be difficult to observe. There are not expected to be any health and wellbeing effects from this predicted level of change in Burnt Bridge Creek.

Although the impact is anticipated to be minimal, a suite of environmental management measures will be implemented including additional geotechnical investigations, monitoring of groundwater quality and levels, and development of a revised groundwater prediction model to accompany the detailed design and inform the controls on tunnel inflows to reduce environmental impacts. Environmental management measures which will be implemented include SG1, SG2, SG16, WM12 and WQ13 (refer to Table D2-1 of this submissions report).

### Recreational activities

Potential impacts to health as a result of impacts to open space and green spaces within the project footprint are assessed in Section 13.4.3 of the environmental impact statement. Temporary loss of recreational land would occur within the construction footprint, including at Balgowlah Golf Course, Cammeray Golf Course, Artarmon Park, Spit West Reserve and Flat Rock Reserve (refer to Table 21-5 of the environmental impact statement). However, these changes would generally be temporary, with permanent changes only anticipated at Cammeray Golf Course, Artarmon Park and Balgowlah Golf Course (refer to Table 21-5 of the environmental impact statement).

The temporary use of parks and open space areas for temporary construction support sites (for example, Artarmon Park, Flat Rock Reserve, and Spit West Reserve), resulting in the temporary loss of access to and use of land within the construction footprint, is assessed in Section 9.4 of Appendix I (Technical working paper: Health impact assessment). As alternate open space is available in these areas and is easily accessed by the community, the potential for this temporary loss to affect community health is minimal.

Acquisition and temporary leasing of the Balgowlah Golf Course (located on Government owned land) for construction would result in the permanent closure of the golf course. Other golf courses are accessible in the area and hence, while some additional travel may be required, recreational golf activities are not expected to be affected. In addition, the design of the project would optimise opportunities for residual land at the Balgowlah Golf Course to become progressively available for use as public open space, as construction progresses.

Following construction, areas of the Cammeray Golf Course not required for permanent project infrastructure would be reinstated and rehabilitated, including replacement trees and landscaping. At Artarmon Park, land affected by construction would be reinstated following the completion of construction.

Where possible, the extent of impacts on public open space areas will be minimised during further design development, as required by environmental management measure SE1 (refer to Table D2-1 of this submissions report). Other measures to manage and mitigate potential open space and recreation-related health impacts include environmental management measures LP4, LP5 and CTT4 (refer to Table D2-1 of this submissions report).

Potential health impacts from the disturbance of dredged sediments and impacts on recreational users is discussed in Section C12.2.3 above. Assessment of recreational uses within Middle

Harbour, documented both in the environmental impact statement and through further analysis in Appendix C2 of this submissions report, indicates that the health risks of recreational exposure to contaminants in sediment in Middle Harbour during dredging are 1000 times less than the relevant recreation water quality guideline value. With adoption of the proposed environmental management measures it is expected that there will be negligible impacts to human health in the event that recreational exposures occur in areas surrounding the proposed works in Middle Harbour (refer to Section 13.4.3 of the environmental impact statement).

## **C12.3 Health impacts during operation**

### **C12.3.1 General**

#### ***Issue raised***

Submitters raised concerns over health impacts during project operation, including:

- Concerns the project would have continued and cumulative long term impacts on physical and mental health
- Concerns about increased health impacts around Balgowlah and Seaforth, near tunnel entrances and exits during operation, due to noise from increased volumes of vehicles and increased congestion
- Concerns that the formation of pools at Burnt Bridge Creek and Quarry Creek due to reduced flows would put residents at risk of mosquito borne diseases
- Concerns that as the project is a long tunnel it would impact motorists with phobias of confined spaces as there is no alternative option for motorists and they would be forced to use the tunnel
- Concerns there is a lack of assessment of health impacts associated with the project's contribution to climate change including increased vehicle emissions during operation.

#### ***Response***

##### **Cumulative and long term health impacts**

Potential cumulative impacts on the community are most likely to stem from air quality, noise and vibration, as well as traffic and transport factors. These are all considered key issues and have been modelled in cumulative impact scenarios in Chapter 12 (Air quality), Chapter 11 (Operational noise and vibration) and Chapter 9 (Operational traffic and transport) of the environmental impact statement, respectively. They are also assessed in Chapter 27 (Cumulative impacts) of the environmental impact statement.

The health impact assessment of the project considered existing conditions (in relation to air quality and noise) and estimated short term (acute) and long term (chronic) impacts during operation of the project, as discussed in Section 2.2.2 of Appendix I (Technical working paper: Health impact assessment).

Operation of the project is expected to result in a redistribution of health impacts associated with vehicle emissions and changes in ambient air quality. For much of the community, this 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. Potential health impacts associated with changes in ambient air quality (specifically nitrogen dioxide and particulates) at these locations within the local community have been assessed in Section 13.5.1 of the environmental impact statement and are considered to be tolerable/acceptable.

The completion of a number of tunnel projects (approved or proposed) creates the potential for air pollutant exposures to occur within a network of tunnels over varying periods of time, depending on the journey. The assessment of potential exposures inside these tunnels, summarised in Section 6.6 of Appendix I (Technical working paper: Health impact assessment) and Section 13.5.2 of the environmental impact statement, has indicated that:

- Concentrations of nitrogen dioxide and carbon monoxide are expected to be below the current health-based guidelines and in-tunnel air quality criteria under all plausible operating scenarios, including significant congestion. Levels inside vehicles are expected to be even lower and placing vehicle ventilation on recirculation is expected to further minimise the exposure of vehicle occupants to particulates during travel through the tunnels
- For motorcyclists, where there is no opportunity to minimise exposure through the use of ventilation, there is the potential for higher levels of exposure to air pollutants such as nitrogen dioxide. 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 due to lane filtering, limiting the duration of exposure and the potential for adverse health effects.

In relation to long term operational noise impacts, the health impact assessment concluded that most receiver buildings within the noise catchment areas would experience either a reduction or relatively minor change in operational traffic noise levels due to the project with only around four per cent of receiver buildings experiencing increases greater than 2 dB(A) due to the project (refer to Section 13.5.3 of the environmental impact statement). Additional mitigation for road traffic noise would be considered for receiver buildings, where generally it is existing road traffic noise that triggers the need for additional mitigation rather than increases due to the project. The project is expected to result in an overall improvement in noise levels within the community (compared with the existing situation) and some potential for improvements in community health.

Changes in the urban environment associated with the project have the potential to result in a range of impacts on the health and wellbeing of the community. The potential for changes to result in impacts on health and wellbeing is complex. Changes that may occur have the potential to result in both positive and negative impacts. Positive impacts include economic benefits, improved safety and access, reduced travel times and increased pedestrian and cycle access. Negative impacts may occur as a result of traffic changes during construction, property acquisitions, visual changes, potential air and noise impacts and changes in access/cohesion of local areas. These impacts may reduce or increase levels of stress and anxiety within the community. In many cases, the negative impacts identified are short term (associated with construction only as discussed in Section C12.2 above) while the positive impacts or benefits would be longer lasting. Environmental management measures have been identified to minimise the potential short-term impacts on community health. The positive impacts relate to the operation of the project, which has the potential for long-term positive health benefits to the community.

Potential cumulative impacts of the project are assessed in Chapter 27 (Cumulative impacts) of the environmental impact statement. Potential cumulative impacts during the operation of the project are included in the operational modelling and assessment of various issues, as noted in Section 27.4 of the environmental impact statement. This has informed the assessment of key issues discussed above, including for traffic and transport, noise and vibration, air quality and human health.

#### Formation of pools and mosquito-related disease

Potential impacts of the project on water balance, environmental water availability and flows have been assessed in Chapter 16 (Geology, soils and groundwater) and Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement. Surface environmental water availability



and flows could potentially reduce as a result of groundwater drawdown at Burnt Bridge Creek and Quarry Creek, which may result in the creation of pools, followed by high flows after rainfall events. Between rainfall events there would still be some low flow along the waterways, meaning that the pools would not stagnate. The project would not contribute to additional mosquito breeding or an increase in the risk of mosquito borne disease such as Ross River Fever. Mosquitos favour higher rainfall, humidity and temperature for breeding, climatic conditions that are not typical of the project area. Furthermore, the incidence of Ross River Fever in the Northern Beaches region has been associated with larger water bodies such as Narrabeen Lagoon and Warriewood wetlands and therefore is unlikely to occur in the watercourses in the project area.

#### Motorists with a phobia of confined spaces

The project would not result in a change to the existing surface road and arterial road network, rather the tunnel provides an alternative route to these surface road options. Motorists who may have phobias of confined spaces can continue to use the existing surface roads.

#### Health risks of the project's contribution to climate change

The potential contribution of the project to climate change is discussed in Chapter 26 (Climate change and greenhouse gases) of the environmental impact statement. Greenhouse gas emissions associated with the operation of the project (from electricity consumption, maintenance and vehicle fuel consumption) are estimated to represent about 0.03 and 0.04 per cent of NSW emissions in 2027 and 2037 respectively, and about 0.01 per cent of Australia's national emissions for the same periods.

At a macro level, the project would redistribute emissions from an existing source (vehicles on surface roads) into a tunnel and back into the atmosphere. The emissions are not expected to contribute to substantial climate change risks or associated impacts on human health.

### **C12.3.2 Air quality**

#### ***Issue raised***

Submitters raised concerns over air quality related health impacts during project operation, including:

- Concerns operational air quality may exacerbate existing conditions for vulnerable populations close to ventilation outlets, particularly when combined with impacts from bushfire smoke or dust storms
- Concerns that inversion events would trap air pollutants within Flat Rock Gully, and that over time pollutants would settle on land and in local waters in increasing concentrations, which could impact human health
- Concerns increased traffic during project operation may lead to air quality impacts and create health risks for receivers
- Concerns about air quality related health impacts for buildings with different heights where airborne pollutant concentrations may be worse than the predicted ground level air quality
- Concerns the environmental impact statement does not provide specific information on the cumulative impacts of living between two ventilation outlets at Seaforth and the associated health impacts for sensitive receivers
- Requests for confirmation of diesel fume levels as a result of increased traffic during project operation which may impact the health of local community
- Concerns about operational in-tunnel air quality impacts on the health of motorists, particularly if there is an accident that would expose motorists to polluted air in tunnels

- Concerns that even if emissions from the project achieve Australian air quality criteria, it does not mean the levels are safe, as such emissions have proven to be unsafe in other countries
- Concern that the Western Harbour Tunnel and Beaches Link program of works runs through a large school corridor and since there is no established safe level for fine particulate matter for school children any increase is unacceptable
- Concern that existing levels of PM<sub>10</sub> and PM<sub>2.5</sub> are already above levels that are considered safe and that the project would exacerbate particulate matter pollution
- Concern that the environmental impact statement forecasts an increase in children at Seaforth Public School and Balgowlah North Public School being hospitalised due to the project.

### **Response**

Potential health impacts related to the project during construction and operation have been assessed in Chapter 13 of the environmental impact statement and Appendix I (Technical working paper: Health impact assessment).

#### Air quality impacts and bushfires and dust storms

To assess the air quality impacts of the project, the predicted contribution of project emissions was added to the existing background air quality to provide total pollutant concentrations, as discussed in Section 12.6.2 of the environmental impact statement. These total pollution concentration predictions were then used to analyse the health impacts of the project.

An overview of existing air quality in Sydney is provided in Section 5.8.1 of Appendix H (Technical working paper: Air quality). It notes that the last exceedance of the air quality standard for carbon monoxide (CO) in NSW was recorded in 1998 and that concentrations of nitrogen dioxide (NO<sub>2</sub>), are below national standards, however concentrations of ozone and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) still exceed the standards on occasion. Concentrations of particulate matter are affected by:

- Natural events such as bushfires and dust storms, as well as hazard-reduction burns
- The location and intensity of local emission sources, such as wood heaters, transport and industry.

A detailed analysis of the historical trends in Sydney's air quality (2004–2019), and the current situation, is provided in Annexure D of Appendix H (Technical working paper: Air quality). The results for specific air quality metrics during the period 2004–2019 can be summarised as follows:

- Maximum 1-hour and rolling 8-hour mean CO – All values were well below the air quality criteria and were fairly stable at all stations between 2004 and 2019
- Annual mean NO<sub>2</sub> – Concentrations at all stations were well below the air quality criterion
- Maximum 1-hour NO<sub>2</sub> – Although variable from year to year, maximum NO<sub>2</sub> concentrations have been fairly stable in the longer term. The values across all stations were well below the criterion
- Annual mean PM<sub>10</sub> – Concentrations at stations have shown an upward trend, largely due to the values increasing from 2017 with drought conditions worsening and then severe bushfire activity in 2018 and 2019
- Maximum 24-hour PM<sub>10</sub> – Concentrations are extremely variable but have exhibited an upward trend since 2018, due to extended drought conditions and widespread bushfires. However, based on the previous 13 years of data, these most recent years are anomalous
- Annual mean PM<sub>2.5</sub> – Concentrations showed a similar pattern to those of PM<sub>10</sub>, with a systematic reduction between 2004 and 2012 followed by a substantial increase in 2013, due to a change in the measurement method. The increases meant that background PM<sub>2.5</sub> concentrations in the study area beyond 2013 were very close to or above the standard in the

*National Environment Protection (Ambient Air Quality) Measure* of  $8 \mu\text{g}/\text{m}^3$ , and above the long-term goal of  $7 \mu\text{g}/\text{m}^3$ . The large increase in 2019 was, again, due to the severe bushfire activity in the second half of the year

- Maximum 24-hour  $\text{PM}_{2.5}$  – There has been no systematic trend in the maximum 24-hour  $\text{PM}_{2.5}$  concentration. The maximum 24-hour concentrations over a year are often close to or above the standard in the *National Environment Protection (Ambient Air Quality) Measure* of  $25 \mu\text{g}/\text{m}^3$  and were generally above the long-term goal of  $20 \mu\text{g}/\text{m}^3$ . Significant events such as dust storms and bushfires will result in maximum levels well above these criteria.

The predicted contributions of the project to maximum 24-hour mean  $\text{PM}_{10}$  concentrations at all residential, workplace and recreational receiver locations are discussed in Section 12.6.2 of the environmental impact statement. The background concentrations of  $\text{PM}_{10}$  are dominantly driven by extreme weather and natural hazard events. While the predicted maximum 24-hour mean  $\text{PM}_{10}$  concentration for community receivers is anticipated to exceed the air quality criterion of  $50 \mu\text{g}/\text{m}^3$  under all modelled scenarios (refer to Figure 12-12 of the environmental impact statement), these exceedances are due to elevated background concentrations which are driven by extreme events such as dust storms, bushfires and hazard reduction burns which occurred in 2016 (the background year used in the assessment).

As shown in recent bushfire seasons, under severe bushfire conditions, concentrations of ambient particulate matter are overwhelmingly sourced from bushfire smoke and the contributions from vehicle emissions and other sources have little overall bearing on prevailing air quality. The operation of the project would not alter this situation. On days with worsened air quality due to bushfire activity, vulnerable members of the population and those with pre-existing conditions are recommended to stay indoors. Under such conditions, operational emissions from the project would have no perceptible impact on these receivers.

#### Inversion event

It is acknowledged that temperature inversions, local meteorology and local topography can influence the dispersion and transformation of air pollutants. The operational ambient air quality model considered meteorology relevant to a broader area and included an analysis of the local terrain. Terrain data used in the air quality modelling was sourced from the Geoscience Australia Elevation Information System as discussed in Section 5.2 of Appendix H (Technical working paper: Air quality). The terrain along the project corridor is noted as varying from an elevation of around 75 metres Australian Height Datum at the southern end at the Warringah Freeway to an elevation of around 240 metres at Frenchs Forest at the northern end.

A detailed three-dimensional meteorological model was developed for the study and was used as one of the inputs to the dispersion model, as described in Section 6.4.3 of Appendix H (Technical Working Paper: Air Quality). This meteorological model takes into account local terrain, land use and meteorological conditions from a number of locations in the study area. A wide range of meteorological conditions are therefore considered, including temperature inversions which are a feature of areas throughout Sydney, particularly during winter. All of this information is used to develop the meteorological conditions that are representative of any given year in that specific area. The terrain surrounding each ventilation outlet is therefore also considered and included in the modelling.

During operation, no emissions are expected to concentrate in Flat Rock Gully, as the Warringah Freeway and Gore Hill Freeway ventilation outlets are located some distance away and emissions from these outlets would be effectively dispersed closer to their source.

### Increased traffic

The air quality assessment of the project is based on traffic predictions from the Sydney Motorway Planning Model, which forecasts traffic in the tunnel and changes to traffic volumes on surface roads, as discussed in Section 12.2.3 of the environmental impact statement. The traffic predictions, and therefore the air quality assessment of the project, include induced demand, which accounts for a very small proportion of additional daily trips in the Sydney metropolitan area in 2037, as discussed in Section 9.2.2 of the environmental impact statement. The project is forecast to reduce traffic demands on the existing arterial roads into and out of the Northern Beaches peninsula, in particular Military Road and Eastern Valley Way, and alleviate congestion on a number of arterial roads in northern Sydney, as discussed in Section 9.4 of the environmental impact statement.

The air quality assessment considered emissions from vehicles under expected traffic conditions (ie operating normally with traffic volumes fluctuating over the day to reflect peak and out of peak periods) and also theoretical worst case conditions when the in-tunnel concentrations are at their regulatory limits for all hours of the day and for all days of the year.

For some short-term air quality measures (1-hour NO<sub>2</sub>, 24-hour PM<sub>2.5</sub> and 24-hour PM<sub>10</sub>), exceedances of the criteria for ambient air quality were predicted to occur both with and without the project in the expected traffic scenarios, as discussed in Section 10.2.2 of Appendix H (Technical working paper: Air quality). Such exceedances are usually due to changes in traffic on surface roads and high background concentrations.

In all of the traffic scenarios with the project, the predicted contribution of the ventilation outlets to pollutant concentrations at ground level was negligible for all receivers. As noted above, changes in air quality due to the project are dominated by changes to the traffic on surface roads – both increases and decreases. Where increases in pollutant concentrations at receivers were predicted, these were mostly small and represented a small proportion of all receivers. It is also likely that the predictions at these locations were overly conservative due to the number of conservative assumptions made in the modelling process. Where traffic on roads is expected to reduce due to use of the tunnels, ambient air quality is expected to improve compared to conditions without the project.

Health related ambient air quality impacts have been assessed for nitrogen dioxide, particulate matter, carbon monoxide and air toxics, for acute exposure as well as long term chronic and cumulative exposures (refer to Section 13.5.1 of the environmental impact statement). The assessment of potential operational impacts has accounted for ambient air quality for receivers at ground level and in multi storey buildings, as a result of changed surface traffic (refer to Section 12.6 of the environmental impact statement) and also included modelling for various cumulative scenarios in 2027 and 2037 after the project's completion. Overall, there would be no marked redistribution of air quality impacts, and there would generally be a shift towards lower concentrations. Most notably, there would be no significant increase in concentrations at receiver locations which already had high concentrations in the 'Do minimum' scenarios.

### Air quality impacts on buildings with different heights

Changes in ambient air quality at elevated receivers were assessed as outlined in Section 12.6.4 of the environmental impact statement. The air quality impact assessment assessed potential issues related to pollutant concentrations that may occur at elevated receivers at 10 metres, 20 metres, 30 metres and 45 metres above ground level. These heights were chosen as representative of potential exposures that may occur in multi-storey buildings. The results of the air quality assessment of elevated receivers were then considered in the health impact assessment, in Section 13.5.1 of the environmental impact statement.

The air quality assessment predicted no exceedances at any modelled height for concentrations of annual average  $PM_{10}$  and  $PM_{2.5}$ , annual average and maximum 1-hour average  $NO_2$  and air toxics.

The NSW Environment Protection Authority impact assessment criterion for maximum 24-hour average  $PM_{10}$  is predicted to be exceeded at one elevated existing residential, workplace and recreational receiver during the regulatory worst case scenario, as discussed in Section 10.2.5 of Appendix H (Technical working paper: Air quality). The NSW Environment Protection Authority impact assessment criterion for maximum 24-hour average  $PM_{2.5}$  is also predicted to be exceeded at this same receiver during the regulatory worst case scenario. Transport for NSW carried out additional modelling for this receiver which shows that the exceedances of maximum 24-hour average  $PM_{10}$  and maximum 24-hour average  $PM_{2.5}$  are due to elevated background concentrations; it is clear that the contribution from the ventilation outlets is not the cause of the exceedance (refer to Section B1.5.4 for further discussion).

The health impact assessment undertook further assessment based on the outcomes of the air quality assessment, calculating risks associated with maximum predicted change in  $PM_{2.5}$  concentrations within 300 metres of the ventilation outlets for the project, at the Warringah Freeway, the Gore Hill Freeway, the Burnt Bridge Creek Deviation and Wakehurst Parkway. For both existing and future elevated receivers at 10 metres, 20 metres, 30 metres height and 45 metres height the calculated  $PM_{2.5}$  risks range from negligible to tolerable/acceptable.

Further assessment of risks related to exposure to  $NO_2$  and volatile organic compounds within 300 metres of the ventilation outlets was also carried out and again found no unacceptable risks for existing buildings during expected traffic scenarios. For the regulatory worst case scenario, unacceptable risks have been identified for non-existing elevated receivers at 45 metres in height within the 300 metres adjacent to ventilation outlets at Warringah Freeway, Gore Hill Freeway and Burnt Bridge Creek Deviation. This regulatory worst case scenario assumes emissions are continuously emitted from the ventilation outlets at the proposed emissions limits for all 8760 hours of the year, which is analogous to both the project and the Western Harbour Tunnel operating under breakdown scenarios continuously for a full-year. The regulatory worst case represents a theoretical upper bound that would never occur for periods longer than a few hours. However, based on the health impact assessment findings, Transport for NSW will provide data to Northern Beaches Council, North Sydney Council, Willoughby City Council and the Department of Planning, Industry and Environment (as appropriate), detailing pollution concentrations at various heights and distances from the ventilation outlets to facilitate the planning of and assessment of new development in areas within a distance of 300 metres around the ventilation outlets, which will be within a potential three-dimensional zone of affectation (buffer volume), in accordance with revised environmental management measure LP7 (refer to Table D2-1 of this submissions report).

#### Simultaneous assessment of ventilation outlets

The health impact assessment was based on air quality modelling for the project which considered the simultaneous operation of all the elements of the project, including all four proposed ventilation outlets at Cammeray, Artarmon, Balgowlah and Seaforth and surface roads in 2027 and 2037 ('Do something' scenario). An additional 'Do something cumulative' scenario also considered the operation of an additional seven ventilation outlets for other projects as outlined in Table 12-2 of the environmental impact statement. In all the expected traffic scenarios with the project, the predicted contribution of the ventilation outlets to pollutant concentrations is negligible for all receivers, including the 'Do something cumulative 2037' scenario, as discussed in Section 12.6.2 of the environmental impact statement. This indicates that the impacts of both ventilation outlets operating at Seaforth would not result in negative health impacts for sensitive receivers in the surrounding community.

### Diesel fume levels

The assessment of air quality and health-related impacts has taken into account projected increases in traffic during project operation as outlined in Section 13.5.1 of the environmental impact statement. The air quality assessment has considered both petrol and diesel emissions during operation, noting that although there are relatively few diesel cars in Australia, heavy-duty diesel vehicles are high contributors to nitrogen oxides and particulate matter emissions.

The operational emission modelling is detailed in Section 12.6 of the environmental impact statement and the health impact assessment in Section 13.5.1 of the environmental impact statement draws upon these results to analyse potential health impacts. It was concluded that concentrations of nitrogen oxides and particulate matter would not result in changes in the incidence of health impacts in the community.

### In tunnel air quality

The operational air quality assessment methodology for in-tunnel air quality modelled a number of scenarios, including worst case scenarios to predict emission impacts, as described in Section 12.2.3 of the environmental impact statement.

The project's ventilation system has been designed to achieve the in-tunnel air quality criteria for NO<sub>2</sub> of 0.5 ppm (tunnel average as a rolling 15-minute average) for all traffic scenarios, including the worst case variable speed and breakdown scenarios (refer to Section 13.5.2 of the environmental impact statement). This is one of the most stringent in-tunnel air quality standards in the world. The air quality assessment confirms that the tunnel ventilation system would be able to maintain in-tunnel air quality well within acceptable limits and would not be expected to substantially impact on human health.

The project is designed to minimise risks to public safety including traffic accident risks, and the incorporation of safety measures in-tunnel to reduce accidents would also reduce motorists' exposure to potentially elevated in-tunnel emissions in such events.

### Adequacy of air quality criteria

Applicable air quality standards in NSW are set by the NSW Environment Protection Authority, having regard to national and international practice, and taking into account local conditions and regulatory requirements, as discussed in Section 6.4.3 of Appendix H (Technical working paper: Air quality).

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 EPA Approved Methods and *National Environment Protection (Ambient Air Quality) Measure* standards for NO<sub>2</sub> are more stringent than other countries and organisations except for the United States of America
- In the case of PM<sub>10</sub>, the NSW standard for the 24-hour mean is lower than, or equivalent to, the standards elsewhere, whereas the annual mean standard for PM<sub>10</sub> is in the middle of the range for other locations
- The PM<sub>2.5</sub> 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 air quality criteria listed in Table 6-4 of Appendix H (Technical working paper: Air quality), as set by the NSW Environment Protection Authority, underpin the Secretary's environmental assessment

requirements on which the project's air quality and health impact assessments were carried out. sections 5.6 through 5.10 of Appendix I (Technical working paper: Health impact assessment) give a detailed discussion on the impacts of exposure to the various airborne pollutants that were assessed, with reference to Australian and international guidelines, using guideline values that are current and which reflect exposures for all members of the community. For each pollutant discussed, the assessment in Appendix I (Technical working paper: Health impact assessment) describes the likely health impacts associated with the levels predicted to be generated by the project.

### Particulate matter

The predicted  $PM_{10}$  and  $PM_{2.5}$  concentrations at receivers during operation of the project, including emissions from tunnel ventilation outlets and surface roads, are discussed in detail in Section 8.4 of Appendix H (Technical working paper: Air quality). Under expected traffic conditions, the predicted contribution from the tunnel ventilation outlets to pollutant concentrations was negligible for all receivers in the study area, including schools. Any predicted changes in concentration were driven by changes in the traffic volumes on the modelled surface road network, not by the ventilation outlets. Where traffic on roads is expected to reduce due to diversion to the tunnels, ambient air quality is expected to improve compared to conditions without the project. The project is predicted to result in noticeable decreases in pollutant concentrations along Military Road, Spit Road, Manly Road and Warringah Road, reflecting reductions in traffic of between 23 per cent and 38 per cent on these roads.

The predicted  $PM_{2.5}$  and  $PM_{10}$  concentrations at receivers in the air quality modelling domain are discussed in more detail in Section C11.4.2 of this submissions report. The background air quality levels of  $PM_{10}$  and  $PM_{2.5}$  were often close to or exceeded the annual mean criteria and the maximum 24-hour average criteria, and these elevated background levels would occur regardless of the construction and operation of the project.

### Increased hospitalisation

The environmental impact statement does not forecast an increase in children being hospitalised due to the project at Seaforth Public School and Balgowlah North Public School or any other school.

Hospitalisations are discussed in the assessment of the health related ambient air quality impacts during operation of the project and specifically, the assessment of incremental exposures to particulate matter, in Section 13.5.1 of the environmental impact statement. 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, including the cumulative scenarios, indicate the maximum risks associated with the changes to  $PM_{2.5}$  and  $PM_{10}$  concentrations would be less than or equal to one in 10,000 for exposures in residential, commercial and industrial areas, childcare centres, schools, aged care homes and open space areas. This is considered to be tolerable or acceptable. The predicted change in health risk assumes an individual is exposed at each maximum impacted location over all hours of the day, every day. This includes locations where childcare and schools are located. Actual risk and realistic impacts for receivers are lower than the maximum risk presented.

For childcare and school locations, the maximum risk is lower than the maximum from all locations, being two in 100,000. Risk calculations for individual receivers are presented in Annexures D and F of Appendix I (Technical working paper: Health impact assessment). Where individual school locations are considered the calculated risk is lower, eg the maximum calculated risk for changes in  $PM_{2.5}$  at Balgowlah North Public School is lower at three in a million. The maximum calculated risk for changes in  $PM_{2.5}$  at Seaforth Public School is negative, meaning that air quality is predicted to

improve and risks associated with exposure to particulate matter would be lower than if the project was not constructed.

Translating a calculated risk to actual hospitalisations, for example, is difficult for very small populations such as at an individual school. However, as an example for Balgowlah North Public School, the maximum risk for asthma emergency department hospitalisations for children aged 1-14 years from changes in PM<sub>2.5</sub> is calculated to be  $6 \times 10^{-7}$  (six in ten million, for 2027 'Do something cumulative' scenario). The baseline (existing) incidence of emergency department hospitalisations is 0.01209 per person per year. The change in exposure to PM<sub>2.5</sub> for this scenario at this location would result in the incidence of emergency department hospitalisations changing from 0.01209 to 0.0120908 per person per year. This change is so small that it is not measurable.

Hence the calculated risks are very small and would not translate into any measurable change or increase in hospitalisations as a result of the project.

The population incidence relevant to each of the health endpoints evaluated has also been presented. This relates to the change in incidence (such as hospitalisations) in the population in suburbs and local government areas surrounding the project. It is more relevant to assess incidence at a larger population level, rather than a very small population or an individual. This shows an overall decrease in incidence, with most suburbs also predicted to have a decrease in incidence as a result of the project. The few increases in incidence are very small, well below an individual person, which is not measurable in any population.

### **C12.3.3 Filtration of 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:

- Concerns regarding health impacts from unfiltered ventilation outlets on the surrounding communities including residential receivers, recreational users at sports fields, and sensitive receivers in schools and care facilities around the project footprint
- Concerns that the environmental impact statement does not acknowledge the health issues and the recommendations of the *NSW Legislative Council's Public Accountability Committee report of 2018 on the Impact of the WestConnex Project* into filtering of ventilation outlets.

#### ***Response***

##### Health impacts from unfiltered ventilation outlets

A discussion of the feasibility of including filtration as part of the ventilation system design, in relation to air quality outcomes, is provided in Section C11.4.6 of this submissions report.

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 local air quality at sensitive receivers during expected traffic conditions, as detailed in Chapter 12 (Air quality) of the environmental impact statement and Appendix H (Technical working paper: Air quality). A regulatory worst case scenario was also used to model the emissions from ventilation outlets at the limits expected to be set by the regulators and the potential health impacts of this scenario were assessed in Section 5.10 of Appendix I (Technical working paper: Health impact assessment). It is anticipated there would not be to be significant contributions from the ventilation outlets to ambient air quality under the regulatory worst case scenarios, that is, when the emissions are released from the tunnel via these outlets are at their



regulatory limits for all 8760 hours of the year. It is also noted that this is a theoretical scenario and is not anticipated to occur for this significant period of time. It is concluded that while the project has the potential to increase individual risks, the maximum individual risks (even when conservative assumptions are adopted) are considered to be tolerable/acceptable.

Potential health impacts associated with changes in air quality, specifically nitrogen dioxide and particulates within the local community have been assessed at residential receivers, recreational facilities, schools and care facilities, and are considered to be acceptable, as discussed in Chapter 13 (Human health) of the environmental impact statement. Furthermore, 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 the 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 C11.4.6 of this submissions report for more details.

Filtration systems are not proposed for the project as the modelling demonstrates the contributions to air quality at ground level due to emissions from the ventilation outlets would be minimal. The inclusion of tunnel filtration was evaluated and was found not to provide any material benefit to air quality or community health as discussed in sections 4.5.6 and 12.7.2 of the environmental impact statement.

#### Government inquiry into the Impact of the WestConnex Project

The environmental impact statement assesses the potential impact of the project on a number of health aspects, including air quality, construction and operational noise, loss of green space and mental health, in Appendix I (Technical working paper: Health impact assessment). The installation of filtration in the project ventilation system was also considered in section 4.5.6 and 12.7.2 of the environmental impact statement. As noted above, no in-tunnel filtration system is proposed for the project because the air quality assessment in Appendix H (Technical working paper: Air quality) demonstrates that the ventilation system would be effective in ensuring compliance with both in-tunnel and ambient air quality criteria. The inclusion of tunnel filtration was evaluated and found not to provide any material benefit to air quality or community health.

The NSW Chief Scientist and Engineer has recently released a series of reports in relation to trends in motor vehicle emissions, the design of road tunnel ventilation systems, road tunnel outlet emissions and options for treating road tunnel emissions. The reports found that emissions from well-designed road tunnels cause a negligible change to surrounding air quality at locations close to the ventilation outlets, and as such, while treatment systems for particulates may be technically feasible, there is little to no health benefit for surrounding communities and outlet dispersion may achieve the same outcomes at a reduced cost. Further information is available at [www.chiefscientist.nsw.gov.au](http://www.chiefscientist.nsw.gov.au) and <https://caportal.com.au/rms/air-quality/>.

The discussion on tunnel ventilation and filtration in the environmental impact statement reflects the outcomes of the review in *TP06: Options for treating road tunnel emissions* (Advisory Committee on Tunnel Air Quality, 2018c). 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 NO<sub>2</sub> is technically feasible, the available technologies will 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.

It is further noted that due to the reduction in surface road traffic caused by diversion to the tunnels, the project would generally result in a better outcome for ambient air quality than conditions without the project.

It has been shown that control of pollutants at the source, such as vehicle emissions controls, is significantly more effective in improving local and regional air quality (Longley, 2014 and National Health and Medical Research Council, 2008). The NSW Government is committed to continuing to work with the Australian Government to implement cleaner fuels and cleaner vehicles including renewables, hence reducing emissions at source.

The environmental impact statement assesses the potential impact of the project on a number of health aspects, including air quality, construction and operational noise, loss of green space and mental health, in Appendix I (Technical working paper: Health impact assessment). The installation of filtration in the project ventilation system was also considered in sections 4.5.6 and 12.7.2 of the environmental impact statement. As noted above, no in-tunnel filtration system is proposed for the project because the air quality assessment in Appendix H (Technical working paper: Air quality) demonstrates that the ventilation system would be effective in ensuring compliance with both in-tunnel and ambient air quality criteria. The inclusion of tunnel filtration was evaluated and found not to provide any material benefit to air quality or community health.

Transport for NSW notes that during operation, air quality monitoring of key pollutants would be carried out throughout the tunnel and the monitoring data would be made publicly available. Emissions from the ventilation outlets would also 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 the project conditions of approval, should the project be approved.

## **C12.4 Environmental management measures**

### ***Issue raised***

Submitters raised questions, recommendations and concerns regarding proposed environmental management measures for health impacts, including:

- Recommendations that environmental management measures should be clarified to ensure measures for operational traffic noise would prevent sleep disturbance at receivers
- Concerns that current environmental management measures proposed for managing silica dust are inadequate. Recommendation that Transport for NSW should accept liability for any health impacts resulting from construction dust, an independent authority should regulate and monitor the exposure to air pollutants (including silica dust) and the monitoring results should be made public
- Recommendations that sleep disturbance of Balgowlah receivers during construction should be mitigated by providing alternative accommodation
- Questions how health impacts would be measured and mitigated regarding vibratory roller and piling impacts on receivers and properties

- Requests for the establishment of compensation funds for children and construction personnel who are injured or affected by pollution and safety hazards during construction, and requests for compensation for health impacts that may arise from tunnel-related air quality impacts
- Queries about personalised mitigation measures to be provided for residents of Pickworth Avenue, Balgowlah to prevent mental health impacts.

### ***Response***

#### **Environmental management measures for operational traffic noise**

A summary of the changes in operational road traffic noise anticipated as a result of the project is provided in Section C12.3.1 above. Where noise levels are predicted to increase, environmental management measures will be investigated during further design development to reduce these identified impacts. These measures principally involve the investigation of quieter pavements and installation of noise barriers and at-property treatments. Indicative locations of proposed noise barriers as part of the project are shown in Figure 5-2, Figure 5-8 and Figure 5-9 of the environmental impact statement. Receivers exceeding the relevant traffic noise criteria would be considered for at-property treatment, where other treatments are not feasible or reasonable. Based on the current proposed design the properties that would be eligible for consideration of noise mitigation beyond the adoption of road design and traffic management measures in this scenario are indicated in Figure 11-1 to Figure 11-3 of the environmental impact statement.

Further investigation and implementation of feasible and reasonable mitigation measures will be carried out in accordance with relevant policies and guidelines including the *NSW Road Noise Policy* (Department of Environment, Climate Change and Water (DECCW), 2011b), *Noise Criteria Guideline* (Roads and Maritime Services, 2015a) and *Noise Mitigation Guideline* (Roads and Maritime Services, 2015b) in accordance with environmental management measure ONV1 (refer to Table D2-1 of this submissions report).

For local roads within the project area in Balgowlah, North Balgowlah and Seaforth where predicted increases in traffic are likely to result in exceedances of the relevant road traffic noise criteria, traffic calming measures with the aim of limiting potential road traffic noise increases to no more than 2 dB(A) will be investigated in consultation with Northern Beaches Council and implemented, in accordance with revised environmental management measure ONV3 (refer to Table D2-1 of this submissions report).

#### **Construction dust environmental management measures**

Air quality impacts on receivers will be managed through the implementation of best practice environmental management measures, as discussed in Section C12.2.1 above, and as a result it is unlikely that construction would result in any health-related impacts at receivers.

Best practice construction air quality environmental management measures will be detailed prior to construction in the air quality management plan, prepared as a sub-plan to the construction environmental management plan for the project (refer to Section 28.5.1 of the environmental impact statement). The construction environmental management plan would be reviewed and approved by Transport for NSW and the Department of Planning, Industry and Environment, prior to the commencement of main construction work. The air quality management plan would also be supplemented by the requirements of the environment protection licence issued for the project and conditions of approval set by the Department of Planning, Industry and Environment, should the project be approved.

Construction air quality impacts will be minimised through the implementation of standard construction air quality environmental management measures. These management measures will

be implemented during dust generating activities in all construction stages of the project. They would include site management, use of water carts to minimise dust, monitoring, preparing and maintaining the construction sites and maintenance and controls on vehicles and machinery. Specific construction measures for dust suppression may include the use of sprinklers, site exit controls, stabilisation of exposed areas or stockpiles and surface treatments (refer to revised environmental management measure AQ1 in Table D2-1 of this submissions report).

Potential impacts associated with silica dust are discussed in Section C12.2.1 above constwhich notes that it is unlikely that silica dust would impact on sensitive receivers surrounding temporary construction support sites. Potential silica dust emissions generated during construction would be managed at source so as to minimise risks to workers and would therefore not be expected to remain airborne for an extended period nor pose health risks to the community. For construction workers, the risk of exposure to silica dust would be managed in accordance with the SafeWork NSW crystalline silica – technical fact sheet (available online at [www.safework.nsw.gov.au/resource-library/hazardous-chemicals/crystalline-silica-technical-fact-sheet](http://www.safework.nsw.gov.au/resource-library/hazardous-chemicals/crystalline-silica-technical-fact-sheet)).

Dust and air quality complaints would be managed in accordance with the overarching complaints handling process for the project. Appropriate corrective action, if required, will be taken to reduce emissions in a timely manner in accordance with environmental management measure AQ3 (refer to Table D2-1 of this submissions report).

Community consultation and engagement activities would help inform and clarify for receivers the environmental management measures proposed to minimise physical and mental health impacts associated with construction dust and other potential impacts, in accordance with the community consultation framework for the project (refer to Appendix E (Community consultation framework)).

#### Respite for sleep disturbance

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 and is committed to minimising these construction noise impacts.

The contractor/s will prepare a construction noise and vibration management plan and out of hours works protocol in accordance with environmental management measures CNV1 and CNV3 (refer to Table D2-1 of this submissions report). They will be required to assess the potential noise and vibration impacts of the proposed construction methodology, in accordance with environmental management measure CNV2, 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, should the project be approved. 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 be implemented as outlined in Appendix J of this submissions report. The mitigation measures to be considered would include providing respite as appropriate to minimise the frequency a sensitive receivers might be subjected to noise levels likely to result in sleep disturbance, or providing alternative accommodation if required.

In addition, to further mitigate construction noise from works outside standard construction hours, noise treatments would be proactively implemented at eligible properties adjacent to the project as early as possible in the construction program as outlined in Appendix I of this submissions report.

### Vibratory roller and piling impacts

For vibration-generating activities on land, potential impacts will be managed through the establishment of minimum working distances (or offsets) to sensitive receivers, in accordance with environmental management measure CNV7 (refer to Table D2-1 of this submissions report). Where construction vibration levels are predicted to exceed the screening levels, a more detailed assessment of the impacted structure will be carried out to assess the susceptibility of the structure to damage due to the project. Appropriate mitigation and management measures, such as equipment substitution and alternative methods, will be identified and implemented to avoid damage.

In any given week, impact piling will be carried out, as required by environmental management measure CNV14 (refer to Table D2-1 of this submissions report) to manage the noise and vibration impacts, over no more than either:

- A two hour period each work day or
- A six hour period on a single work day.

In addition, a new environmental management measure CNV15 (refer to Table D2-1 of this submissions report) has been included which requires the consideration of less noise and vibration intensive piling methods and the need to minimise potential noise and vibration impacts to adjacent sensitive receivers, during the development of the detailed piling methodology for the Middle Harbour crossing. Less noise and vibration intensive methods will be adopted where feasible and reasonable and subject to addressing potential constructability and engineering constraints.

Attended vibration monitoring will be carried out during vibration-intensive activities in the vicinity to ensure vibration levels remain below appropriate limits for that structure, in accordance with environmental management measure CNV7 (refer to Table D2-1 of this submissions report). 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.

Pre-construction building condition surveys will also be carried out in accordance with environmental management measure SG7 (refer to Table D2-1 of this submissions report). Any building and/or structure damage from vibration caused by the project will be repaired at no cost to the owner.

### Request for compensation fund

The health impact assessment concludes that, with the implementation of appropriate management measures in Table D2-1 of this submissions report there would not be any issues that will result in substantial negative impacts to the community and public health, including in relation to air quality, noise and vibration, public safety, contamination and social aspects. Therefore, Transport for NSW believes a compensation fund for the project is not required and does not propose to provide compensation beyond what is required for acquisition of property.

### Personalised mitigation measures

Potential impacts to mental health from the project are outlined in Appendix I (Technical working paper: Health impact assessment). Specifically, stress and anxiety issues have been assessed in Section 9.10 of Appendix I (Technical working paper: Health impact assessment), with both short and long term potential impacts on physical and mental health discussed. It is acknowledged that there is a broad range of complex factors that can determine mental health in any community, and mental health issues cannot be conclusively attributed to any particular environmental stressors. It is also acknowledged that mental health impacts are difficult to quantify and assess for the project. Nonetheless, on a larger scale, the project aims to improve infrastructure, connectivity and access

and would incorporate long term management measures to minimise potential construction impacts to avoid or reduce health impacts on the community.

During construction, consultation for the project will be carried out in accordance with the Appendix E (Community Consultation Framework), as required by environmental management measure SE3. In addition, the environmental management measures in Table D2-1 of this submissions report will be implemented to help avoid or reduce impacts where possible. Ongoing engagement with the community would assist in providing clarity on potential impacts and minimise impacts to the health and wellbeing of receivers surrounding the project construction footprint.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C13 – Non-Aboriginal heritage

## **C13 Non-Aboriginal heritage**

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## C13.1 Adequacy of the assessment

### *Issue raised*

Submitters raised concerns about the adequacy of the non-Aboriginal heritage assessment. Specific queries, concerns and comments included:

- Concern that the proposed environmental management measures to protect non-Aboriginal heritage items are inadequate, including the measures proposed to protect the historic stone library and former schoolhouse at Seaforth
- Concern that heritage homes at Nareburn and Cammeray have not been included in the environmental impact statement
- Concern that the history of Nareburn and the Flat Rock Creek catchment has been under-scoped, including a request for an independent assessment of the historical importance of the Nareburn area
- Concern that heritage listed shipwrecks in Middle Harbour have not been included
- Request for the reassessment of risks to items of non-Aboriginal heritage.

### *Response*

Transport for NSW is committed to preserving heritage items along the project corridor and minimising project impacts.

The non-Aboriginal heritage assessment is included in Chapter 14 (Non-Aboriginal heritage) of the environmental impact statement, Appendix J (Technical working paper: Non-Aboriginal heritage) and Appendix K (Technical working paper: Maritime heritage).

The methodology adopted for the assessment of non-Aboriginal heritage is outlined in Section 2 of Appendix J (Technical working paper: Non-Aboriginal heritage) and Section 2 of Appendix K (Technical working paper: Maritime heritage). The assessment was carried out to meet the requirements of the Secretary's environmental assessment requirements and in accordance with relevant guidelines and current industry best management practice. The assessment has been carried out by experienced, qualified heritage specialists and is considered to be a robust assessment of potential project impacts on non-Aboriginal heritage.

### Environmental management measures

A suite of environmental management measures have been proposed for the project to manage potential non-Aboriginal heritage impacts and ensure ongoing consideration is given to further minimise impacts of the project on both terrestrial and maritime non-Aboriginal heritage items of both local and State significance. This includes measures outlined in Section 14.5 of the environmental impact statement as well as measures in other chapters including Chapter 10 (Construction noise and vibration) and Chapter 16 (Geology, soils and groundwater).

It should be noted that following exhibition of the environmental impact statement, and in response to issues raised by Northern Beaches Council (refer to Section B11.13 of this submissions report), assessment of two additional potential non-Aboriginal heritage items on Wakehurst Parkway, and further assessment of potential impacts on Frenchs Bullock Track has been carried out. This assessment is detailed in Appendix H of this submissions report and has resulted in several new environmental management measures being adopted for the project.

Potential impacts to the stone library (former school house) at Seaforth were considered in Section 5.3.2 and Table 5-3 of Appendix J (Technical working paper: Non-Aboriginal heritage). The assessment found that there would be no project impact to this heritage item.

A full list of environmental management measures for the project can be found in Table D2-1 of this submissions report. These measures are considered to be appropriate for the management of potential impacts from the project.

### Heritage homes and properties

A search of relevant heritage registers and databases for non-Aboriginal heritage items was carried out as part of the assessment and results are summarised in Section 3.2.1 of Appendix J (Technical working paper: Non-Aboriginal heritage). A summary of the heritage significance of the items identified is provided in Section 4 of Appendix J (Technical working paper: Non-Aboriginal heritage). A number of heritage homes and properties within the proposed project area were identified and their significance evaluated, including properties in Cammeray and Naremburn.

### Consideration of historical context

The historical context of the project area is documented in Section 14.3.1 of the environmental impact statement and Section 3.1 of Appendix J (Technical working paper: Non-Aboriginal heritage). Discussion has been divided into suburbs and local government areas in order to further define and understand the historical context specific to each location.

The assessment of potential project impacts has been carried out in accordance with the relevant frameworks and guidelines of the NSW and Australian governments, as relevant. The historical context is an appropriate summary of the available information and supports the non-Aboriginal heritage impact assessment that has been carried out.

### Shipwrecks in Middle Harbour

Impacts to potential non-Aboriginal maritime heritage items on the bed of Middle Harbour have been considered in Section 14.4.3 of the environmental impact statement and Appendix K (Technical working paper: Maritime heritage).

Three unidentified shipwrecks of potential heritage significance were identified during field surveys, namely Clive Park Unidentified Shipwreck No.1, Pearl Bay Unidentified Shipwreck No.1, and Middle Harbour Unidentified Shipwreck No.1. The location of these unidentified shipwrecks is shown on Figure 14-3 of the environmental impact statement. These shipwrecks are not listed items, but the assessment has considered them to be of local heritage significance for their rarity and research potential. The potential impacts to these items is included in Table 14-4 of the environmental impact statement. Potential impacts to shipwrecks are not considered to be significant and will be minimised and managed through the implementation of the proposed environmental management measures (refer to Table D2-1 of this submissions report).

In addition, further consideration of Pearl Bay Unidentified Shipwreck No. 1 is included in Section 3 (Spit West Reserve construction support site (BL9) reconfiguration) of the preferred infrastructure report, in regard to the reconfiguration of Spit West Reserve construction support site (BL9). Direct impacts to this wreck have been avoided and potential indirect impacts would be minor, which is consistent with the findings presented in the environmental impact statement for this item.

### Risks to items of non-Aboriginal heritage

As detailed in Section 14.4.1 of the environmental impact statement, the project has avoided or minimised impacts to heritage in the following ways:

- The majority of the project would be constructed and located underground, avoiding impacts through the subsurface tunneling of the project

- 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). Residual land (ie outside operational requirements) would be returned to enable incorporation into the golf course at the completion of construction
- At Middle Harbour, the construction methodology for the project has been selected to avoid direct impacts on foreshore areas, such as Clive Park. Specifically, the use of cofferdams has minimised temporary and permanent impacts to the shoreline and avoids direct impacts to the park
- At the Wakehurst Parkway, project work has been contained within the existing road reserve to avoid direct impact to Bantry Bluff, which is listed on the Manly Local Environmental Plan 2013 as locally significant, and Upper Middle Harbour Area and the Narrabeen Catchment Lagoon, which are listed on the Register of the National Estate for landscape values
- The Wakehurst Parkway east construction support site (BL13) has been designed to avoid direct impacts to key heritage elements of the Bantry Bay Water Pumping Station and the Bantry Bay Reservoir
- Permanent direct impacts to the Manly Warringah War Memorial State Park have been avoided. Less than one per cent of the heritage item would be impacted during a short period of the construction phase to reconnect the upgrade works to an existing fire trail/high voltage powerline maintenance access track.

An environmental risk analysis for the project was carried out and is included in Appendix C (Environmental risk analysis) of the environmental impact statement. Risks to items of non-Aboriginal heritage during the construction stage have been considered and include consideration of possible direct and indirect impacts to heritage items, both terrestrial and maritime.

The 19 proposed non-Aboriginal heritage environmental management measures, along with other environmental management measures identified as part of related assessments in the environmental impact statement and those proposed for the Western Harbour Tunnel and Warringah Freeway Upgrade project, will minimise the risks and potential impacts to non-Aboriginal heritage items. Following the application of the proposed environmental management measures, the residual risk rating to identified non-Aboriginal heritage items would range from low to medium, as shown in Appendix C (Environmental risk analysis).

## **C13.2 Heritage impacts during construction**

### ***Issue raised***

Submitters raised concerns about non-Aboriginal heritage impacts during construction. Specific queries, concerns and comments include:

- Concern about impacts to the Manly Warringah War Memorial State Park and the heritage significance of Manly Dam and its surrounds
- Concern about the impact of construction works, including tunnelling, blasting, and heavy vehicle movements, on heritage listed houses within the project corridor
- Concern about vibration impacts to non-Aboriginal heritage sites including Clive Park, Northbridge, and sites in Cammeray and Artarmon
- Concern about impacts to non-Aboriginal heritage items within the Naremburn Heritage Conservation Area
- Concern about impacts of marine activities during construction, including dredging, to non-Aboriginal heritage sites.

## ***Response***

### **Manly Dam and surrounds**

The heritage item Manly Dam and surrounds has been assessed in Table 14-3 of the environmental impact statement. Please note that Table A5-13 of this submissions report includes a clarification from Northern Beaches Council that Manly Dam Reserve should be referred to as Manly Warringah War Memorial State Park.

Manly Dam and surrounds is located at Allambie Heights, comprising Manly Dam, the surrounding Manly Warringah War Memorial State Park and adjoining bushland to the north, as discussed in Section 5.4.14 of Appendix J (Technical working paper: Non-Aboriginal heritage). The heritage item is listed on the Warringah Local Environmental Plan 2011 and the Register of the National Estate, and is of local significance.

Potential impacts to non-Aboriginal heritage item Manly Dam and surrounds have been avoided, with less than one per cent of the heritage item impacted during a short period of the construction phase to reconnect the upgrade works to an existing fire trail/high voltage powerline maintenance access track (refer to Section 14.4.1 of the environmental impact statement).

The vast majority of the area surrounding Manly Dam and surrounds would not be impacted by the project, with only a small section of the boundary along the Wakehurst Parkway being impacted. With the implementation of the proposed environmental management measures (refer to Table D2-1 of this submissions report), the level of impact to Manly Dam and surrounds will be negligible, as there will be little or no physical impact to the heritage item.

### **Impacts to non-Aboriginal heritage sites and heritage listed houses**

Construction impacts on non-Aboriginal heritage items including heritage listed houses within the project corridor have been considered in Section 14.4.2 of the environmental impact statement and Appendix J (Technical working paper: Non-Aboriginal heritage). For the purpose of the heritage assessment, the study area considered all potential heritage sites within 50 metres of the project construction footprint. Relevant heritage items identified included Cammeray Conservation Area, Holtermann Estate A Conservation Area, Artarmon heritage conservation area, Naremburn Central Township (Conservation Area) and five houses in Ernest Street at Neutral Bay. Impacts from vibration generating construction activities including tunnelling, blasting and heavy vehicle movements on these heritage items has been considered in Section 14.4.2 and Table 14-3 of the environmental impact statement. Impacts were found to be negligible, with the exception of Cammeray Conservation Area where the impacts were assessed as minor.

Construction activities for the project will be carried out in accordance with the environmental management measures listed in Table D2-1 of this submissions report to ensure potential impacts are minimised.

### **Vibration impacts at Clive Park, Cammeray and Artarmon**

Potential vibration impacts on heritage items have been assessed in Section 14.4 of the environmental impact statement and Section 5 of Appendix J (Technical working paper: Non-Aboriginal heritage). The sensitivity of heritage structures is discussed in Section 3.4.5.3 of Appendix G (Technical working paper: Noise and vibration) and the project has adopted a conservative vibration damage screening level of 2.5 millimetres per second for their assessment.

Vibration impacts will be managed through the establishment of minimum buffer distances to achieve screening levels, as required by environmental management measure CNV7 (refer to Table D2-1 of this submissions report). Where vibration levels are predicted to exceed screening levels, a

more detailed assessment of the impacted structure will be carried out and for heritage items, this 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. In addition, pre-construction building structure condition surveys will be carried out in accordance with revised environmental management measure SG7 (refer to Table D2-1 of this submissions report). Any building and/or structure damage from vibration caused by the project will be repaired at no cost to the owner.

The vibration impact assessment outcomes for Clive Park, Cammeray and Artarmon are discussed further below.

#### *Clive Park*

Clive Park is a site with both terrestrial and maritime non-Aboriginal heritage elements. The heritage item Clive Park and Tidal Pool, Northbridge is listed as having local heritage significance under the Willoughby Local Environmental Plan 2012.

The construction methodology for the project has been selected to avoid direct impacts to the heritage item Clive Park and Tidal Pool. Specifically, the use of cofferdams has minimised temporary and permanent impacts to the shoreline and avoided direct impact to the heritage item.

In terms of vibration, there is the potential for the heritage item to be indirectly impacted due to ground movement impacts caused by vibration and tunnel excavation however these have been assessed as minor (refer to Section 5.4.8.3 of Appendix J (Technical working paper: Non-Aboriginal heritage)).

The overall level of impact on Clive Park and Tidal Pool has been assessed as minor with the implementation of the proposed environmental management measures listed in Table D2-1 of this submissions report. Refer to Table 14-3 of the environmental impact statement for more information.

#### *Cammeray*

There are four heritage items that have been identified in Cammeray namely ANZAC Park, Cammeray Park (including Cammeray Golf Course), Cammeray Conservation Area and Tarella.

Potential project impacts at ANZAC Park and Tarella have been assessed as being negligible.

Cammeray Park is listed on the North Sydney Local Environmental Plan 2013. The predicted vibration levels at the heritage item from tunnelling (rock breaking only) and surface works would be above 2.5 millimetres per second. As such, structural review would be required if any structures are within these levels (refer to Section 5.4.2.4 of Appendix J (Technical working paper: Non-Aboriginal heritage)). Environmental management measures will control and minimise vibration impacts and with the implementation of the management measures, the overall level of impact on the Cammeray Conservation Area has been assessed as moderate. The moderate rating is mainly due to temporary and permanent direct impacts associated with areas previously disturbed by the Western Harbour Tunnel and Warringah Freeway Upgrade project.

The Cammeray Conservation Area is listed under the North Sydney Local Environmental Plan 2013 and the Register of the National Estate and is considered to be of local heritage significance. The predicted vibration levels at the heritage item from tunnelling (rock breaking only) and surface works would be above 2.5 millimetres per second. As such, structural review would be required if any structures are within these levels (refer to Section 5.4.2.4 of Appendix J (Technical working paper: Non-Aboriginal heritage)). Environmental management measures will control and minimise vibration impacts and with the implementation of the project management measures, the overall level of impact on the Cammeray Conservation Area would be minor.

### *Artarmon*

There is one non-Aboriginal heritage item that has been identified at Artarmon, namely the Artarmon Heritage Conservation Area. This item is listed as having local heritage significance under the Willoughby Local Environmental Plan 2012.

The on ramp and off ramp for the connections to and from the Gore Hill Freeway Connection to the mainline tunnels are located directly below the southern extent of the heritage conservation area. Any physical works associated with the project at the surface would be limited to the Gore Hill Freeway road reserve or existing water quality basins. Temporary and permanent works within the heritage conservation area would be limited to minor pavement and drainage works and be restricted to previously disturbed areas. Areas impacted by vibration would be vegetated open space (Artarmon Reserve), with no structures relevant to the heritage listing present. As such any impact would be negligible (refer to Section 5.4.7.3 of Appendix J (Technical working paper: Non-Aboriginal heritage)). The level of impact on the Artarmon Heritage Conservation Area has been assessed as negligible with the implementation of the environmental management measures described in Table D2-1 of this submissions report.

### Potential impacts within Naremburn Heritage Conservation Area

The Naremburn Central Township conservation area is listed under the Willoughby Local Environmental Plan 2012 and is located above the mainline tunnel alignment and within 50 metres of surface works within the Warringah Freeway road reserve. In relation to impacts on the Naremburn Heritage Conservation Area, the assessment found that there would be no direct or potential direct impact on the Naremburn Central Township heritage conservation area, as detailed in Table 14-3 of the environmental impact statement. Indirect impacts would include temporary vibration impacts due to construction activities and slight permanent settlement and ground movement impacts caused by tunnel excavation. The level of impact on the Naremburn Central Township heritage conservation area has been assessed as negligible with the implementation of the proposed environmental management measures (refer to Section 5.4.15 of Appendix J (Technical working paper: Non-Aboriginal heritage)).

### Impacts of marine activities

Impacts to non-Aboriginal heritage from marine activities during construction are discussed in Section 8 of Appendix K (Technical working paper: Maritime heritage) and Section 14.4.3 of the environmental impact statement.

Project construction activities will be carried out in accordance with the maritime non-Aboriginal heritage environmental management measures NAH3, NAH4, NAH5, NAH6, NAH7 and revised environmental management measure NAH8 (refer to Table D2-1 of this submissions report). These measures will ensure that potential impacts on maritime heritage are minimised and will either be negligible or minor.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C14 – Aboriginal cultural heritage

## C14 Aboriginal cultural heritage

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## C14.1 Adequacy of the assessment

### C14.1.1 General adequacy issues

#### ***Issue raised***

Submitters expressed concerns about the adequacy of the Aboriginal cultural heritage assessment including:

- The Aboriginal cultural heritage assessment methodology, impact assessment and environmental management measures are not sufficient to address impacts to or preserve Aboriginal heritage values
- The environmental impact statement does not adequately consider alternatives to the road and tunnel option in order to avoid and protect Aboriginal heritage values
- The environmental impact statement does not include or assess some recorded Aboriginal heritage sites along Burnt Bridge Creek close to Kitchener Street, Balgowlah
- Aboriginal heritage in the Flat Rock Gully catchment and the wider Naremburn area is under-assessed in the environmental impact statement
- Specific Aboriginal heritage sites (including Aboriginal Heritage Information Management System (AHIMS) 45-6-0662, 45-6-0271 and 45-6-2111) have not been assessed.

#### ***Response***

Transport for NSW is committed to preserving Aboriginal cultural heritage items along the project corridor and minimising project impacts.

#### **Assessment methodology**

The Aboriginal cultural heritage assessment was carried out in accordance with the Secretary's environmental assessment requirements and the *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime Services, 2011a), which is consistent with and gives effect to the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water (DECCW), 2010b). The Procedure for Aboriginal Cultural Heritage Consultation and Investigation (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.

In addition, the assessment has been carried out by experienced, qualified Aboriginal cultural heritage specialists, as detailed in Section 1.9 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report). Please note that Section A5.1.12 of this submissions report includes a minor update on the authorship. An overview of the assessment methodology and application of the PACHCI's stages of assessment to the project is provided in Section 15.2 of the environmental impact statement, with further detail provided in Appendix L (Technical working paper: Aboriginal cultural heritage assessment report). The Aboriginal cultural heritage assessment considered all areas within 300 metres of the project's construction footprint. As project refinements were made during the Stage 3 PACHCI process, this search area was refined to 50 metres. Site surveys were carried out in May, June and August 2017 by a qualified archaeologist accompanied by a representative of the Metropolitan Local Aboriginal Land Council. Aboriginal site officers were also engaged for archaeological field inspections in January 2018. Additional assessments were carried out with nominated site officers representing the Metropolitan Local Aboriginal Land Council in August 2018, February and September 2020 and May 2021. Since exhibition of the

environmental impact statement, further assessment has also been carried out and documented in Appendix A of this submissions report.

Registered Aboriginal Parties were identified in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a) and invited to an Aboriginal focus group (AFG) meeting on the project, held on 28 September 2017. A second AFG was held on 3 November 2020. Through these meetings, Registered Aboriginal Parties have been provided an opportunity to review site surveys and the assessment methodology. Section 3 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) provides further detail on Aboriginal stakeholder consultation for the project.

Before the second AFG meeting held on 3 November 2020, the draft Aboriginal cultural heritage assessment report was issued to the Registered Aboriginal Parties for review and comment, allowing for the minimum statutory response time of 28 days. At the end of the review and comment period, multiple Registered Aboriginal Parties had expressed support for the level of assessment and environmental management measures proposed.

The assessment of potential impacts is considered conservative and through implementation of the environmental management measures in Table D2-1 of this submissions report, residual impacts to Aboriginal cultural heritage has been assessed as low (refer to Appendix C (Environmental risk analysis)).

Overall, the assessment is considered to be a comprehensive assessment of potential project impacts on Aboriginal cultural heritage.

Further, it should be noted that as a result of issues raised by the Aboriginal Heritage Office in the Northern Beaches Council submission (refer to Section B11.4.2 of this submissions report), a new search of the Aboriginal Heritage Information Management System (AHIMS) register was carried out in February 2021 to confirm site locations for Aboriginal cultural heritage sites along the project alignment. The results of this new search, additional site inspections and an updated impact assessment is included in Appendix A of this submissions report.

#### Consideration of Aboriginal heritage values in project development

All recorded Aboriginal heritage sites within the study area have been considered in relation to the proposed construction and operation of the project, and wherever possible, Transport for NSW has sought to avoid and reduce impacts to Aboriginal cultural heritage sites (refer to Section 8.1 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)).

Throughout design development and refinement, the project's alignment and associated required infrastructure have been modified where possible to avoid or reduce the impact to identified Aboriginal heritage sites, particularly those of high significance (refer to Chapter 4 (Project development and alternatives) of the environmental impact statement). In summary this includes:

- Most of the project would be constructed and located underground, avoiding direct impacts through the subsurface tunnelling of the project
- The construction methodology for the project has been selected to avoid direct impacts on Clive Park and its immediate foreshore
- At the Wakehurst Parkway, project work has been contained within the existing road reserve
- The project has avoided the following potential archaeological deposits identified in the archaeological survey:
  - Artarmon Park potential archaeological deposit (PAD) (45-6-3362)
  - Flat Rock Creek PAD (45-6-3361)

- Burnt Bridge Creek PAD (45-6-3363)

- Chapter 4 (Project development and alternatives) of the environmental impact statement provides a detailed analysis of the alternatives that were considered as part of the project development process and explains the selection of the preferred alternative. Selection of the preferred corridor required consideration of various technical, environmental and community factors including heritage.

Consideration of Aboriginal heritage values along Burnt Bridge Creek

Targeted archaeological surveys were carried out as part of the Aboriginal cultural heritage assessment to confirm the location of registered AHIMS sites and to assess areas identified as having potential Aboriginal archaeological sensitivity based on landforms. Table 15-5 of the environmental impact statement includes the outcomes of the survey at Balgowlah Golf Course and Burnt Bridge Creek, Balgowlah. Figure A-5 of Attachment D to Annexure D of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) also shows the extent of the PACHCI stage 2 survey area at Balgowlah around Kitchener Street.

The Burnt Bridge Creek PAD (45-6-3363) was identified during the archaeological survey and the likelihood of archaeological deposits was considered moderate to high (refer to Section 4.5.2 of Annexure D of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)). However, and as noted above, as a result of further project development, the Burnt Bridge Creek PAD (45-6-3363) has been avoided (refer to the updated impact assessment provided in Table 5-1 in Appendix A of this submissions report).

The archaeological surveys also found that in the Balgowlah Golf Course and Burnt Bridge Creek survey area, there is low Aboriginal archaeological sensitivity due to high levels of disturbance. Two recorded AHIMS sites at Balgowlah (45-6-0965 and 45-6-0964) were unable to be located and have since been documented as being destroyed and Heritage NSW has updated AHIMS to reflect this (refer to Table 15-5 of the environmental impact assessment).

Consideration of Aboriginal heritage values at Flat Rock Gully and Naremburn

As described above, targeted archaeological surveys were carried out to confirm the location of registered AHIMS sites and to assess areas identified as having potential Aboriginal archaeological sensitivity based on landforms. Table 15-5 of the environmental impact statement includes the outcomes of the survey at Flat Rock Creek, Willoughby and Naremburn. Figure A-3 of Attachment D to Annexure D of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) also shows the extent of the PACHCI stage 2 survey area. Further surveys of the Flat Rock Drive construction support site (BL2), including Flat Rock Reserve and Wilksch Walk, were carried out in 2020 in consultation with the Metropolitan Local Aboriginal Land Council (refer to Table 3-1 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)).

The Flat Rock Baseball Diamond was assessed as having low heritage significance. The Flat Rock Creek PAD (45-6-3361) was identified during the archaeological survey and the likelihood of archaeological deposits was considered moderate to high (refer to Section 4 of Annexure D of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)). The area of PAD was identified near large sandstone outcrop areas west of Flat Rock Drive. However, and as noted above, as result of further project development, the Flat Rock Creek PAD (45-6-3361) has been avoided.

In addition, Section 4 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) provides detailed background information of the study area which includes consideration of Flat Rock Gully and Naremburn.

### AHIMS sites 45-6-0271 and 45-6-2111

An assessment of AHIMS sites 45-6-0271 and 45-6-2111 is provided in Appendix A of this submissions report.

For the environmental impact statement, the coordinates of AHIMS site 45-6-0271 (Clive Park, Northbridge) were located outside of the study area. It was therefore not realised that this site was a standalone site, and the site was inadvertently recorded as part of AHIMS site 45-6-0654 (Clive Park 1, Northbridge). Following exhibition of the environmental impact statement, a new AHIMS search was carried out on 19 February 2021 to confirm locations of AHIMS sites along the project alignment. The results of the updated search are included in Appendix A of this submissions report, including an updated impact assessment of AHIMS site 45-6-0271 in Section 5 of Appendix A. The risk of potential vibration and settlement impacts at this site have been assessed as negligible.

AHIMS site 45-6-2111 (Clive Park 3, Northridge) was also identified in the environmental impact statement as being located outside of the study area. As stated above, following exhibition of the environmental impact statement, a new AHIMS search was carried out on 19 February 2021 to confirm locations of AHIMS sites along the project alignment and the results of the updated search are included in Appendix A of this submissions report. Updated mapping (using February 2021 AHIMS search data) shows that the site is located immediately adjacent to the study area boundary line. The site was inspected on 20 May 2021 to confirm the site location and accurately record GPS coordinates. The GPS coordinates confirmed that the site is located very close to the edge of the study area boundary line, but is just outside the study area. However, the site has still been assessed and this assessment is included in Section 5 of Appendix A of this submissions report. The risk of potential vibration impacts at this site have been assessed as negligible.

#### **C14.1.2 Clive Park 1 (45-6-0654) rock shelter and overhang**

##### ***Issue raised***

Section 8.2.1.2 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) states that the probability of subsidence risk to rock shelters is determined by overhang size, with shelters greater than 50 cubic metres at greater risk of impact. The assessment then infers that the Clive Park shelters/caves are less than 50 cubic metres and so are unlikely to be impacted by subsidence. When using an average rock depth of about three metres (and noting some areas of the shelter/cave sections are over four metres in rock depth) the rock shelter with a large overhang at Clive Park (Clive Park 1 (45-6-0654)) is 167 cubic metres of existing rock mass, which is substantially greater than the 50 cubic metre threshold (being three times the threshold rock volume).

##### ***Response***

The Sefton (1996) study into the effects of subsidence on rock shelters, referenced in Section 8.2.1.2 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) showed that larger rock shelters (greater than 50 cubic metres) were at greater risk of impact. The study concluded that no rock shelter site less than 50 cubic metres was found to have been impacted by subsidence, and that impacts to larger shelters were also rare. The findings of Appendix L (Technical working paper: Aboriginal cultural heritage) are that all rock shelters within the study area are significantly smaller than 50 cubic metres, suggesting that harm from subsidence related impacts would be unlikely.

Following exhibition of the environment impact statement, and in response to issues raised, a clarification has been provided in Section 4.3 of Appendix A of this submissions report. The clarification includes correction of the referenced Sefton (1996) publication in Appendix L (Technical

working paper: Aboriginal cultural heritage assessment report) to Sefton (2000), and correction of the statement that all rock shelters within the study area are less than 50 cubic metres.

As a result of the clarification provided in Section 4 of Appendix A of this submissions report, the following response is provided in relation to Clive Park 1 (45-6-0654):

The results of Sefton (2000) analysis show that one of the determining probabilities of subsidence related impacts to a rock shelter was overhang size, with a measurement of greater than 50 cubic metres being of importance. Wetness of overhang is another criteria. These are not 'thresholds' as such, rather factors that were considered in the Sefton (2000) findings and have also been considered in the assessment of potential impacts from the project. The Clive Park 1 (45-6-0654) rock shelter has a volume of greater than 50 cubic metres, and the overhang is considered to be dry. However, the impact assessment for Clive Park 1 (45-6-0654) and management recommendations as described in the environmental impact statement are still considered to be adequate and appropriate to manage potential risks associated with subsidence.

It should be noted that the indirect settlement impacts for Clive Park 1 (45-6-0654) have been assessed as minor and remain unchanged from those provided in the environmental impact statement (refer to Table 15-7 of the environmental impact statement). The size of the overhang was already considered by the specialist when making this assessment for the environmental impact statement and has since been reconsidered in response to the updates provided in Table 5-1 of Appendix A of this submissions report. Settlement at Clive Park 1 (45-6-0654) is predicted to be small (between 20-25 millimetres), however, as outlined in Table 15-7 of the environmental impact statement, the large overhang and high significance of this site increased the significance outcome of potential impact from negligible to minor. This varies from Clive Park Shelter 8 (45-6-3012) where indirect settlement is predicted to be slightly more (25-30 millimetres) than at Clive Park 1 (45-6-0654), but the impacts at this rock shelter have been assessed as negligible due to the absence of a large overhang.

Impacts on Aboriginal heritage items due to vibration and other construction-related risks will be managed during construction through the implementation of environmental management measures AH2, AH3 and AH4 (refer to Table D2-1 of this submissions report).

In addition, where vibration intensive works are required to take place within the site specific and activity specific minimum working distance, then the mitigation and management process outlined in environmental management measure CNV7 (refer to Table D2-1 of this submissions report) will apply, including:

Vibration generating activities will be managed through the establishment of minimum working distances to achieve vibration screening levels.

Where vibration levels are predicted to exceed the screening levels, a more detailed assessment of the impacted structure or heritage items would be carried out to assess the susceptibility of the structure to damage from vibration due to the project. Appropriate mitigation and management measures, such as equipment substitution and alternative methods, will be identified and implemented to avoid damage. Attended vibration monitoring will be carried out during vibration intensive activities in the vicinity 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.

## C14.2 Aboriginal cultural heritage impacts during construction

### C14.2.1 General impacts

#### *Issue raised*

Submitters raised concerns over potential impacts to Aboriginal heritage sites within and beyond the construction footprint. General concerns included:

- Construction vibration and other construction activities would cause unpredicted or unexpected impacts that are not assessed in the environmental impact statement
- Waste from the project would impact Aboriginal heritage sites within 50 metres of the construction footprint
- There could be unexpected impacts to potential and unknown terrestrial and submerged Aboriginal heritage sites.

#### *Response*

##### Construction vibration and other potential construction impacts

The potential for construction impacts on Aboriginal heritage sites has been considered in Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) and Chapter 15 (Aboriginal cultural heritage) of the environmental impact statement. The assessment has included consideration of both potential direct impacts (such as the removal, modification or destruction of Aboriginal sites) and potential indirect impacts associated with construction vibration generated by tunnelling of surface works and the settlement of land due to tunnelling below or near Aboriginal sites. Potential impacts during operation that have been considered include indirect impacts associated with Aboriginal site settling (visual impacts, changes to vistas/landscapes) as well as changes to ongoing use or environmental association.

The vibration assessment for Aboriginal heritage sites was based on the detailed construction vibration assessment prepared as part of Appendix G (Technical working paper: Noise and vibration). The construction vibration prediction methodology and details of how the Aboriginal heritage sites were assessed are provided in Section 4.4 of Appendix G (Technical working paper: Noise and vibration). The methodology considered the sensitivity of heritage items and has adopted a conservative vibration damage screening level of 2.5 millimetres per second for the assessment of Aboriginal heritage sites (refer to Section 3.4.5.3 of Appendix G (Technical working paper: Noise and vibration)). This does not necessarily reflect that there would be a vibration impact on the item if this level is exceeded. Instead, it is a suitable vibration level that can be used as part of the construction vibration management process to trigger further investigation as detailed in environmental management measures AH2, AH3 and AH4 (refer to Table D2-1 of this submissions report). This approach to the assessment of construction vibration impacts on Aboriginal heritage sites complies with the Secretary's environmental assessment requirements. With the implementation of the environmental management measures AH2, AH3 and AH4, including the requirements for further condition surveys, vibration assessment and monitoring, the risk of unpredicted or unexpected vibration impacts is minor to negligible.

The overall assessment results for potential impacts to known Aboriginal cultural heritage sites are included in Table 15-7 of the environmental impact statement and have been updated in Table 5-1 of Appendix A of this submissions report. Refer to Appendix A of this submissions report for further information about the updated impact assessment.

### Construction waste impacts

Construction waste would be managed to avoid impacts to Aboriginal heritage within and adjacent to the construction footprint through a construction waste management plan that will be prepared and implemented during construction and will include procedures for handling and storing wastes, as required by environmental management measure SG12 (refer to Table D2-1 of this submissions report). In addition, waste impacts will be minimised during construction through appropriate waste transportation, storage and handling according to waste classification and in a manner that prevents pollution of the surrounding environment, as required by environmental management measure WM4 (refer to Table D2-1 of this submissions report).

### Managing unexpected terrestrial and potential submerged Aboriginal sites

Environmental management measures will be implemented to address potential impacts to terrestrial Aboriginal heritage sites during construction of the project. If unexpected items of potential Aboriginal archaeological heritage significance are found during construction, they will be managed in accordance with environmental management measure AH5 (refer to Table D2-1 of this submissions report) and the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services, 2015c). This management procedure outlines appropriate methods for managing both Aboriginal and non-Aboriginal unexpected heritage items discovered during construction activities and is provided in Annexure B of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report).

An assessment of potential submerged Aboriginal archaeological sites is included in Annexure E of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report). The study area included the bed of the harbour between Northbridge and Seaforth, Pearl Bay adjacent to Spit West Reserve and the area for the proposed temporary mooring facility east of Clive Park in Middle Harbour.

Potential submerged Aboriginal archaeological sites refer to archaeological sites inundated since around 17,000 years ago when the sea level began to rise, eventually flooding the river valley and forming a flood tide delta (Sydney Institute of Marine Science, 2014). Aboriginal archaeological sites that could occur in inundated areas of the study area include:

- Rock shelters with occupation evidence and deposit
- Art and grinding grooves on sandstone ledges and faces
- Middens and/or stone artefact scatters on sandstone platforms and elevated area
- Fish traps on shallow, wide and gently sloping sandstone platforms.

Because potential submerged Aboriginal sites are under water and concealed by marine sediments, they cannot be readily accessed and assessed. The assessment of impacts to submerged Aboriginal archaeological sites is therefore based on the potential for such sites to exist, using available geophysical information and an understanding of site formation processes. The assessment outcomes for potential submerged Aboriginal sites are included in Table 15-8 of the environmental impact statement. Further investigation would be required to confirm the presence of potential Aboriginal submerged sites and their condition. Environmental management measures AH8 and AH9 (refer to Table D2-1 of this submissions report) address this issue and require consideration of further geophysical surveys, possible dive inspections and visual monitoring and sampling within the cofferdams as appropriate. These environmental management measures will be implemented during further design development and the construction phases of the project and would ensure that any potential impacts would be controlled and minimised.

## C14.2.2 Specific impacts

### ***Issue raised***

Submitters raised concerns over potential impacts to Aboriginal heritage within and beyond the project construction footprint. Specific concerns and requests included:

- Concern that Aboriginal heritage sites near Wakehurst Parkway, including the Engraving Trail, rock carvings, rock art and rock shelters, could be impacted during construction due to vibration, blasting, road run off, or construction debris
- Concern that project construction activities at Seaforth could impact Aboriginal rock carvings and middens
- Concern that Aboriginal heritage sites at Clive Park and nearby including shelters, caves, artwork, artefacts, whale and snake engravings, carvings, fish traps, middens and unidentified items could be impacted during construction due to vibration, groundwater drawdown and cumulative and indirect impacts
- Concern that construction wastewater discharge could impact Aboriginal heritage sites at Manly Lagoon
- Concern that project construction activities could impact Bantry Bay Aboriginal rock engravings
- Request for further investigation and protection of possible inundated Aboriginal heritage sites, including shelters at rock outcrops at depths of about 20 metres close to Seaforth Bluff, at Pearl Bay west of Spit West Reserve, and at the area between Clive Park and Beauty Point.

### ***Response***

#### Construction impact management measures (general)

For all heritage items where vibration generating activities are predicted to exceed screening levels, a more detailed impact assessment of the affected structure 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 required by environmental management measure CNV7 (refer to Table D2-1 of this submissions report).

In order to address potential impacts to Aboriginal heritage sites from construction blasting, prior to blasting all potentially affected sensitive receivers and features in the vicinity will be identified and all blasting activities will be carried out in a manner that does not generate unacceptable overpressure and vibration impacts, and does not pose substantial risk of impacts to structures, as required in environmental management measure CNV12 (refer to Table D2-1 of this submissions report).

A construction noise and vibration management plan will be developed to detail management of construction vibration including for heritage structures, and will consider all types of vibration generating works including blasting, as required by revised environmental management measure CNV1 (refer to Table D2-1 of this submissions report). Further detail on vibration-specific environmental management measures that would be implemented to further minimise potential impacts to Aboriginal heritage sites are detailed in Section C14.2.1 of this submissions report, including environmental management measures AH2, AH3 and AH4 that outline specific requirements for further condition surveys and vibration assessment and monitoring.

The impacts of construction debris/waste are addressed in Section C14.2.1 above.

The impacts of groundwater drawdown on Aboriginal heritage sites will be managed through ongoing groundwater monitoring, groundwater modelling and predictions that will be updated prior to finalising the design and prior to the start of construction. If the updated predictions of groundwater levels and drawdown indicate the potential impacts are greater than predicted in the



environmental impact statement, feasible and reasonable mitigation measures will be implemented during further design development, as required by revised environmental management measure SG2 (refer to Table D2-1 of this submissions report).

Unexpected finds discovered during construction will be managed in accordance with environmental management measure AH5, which requires implementation of *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime, 2015c) (refer to Table D2-1 of this submissions report). The procedure is provided in Annexure B of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report).

### Wakehurst Parkway and surrounds

The study area for Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) included the construction footprint associated with surface works plus land above the tunnel alignment. To account for potential impacts due to vibration or settlement, a 50 metre search area around the surface works and tunnel alignment was also considered. Known AHIMS sites were identified and additional assessments were carried out to identify any new areas of archaeological potential and ensure that the level of assessment was adequate. At the end of the assessment report review and comment period, multiple registered Aboriginal parties had expressed approval of the level of assessment carried out for the project.

Inspected AHIMS sites in the Wakehurst Parkway, Seaforth to Frenchs Forest survey area were found to contain high Aboriginal archaeological sensitivity (Bantry Bay Aboriginal Engraving Site 45-6-0655, Wakehurst Engraving MAN 104 45-6-3032, Rock Engraving (Garigal National Park) 45-6-2940, Frenchs Forest; Bantry Bay) as per Table 15-5 of the environmental impact statement.

Following exhibition of the environmental impact statement, a potential engraving site adjacent to Wakehurst Parkway has also been identified, as shown in Figure 2-5 of Appendix A of this submissions report. The potential engraving site has been assessed as having overall low to moderate significance at a local level (refer to Table 4-2 of Appendix A of this submissions report).

There would be no direct impacts to the AHIMS sites in the Wakehurst Parkway, Seaforth to Frenchs Forest survey area as a result of the project (refer to Table 5-1 of Appendix A of this submissions report). The Aboriginal cultural heritage assessment and the updated impact assessment provided in Appendix A of this submissions report concluded that potential indirect impacts to these AHIMS sites may include indirect vibration impacts, indirect settlement impacts and indirect impacts from changed visual environmental setting and access during construction. Both vibration and settlement impacts were considered negligible risks given the distance from the proposed construction footprint and the assessed vibration impact would be outside the minimum working distance for unsound structures. The location and condition of AHIMS site Frenchs Forest; Bantry Bay; Wakehurst Parkway (45-6-0662) was unable to be confirmed during several site inspections as the site was likely covered by gravel/vegetation. The Aboriginal cultural heritage assessment and Appendix A of this submissions report concluded that this site could have partial/potential direct impact but this would need to be determined through further investigation as part of environmental management measure AH1 (refer to Table D2-1 of this submissions report).

Although the overall risk of potential construction impacts on AHIMS sites in the Wakehurst Parkway, Seaforth to Frenchs Forest survey area are considered negligible (for AHIMS sites 45-6-0655, 45-6-3032, 45-6-2940) to minor (for AHIMS site 45-6-0662), environmental management measures will be implemented to minimise indirect impacts as a result of vibration, including AH2, AH3, AH4, CNV5 and CNV7 (refer to Table D2-1 of this submissions report). Environmental management measure AH1 has been updated/revised in Appendix A of this submissions report to address management of AHIMS site 45-6-0662:

Before the start of construction, an archaeological investigation will be carried out at the possible Aboriginal heritage site 45-6-0662 location to carefully remove the gravel/vegetation, to try and locate and confirm its presence and record the underlying site condition. This will occur in the presence of a representative from Metropolitan Local Aboriginal Land Council.

If new information regarding site condition is identified during consultation suggesting the site may be subject to impacts due to vibration and settlement, environmental management measures AH2, AH3 and AH4 will apply.

In the absence of confirming the site, if during construction works a site is located, the unexpected finds protocol prescribed in AH5 would apply. Further, Heritage NSW, an appropriately qualified archaeologist and the Metropolitan Local Aboriginal Land Council will be contacted and the site will be re-recorded in situ.

### Clive Park at Northbridge

Inspected terrestrial AHIMS sites in the Clive Park at Northbridge survey area were found to contain high Aboriginal archaeological sensitivity as per Table 15-5 of the environmental impact statement.

The locations of identified Aboriginal heritage sites within 50 metres of the project construction footprint at Clive Park have been updated in Figure 2-3 in Appendix A of this submissions report. This figure shows the project construction footprint, Middle Harbour south cofferdam construction support site (BL7) and the 50 metre study area around the construction footprint for the heritage assessment. The Beaches Link tunnel is about 85 metres deep below ground level at Clive Park. The Middle Harbour south cofferdam construction support site (BL7) is offshore and does not physically interact with the Clive Park heritage sites.

Four Aboriginal cultural heritage sites have been identified at Clive Park within the study area, including AHIMS sites 45-6-3012, 45-6-0654, 45-6-0271 and 45-6-0996. AHIMS site 45-6-2111 is situated just outside the study area boundary but has still been assessed. These Aboriginal cultural heritage sites include rock shelters, artefact scatter, middens, art, engravings and burial/s.

As discussed above in Section C14.1, the construction methodology for the project has been selected to avoid direct impacts on Clive Park and its immediate foreshore. Potential impacts to AHIMS sites at Clive Park during construction may occur as a result of indirect vibration and settlement impacts, however the risk of potential impacts is considered to be minor to negligible, as identified in the updated impact assessment provided in Table 5-1 in Appendix A of this submissions report. Specifically, the risk of indirect vibration and settlement impacts at AHIMS sites 45-6-3012, 45-6-0271, 45-6-0996 and 45-6-2111 would all be negligible, as would the risk of indirect vibration impacts at the Clive Park 1 (45-6-0654), due to the vibration impact being outside the minimum working distance for unsound structures. At Clive Park 1 (45-6-0654), settlement is predicted to be between 20 to 25 millimetres (the site is within 50 metres of the tunnel alignment) and the large overhang and high significance of this site increased the significance outcome of the risk of potential impacts to minor. Proposed environmental management measures AH2, AH3, AH4 and CNV7 (refer to Table D2-1 of this submissions report) specifically address vibration risks and would manage and minimise the indirect impacts to the Clive Park Aboriginal cultural heritage sites.

Further discussion on the rock overhang at Clive Park 1 (45-6-0654) is included in Section C14.1.2 above.

### Manly Lagoon

Manly Lagoon is located well outside of the study area for the Aboriginal heritage assessment and so potential Aboriginal heritage sites at Manly Lagoon were not considered. No direct or indirect Aboriginal heritage impacts would be expected at Manly Lagoon. The below response discusses

potential water quality impacts at Manly Lagoon as this could be the only possible potential project impact at this location.

Inflows to Manly Lagoon come from the Burnt Bridge Creek, Manly Creek (including Manly Dam) and Brookvale Creek catchments. It should be noted that the construction footprint of the project is within the Burnt Bridge Creek and Manly Creek catchments only.

Construction wastewater discharges from the project will be managed through proposed environmental management measures in order to minimise potential impacts on receiving waters. Any wastewater discharge from construction wastewater treatment plants will be required to meet and comply with relevant discharge criteria and standards, as per revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report). Additional mitigation measures such as storage detention to control water outflow during wet weather events will be considered and implemented within the construction footprint where feasible and reasonable, as required by revised environmental management measure WQ9 (refer to Table D2-1 of this submissions report). These measures are considered adequate to manage potential construction impacts to any Aboriginal heritage sites at Manly Lagoon.

The operational surface water quality assessment at Balgowlah and Wakehurst was carried out using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) modelling of the areas likely to be directly affected by the project. The model results for the combined stormwater catchments associated with the surface connections at Balgowlah indicate that there would not be a decrease in the water quality of Burnt Bridge Creek as a result of the operation of the project. Similarly, the MUSIC model results for the Wakehurst Parkway surface road works indicate they would not decrease the water quality of Manly Dam or Manly Creek. Operational wastewater discharges will be required to meet and comply with relevant discharge criteria and standards, as per revised environmental management measure WQ17 (refer to Table D2-1 of this submissions report).

On this basis, the project is not expected to worsen water quality in downstream areas such as at Manly Lagoon, Queenscliff or Manly beaches.

### Bantry Bay

The Bantry Bay Aboriginal Engraving Site (45-6-0655) was identified as having Aboriginal cultural values within the study area and verified through archaeological survey. Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) found that there would be potential impacts to the Bantry Bay Aboriginal Engraving Site (45-6-0655) including indirect environmental visual setting and access impacts, and indirect vibration impacts during construction. However, as the site is located outside the minimum working distance for unsound structures the risk of indirect vibration impact would be negligible and the risk of change to environmental setting and access has also been assessed as negligible (refer to the updated impact assessment provided in Table 5-1 in Appendix A of this submissions report).

As discussed in Section C14.2.1 of this submissions report, environmental management measures AH2, AH3 and AH4 will be implemented to carry out necessary vibration monitoring for all registered AHIMS sites subject to vibration intensive activities. Environmental management measures CNV5 and CNV7 will also be implemented to mitigate construction vibration impacts (refer to Table D2-1 of this submissions report). Additionally, cultural and historic heritage awareness training will be carried out for personnel engaged in work that may impact heritage items before commencing work for the project, as required by environmental management measure AH6 (refer to Table D2-1 of this submissions report). If at any time during construction, unexpected items of potential Aboriginal archaeological significance are discovered, they will be managed in accordance with the *Standard*

*Management Procedure: Unexpected Heritage Items* (Roads and Maritime, 2015c) as required by environmental management measure AH5 (refer to Table D2-1 of this submissions report).

#### Potential submerged Aboriginal archaeological sites

An assessment of potential submerged Aboriginal archaeological sites is included in Annexure E of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report). The study area included the bed of the harbour between Northbridge and Seaforth, Pearl Bay adjacent to Spit West Reserve and the area for the proposed temporary mooring facility east of Clive Park in Middle Harbour. Further information is included in Section C14.2.1 above.

Impacts at Pearl Bay and between Clive Park and Beauty Point were assessed and considered to be negligible. Measures to manage potential impacts to submerged Aboriginal archaeological heritage sites and items at locations between Northbridge and Seaforth would, subject to feasibility, include high resolution geophysical surveys to identify potential rock overhangs concealed by marine sediments, as required by environmental management measure AH8 (refer to Table D2-1 of this submissions report). If the geophysical survey shows inconclusive results or identifies distinct rock overhangs, then further investigation will be carried out in the form of an archaeological dive to examine potential Aboriginal heritage and identify submerged sites at Seaforth, outside the Middle Harbour north construction support site (BL8) cofferdam footprint but within the dredge footprint.

Within the footprint of the Middle Harbour south and north cofferdams and temporary construction support sites (BL7 and BL8), if the geophysical survey is inconclusive or rock overhangs are found, further onsite visual monitoring within the cofferdams in Middle Harbour will be carried out during the construction period, as required by environmental management measure AH9 (refer to Table D2-1 of this submissions report). The geophysical survey investigations will seek to find and understand the nature of potential submerged Aboriginal heritage sites and consider further potential measures to manage potential impacts on such sites as a result of construction activities.

### **C14.2.3 Aboriginal cultural heritage environmental management measures**

#### ***Issue raised***

Submitters raised concerns regarding, and requests for, Aboriginal cultural heritage environmental management measures, including:

- Concern that proposed environmental management measures are inadequate to protect both known and potential Aboriginal heritage sites
- Request for further identification, assessment, protection and monitoring of Aboriginal heritage sites including those at Wakehurst Parkway, Clive Park shoreline, Naremburn, Garigal National Park, Manly Dam, Manly Warringah War Memorial Park
- Request for the proposed Aboriginal heritage interpretation strategy to include local indigenous community representatives that are independent from government bodies
- Request for all mitigation measures in Table 9-1 in Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) to be made conditions of approval
- Request for construction activities to cease in the event that impact to Aboriginal heritage sites are detected and for a qualified archaeologist to assess the impact
- Request for the management of unexpected finds and for a qualified archaeologist specialising in Aboriginal cultural heritage to be present during construction
- Request for the project to include a provision for funds for maintenance and repair for any damage to Aboriginal heritage sites including Henry Lawson Cave, and sites in Clive Park and Flat Rock Gully caused by the project. This should be determined in consultation with

stakeholders such as Aboriginal Heritage Office, NSW Government authorities, local government and Aboriginal custodians.

### **Response**

#### Adequacy of environmental management measures

Environmental management measures specific to Aboriginal heritage sites are provided in AH1 to AH9 (refer to Table D2-1 of this submissions report). These environmental management measures apply to known terrestrial and potential submerged Aboriginal heritage sites that have been identified during the assessment, as well as any unexpected Aboriginal heritage sites that could be discovered during construction. The environmental management measures aim to avoid, minimise and/or manage potential Aboriginal cultural heritage impacts within and beyond the project construction footprint. The environmental management measures proposed have been developed by Aboriginal cultural heritage specialists in consultation with relevant Registered Aboriginal Parties. Overall, the assessment is considered to be a comprehensive assessment of potential project impacts on Aboriginal cultural heritage and the proposed management measures are considered to be appropriate (refer to Section C14.1 above for further detail on the assessment methodology, approach and consultation with Registered Aboriginal Parties).

#### Aboriginal heritage sites along Wakehurst Parkway, Clive Park shoreline, Garigal National Park and Manly Dam

Aboriginal heritage sites identified along Wakehurst Parkway, Clive Park shoreline, and at Garigal National Park and Manly Dam have been assessed in terms of potential direct and indirect impacts, as discussed in Chapter 15 (Aboriginal cultural heritage) of the environmental impact statement. Responses to issues raised in Section C14.2.2 of this submissions report provide further information in relation to the identification, assessment, protection and monitoring of potential Aboriginal heritage sites. The overall risks of potential impacts range from minor to negligible and would be minimised through the implementation of the environmental management measures AH1 to AH9 (refer to Table D2-1 of this submissions report). Cultural and historic heritage awareness training will also be carried out for personnel engaged in work that may impact heritage items, before commencing work during construction of the project, as required by environmental management measure AH6 (refer to Table D2-1 of this submissions report).

#### Further identification, assessment, protection and monitoring

The Aboriginal cultural heritage assessment carried out for the project was prepared to address the relevant Secretary's environmental assessment requirements (refer to Appendix A (Secretary's environmental assessment requirements checklist) of the environmental impact statement), and the assessment was prepared to align with the *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime, 2011a), relevant Commonwealth and State legislation, and relevant guidelines and requirements (refer to Section 15.1 of the environmental impact statement and Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)). The Aboriginal cultural heritage assessment was also carried out in consultation with registered Aboriginal parties and agency stakeholders, including the Metropolitan Local Aboriginal Land Council, to provide ongoing opportunities for participation and incorporate comments on cultural heritage knowledge into project planning (refer to Section 3 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)). By addressing the Secretary's environmental assessment requirements and PACHCI requirements, the assessment fulfills its legislative requirements and Transport for NSW requirements and would implement specific mitigation measures to address potential impacts to Aboriginal heritage sites within the study area.

The Aboriginal cultural heritage assessment has identified and assessed Aboriginal heritage sites and potential archaeological deposits during site inspections and archaeological surveys carried out across the proposed project construction footprint. Three new PADs were identified during archaeological survey (Flat Rock Creek PAD 45-6-3361, Burnt Bridge Creek PAD 45-5-3363 and Artarmon Park PAD 45-6-3362), indicating that the archaeological surveys, test excavations as well as desktop assessment and predictive modelling methodology were effective in identifying sites, items and potential archaeological deposits prior to the start of construction (refer to Annexure C and Annexure D of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)).

As discussed earlier in sections C14.2.1 and C14.2.2 of this submissions report, further investigation of the presence and condition of potential submerged Aboriginal heritage sites, including around the Clive Park shoreline, will be carried out prior to project construction in accordance with environmental management measures AH8 and AH9 (refer to Table D2-1 of this submissions report).

#### Aboriginal heritage interpretation strategy and consultation

As part of the project urban design and landscape plan, an Aboriginal heritage interpretation strategy will be developed for the project in consultation with registered Aboriginal parties and other relevant stakeholders, as required by environmental management measure AH7 (refer to Table D2-1 of this submissions report). Appropriate Aboriginal heritage interpretation will be incorporated into the project urban design and landscape plan in accordance with the interpretation strategy.

#### Conditions of approval

As part of ongoing consultation with agency stakeholders, Heritage NSW and the Heritage Council of NSW have reviewed Appendix L (Technical working paper: Aboriginal cultural heritage assessment report) and provided feedback and comments, all of which have been addressed in sections B9 and B10 of this submissions report to ensure environmental management measures are appropriate to address potential impacts on Aboriginal heritage. The environmental management measures provided in Chapter 15 (Aboriginal cultural heritage) of the environmental impact statement were developed from mitigation measures recommended in Table 9-1 of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report). Effectively, the environmental management measures that have been presented in Table 15-9 of the environmental impact statement reflect the recommendations from the Aboriginal cultural heritage assessment report, as developed in consultation with registered Aboriginal parties, stakeholders and prepared by appropriately qualified Aboriginal cultural heritage specialists. The project would be carried out in accordance with these environmental management measures, which are comprehensively presented by Transport for NSW in Table D2-1 of this submissions report.

If the project is approved, the Department of Planning, Industry and Environment will issue conditions of approval for the management of key issues. Specific conditions of approval are a matter for the Department of Planning, Industry and Environment to consider in their assessment of the project.

#### Stop work and unexpected finds procedure

Specific measures will be implemented to limit potential direct and/or indirect impacts to Aboriginal heritage sites during construction of the project. For example, vibration monitoring will be carried out in accordance with environmental management measures AH2, AH3 and AH4 (refer to Table D2-1 of this submissions report). As required by environmental management measure AH3, the

monitoring process will be developed by a suitably qualified person, be risk based and will include appropriate management protocols for any exceedances.

If at any time during construction of the project, any items of potential Aboriginal archaeological or cultural heritage conservation significance or Ancestral remains are discovered, they will be managed in accordance with the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime, 2015c), as required by environmental management measure AH5 (refer to Table D2-1 of this submissions report) and included in Annexure B of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)). The standard management procedure outlines that when an unexpected heritage item is discovered, construction activities and work will stop, the item will be protected within an established 'no-go zone', and Transport for NSW staff will be informed at first instance. An archaeologist or a suitably qualified and experienced archaeological consultant will be contacted and engaged and where required, an Aboriginal Site Officer will also attend the site or item to conduct an assessment of, and to record, the finding. Relevant government agencies would be notified as appropriate.

Based on the procedures and requirements outlined in the Aboriginal heritage environmental management measures (refer to Table D2-1 of this submissions report), the need for a qualified archaeologist specialising in Aboriginal cultural heritage to be present at all times across all construction sites during the construction period is not required. However, a suitably qualified person will be engaged as required by environmental management measures AH2, AH3, AH4, AH5, AH8 and AH9 (refer to Table D2-1 of this submissions report).

#### Request for funding

Potential impacts to Aboriginal cultural heritage sites are included in Table 5-1 of Appendix A of this submissions report. There would be no impact at the Flat Rock Creek PAD (45-6-3361). There would also be no impact at Henry Lawsons Cave, which is identified as being outside of the study area in Appendix L (Technical working paper: Aboriginal cultural heritage). Sites in Clive Park have been identified and assessed as being negligible to minor impact.

Ongoing consultation with Aboriginal stakeholders prior to and during construction of the project will be carried out as required by environmental management measures AH1, AH4, AH5 and AH7 (refer to Table D2-1 of this submissions report). Consultation with stakeholders for the project will also be carried out in accordance with the Community consultation framework (Appendix E of the environmental impact statement), as required by environmental management measure SE3 (refer to Table D2-1 of this submissions report).

Transport for NSW is committed to preserving Aboriginal cultural heritage items along the project corridor and minimising project impacts. The environmental management measures proposed to protect Aboriginal cultural heritage are considered to be appropriate and have been advised by independent, experienced specialists in the field of Aboriginal cultural heritage and were developed in consultation with the Registered Aboriginal Parties. It is expected that further monitoring and ongoing consultation with stakeholders would manage potential impacts to Aboriginal heritage sites and funding provision for maintenance or damage would not be required.

## C14.3 Aboriginal cultural heritage impacts during operation

### C14.3.1 Concern regarding risks to heritage after project construction

#### ***Issue raised***

Submitters raised concerns over potential impacts to Aboriginal heritage during operation of the project, including:

- Construction activities would lead to exacerbated impacts during project operation at the Bantry Bay Aboriginal Engraving Site
- Aboriginal heritage sites at Manly Dam including meeting areas and rock art becoming more exposed to vandalism during project operation
- Potential impacts to Aboriginal rock art as a result of emissions from unfiltered ventilation outlets during project operation
- Aboriginal heritage carvings at Wakehurst Parkway may be damaged from water runoff as a result of the project.

#### ***Response***

##### Bantry Bay Aboriginal Engraving Site

The Aboriginal cultural heritage assessment found that the Bantry Bay Aboriginal Engraving Site (45-6-0655) has high overall significance at the local level, as the site has multiple rock engravings that may have ceremonial significance (refer to Section 7.2.1 of Annexure D of Appendix L (Technical working paper: Aboriginal cultural heritage assessment report)). The Aboriginal cultural heritage assessment concluded that potential impacts during operation are expected to be limited, and generally associated with visual and landscape change, ongoing use or environmental association aspects. Although the Bantry Bay Aboriginal Engraving Site (45-6-0655) is located within 50 metres of the construction footprint, it would be buffered by vegetation screening along the Wakehurst Parkway (refer to Figure 22-4a of the environmental impact statement, which shows the indicative extent of landscape treatment along Wakehurst Parkway and environmental management measure V1 in Table 22-25 of the environmental impact statement, which commits to further development of the urban design and landscape plan). Potential operation phase impacts to this heritage site have been assessed as negligible.

##### Manly Dam

Aboriginal sites within Manly Warringah War Memorial State Park would not be impacted by the project and are located over 50 metres from the construction footprint, as shown in Figure 2-5 in Appendix A of this submissions report. Given this distance and the retention of a vegetation buffer of 50 metres between the project and the closest Aboriginal site, it is not considered that these sites would become more exposed to vandalism during operation compared to their current level of exposure.

Protection of these sites including management actions are detailed within the *Manly Warringah War Memorial Park Plan of Management* (Warringah Council, 2014). There are a number of Aboriginal rock engravings located within the Wakehurst Golf Course property, which are also located a sufficient distance from the project to avoid increased exposure to vandalism during project operation. Management of these sites is the responsibility of the Wakehurst Golf Club Limited (Warringah Council, 2014).

Based on these factors and the Aboriginal cultural heritage assessment, operational impacts to Aboriginal heritage sites at Manly Dam are expected to be negligible (refer to Section 15.4.1 of the environmental impact statement). Potential operational impacts to Aboriginal heritage sites including



potential exposure to vandalism would be considered through a project urban design and landscape plan, which also includes an Aboriginal heritage interpretation strategy as required by environmental management measure AH7 (refer to Table D2-1 of this submissions report).

#### Potential impacts from ventilation outlets

Consistent with other recent motorway tunnel projects in NSW, and as described in *Technical Paper TP05: Road Tunnel Stack Emissions* (Advisory Committee on Tunnel Air Quality (ACTAQ), 2018b), the ventilation outlets for the project have been designed to improve dispersion and lower ground level concentrations of vehicle emissions compared to existing lower ground level concentrations of vehicle emissions by:

- Moving the point of release further away from sensitive receivers at ground level, giving more time and distance for emissions to dilute
- Moving the point of release higher in the atmosphere where dispersion is improved by more turbulence and stronger winds.

Given the above and the location of the project's ventilation outlets compared to known Aboriginal heritage sites that include rock art in the vicinity of the project, the potential impact of emissions from ventilation outlets during operation damaging Aboriginal rock art is considered negligible.

#### Water runoff during operation

The impact of water runoff during the operation of the project would be managed by the surface water drainage and management infrastructure outlined in Section 5.2.11 of the environmental impact statement, which includes environmental controls designed to avoid or minimise environmental impacts, including impacts to Aboriginal heritage. These drainage infrastructure management measures would be refined during further design development. Design development would consider options to avoid or limit impacts to potentially sensitive sites, including the placement of drainage outlets, which would aim to reduce the risk of increased scour in the receiving drainage lines located along the Wakehurst Parkway as far as is practical. Design features to manage the potential for scour of receiving environments will be provided at the outlet of new or upgraded drainage lines, as required by revised environmental management measure F4 (refer to Table D2-1 of this submissions report).



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C15 – Geology, soils and groundwater

## C15 Geology, soils and groundwater

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## C15.1 Adequacy and accuracy of the contamination assessment

### C15.1.1 General contamination issues

#### ***Issue raised***

Submitters raised concerns about the general adequacy and accuracy of the contamination assessment carried out for the environmental impact statement. Specific concerns include:

- Concerns that the contamination assessment does not adequately assess and clarify contamination risks of the project in accordance with the Secretary's environmental assessment requirements. For example, the assessment does not identify if remediation of the land is required
- Requests that a Stage 2 contamination assessment be carried out that includes further contamination testing at all temporary construction support sites, for the results to be made publicly available, and for a remediation action plan to be approved by an accredited site auditor
- Further requests that the project include a remediation action plan for the entire catchment area from Flat Rock Creek to Middle Harbour, and for all temporary construction support sites to be fully remediated post construction (in coordination with councils) and have no contaminated materials left on site
- Concerns that the environmental impact statement does not reach a conclusion about whether the land is suitable or can be made suitable for the proposed development, which does not align with Section 2.2 of *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
- Concerns that the contamination assessment involved limited sampling and insufficient testing of soil and sediment samples for contamination
- Concerns that locations and results from soil sampling carried out during previous contamination investigations have not been included in the contamination assessment
- Concerns that the contamination assessment does not consider the impact of groundwater drawdown and runoff of contaminated sediment from Wakehurst Parkway to Garigal National Park and Manly Dam Reserve
- Concerns that the project is within 40 metres of an escarpment at Wakehurst Parkway and therefore the rules for water supply works located near sensitive environmental areas in the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 apply
- Concerns that Chapter 16 (Geology soils and groundwater) of the environmental impact statement and Appendix M (Technical working paper: Contamination) include references to outdated and superseded documents including the *Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW Environment Protection Authority (EPA), 2012a) which has been updated in 2019 and 2020
- Concerns that the contamination assessment does not include elements required by *Consultants reporting on contaminated land: Contaminated land guidelines* (NSW EPA, 2020a).

#### ***Response***

##### Adequacy of the contamination assessment

Appendix M (Technical working paper: Contamination) was prepared by a team of suitably qualified technical specialists, and reviewed by subject matter experts from Transport for NSW, to ensure that it met the Secretary's environmental assessment requirements and provided a balanced, merit-based impact assessment in accordance with the *Environmental Planning and Assessment Act 1979* and applicable NSW assessment policies.

### Approach to the contamination assessment

Appendix M (Technical working paper: Contamination) documents the Stage 1 contamination investigation carried out for the project. Stage 2 investigations including additional boreholes to assess further for potential contamination and landfill gas, will be carried out prior to construction activities so that contamination (if present) can be adequately planned for and managed (refer to revised environmental management measures SG8 and SG15 of Table D2-1 of this submissions report).

The objectives of the Stage 1 contamination investigation carried out for the environmental impact statement were 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. Areas of environmental interest include areas with potential risks associated with soil, groundwater and vapour contamination which may be present as a result of historic and/or current activities carried out on and/or next to the project area (refer to Section 1.6 of Appendix M (Technical working paper: Contamination)).

The Stage 1 contamination investigation process is described in Section 2 of Appendix M (Technical working paper: Contamination) and involved the following:

- Review of existing land uses along and in vicinity to the project alignment, topography, drainage, geology, soils (including erosions hazard, acid sulfate soils risk and salinity potential), hydrogeology and receiving environments
- Review of historical aerial photographs (1930 to 2005) and available aerial imagery services (Google Earth, SIX Maps and Metro Map)
- Searches in the NSW Environment Protection Authority Contaminated Sites Register and Record of Notices, and in the Yellow Pages business directory
- Review of previous harbour sediment, soil, groundwater and contamination site investigations (discussed further below)
- Visual inspections of surface areas above the tunnel alignment, all above-ground project features, nearby land uses and potential areas of environmental interest for contamination
- Field investigations related to geotechnical assessment including drilling of boreholes and assessment of materials presented in the retrieved samples including historic landfill materials in and around the Flat Rock Drive area.

Notwithstanding that some of the guidelines relevant to the assessment and management of contaminated land were recently updated during the development of the environmental impact statement, Transport for NSW is confident that adoption of the updated guidelines would not have changed the outcomes of the assessment completed (refer to response under 'Currency of guidelines referenced in the assessment' heading below).

Results of sampling and analysis of sediments from Middle Harbour taken during preparation of the environmental impact statement were also reviewed (refer to Section C15.3.1 for more information).

The Stage 1 contamination investigation was prepared with consideration of the following guidelines where relevant:

- *Acid Sulfate Soil Manual* (Acid Sulfate Soils Management Advisory Committee (ASSMAC), 1998)
- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)

- *Guidelines for Consultants Reporting on Contaminated Sites* (Office of Environment and Heritage, 2011).

#### Further contamination investigations

Potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 1997*, as required by revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). This includes, but is not limited to, further investigations at:

- a) Punch Street, Artarmon
- b) Willoughby Leisure Centre and Bicentennial Reserve, Willoughby
- c) Flat Rock Reserve, Northbridge
- d) Spit West Reserve, Mosman
- e) Balgowlah Golf Course, Balgowlah
- f) Wakehurst Parkway (from Seaforth to Frenchs Forest).

Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted. The level of remediation or treatment will be determined based on the proposed final land use for the relevant site. 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, addressing the requirements of State Environmental Planning Policy No. 55 – Remediation of Land.

The need for further investigations of Warringah Freeway (from North Sydney to Cammeray) were identified in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement and included in environmental management measure SG8. However, Stage 2 contamination investigations will be carried out as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, as discussed in the clarification provided in Table A5-11 of this submissions report. Environmental management measure SG8 has been revised accordingly.

#### Adequacy of sampling and testing carried out for the project

The contamination assessment for the project commenced in 2017 and included an assessment of results from sampling and testing carried out as part of the geotechnical investigations for the project during 2017 and 2018. More recent sampling and testing of sediments in Middle Harbour was carried out in 2020 to assess the suitability of dredged sediments for offshore disposal. Further sampling and testing will also be carried out for the project in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report).

As discussed above, the objective of the preliminary site investigation (Stage 1 contamination investigation) carried out for the contamination assessment was to assess whether contamination has the potential to exist on the site and whether further investigation is needed, as required by the relevant contamination assessment guidelines (*Consultants reporting on Contaminated Land – Contaminated Land Guidelines* (NSW EPA, 2020a)).

The sampling methodology, test results and interpretation of test results are summarised in Section 16.3.5 of the environmental impact statement and described in Section 4.4 and Annexure B of Appendix M (Technical working paper: Contamination). The locations of the investigation sites are shown in Figure 4-1 of Appendix N (Technical working paper: Groundwater).

No other sampling was carried out as part of the contamination assessment and therefore no other sampling results are included in the environmental impact statement. Please refer to Section C15.3.1 for more information on sampling and testing carried out for marine contamination.

#### Impact of groundwater drawdown and runoff to Garigal National Park and Many Dam Reserve

Impacts relating to groundwater drawdown (including migration of contaminated groundwater due to drawdown) are presented in Section 16.4.5 of the environmental impact statement and Appendix N (Technical working paper: Groundwater). Additionally, information relating to potential runoff of contaminated sediment from Wakehurst Parkway is presented in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement and Appendix O (Technical working paper: Surface water quality and hydrology).

#### Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011

While the project does not require a licence and/or approval under the *Water Management Act 2000*, the rules of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* were used for the purposes of the assessment (refer to Table 16-18 of the environmental impact statement). Part 9-41 of the water sharing plan relates to water supply works located near sensitive environmental areas. However, the project is outside of the required distances for the following sensitive environmental areas:

- 200 metres of a high priority groundwater dependent ecosystem
- 500 metres of a karst groundwater dependent ecosystem
- 40 metres from a lagoon or escarpment.

As such, the rules under Part 9-41 do not apply to the project.

#### Currency of guidelines referenced in the assessment

It is acknowledged that a number of guidelines relevant to the assessment and management of contaminated land were updated in 2019 and 2020 during the course of the environmental impact statement development.

According to the NSW Environment Protection Authority, “... *both guidelines (Consultants reporting on contaminated land and Assessment and management of hazardous ground gases) have been re-published with minor changes to:*

- *Improve useability*
- *Update reference to per- and poly-fluoroalkyl substances (PFAS) National Environmental Management Plan 2.0*
- *Fix grammatical and formatting errors”*

The update of these guidelines during the period of the environmental impact statement is not expected to affect the conclusions or outcomes of the assessment completed or the environmental management measures proposed to address these issues. However, environmental management measure SG15 has been revised to refer to the republished version of the *Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2012a) as follows (refer to Table D2-1 of this submissions report):

Ground gas investigations will be carried out in Flat Rock Reserve to further assess the potential presence of landfill generated gas which could impact on the construction and/or operation of the project.

Ground gas investigations will be carried out in accordance (where applicable) with the ~~Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases~~ **Assessment and management of hazardous ground gases: Contaminated land guidelines** (NSW EPA, 20122020). **If ground gas risks are established, appropriate design and/or management measures will be developed and implemented to remove or reduce the associated risk.**

### C15.1.2 Specific contamination issues

#### ***Issue raised***

Submitters raised concerns about the assessment of specific issues in the contamination assessment. Specific concerns include:

- Concerns that potential contamination from the BP service station on Sydney Road is not considered in the contamination assessment, and concern that there could be offsite migration of petroleum hydrocarbons from this site that may impact the Balgowlah Golf Course construction support site (BL10)
- Concerns that there is no assessment of the potential impacts of bioaccumulation and other long term environmental impacts associated with contamination
- Concerns that Tunks Park was not included in the list of regulated/notified sites within 500 metres of the project (provided in Table 4-4 in Appendix M (Technical working paper: Contamination)), considering that it was declared a remediation site in 2003 (Declaration No 21003). Further investigation is needed on the source, degree and type of contamination that led to the declaration
- Concerns that activities that are commonly associated with PFAS contamination within the project footprint, as specified by the *PFAS National Environmental Management Plan Version 2.0* (Heads of EPA Australia and New Zealand (HEPA), 2020), are not sufficiently assessed.

#### ***Response***

##### Potential petroleum hydrocarbon contamination

An assessment of contamination risk from the BP service station at the corner of Sydney Road and Maretimo Street is provided in Section 16.3.5 of the environmental impact statement and in Section 4.3 of Appendix M (Technical working paper: Contamination). Since exhibition of the environmental impact statement, a review of the NSW Environment Protection Authority Contaminated Sites Record of Notices (under Section 58 of *the Contaminated Land Management Act 1997*) and the list of contaminated sites notified to NSW Environment Protection Authority (under Section 60 of the *Contaminated Land Management Act 1997*) was carried out in June 2021, with reference to the service station and potential contaminated land. The service station site is registered on the list of contaminated sites notified to the NSW Environment Protection Authority under Section 60 of the *Contaminated Land Management Act 1997*, but regulation under the *Contaminated Land Management Act 1997* is not currently required for the site.

Contamination exposure risk from service stations located near surface works and construction support sites is likely to be low (ie contamination, if present is likely to be below the depth of construction activities), as detailed in Section 4.3 of Appendix M (Technical working paper: Contamination). The tunnel would be about 200 metres to the west of this service station, and about 30 metres deep in this location as identified in Figure 5-10 of the environmental impact statement.

No further information with respect to offsite migration of petroleum hydrocarbons from the BP service station site was made available or was in the public domain at the time of preparing Appendix M (Technical working paper: Contamination), and none has become available since that



time. The contamination risk from this service station is likely to be low considering the lateral separation and vertical migration of contamination (if present) required to the tunnel.

#### Bioaccumulation and other long term contamination impacts

The potential for long term bioaccumulation impacts on terrestrial, aquatic and marine biodiversity due to the mobilisation of contaminants is discussed in Section C18.8.4 of this submissions report.

The potential long term impacts on soils and groundwater, due to contaminant migration from contaminated sites caused by drawdown from the tunnel, are discussed in Section 16.5 of the environmental impact statement. Of the areas of environmental interest for contamination presented in Table 16-12 and Table 16-15 of the environmental impact statement, the potential drawdown is conservatively predicted to be highest in the Willoughby Leisure Centre and Bicentennial Reserve area. In this area, the potential drawdown is predicted to be up to 22 metres at the end of tunnel construction and up to 27 metres after 100 years of operation. This is because parts of this area are located immediately above the proposed tunnel centrelines. There is potential for contaminants associated with the former use of the land as a waste disposal area to migrate and reduce the groundwater quality in adjacent areas. However, the assessment found that groundwater quality in bores and groundwater dependent ecosystems is not expected to be impacted by potential contaminant migration that would result from the project.

The risk of contaminants migrating towards the tunnel during operation would be managed through the ongoing monitoring of groundwater levels and quality, as required by environmental management measure SG1 in addition to the application of revised environmental management measures SG2 and SG19 (refer to Table D2-1 of this submissions report). This will include implementation of feasible and reasonable management measures where monitoring and associated analysis identifies migration of potential contaminant hazards.

Groundwater inflows would also be collected and treated at the Gore Hill Freeway wastewater treatment plant and will meet the discharge requirements of revised environmental management measure WQ17 (refer to Table D2-1 of this submissions report), which includes adherence to ANZG (2018) 95 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which will be treated to meet the ANZG (2018) 99 per cent species protection levels.

#### Tunks Park

Since exhibition of the environmental impact statement, a review of the NSW Environment Protection Authority Contaminated Land Record has been carried out with reference to Tunks Park. Tunks Park, which lies about 570 metres south of the mainline tunnel alignment at its closest point, was declared a remediation site by the NSW Environment Protection Authority on 4 April 2003 (Declaration No 21003). However, on 16 April 2004, the NSW Environment Protection Authority issued a notice to end the remediation declaration (Notice No 22001), indicating that the NSW Environment Protection Authority was satisfied that the land is no longer contaminated in such a way as to present a significant risk of harm, and therefore further investigation is not required for this site.

#### Per- and poly-fluoroalkyl substances (PFAS) contamination

The project's approach to identifying and assessing contamination risk including PFAS during construction and operation is described in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement. The impact assessment was prepared in accordance with applicable State and Commonwealth legislation and guidelines, including the *PFAS National Environmental Management Plan Version 2.0* (HEPA, 2020).

The methodology for the assessment included:

- A review of the geological context, soil landscapes, salinity and acid sulfate soils
- A review of similar assessments and previous tunnelling projects in the Sydney region, including Sydney Metro City & Southwest (Chatswood to Sydenham) (Jacobs, 2016), North West Rail Link (Transport for NSW, 2012b), M4-M5 Link (AECOM, 2017), M4 East (GHD, 2015) and the New M5 (now M8) (AECOM, 2015)
- Field investigations related to groundwater assessment including drilling, permeability testing, monitoring bore installation, and water level and quality monitoring
- Field investigations related to geotechnical assessment including drilling of boreholes and assessment of materials presented in the retrieved samples including historic landfill materials in and around the Flat Rock Drive area
- Preparation of a Stage 1 contamination investigation including a review of background and historical information, site inspections, and sampling
- Development of a conceptual model of the hydrogeological environment and groundwater numerical modelling to predict groundwater inflows and drawdown propagation
- Technical review by a suitably qualified independent expert to confirm the groundwater modelling methodology and outputs
- Identification and assessment of potential construction and operational impacts associated with soils, contamination and groundwater
- Identification of environmental management and monitoring measures required to mitigate impacts and manage tunnel inflows.

Based on the above approach, 17 areas within and adjacent to the project were identified as having a moderate to high potential contamination risk rating and were considered to be potential areas of environmental interest that would be subject to further investigation, remediation and/or management.

All identified contamination risk areas would be managed during construction by the comprehensive environmental management measures and in accordance with guidelines made or approved under section 105 of the *Contaminated Land Management Act 1997*, as required by revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). This includes further investigations in potential areas of environmental interest in the project footprint that will inform how the sites would be managed.

Testing for PFAS would be carried out where there are known or potential contamination sources. Contamination sources would include activities associated with on-site firefighting, for example petrol stations (due to risk of fire).

Since the completion of Appendix M (Technical working paper: Contamination), the NSW Environment Protection Authority have endorsed the *PFAS National Environmental Management Plan Version 2.0* (HEPA, 2020). The *PFAS National Environmental Management Plan* details PFAS human health investigation levels for different media with the exception of sediments. In 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 which relates to uptake into edible fruit and vegetables. In addition, the criteria for the protection of ecosystems in soil has been adopted, in the absence of an aquatic sediment quality guideline.

One PFAS compound (perfluorohexane sulfonic acid or PFHxS) was detected above laboratory levels of reporting in sediment samples collected from Middle Harbour as part of the geotechnical investigations carried out for the project, as noted in Section 4.4.1 of Appendix M (Technical working paper: Contamination). The one PFAS compound detected above laboratory levels of reporting was below the human health criteria for open space and criteria for the protection of ecosystems in soils. The Middle Harbour catchment area covers a large and highly urbanised environment influenced by surrounding residential areas with some industrial and commercial development as described in Section 17.3 of the environmental impact statement. The source of the PFAS compound detected above laboratory levels of reporting would therefore be difficult to determine.

Additional site investigations during further design development and construction planning phases would inform management measures for all contaminants, including PFAS. It should be noted however other potential contaminants, as opposed to PFAS, may ultimately determine the final waste classification for the material in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014b), as required by environmental management measure WM3 (refer to Table D2-1 of this submissions report).

## C15.2 Land contamination

### C15.2.1 Contaminated spoil

#### ***Issue raised***

Submitters made requests about potential contaminated spoil stockpiles and requested testing for all construction spoil, including:

- Requests that contaminated spoil is not stored or stockpiled at the temporary construction support sites, Willoughby Leisure Centre or Bicentennial Oval, and requests that contaminated spoil is immediately sealed and removed
- Requests for all loads on construction vehicles carrying excavated materials to be tested for contamination and inspected to ensure contaminants are fully contained
- Concerns that encapsulation may not be sufficient or suitable to manage construction contamination risks, in addition to queries as to who would be responsible for the encapsulation and whether they would require an environment protection licence.

#### ***Response***

##### Storage of contaminated spoil

The approach to the management of land-based spoil is shown in Figure 24-1 of the environmental impact statement and discussed in Section 24.3.3 of the environmental impact statement. Stockpiling of material on site would be required where the material cannot be removed immediately. Stockpiles located outside of acoustic sheds would comprise relatively small volumes, as shown in Table 24-7 of the environmental impact statement, relative to the indicative land-based spoil generation volumes shown in Table 24-6 of the environmental impact statement. Contaminated spoil would be an even smaller component of these volumes.

Spoil would be classified on site in accordance with NSW and Australian standards and guidelines. Any contaminated spoil would be separated from uncontaminated spoil to prevent cross contamination, as described in Section 24.3.3 of the environmental impact statement. Contaminated spoil will be appropriately handled, stored and transported according to its waste classification and 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 EPA, 2014a), to prevent pollution of the surrounding

environment (refer to environmental management measures WM4, WM7, WM11 and F8 in Table D2-1 of this submissions report).

Contingency measures would be implemented to manage unexpected volumes and types of waste materials generated from the construction of the project, as described in Section 24.6.1 of the environmental impact statement. Suitable areas would be identified 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. The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contamination discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013a), and as required by environmental management measure SG13 (refer to Table D2-1 of this submissions report).

A Construction Waste Management Plan will be prepared and implemented during construction, as required by environmental management measure SG12 (refer to Table D2-1 of this submissions report). The plan will include, but not be limited to, procedures for handling and storing potentially contaminated substances.

#### Testing of all excavated materials

There is potential to discover contaminated material during excavation works for the project. A Stage 1 contamination investigation has been carried out to determine the potential for encountering contaminated material during construction (refer to Chapter 16 (Geology, soils and groundwater) of the environmental impact statement).

The contamination assessment identified 12 locations within or adjacent to the construction footprint of the project that are considered to be potential areas of environmental interest. These locations and types of potential contaminated material are provided in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement. Further investigations of these sites including a Stage 2 contamination assessment are required to quantify the exposure risk. These investigations would be carried out prior to construction activities so that contamination (if present) can be adequately planned for and managed.

Wastes, including spoil, will be classified prior to removal from site in accordance with *Waste Classification Guidelines* (NSW EPA, 2014b) (refer to environmental management measure WM3 in Table D2-1 of this submissions report). Waste materials would then be loaded into trucks for transport to a suitably licenced facility. All wastes will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment, as required by revised environmental management measure WM4 (refer to Table D2-1 of this submissions report).

#### Encapsulation and other remediation methods

Further investigations will be carried out at a number of areas of environmental interest to determine the feasibility of encapsulation of contaminated materials on site. Where contaminated soils and other materials are to be encapsulated onsite, encapsulation will be designed in accordance with the requirements detailed in the *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (Australian and New Zealand Environment and Conservation Council (ANZECC), 1999), as required by environmental management measure WM9 (refer to Table D2-1 of this submissions report). Note that not all contaminated areas may be suitable for encapsulation. Any remediation or treatment process proposed would need to be appropriate to the particular circumstance of the contaminated material, and feasible and reasonable to implement.

The *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (ANZECC, 1999) apply where contaminated soil originates from the same site at which the contaminated material would be encapsulated, with the general aim being to minimise the amount of waste being disposed of unnecessarily to landfill where on-site containment is suitable.

Guidelines endorsed by the Environment Protection Authority (*National Environment Protection (Assessment of Site Contamination) Measure 1999*) (as modified 2013; referred to as NEPM, 2013) define a hierarchy of options for site clean-up and management. The selection of the appropriate option/s would be ultimately dependent on numerous factors including (but not limited to) contamination (type, quantity, media), exposure scenarios, cost, remediation techniques, site and legislative constraints, acknowledging that the remediation goal, regardless of the option chosen, will be to protect the health of human and environmental receptors. This does not mean that on-site management of contaminated materials is not an option, or that it may not be the preferred option. The remediation hierarchy provides flexibility and the decision on in-situ (or other) treatment of contamination does not necessarily have to follow the order set out under the hierarchy.

Should the project be approved, an environment protection licence for the project would be required for the construction of the project under Chapter 3 of the *Protection of the Environment Operations Act 1997*, as described in Section 2.2.1 of the environmental impact statement. The construction environment protection licence would cover all construction activities, including encapsulation. The project would be required to comply with all relevant conditions of approval in relation to contamination.

### **C15.2.2 Flat Rock Reserve**

#### ***Issue raised***

Submitters raised requests, queries and concerns about potential contamination impacts of construction activities at the Flat Rock Drive construction support site (BL2) at Flat Rock Reserve, including:

- Questions on whether all spoil from the Flat Rock Drive construction support site (BL2) would be treated as contaminated and requests for further details
- Requests for the Flat Rock Drive construction support site (BL2) to be relocated to the Artarmon industrial precinct to avoid the disturbance of contaminated land
- Concerns that the results from contamination testing at Flat Rock Reserve have not been published
- Concerns that the contamination assessment assumed a shallower depth of fill at Flat Rock Reserve than indicated in historic records
- Concerns that the contamination assessment assigned a high contamination risk to the Willoughby Leisure Centre and Bicentennial Reserve potential area of environmental interest (B10) and a moderate contamination risk to the Flat Rock Reserve potential area of environmental interest (B9), yet historic records indicate that landfill activities took place to the west and east of Flat Rock Drive
- Concerns that the environmental impact statement predicts that the former landfill at Flat Rock Reserve only contained building and household waste, whereas historic records indicate that the landfill potentially contained industrial, chemical and putrescible waste, including medical waste from the Royal North Shore hospital, refrigerants from a refrigerant factory and heavy metals from two quarries
- Concerns that not all of the potential contaminants identified in *Managing our Waste: An environmental history of Flat Rock Creek and the Willoughby Incinerator 1900-2011* (McKillop, 2012) are presented in Table 4-15 (Potential contamination sources) in Appendix M (Technical

working paper: Contamination), which only includes three sites and does not identify the Hallstrom refrigerator plant site and the chrome plating process as potential sources of contaminants

- Requests for the implementation of lining and containment structures to contain contamination at the Willoughby Leisure Centre and Bicentennial Oval sites
- Concerns that the contamination assessment only considers potential dust impacts from landfilling at Flat Rock Reserve and not potential contamination impacts
- Comments that notifications to the NSW Environment Protection Authority would be required upon confirmation of contamination at Flat Rock Drive construction support site (BL2)
- Concerns that potential contaminated materials would be disturbed at Flat Rock Reserve, which could result in contamination impacts on the surrounding environment and downstream receivers including open space and bushland (including Tunks Park and Middle Harbour) and at residences and schools
- Concerns about the risk of encountering odorous waste and landfill gas at Flat Rock Reserve and concerns that detailed investigations have not been carried out to confirm the presence and extent of the waste material or gases
- Concerns about how release of any potential landfill gases from the Flat Rock Drive construction support site (BL2) will be managed
- Requests for regular monitoring and detailed investigation to confirm the presence of odorous materials and landfill gases at the Flat Rock Drive construction support site (BL2) and for mitigation measures to be implemented to minimise potential exposure impacts
- Requests for a landfill gas risk assessment to be carried out to address potential sources, pathways and receptors for landfill gas migration, and for this assessment to be publicly available
- Concerns that the potential for polluted flows from the Flat Rock Reserve landfill site due to leachate and flooding have not been addressed adequately in the environmental impact statement, particularly as it could impact Tunks Park playing fields and Middle Harbour. Two 1:100 year rain events have occurred in the last three years at Flat Rock Creek which could add to the risk of contamination flowing downstream
- Requests for measures to prevent contaminated fill being disturbed at the Flat Rock Drive construction support site (BL2).

### ***Response***

#### **Identification of contaminated spoil at the proposed Flat Rock Drive construction support site (BL2)**

The location of the proposed Flat Rock Drive construction support site (BL2) has the potential for contamination risks given the history of landfill activities in the area. This area poses a moderate potential contamination risk associated with the possible presence of contamination beneath Flat Rock Drive construction support site (BL2) and known groundwater contamination in adjoining areas (Willoughby Leisure Centre and Bicentennial Reserve), as discussed in Section 16.4.3 of the environmental impact statement.

Further site investigations will be carried out on sites with moderate to very high potential contamination risk as identified in Section 6.4 and Figure 5-2 of Appendix M (Technical working paper: Contamination). This includes the Flat Rock Drive construction support site (BL2). Appendix M (Technical working paper: Contamination) documents the Stage 1 contamination investigation carried out for the project. Stage 2 contamination investigations, including additional boreholes and test pits, will be carried out prior to finalisation of the detailed design to assess further

the potential for contamination, so that contamination (if present) can be adequately planned for and managed.

A number of environmental management measures have been proposed to manage potential contamination (refer to Table D2-1 of this submission report), including:

- Potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under Section 105 of the *Contaminated Land Management Act 1997*. This includes, but is not limited to, further investigation in potential areas of environmental interest within the project footprint, including Flat Rock Reserve. Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted. 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 (refer to revised environmental management measure SG8)
- Ground gas investigations will be carried out in Flat Rock Reserve to further assess the potential presence of landfill generated gas which could impact on the construction and/or operation of the project. Ground gas investigations will be carried out in accordance (where applicable) with the *Assessment and management of hazardous ground gases: Contaminated land guidelines* (NSW EPA, 2020b) (refer to revised environmental management measure SG15)
- The groundwater monitoring program will consider additional locations for monitoring that are subject to medium and high risk of groundwater contamination during construction and operation of the project (refer to revised environmental management measure SG18)
- Further investigations will be carried out at the Flat Rock Drive (BL2) and Balgowlah Golf Course (BL10) construction support sites, and surface works and construction support site locations along the Wakehurst Parkway (BL12, BL13 and BL14) to determine the feasibility of encapsulation of contaminated materials on site. Where contaminated soils and other materials are to be encapsulated on-site, encapsulation will be designed in accordance with the requirements detailed in the *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (ANZECC, 1999) (refer to environmental management measure WM9).

Refer to Section C15.2.1 for further discussion on encapsulation.

#### Flat Rock Drive construction support site (BL2) location

Context and justification for the selection of the Flat Rock Drive construction support site (BL2) at Flat Rock Reserve is provided in Section C5.4.2 of this submissions report.

Further discussion on the selection of the preferred location of Flat Rock Drive construction support site (BL2) is provided in Section 2 (Flat Rock Drive temporary construction support site (BL2) options analysis) of the preferred infrastructure report.

#### Contamination at Flat Rock Reserve

Flat Rock Reserve was identified as an area of environmental interest and considered as part of the Stage 1 contamination investigation prepared as part of Appendix M (Technical working paper: Contamination). The process for the Stage 1 contamination investigation and the guidelines applied to the investigation are discussed in Section C15.1.1 above, and include review of existing information to determine the history of land use within and next to the project. This has included review of previous site investigations that may have been carried out, as appropriate. Previous site investigation results are not published, but have been summarised where relevant and referenced in Chapter 29 (References) of the environmental impact statement.

The location of the proposed Flat Rock Drive construction support site (BL2) in Flat Rock Reserve was identified as being at moderate risk of land and groundwater contamination, whilst the adjacent

Willoughby Leisure Centre/Bicentennial Reserve area was identified as being at high risk of land and groundwater contamination (refer to the response below for further information on contamination risk categorisations). This is due to the historical landfilling activities carried out within the areas surrounding the Willoughby Leisure Centre, Bicentennial Reserve and part of Flat Rock Reserve.

Details of fill materials, depths of landfill layers and similar information included in the assessment is based on desktop, historical information and records. Contaminated soils and wastes associated with the historical landfilling activities at the Flat Rock Drive construction support site (BL2) could include putrescible materials and potential contaminants including heavy metals, hydrocarbons, pesticides, polychlorinated biphenyls, nutrients, cyanide, volatile organic compounds, asbestos and landfill gas, as described in Table 5-1 of Appendix M (Technical working paper: Contamination).

Historic landfilling to the east of Flat Rock Drive is more recent relative to landfilling to the west of Flat Rock Drive. The more recent landfilling east of Flat Rock Drive consists of building type wastes which are situated in the upper layers, with the possible presence of putrescible materials located at greater depths of the waste mass, as discussed in Section 5.2 of Appendix M (Technical working paper: Contamination). Works proposed for the Flat Rock Drive construction support site (BL2) have been designed as generally limited to the upper layers of the former landfill.

As outlined in the response to Section C15.1.1 of this submissions report, potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under Section 105 of the *Contaminated Land Management Act 1997*, as required by revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). This includes investigations at Flat Rock Reserve.

#### Contamination risk assessment

The contamination risk at Flat Rock Reserve has been assessed based on the risk assessment matrix shown in Figure 2-1 of Appendix M (Technical working paper: Contamination). A high contamination risk is assigned to areas of known contamination within the project area (where excavations or other construction activities would take place), whereas a moderate contamination risk is assigned to areas where possible contamination has been identified within the project area or where there is known contamination adjacent to the project area.

Information reviewed as part of the contamination assessment indicated that the disposal of industrial and domestic waste, as well as furnace waste (from the on-site incinerator), was carried out at the Willoughby Leisure Centre and Bicentennial Reserve site from the late 1940s until 1985 (refer Section 3.3.1 and Section 4 of Appendix M (Technical working paper: Contamination)). From the 1940s, the site of the open tip expanded and is understood to have extended from Willoughby Road in the west to Flat Rock Drive in the east. This area located west of the Flat Rock Reserve therefore poses a high potential contamination risk associated with the known presence of contaminated soils/wastes and groundwater. Construction activities could also create preferential pathways for groundwater contamination to other areas, including the adjacent Flat Rock Drive construction support site (BL2) to the east of Flat Rock Drive.

At Flat Rock Reserve however, the material most likely to be encountered during excavation would be non-putrescible (building) waste, with putrescible materials potentially located at greater depths of the waste mass, as discussed in the response above and in Section 5.2 of Appendix M (Technical working paper: Contamination). Therefore based on current information and analysis, this area poses a lower, moderate contamination risk, due to the possible presence of contamination in deeper layers beneath the Flat Rock Drive construction support site (BL2) and known groundwater contamination in adjoining areas (Willoughby Leisure Centre and Bicentennial Reserve).



Medical waste has not been specifically identified as a potential source of contamination as part of the assessment carried out to date. However, further investigations would be performed prior to construction to confirm the presence of contaminated materials in locations directly affected by the project and to inform appropriate response actions to maintain the safety of workers and the environment in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report).

As the project would not disturb areas of potential soil contamination at Willoughby Leisure Centre or Bicentennial Oval, it is not within the scope of the project to implement systems or structures to contain contamination at these sites. If, however, as a result of water table drawdown, landfill gas or contaminated groundwater from these areas migrate toward the adjacent construction support site or the mainline and ramp tunnels, these risks would be managed by pre-construction planning activities and construction environmental management plans including as necessary monitoring of confined spaces for potential landfill gas. Environmental management measures to manage contamination are discussed below under 'Management of potential contamination impacts'.

#### Potential contaminants at Flat Rock Reserve

Potential contaminants at Flat Rock Reserve, Bicentennial Reserve and Willoughby Leisure Centre are noted in Table 5-1 of Appendix M (Technical working paper: Contamination) and include heavy metals, hydrocarbons, pesticides, polychlorinated biphenyls, nutrients, cyanide, volatile organic compounds, asbestos and landfill gas. The list of potential contaminants is purposely broad to address a large range of compounds, reflecting the variety of different commercial and industrial operations and historic waste segregation practices which might have occurred at the former landfill and incinerator locations including those identified in *Managing our Waste: An environmental history of Flat Rock Creek and the Willoughby Incinerator 1900-2011* (McKillop, 2012). 'Heavy metals' includes the suite of contaminants listed under Australian Standard AS4482.1-2005 - *Guide to the investigation and sampling of sites with potentially contaminated soil*, as being used in 'metal treatments' such as the chrome plating process. These include nickel, chromium, zinc, aluminium, copper, lead, cadmium and tin and also VOC compounds and cyanide.

The project will assess any actual or potential sources of contaminants of concern, in accordance with revised environmental management measure SG8 (refer to Table D2-1 in this submissions report) which specifically includes Flat Rock Reserve, Bicentennial Reserve and Willoughby Leisure Centre as locations to be investigated further. Revised environmental management measure SG8 also notes the list of sites is not exhaustive and other locations may be added. In addition, the potential risk of contaminated groundwater impacting the project will be managed in accordance with revised environmental management measures SG2, SG18 and SG19 (refer to Table D2-1 in this submissions report).

Transport for NSW acknowledges the former Hallstrom refrigerator factory was not included in Table 4-15 of Appendix M (Technical working paper: Contamination) as a potential contamination risk to the construction and operation of the project. The factory was located about 650 metres west of Flat Rock Drive construction support site (BL2) and operated between 1934 until the mid-1970s when the factory site was converted to residential use. Given the distance from the Flat Rock Drive construction support site (BL2), any site activity would not be expected to affect or be affected by any residual site contamination at the former factory site (if present). Tunnelling would be carried out beneath the former factory site for the ramp tunnel connection to the Gore Hill Freeway, but at a depth whereby any residual soil or groundwater contamination would not be expected to impact or be impacted by the project.

As stated above however, chromium is included in the suite of analytes discussed in Appendix M (Technical working paper: Contamination). Elevated levels of chromium have been detected in

groundwater at location B134A at Bicentennial Reserve, Willoughby, the location of the former landfill adjacent to the Hallstrom factory site (refer to Table 4-8 of Appendix M (Technical working paper: Contamination). Waste segregation practices at the time of operation of the Hallstrom refrigerator factory and municipal landfill would have resulted in a variety of non-hazardous and potentially hazardous wastes being co-disposed and/or discharged into Flat Rock Creek as suggested in *Managing our Waste: An environmental history of Flat Rock Creek and the Willoughby Incinerator 1900-2011* (McKillop, 2012). However, while the original source of the contamination may be of historical interest, of greater relevance is the potential consequences of its disturbance as a result of the project.

The existing groundwater flow regime is from the former Hallstrom refrigerator factory towards Flat Rock Creek and the former landfills at Flat Rock Reserve, Willoughby Leisure Centre and Bicentennial Reserve. If there was residual contamination in groundwater associated with the factory, it is likely that it would have (at least partially) migrated towards the former landfills at Flat Rock Reserve, Willoughby Leisure Centre and Bicentennial Reserve. The potential groundwater related impacts due to the project and associated with this potential contamination would be consistent with those discussed for the Flat Rock Reserve, Willoughby Leisure Centre and Bicentennial Reserve areas of environmental interest sites (B9 and B10 respectively) in Section 16.4.3 of the environmental impact statement.

#### Management of potential contamination impacts

The potential impacts and associated risks of disturbing contaminated soil at the Flat Rock Drive construction support site (BL2) at Flat Rock Reserve, before consideration of appropriate remediation and/or management, are outlined in Table 16-10 of the environmental impact statement. The assessment considered impacts from multiple sources and not just dust/air quality, including soils, sediment, groundwater and landfill materials.

As stated above, excavated materials at the Flat Rock Drive construction support site (BL2) are expected to be building type waste and less likely non-putrescible waste. Leachate (ie contaminated liquid that drains from a landfill or stockpile) and contaminant mobilisation could potentially impact upon the following (refer to Section 16.4.1 of the environmental impact statement):

- Contaminant exposure risk to project personnel and the general public
- Contaminant exposure to environmental receivers
- Degradation of terrestrial and aquatic ecosystems
- Damage to existing structures.

Further investigations of potentially contaminated areas directly affected by the project, including at Flat Rock Reserve, Willoughby Leisure Centre and Bicentennial Reserve (near Flat Rock Reserve) have been described above and will be implemented in accordance with revised environmental management measures including SG8 and SG15. In addition, a construction waste management plan will be prepared and implemented during construction as required by environmental management measure SG12 (refer to Table D2-1 of this submissions report). The plan will include but not be limited to procedures for handling and storing potentially contaminated substances.

The NSW Environment Protection Authority would be notified of contamination identified during detailed investigations, if required, in accordance with the *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (NSW EPA, 2015).

A comprehensive set of environmental management measures would be implemented to minimise contamination risks on the surrounding environment during construction including from wind (dust/erosion), water runoff and infiltration into the ground. Contaminated spoil would be

encapsulated on site where appropriate (as discussed above in Section C15.2.1), and in accordance with relevant regulatory requirements, including reference to *Guidelines for the Assessment of On-site Containment of Contaminated Soil* (ANZECC, 1999) (refer to environmental management measure WM9 in Table D2-1 of this submissions report). Contaminated spoil and excavated materials would be handled, stored and transported according to their waste classification and in accordance with relevant applicable legislation, policies and guidelines to prevent pollution of the surrounding environment, as discussed in Section C15.2.1.

Erosion and off site transport of contamination via overland flow and stormwater runoff would be avoided and minimised with the implementation of standard erosion and sediment control measures, in accordance with revised environmental management measure SG9 (refer to Table D2-1 of this submissions report). As required by this environmental management measure, erosion and sediment control measures will be implemented at all construction support sites and surface road upgrades in accordance with the principles and requirements in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (Department of Environment and Climate Change (DECC), 2008) and relevant guidelines, procedures and specifications of Transport for NSW. A soil conservation specialist will be engaged for the duration of construction of the project to provide advice regarding erosion and sediment control including review of erosion and sediment control plans.

Groundwater inflows would be collected and treated at the construction wastewater treatment plants. The existing monitoring program for groundwater quality will be continued through construction, as required by environmental management measure SG1 (refer to Table D2-1 of this submissions report). Outcomes of updated groundwater modelling (as required by revised environmental management measure SG2) will identify any requirements for further groundwater monitoring during the operational phase. If the groundwater quality monitoring and associated analysis identifies potential impacts to beneficial aquifer use from the migration of contaminated groundwater, the quality of groundwater tunnel inflows, or migration of potential contaminant hazards, feasible and reasonable management measures will be identified and implemented, as required by revised environmental management measure SG19 (refer to Table D2-1 of this submissions report).

#### Landfill gas risk and odours

The potential risk of encountering landfill gases and odours during construction activities at Flat Rock Reserve is discussed in Section 16.4.3 and Section 12.5.4 of the environmental impact statement. There is potential that landfill gases might be present in the soils underneath the Flat Rock Drive construction support site (BL2) from any deeper buried putrescible waste present below mostly building rubble in upper layers, or that might have migrated from the landfilled areas to the west (see responses above).

To manage the potential risks associated with the historic use of the area, the Flat Rock Drive construction support site (BL2) has been designed to minimise depth of piling and excavations, as discussed in Section 12.5.4 of the environmental impact statement. The location of the decline has been chosen to minimise the amount of excavation required to reach bedrock. This reduces the potential to encounter putrescible landfill (if present) that could generate odour, as well as the potential for the release of significant volumes of landfill gases (if present).

Prior to excavation at the Flat Rock Drive construction support site (BL2), further investigations will be carried out to further assess the potential presence of landfill generated gas which could impact on the construction and/or operation of the project in accordance with revised environmental management measure SG15 (refer to Table D2-1 of this submissions report). Ground gas

investigations will be carried out (where applicable) in accordance with the *Assessment and management of hazardous ground gases: Contaminated land guidelines* (NSW EPA, 2020b). Environmental management measure SG15 has been revised to state that if ground gas risks are established, appropriate design and/or management measures will be developed and implemented to remove or reduce the associated risk.

Further site investigations will also be carried out to determine the potential to encounter odorous gases. Odour monitoring will be carried out during relevant site activities, and mitigation and management measures adjusted as required to minimise potential off-site impacts as required by revised environmental management measure AQ2 (refer to Table D2-1 of this submissions report).

Any areas of exposed material at the Flat Rock Drive construction support site (BL2) that have the potential to generate odour will be kept to a minimum during site establishment works and while the area is uncovered. If odorous areas are to remain uncovered at the end of the work shift, temporary cover or other suitable measures to minimise odour emissions will be implemented, as required by revised environmental management measure AQ4 (refer to Table D2-1 of this submissions report).

### Contamination testing results

Results from previous contamination investigations that are relevant to the project have been summarised in Section 16.3.5 of the environmental impact statement and Section 4.4 of Appendix M (Technical working paper: Contamination). Contamination investigation findings are outlined in Section 5 of Appendix M (Technical working paper: Contamination). This section includes reference to Flat Rock Reserve.

### Downstream surface water quality

The potential impacts of construction activities at the Flat Rock Drive construction support site (BL2) on the water quality of receiving waterways are described in Table 16-10 and Table 17-14 of the environmental impact statement.

Environmental management measures that will be implemented to prevent and minimise erosion and off-site movement of contaminated soils and sediment include the implementation of erosion and sediment control measures at all construction support sites and surface road upgrades, as required by revised environmental management measure SG9 (refer to Table D2-1 of this submissions report), as outlined in Section C15.2.1. A freshwater water quality monitoring program for the construction of the project will be developed and implemented in accordance with environmental management measure WQ10 (refer to Table D2-1 of this submissions report). Additionally, discharges from wastewater treatment plants during the construction phase will be required to meet the discharge criteria listed in revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report).

Detailed construction planning will consider the flood risk at construction sites and construction support sites, in accordance with 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 per cent AEP flood extent as required by environmental management measure F8 (refer to Table D2-1 of this submissions report). Entries to tunnel excavations, including cut and cover sections of tunnel, will be protected against frequent flooding by locating openings outside of flood prone areas, and/or the provision of local bunding and flood protection barriers as required by environmental management measure F6 (refer to Table D2-1 of this submissions report).

Spills and leakages associated with the on-site storage and use of chemicals, fuels and materials would be managed through standard mitigation measures, refer to Table D2-1 of this submissions report.

With the implementation of these environmental management measures, potential pollutant loading to the receiving waterways is expected to be low compared to the existing pollutant loading from the Flat Rock Creek catchment. As a result, it is unlikely that there would be impacts to downstream receivers at Tunks Park or Middle Harbour.

#### Minimising the disturbance of contaminated fill at Flat Rock Drive construction support site (BL2)

As stated above, based on existing information, it is expected that construction would not encounter the deeper layers of putrescible waste and is most likely to disturb building debris beneath the Flat Rock Drive construction support site (BL2).

The Flat Rock Drive construction support site (BL2) has been designed to minimise excavation depth. The main excavations that would be required are associated with piling for structures and excavation of the tunnel access decline. The location of the decline has been chosen to minimise the amount of excavation required to reach bedrock. As such, there is limited potential to encounter putrescible landfill waste (refer to Section 12.5.4 of the environmental impact statement). Potentially contaminated areas directly affected by the project, including Flat Rock Reserve, will be further investigated and managed in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contamination discovery procedure, in accordance with environmental management measure SG13 (refer to Table D2-1 of this submissions report).

### **C15.2.3 Other land contamination issues**

#### ***Issue raised***

Submitters raised issues over impact to the surrounding environment due to potential land contamination. Specific queries, comments and concerns include:

- Requests for the environmental impact statement to include a comprehensive and thorough review of all available historical data and current community knowledge to determine potential contaminants and to inform testing
- Concerns that the project activities during construction could potentially exacerbate existing contamination issues across the project area
- Concerns that the green space and bushland vegetation at Cammeray Golf Course would be impacted by contamination due to construction activities
- Concerns about contamination risks at Warringah Freeway, specifically the unsealed areas next to Warringah Freeway that may be contaminated with heavy metals, hydrocarbons, asbestos and other risks described in the environmental impact statement
- Concerns that the Kitchener Street construction support site (BL11) is contaminated as it is an old gas works site that could have contaminants such as cyanide, chromium, lead, zinc, polycyclic aromatic hydrocarbons, which could be disturbed during construction
- Concerns about contamination risks at Wakehurst Parkway south construction support site (BL12), Wakehurst Parkway east construction support site (BL13) and potential impacts to nearby residents during construction and operation

- Queries regarding whether the rubble fill around Wakehurst Parkway east construction support site (BL13) has been investigated for contamination, including asbestos, as part of the environmental impact statement
- Concerns that the environmental impact statement is unclear about the presence of asbestos at the Wakehurst Parkway east construction support site (BL13) and how asbestos will be treated if encountered during construction
- Suggestions for a site auditor to be present at all moderate or high risk sites and to issue a site audit statement confirming sites are suitable for the proposed land use. The site auditor should also review and approve investigations and remedial action plans, check compliance for the project and manage unexpected contamination finds encountered during the project
- Questions as to what is regarded as 'complex' contamination in environmental management measure SG8 (refer to Table D2-1 of this submissions report).

### ***Response***

#### Review of available information and community knowledge

The methodology for the assessment of contamination risks has included reviews of background and historical information as well as field investigation and sampling, as outlined in Section 16.2 of the environmental impact statement. Further information from local knowledge sources has also been used to investigate historic contamination activities within the project footprint (refer to sections 4.4 and 4.5 of Appendix M (Technical working paper: Contamination)).

#### Potential to exacerbate existing contamination

Existing known and potential contamination within and surrounding the project area is identified in Section 16.3.5 and Section 16.4.3 of the environmental impact statement. A number of these sites have been assessed as posing a moderate to high contamination risk to the project and have been identified as potential areas of environmental interest which will be subject to further investigation prior to construction commencing.

A comprehensive set of environmental management measures have been proposed to manage potential contamination risks and issues, as detailed in Table D2-1 of this submissions report. This includes the preparation of a Remediation Action Plan in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) where site remediation is warranted, as required by revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). With the implementation of these measures, the project would appropriately and effectively manage contamination issues and is not expected to exacerbate existing contamination issues across the project area.

#### Potential for contamination impacts on green space and bushland

Potential contamination risks at the Cammeray Golf Course are described in Section 16.4.3 of the environmental impact statement. At Cammeray Golf Course, there is the potential for contamination to be present within soils which are likely to be excavated and exposed during the carrying out of surface works and construction of the Cammeray Golf Course construction support site (BL1). The potential contamination could be associated with inappropriate handling and disposal of building materials during demolition of buildings, filling with material of unknown quality during the original construction of the Warringah Freeway, or particulate matter deposition from Warringah Freeway traffic since its opening, as described in Table 4-1 of Appendix M (Technical working paper: Contamination). Contaminants could consist of a variety of heavy metals, hydrocarbons, particulate matter and asbestos.

Stage 2 contamination investigations will be carried out at the Cammeray Golf Course construction support site (BL1) area as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, as discussed in the clarification provided in Table A5-11 of this submissions report. These investigations will be carried out prior to project construction activities so that contamination (if present) can be adequately planned for and managed. Asbestos handling, management and disposal will be carried out in accordance with relevant legislation, codes of practice and Australian standards, as required by environmental management measure SG10 (refer to Table D2-1 of this submissions report).

#### Potential contamination risks at Warringah Freeway

Potential contamination risks at Warringah Freeway are described in Section 16.4.3 of the environmental impact statement and in the response above. Unsealed areas next to Warringah Freeway pose a moderate contamination risk to construction given that contamination is potentially present within soils which are likely to be excavated and exposed during the carrying out of surface works and construction of the Cammeray Golf Course construction support site (BL1). Stage 2 contamination investigations will be carried out within the Warringah Freeway at Cammeray as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, as discussed in the clarification provided in Table A5-11 of this submissions report. These investigations will be carried out prior to project construction activities so that contamination (if present) can be adequately planned for and managed. Detailed site investigation reports will be published online in accordance with the Western Harbour Tunnel and Warringah Freeway Upgrade conditions of approval.

#### Kitchener Street construction support site (BL11)

A review of existing information to determine the history of land use within and next to the project is included in Section 4 of Appendix M (Technical working paper: Contamination). Sources of information review included:

- NSW Land and Property Management Authority, Land and Property Information Division: Historical aerial photographs (1930 to 2005)
- NSW Environment Protection Authority Contaminated Sites Register and Record of Notices
- Available aerial imagery services including Google Earth, SIX Maps and Metro Map
- Yellow Pages business directory
- Previous contamination site investigations.

The review of the above sources did not identify a former gasworks site at the Kitchener Street construction support site (BL11). However, filling at the site with material of unknown quality during the construction of Burnt Bridge Creek Deviation was identified.

In response to issues raised, a further review of the NSW Environment Protection Authority Contaminated Sites Register and Record of Notices was carried out in July 2021 for the suburbs surrounding the Kitchener Street construction support site (BL11) (including Balgowlah, North Balgowlah, Manly Vale and Seaforth). This review also did not identify any records of a former gas works site in the area.

Notwithstanding, if contamination is encountered it will be managed in accordance with the environmental management measures listed in Table D2-1 of this submissions report. In particular, the discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contamination discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013a), as required by environmental management measure SG13 (refer to Table D2-1 of this submissions report).

### Potential contamination risks along Wakehurst Parkway

Potential contamination risks along Wakehurst Parkway and at the Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites are described in Section 16.4.3 of the environmental impact statement.

Hydrocarbon contamination may be present in surface soils adjacent to the Wakehurst Parkway from Seaforth to Frenchs Forest as a result of degrading asphalt road surfaces. These areas have a high risk of land contamination to construction given the presence of known soil contamination and that soils are expected to be excavated and exposed during the upgrade works to Wakehurst Parkway and adjacent construction of the Wakehurst Parkway south construction support site (BL12). There is also the potential for illegally dumped waste which could include heavy metals, hydrocarbons, pesticides and/or asbestos, to be present in non-urbanised areas immediately surrounding the Wakehurst Parkway, as outlined in Table 16-10 of the environmental impact statement. Illegally dumped waste, if it exists, presents a moderate contamination risk to construction given the potential for contamination and that soils/wastes are expected to be excavated and exposed during the Wakehurst Parkway upgrade works.

Potential soil contamination may be present in surface soils at the location of the Wakehurst Parkway east construction support site (BL13) (the Sydney Water Bantry Bay Reservoir site) and adjacent areas. The potential contamination could be associated with the degradation of painted surfaces on the reservoirs and windblown deposition of paints on adjoining areas. Contamination could also be potentially associated with the presence of demolition waste materials observed across the surface of the site. These areas have a moderate risk of land contamination given the potential for contamination and that soils are expected to be excavated and exposed during construction of the Wakehurst Parkway east construction support site (BL13).

Further investigations of potentially contaminated areas directly affected by the project, including at Wakehurst Parkway (Seaforth to Frenchs Forest), will be carried out and managed in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). Environmental management measures that will be implemented to avoid and minimise contamination impacts include those listed above as well as in Table D2-1 of this submissions report. With the implementation of these environmental management measures, it is unlikely that nearby residents would be impacted by contamination issues during construction or operation.

### Risk of asbestos exposure at the Wakehurst Parkway east construction support site (BL13)

Potential contamination risks at the Wakehurst Parkway east construction support site (BL13) are discussed in Table 16-10 of the environmental impact statement and in Table 5-1 of Appendix M (Technical working paper: Contamination). There is a moderate risk for asbestos to be present within potentially 0 – 0.1 metres of the ground surface, due to the degradation of painted surfaces on the reservoirs and the presence of demolition wastes observed across the surface of the site.

As discussed above, further investigations of potentially contaminated areas directly affected by the project, including at Wakehurst Parkway (Seaforth to Frenchs Forest), will be carried out and managed in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report).

Asbestos handling, management and disposal will be carried out in accordance with relevant legislation, codes of practice and Australian standards, as required by environmental management measure SG10 (refer to Table D2-1 of this submissions report). A construction waste management plan will be prepared and implemented during construction that will include, but not be limited to, procedures for handling and storing potentially contaminated substances, as per environmental management measure SG12 (refer to Table D2-1 of this submissions report).



### Role of an Environment Protection Authority Accredited Site Auditor

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, in accordance with revised environmental management measure SG8 (refer to Table D2-1 of this submissions report).

The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contamination discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013a), as required by environmental management measure SG13 (refer to Table D2-1 of this submissions report).

A site auditor would not be required to be present at all contaminated sites at all times. The implementation of Remediation Action Plans (in the event that site remediation is warranted) and other environmental management measures including SG10 and SG14 (refer to Table D2-1 of this submissions report) would address potential contamination risks during construction of the project.

### 'Complex' contamination referred to in SG8

An independent NSW Environment Protection Authority Accredited Site Auditor will be engaged for specific sites where contamination is complex. As relevant, this may include where there is significant groundwater contamination, contamination that requires specialised remediation techniques, or contamination that requires ongoing active management during and beyond construction.

## **C15.3 Marine sediments**

### **C15.3.1 General marine sediment issues**

#### ***Issue raised***

Submitters raised issues regarding potential impacts from contaminated marine sediments. Specific queries, comments and concerns include:

- Some contaminants identified in sediment sampling from Middle Harbour were found to be at concentrations that is toxic to organisms (refer to Table 1 of Annexure C of Appendix M (Technical working paper: Contamination))
- Concerns that no information is provided on the number of samples collected and analysed in Middle Harbour
- Concerns that sampling for contamination was mostly taken in 2017 and 2018 with no recent assessment of contamination risks
- Concerns that PFAS sampling was only carried out in Middle Harbour and not at The Spit or other locations
- Requests for a detailed contamination analysis of the bed of Middle Harbour in the construction footprint to provide a baseline for measuring contamination and to determine impacts on the bed of Middle Harbour, foreshore, beaches and general water quality during and after construction, at different times and tides.

#### ***Response***

### Toxicity to organisms

The results of the sediment sampling investigation carried out by Royal HaskoningDHV as described in Annexure C of Appendix M (Technical working paper: Contamination) indicated that

select contaminants were detected above the sediment quality guideline screening levels included in the *National Assessment Guidelines for Dredging* (Department of Environment, Water, Heritage and the Arts, 2009) for samples collected in the grey green sediment in the top one metre of sediment below the bed of the harbour. This included the metals copper, mercury, lead, silver and zinc, as shown in Table 1 of Annexure C of Appendix M (Technical working paper: Contamination). The screening levels are the level of a contaminant in the sediment below which toxic effects on organisms are not expected (Department of Environment, Water, Heritage and the Arts, 2009).

Elutriate testing was then carried out to provide an indication of how potentially soluble contaminants are when disturbed by works such as dredging. A 95 per cent species protection level (ANZG, 2018) was used for the assessment, which is considered appropriate for Middle Harbour on the basis of it being a slightly to moderately disturbed system. Based on the elutriate test results for metals and 2,3,7,8- tetrachlorodibenzo para dioxin (TCDD), a minimum natural dilution of 1:24 would be required to meet the 95 per cent species protection level in the ANZG (2018).

Available natural dilution was then considered. The approach used would give an initial dilution (the ratio of wet sediment to seawater) exceeding 200, which is well in excess of the required initial dilution of 24 to satisfy the 95 per cent species protection level in the ANZG (2018). Based on the elutriate test results and the assessed available natural dilution, water quality impacts at the dredging site due to dissolved contaminants would not be expected. For more information refer to Annexure C of Appendix M (Technical working paper: Contamination).

#### Number and locations of sediment samples in Middle Harbour and The Spit

Two rounds of sampling and testing of the Middle Harbour sediment have been carried out, namely by Douglas Partners and Golder Associates (2018) and then subsequently by Royal HaskoningDHV in 2020, as discussed in Annexure C of Appendix M (Technical working paper: Contamination). The purpose of the Royal HaskoningDHV 2020 investigation was to assess the suitability of dredged sediments for offshore disposal, an activity regulated under the Commonwealth *Environment Protection (Sea Dumping) Act 1981*. The regulator for offshore disposal at the nominated disposal ground (Sydney Offshore Spoil Ground) is the Commonwealth Department of Agriculture, Water and Environment.

As part of the Middle Harbour sediment sampling carried out by Douglas Partners and Golder Associates (2018), Sediment samples were collected at 15 locations (22 samples) at the Middle Harbour crossing location. The results and sampling are provided in Section 16.3.5 of the environmental impact statement and Annexure B of Appendix M (Technical working paper: Contamination) respectively. Sediment samples were collected from a range of depths and analysed for a range of contaminant compounds including heavy metals, hydrocarbon compounds (total recoverable hydrocarbons (TRH), benzene / toluene / ethyl-benzene and xylenes (BTEX), polycyclic aromatic hydrocarbon (PAH), tributyltin (TBT), organochlorine pesticides (OCP), polychlorinated biphenyls (PCB), per- and poly-fluoroalkyl substances (PFAS) and dioxins. The sediment tables in Annexure B of Appendix M (Technical working paper: Contamination) indicate where sediment quality guideline criteria were exceeded.

The results of sediment testing and results of elutriate testing that was carried out by Royal HaskoningDHV in 2020 at Middle Harbour, subsequent to the investigations carried out by Douglas Partners and Golder Associates (2018), for the purpose of assessing the suitability of dredged sediments for offshore disposal are provided in Annexure C of Appendix M (Technical working paper: Contamination). Figure 2 of Annexure C of Appendix M (Technical working paper: Contamination) shows the Douglas Partners and Golder Associates (2018) sampling locations as yellow circles, and shows yellow stars to depict the subsequent sampling locations in the Royal

HaskoningDHV investigation in 2020. Discussion of results of testing for PFAS can also be found in Section C15.1.2 of this submissions report.

For the Spit West Reserve construction support site (BL9), sediment sampling was carried out as part of the Douglas Partners and Golder Associates (2018) investigation at 25 locations. The results and sampling locations are provided in Section 16.3.5 of the environmental impact statement and Annexure B of Appendix M (Technical working paper: Contamination) respectively. PFAS analysis was not carried out on the Spit West Reserve harbour samples. It should be noted that there would be no dredging carried out at the Spit West Reserve construction support site (BL9) area of the project.

At the Spit West Reserve construction support site (BL9), temporary piling is required to facilitate the construction of the floating facility and fixed jetties, as described in Table 6-23 of the environmental impact statement. Construction activities such as piling, the construction of temporary wharf facilities and vessel movements (indicatively up to about 67 per day) would be likely to lead to mobilisation of bed sediments within shallower waters and the formation of minor plumes which would be short lived and localised, owing to the nature of the activities and the low current speeds in the area, and which would resettle to the bed of the harbour. These activities and the plumes generated are likely to lead to elevated total suspended solids concentrations over small areas and for periods of less than 10 minutes. These small plumes would be unlikely to lead to any measurable effects.

#### Middle Harbour sediment analysis

Analysis and description of existing Middle Harbour sediment results for contamination testing is provided in Section 16.3.5 of the environmental impact statement, Section 4.4.1 of Appendix M (Technical working paper: Contamination) and Annexure C of Appendix M (Technical working paper: Contamination).

The analysis included a review of previous studies and a review of sediment samples taken as part of investigations carried out for the project in Middle Harbour. The results of the sediment sampling in Middle Harbour indicated a range of guideline exceedances including mercury, zinc, silver, lead, heavy metals, polycyclic aromatic hydrocarbons, total recoverable hydrocarbons, tributyltin and organochlorine pesticides. Elevated levels of contamination were generally detected in samples collected within the first metre of sediments. Further information on sediment sampling is provided in Appendix M (Technical working paper: Contamination). Further, Appendix Q (Technical working paper: Marine water quality) considers tidal conditions during marine water quality data collections periods (refer to Section 3.3.1 of Appendix Q (Technical working paper: Marine water quality)).

Issues related to marine water quality are discussed in Section C16.2 of this submissions report.

#### **C15.3.2 Dredging and disposal of marine sediments**

##### ***Issue raised***

Submitters raised concerns about potential impacts of dredging, spills and construction activities in Middle Harbour, including:

- Concerns that there is a lack of detail about how contaminated sediment dredged from Middle Harbour will be managed and treated, in addition to concerns about disposal of marine sediment offshore and requests for Middle Harbour sediment to be treated and disposed of at appropriately licensed and geographically suitable onshore facilities
- Request for the treatment of PFAS contaminants that are found in Middle Harbour to be aligned with *PFAS National Environmental Management Plan Version 2.0* (HEPA, 2020)

- Concern that the potential presence of PFAS in dredged materials would result in such material not being accepted by landfills in NSW
- Requests for contaminant testing and monitoring be carried out in Middle Harbour around Northbridge Baths and Northbridge Sailing Club.

### ***Response***

#### Management and treatment of marine sediments from Middle Harbour

The management of dredged and excavated materials from Middle Harbour is outlined in Section 16.4.4 and Section 24.3.3 of the environmental impact statement. Issues relating to disturbance and removal of sediments with elevated levels of contamination during dredging are addressed in Section C16.2 of this submissions report.

The dredging methodology has been designed to minimise impacts on the marine environment and is detailed in Chapter 6 (Construction works) of the environmental impact statement. This includes the use of a closed bucket (environmental clamshell) and the use of multiple silt curtains to minimise the spread of potentially contaminated material. Specific environmental management measures to avoid adverse impacts to water quality as a result of sediment plumes are described in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement, and further information on the proposed dredging methodology is also provided in Appendix C1 of this submissions report.

Marine construction works for the project within Middle Harbour would produce around 163,000 cubic metres of dredged and excavated materials, made up of:

- Soft soils, sediment and rock excavated from the two temporary cofferdams in Middle Harbour
- Soft soils, sediment and rock dredged for the installation of the immersed tube tunnels.

The approach to management of marine dredged and excavated materials is shown in Figure 24-1 of the environmental impact statement.

Dredged and excavated materials suitable for offshore disposal would be transported from Middle Harbour on split hopper barges and disposed of at the designated offshore disposal site, in accordance with legislative requirements. The appropriateness of offshore disposal would be assessed in accordance with the Australian Government *National Assessment Guidelines for Dredging* (Department of Environment, Water, Heritage and the Arts, 2009), as required by environmental management measure SG17 (refer to Table D2-1 of this submissions report). Offshore disposal will only occur for material that meets the criteria provided in the guidelines. Offshore disposal of dredged and excavated materials is subject to a separate assessment process by the Australian Government Department of Agriculture, Water and the Environment, as detailed in Chapter 2 (Assessment process) of the environmental impact statement. Transport for NSW has submitted an application to the Australian Government Department of Agriculture, Water and Environment for this offshore disposal permit relating to sediments dredged and excavated from Middle Harbour.

Results of elutriate testing and contamination testing of Middle Harbour sediments are presented in Annexure C of Appendix M (Technical working paper: Contamination). The contaminant levels of material to be dredged were assessed in accordance with the *National Assessment Guidelines for Dredging* (Department of Environment, Water, Heritage and the Arts, 2009). The key findings of the Royal HaskoningDHV investigation in 2020 are outlined below:

- The gravelly, muddy sand near the shoreline is suitable for offshore disposal
- The top one metre of grey green sediment along the majority of the Middle Harbour crossing tunnel alignment is not suitable for offshore disposal. Based on the available sediment data, the

top one metre of sediment would need to be disposed to land and would be classified as general solid waste (the approach to excavation of soft sediments is discussed in Section 6.4.4 of the environmental impact statement)

- Contaminant concentrations in the grey green mud reduce with depth. Sediment below one metre in depth is suitable for offshore disposal.

Of the 163,000 cubic metres of dredged material requiring removal from Middle Harbour, it is expected that about 12,000 cubic metres from the top one metre of the bed of the harbour would not be suitable for offshore disposal. Marine sediments unsuitable for offshore disposal will be subject to waste classification under the *Waste Classification Guidelines* (NSW EPA, 2014b), in accordance with environmental management measure WM3 (refer to Table D2-1 of this submissions report) and would be treated to make the material spadable (a consistency which allows the material to be spaded or shovelled). During this process, additives such as lime or absorbent polymers would be mixed into the material to assist in mitigating potential odour and to neutralise acid sulfate soils. Once treated, materials would be transported to an appropriate loadout facility located outside of Middle Harbour and loaded into sealed and covered trucks for transport to a suitably licensed facility, as described in Section 24.3.3 of the environmental impact statement. Wastes will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment, as required by revised environmental management measure WM4 (refer to Table D2-1 of this submissions report).

It should be noted that the environmental impact statement states that the location of an appropriate loadout facility outside of Middle Harbour for any dredged material not suitable for offshore disposal would be confirmed during further construction planning (refer to Table 28-2 of the environmental impact statement). Since exhibition of the environmental impact statement, Transport for NSW has prepared a preferred infrastructure report and this includes identification of a loadout facility at the Port of Newcastle. Please refer to Section 5 (Treatment and loadout of dredged and excavated material not suitable for offshore disposal) of the preferred infrastructure report for further information.

#### PFAS treatment and disposal

As discussed in Section C15.1.2, the impact assessment carried out for the environmental impact statement was prepared in accordance with applicable State and Commonwealth legislation and guidelines, including the *PFAS National Environmental Management Plan Version 2.0* (HEPA, 2020).

PFAS testing of marine sediments was carried out for the Douglas Partners and Golder Associates (2018) investigations, as discussed in Section 4.4.1 of Appendix M (Technical working paper: Contamination). One PFAS compound was detected above laboratory levels of reporting in sediment samples collected from Middle Harbour. However, this was at a low concentration and was not considered to be a contaminant of concern (refer to discussion on concentration levels in Section C15.1.2). All PFOS (perfluorooctanesulfonic acid, a type of PFAS) concentrations detected were <0.01 µg/L. These are well below the leachate concentration TCLP (0.05 mg/L) and specific contaminant concentration SCC1 (1.8 mg/kg) values for PFOS for general solid waste in Table 2 of the *Waste Classification Guidelines* (NSW EPA, 2014b) – *Part 1 classifying waste*. All material requiring offsite disposal to land, including marine sediments unsuitable for offshore disposal, will be classified in accordance with *Waste Classification Guidelines* (NSW EPA, 2014b), as required by environmental management measure WM3 (refer to Table D2-1 of this submissions report).

As discussed above, the top one metre of grey green mud along the majority of the Middle Harbour crossing tunnel alignment would not be suitable for offshore disposal and has been classified as general solid waste. Accordingly, the top one metre of sediment would be disposed to land at an appropriately licenced landfill.

### Middle Harbour monitoring during dredging

In response to issues raised in various submissions, further assessment of potential recreational exposures to sediments in Middle Harbour has been carried out and is detailed in Section C12.2.3 and Appendix C2 of this submissions report. Locations of interest around Middle Harbour including Sailors Bay, Northbridge Park, Clive Park, Sandy Bay, The Spit, Clontarf Marina, Clontarf Baths, Clontarf Beach and Tunks Park have been assessed to evaluate whether there are any risk issues of concern for recreational exposures to sediments disturbed by the project. The assessment, carried out by Environmental Risk Sciences, concludes that all maximum (or worst-case) concentrations of chemicals in water as a result of the presence of suspended sediments or dissolved phase concentrations from dredging activities are well below (at least 1000 times below) recreational water guidelines at Clive Park, which is the closest recreational swimming area to the project construction works. Concentrations in all other locations assessed (which are further away from the construction footprint) would be lower due to increased dilution or mixing in larger volumes of water.

During construction, revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report) will be implemented to monitor dredging works in Middle Harbour as follows (refer to Table D2-1 of this submissions report):

Monitoring during dredging activities will be carried out to validate the effectiveness of mitigation measures implemented to manage potential impacts on the water quality and sensitive marine vegetation and habitats of Middle Harbour. The use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites to manage any potential impacts, will be included in a dredge monitoring program. The dredge monitoring program will be developed in consultation with an appropriately qualified and experienced specialist, DPI Fisheries and the NSW EPA prior to its implementation.

## **C15.4 Geology**

### ***Issue raised***

Submitters raised concerns about the geological assessment for the project, including:

- Concerns about geologic uncertainty along the proposed tunnel route and that disturbance of fault lines (specifically Luna Park Fault Zone) could increase groundwater inflows. Further, requests were made for further investigation of the Luna Park Fault Zone
- Concerns about the lack of assessment, including topographical survey, geotechnical investigation, geological mapping and structural assessment of the existing site conditions at Clive Park, which would help determine impacts of construction in this area.

### ***Response***

#### Geologic uncertainty and Luna Park Fault Zone

The geological structural features are detailed in Section 16.3.2 of the environmental impact statement and Section 5.3 of Appendix N (Technical working paper: Groundwater). Structural features including geological faults are important in the consideration of groundwater inflows and the nearest major fault zone to the project is the Luna Park Fault Zone, as shown in Figure 16-1 of the environmental impact statement. Measures will be implemented during tunnel construction to ensure that groundwater inflows into each tunnel during the operation phase do not exceed one litre per second per kilometre (1L/s/km) across any given kilometre, as required by revised environmental management measure SG16 (refer to Table D2-1 of this submissions report).

Additionally, encountering dykes and faults is not uncommon in large tunnelling projects and the construction tunnelling methodology would have measures in place to manage risk associated with elevated inflows, or a sudden in-rush risk.

The Luna Park Fault Zone is the predominant geological structural feature underlying the project area, spanning an area between North Sydney in the south, and Allambie Heights to the north, and passing beneath Clive Park Reserve. This fault zone has been investigated and is mapped in Figure 16-1 of the environmental impact assessment. The Luna Park Fault Zone has been shown to comprise up to three metres wide crushed zones with closely spaced jointing and faulting, and is projected to intersect the project alignment at Middle Harbour. The final tunnel alignment is not expected to be impacted by any geologic instability, and the final tunnel route and construction methodologies would be carried out during detailed design and construction planning.

Further investigations and survey works (including but not limited to geotechnical investigations) would continue under separate approvals as described in Section 5.1.3 of the environmental impact statement. Additional geotechnical testing of underlying sub soil and rock stratum will be carried out during further design development to determine the composition of rock and soil types likely to be present within excavation areas. The further geotechnical investigation and testing would reduce uncertainty and risks for future design and construction planning.

#### Assessment at Clive Park

Geotechnical investigations have been carried out for the broader project footprint and available information has been reviewed and assessed as inputs to the project reference design.

Geotechnical information has also been reviewed and assessed in Appendix N (Technical working paper: Groundwater) and Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) as appropriate. Previous geotechnical investigations also covered contaminated sites, as outlined in Section 4.4 of Appendix M (Technical working paper: Contamination). Geological features and hydrogeological cross sections are provided in Attachment 2 of Annexure F in Appendix N (Technical working paper: Groundwater).

A maximum predicted surface settlement of 25-30 millimetres has been predicted at The Middle Harbour crossing, on the western (Northbridge) side near Clive Park. This is considered a 'slight' severity for building or structure damage that may result in small cracks, as described in Section 16.4.2 of the environmental impact statement. This predicted settlement represents a worst-case scenario, as the modelling was based on unconstrained groundwater inflows into the tunnel and did not account for additional mitigation measures that will be adopted to reduce drawdown and settlement impacts across the project footprint, including implementation of environmental management measures SG2, SG4 and SG16 as described in Table D2-1 of this submissions report. Due to additional geotechnical information proposed to be collected and more refined groundwater modelling and predictions occurring during the detailed design phase, the preliminary settlement estimates in the environmental impact statement are expected to reduce.

An assessment of settlement impacts on heritage items at Clive Park is included in Chapter 14 (Non-Aboriginal heritage) and Chapter 15 (Aboriginal cultural heritage) of the environmental impact statement.

In terms of further assessment, Transport for NSW is currently planning additional geotechnical investigations and monitoring at key locations to gather additional hydrogeological data and the contractor/s would also carry out more detailed geotechnical assessments to provide additional factual geological data to inform tunnel design. The need for further investigations is outlined in Section 5.1.3 of the environmental impact statement.

## C15.5 Erosion

### ***Issue raised***

Submitters raised concerns and requests about erosion, including:

- Concerns that the proposed tree removal at Flat Rock Reserve, Wakehurst Parkway and Manly Dam during construction would increase soil erosion and affect soil stability in the long term
- Requests for a community hotline to address community concerns related to erosion and sediment control and contamination risks, and for communication channels to be established with local sports and community groups to inform them of such risks.

### ***Response***

#### Tree removal and potential erosion

Erosion potential of soils were investigated across the project footprint, and soil erosion potential on different landscapes have been provided in Section 16.3.3 of the environmental impact statement.

The disturbance of soils and vegetation removal on existing slopes during construction has the potential to lead to soil erosion, particularly at temporary construction support sites and surface work construction sites located next to Garigal National Park and Manly Dam Reserve, as discussed in Section 16.4.1 of the environmental impact statement. However, the majority of temporary construction support sites are not located in areas with steep terrain, which reduces the potential for soil erosion (refer to Section 6.1 of Appendix M (Technical working paper: Contamination)). In addition, suitable stabilisation and management techniques would be implemented for the periods of vegetation establishment to minimise the potential for erosion during rehabilitation of temporary construction support sites near Flat Rock Reserve, as identified in Section 6.2.3 of Appendix O (Technical working paper: Surface water quality and hydrology).

Erosion impacts for the construction of a temporary box culvert within the Flat Rock Drive temporary construction support site (BL2) at Flat Rock Reserve will be mitigated through the implementation of environmental management measures including WQ13 (refer to Table D2-1 of this submissions report). Further, erosion and sediment control measures will be implemented at all construction support sites and surface road upgrades in accordance with the principles and requirements *in Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (DECC, 2008) and relevant guidelines, procedures and specifications of Transport for NSW, as required by revised environmental management measure SG9 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, a soil conservation specialist will be engaged for the duration of construction of the project to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans.

#### Community hotline and communication channels

Consultation for the project will be carried out in accordance with the Community consultation framework provided as Appendix E of the environmental impact statement, as required by environmental management measure SE3 (refer to Table D2-1 of this submissions report). An enquiries and complaints handling protocol would be established as outlined in Section 3 of Appendix E (Community consultation framework).



## C15.6 Settlement, subsidence and ground movement

### C15.6.1 General settlement, subsidence and ground movement issues

#### ***Issue raised***

Submitters raised concerns about assessment of settlement, subsidence and ground movement, including:

- Concerns about the degree of severity of settlement induced by groundwater drawdown at Flat Rock Reserve being classified as a severe
- Requests for analysis of the risks of subsidence as a result of groundwater drawdown of greater than 20 metres
- Concerns that the environmental impact statement is unclear on how long the time frame of 'long term' is regarding surface settlement
- Confusion over how ground subsidence is calculated and whether the surface settlement in Table 16-9 includes ground subsidence numbers. Concerns that the maximum total settlement numbers do not appropriately sum the maximum stress redistribution settlement value and the maximum groundwater induced settlement value
- Concerns about potential damage to stormwater, sewage and water infrastructure due to settlement. Requests for tilt meters to be installed prior to construction for monitoring of the water infrastructure during construction and operation

Concerns about Seaforth Bluff being a landslip area, and that tunnel construction activities may affect the cliff stability on the Bluff.

#### ***Response***

##### Settlement at Flat Rock Reserve

A preliminary assessment of ground settlement induced by groundwater drawdown (as well as stress redistribution in the surrounding ground) has been carried out and is documented in Section 16.4.2 of the environmental impact statement. The assessment found that a maximum total settlement of 85 millimetres (which is classified as having a building and structure settlement damage classification degree of severity of 'severe') is predicted at Flat Rock Reserve. However, this was based on a conservative approach that did not take into account measures to reduce tunnel inflows beneath Flat Rock Reserve, and therefore assumed that groundwater inflows are unconstrained. It also assumed that there is full hydraulic connectivity in the underlying geology and the impact of tunnel inflows would be realised at the surface, which is unlikely to be the case. Additional modelling and settlement predictions were completed at this location. The additional modelling included tunnel linings to preclude groundwater inflows beneath Flat Rock Reserve. When the reduced inflows and reduced groundwater drawdown were taken into account, the maximum predicted settlement reduced to 35 millimetres, reducing the degree of severity to 'slight' under relevant guidelines (refer to Table 16-8 of the environmental impact statement). Additionally, there are no buildings at the Flat Rock Reserve location, therefore settlement impact to buildings and structures would not be expected as a result of the project. This demonstrates that appropriate choice of linings can be used to minimise groundwater drawdown induced settlement at this location.

The existing groundwater monitoring program for both groundwater levels and quality will be continued through construction, as required by environmental management measure SG1 (refer to Table D2-1 of this submissions report). As more information becomes available on groundwater levels and contamination through ongoing groundwater monitoring, groundwater modelling will be

updated to refine the predictions. Inflow predictions will be updated prior to finalising detailed design and will include designed tunnel linings, and the detailed design will be updated based on the updated operational inflow and impact predictions, in accordance with revised environmental management measure SG2 (refer to Table D2-1 of this submissions report). 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, as required by environmental management measure SG4 (refer to Table D2-1 of this submissions report).

#### Groundwater drawdown of greater than 20 metres and long term settlement timeframes

Predicted groundwater drawdown contours (including where greater than 20 metres) for the project at the end of tunnel construction (2028) are outlined in Figure 16-11 and Figure 16-12 of the environmental impact statement. Predicted groundwater drawdown contours for the project during operation (2128) are outlined in Figure 16-13 and Figure 16-14 of the environmental impact statement.

An assessment of ground settlement induced by tunnel excavation due to both stress redistribution in the surrounding ground (due to the removal of subsurface materials during tunnelling activities) and groundwater drawdown around drained tunnels has been carried out (Arup and WSP, 2020). The assessment approach and findings are included in Section 4.6 of Appendix N (Technical working paper: Groundwater), and are also summarised in Section 16.4.2 of the environmental impact statement.

Maximum long-term total surface settlement impacts are predicted across the construction footprint and were estimated based on the potential groundwater level drawdown after 100 years of operation (refer to Section 8.1.2 of Annexure F of Appendix N (Technical working paper: Groundwater)).

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, as required by environmental management measure SG4 (refer to Table D2-1 of this submissions report).

#### Maximum settlement value

As stated above, an assessment of ground settlement induced by tunnel excavation due to both stress redistribution in the surrounding ground (due to the removal of subsurface materials during tunnelling activities) and settlement resulting from groundwater drawdown around drained tunnels has been carried out. The maximum predicted surface settlement across the project footprint is provided in Table 16-9 of the environmental impact statement.

It should be noted that at each site there are a range of settlement values for both stress redistribution induced settlement and groundwater drawdown induced settlement with a maximum value assigned for each. However, the maximum total settlement value is not necessarily the combined sum of the two values as there may be interaction and overlap between each of these contributing factors. The final result is based on consideration of both values to make a prediction of the final maximum total settlement.

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 in accordance with environmental management measure SG4 (refer to Table D2-1 of this submissions report).

### Stormwater and associated water infrastructure

Across most of the project footprint, settlement due to stress redistribution in the surrounding ground (due to the removal of subsurface materials during tunnelling activities) is predicted to cause the majority of settlement (compared to groundwater drawdown induced settlement or subsidence), and this settlement would occur at the time of excavation during construction. Operational impacts on the final landform due to settlement are expected to be negligible (refer to Section 6.2.3.12 of Appendix N (Technical working paper: Groundwater)).

In terms of existing water supply, sewage and associated water infrastructure in the project footprint, the assessed potential degree of severity for damage resulting from settlement was 'slight' for identified utilities, which includes two existing sewers at Cammeray and an existing sewer at Seaforth. No utilities were assessed to be in the 'moderate', 'severe' or 'very severe' categories (refer to Section 6.1.3.8 of Appendix N (Technical working paper: Groundwater)), however it should be noted that the risk categories are relevant to buildings and may not be suitable for application to utilities. The potential for predicted ground movement to impact utilities would have to be confirmed with the respective utility service provider/asset owner.

Engagement with utility and infrastructure owners regarding construction works has been ongoing to date. Utility and infrastructure owners will be further consulted when detailed design has been finalised and prior to commencement of excavation or tunnelling works which may potentially affect the asset to identify settlement criteria and appropriate mitigation measures to ensure, where possible, that the asset will not experience exceedances of the relevant criteria, as required by environmental management measure SG21 (refer to Table D2-1 of this submissions report).

### Seaforth Bluff land stability

The sections above address concerns related to ground movement, which includes potential subsidence and landslip risks as a result of the project.

The cliff stability at Seaforth Bluff is not expected to be impacted by ground movement as a result of the project. Middle Harbour crossing on the northern (Seaforth) side has a maximum predicted surface settlement of 25-30 millimetres, as shown in Table 16-9 of the environmental impact statement. This is considered a 'slight' severity for building or structure damage that may result in small cracks, as described in Section 16.4.2 of the environmental impact statement. This predicted settlement represents a worst-case scenario, as the modelling assumed that the tunnel was unlined, with the exception of a 125 metre section on either side of Middle Harbour, and that groundwater inflows to the tunnel were constrained by the formation permeability. Further, the modelling did not account for additional mitigation measures that will be adopted to reduce drawdown and settlement impacts across the project footprint, including implementation of environmental management measures SG2 and SG16 as described in Table D2-1 of this submissions report. As mentioned above, due to additional geotechnical information proposed to be collected and more refined groundwater modelling and predictions occurring during the detailed design phase, the settlement estimates in the environmental impact statement are expected to reduce.

## **C15.6.2 Property**

### ***Issue raised***

Submitters raised concerns and queries about potential impacts on property as a result of ground movement including settlement and subsidence. Specific concerns and queries include:

- Queries about building structure condition surveys, including requests for all homes in groundwater drawdown areas, within Naremburn Conservation Area, at Kirkwood Street Seaforth, and homes over 100 years old to be offered building structure condition surveys

- Concerns that the currently proposed threshold for repair or compensation is not enough and compensation should be provided for smaller cracks less than 50 millimetres
- Concerns about impacts to properties due to settlement, particularly in the Northbridge and Willoughby areas
- Queries as to when the Independent Property Impact Assessment Panel would be formed.

### ***Response***

#### **Building structure condition surveys**

Transport for NSW understand and acknowledge the concern about the potential for settlement from tunnelling to cause damage to homes. 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.

Pre-construction building structure condition surveys will be offered and prepared in accordance with revised environmental management measure SG7 as follows (refer to Table D2-1 of this submissions report):

Pre-construction building structure condition surveys will be offered and prepared (where the offer is accepted by the owner) for properties (and heritage assets) within the zone of influence of tunnel settlement where the degree of severity has been assessed as 'slight' (or above) and or 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 cause settlement or vibration-related damage to 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, a post-construction building condition survey will be carried out by a suitably qualified person. The results of the survey 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 month of the survey being completed. Any building and/or property damage from settlement caused by the project will be repaired at no cost to the owner.

The use of a zone of influence for the project is consistent with recent tunnel projects in NSW such as WestConnex and NorthConnex.

The project would contact owners of properties eligible for pre-construction condition surveys. This would happen during further design development for the project.

#### **Threshold for repair or compensation**

As outlined in above and in revised environmental management measure SG7 (refer to Table D2-1 of this submissions report), pre-construction building structure condition surveys will be offered and prepared (where the offer is accepted by the owner) for properties (and heritage assets) within the zone of influence of tunnel settlement where the degree of severity has been assessed as 'slight' or above or within the minimum working distances for cosmetic and structural damage due to vibration. The degree of severity of 'slight' is defined as a maximum building settlement of 10 – 50 millimetres, as described in Table 16-8 of the environmental impact statement.

As required by revised environmental management measure SG7, all property owners of buildings for which a pre-construction building condition survey was carried out will be offered a second building condition survey within three months of the completion of construction activities that have the potential to cause settlement or vibration-related damage. Any building and/or property damage from settlement caused by the project will be repaired at no cost to the owner.

The use of a zone of influence for the project is consistent with recent tunnel projects in NSW such as WestConnex and NorthConnex.

#### Potential settlement impacts to properties

Potential impacts resulting from the preliminary estimates of settlement associated with stress redistribution in the surrounding ground (due to the removal of subsurface materials during tunnelling activities) and predicted groundwater drawdown around drained tunnels are discussed in Section 16.4.2 of the environmental impact statement. As discussed in Section C15.6.1 above, the maximum total predicted settlement along the tunnel alignment is conservative and is based on unconstrained groundwater inflows into the tunnel, with the exception of a 125 metre section on either side of Middle Harbour, and full hydraulic connectivity in the underlying geology.

Settlement contours for Cammeray and Willoughby are shown on Figure 16-8 of the environmental impact statement. Note that Figure 16-8 and Figure 16-9 of the environmental impact statement incorrectly present settlement contours in metres within the figure legends. Settlement contours are in millimetres, and the legend should reflect this accordingly. This issue has been corrected in Table A5-13 of this submissions report.

Other than at Flat Rock Reserve which was subject to further modelling as described in Section 16.4.2 of the environmental impact statement, the maximum long-term surface settlement is predicted to be up to 40 millimetres at the Burnt Bridge Creek Deviation portal and the Wakehurst Parkway portals. This would be assessed as 'slight' severity under relevant guidelines.

A description of building and structure settlement damage classification is provided in Table 16-8 of the environmental impact statement. No buildings or structures surrounding the project are predicted to be in the 'slight', 'moderate', 'severe' or 'very severe' damage classification categories for potential settlement damage. Sixty-one buildings are categorised as potentially within the 'very slight' damage category. These buildings are mainly in the vicinity of locations where the tunnel would have shallow cover near portals and larger span caverns, including:

- The Warringah Freeway portals
- Northbridge, east of the Flat Rock Reserve area
- Seaforth Bluff
- Seaforth at the junction of the mainline and ramp tunnels
- Wakehurst Parkway cavern and portal.

'Very slight' damage (fine cracks) would be easily treated during normal decoration. Damage would generally be restricted to internal wall finishes, with small cracks visible on external brickwork or masonry, as described in Section 16.4.2 of the environmental impact statement. With the implementation of proposed mitigation measures outlined in Table D2-1 of this submissions report, it is expected that the likely subsidence impacts would be less than predicted.

For properties in Kirkwood Street Seaforth, while the maximum predicted long-term surface settlement of up to 40 millimetres is predicted around the Wakehurst Parkway portal/tunnel access decline, the maximum degree of severity for potential settlement damage for any property or structure surrounding the project is classified as 'very slight' (less than 10 millimetres), as described

above and in Section 16.4.2 of the environmental impact statement. It should also be noted that during development of the reference design and consideration of the Balgowlah connection alternatives, the preferred alternative of relocating the tunnel portal further to the south has meant that relatively low cover tunnelling has been eliminated under residential properties in Hope Street, minimising settlement risk at this location (refer to Table 4-19 of the environmental impact statement).

A search of relevant heritage registers and databases for non-Aboriginal heritage items was carried out as part of the Non-Aboriginal heritage assessment and results are summarised in Section 3.2.1 of Appendix J (Technical working paper: Non-Aboriginal heritage). A summary of the heritage significance of the items identified is provided in Section 4 of Appendix J (Technical working paper: Non-Aboriginal heritage). A number of heritage homes and properties within the proposed project area were identified and their significance evaluated, including properties in Cammeray and Naremburn. Potential settlement and ground movement impacts caused by tunnel excavation for the Naremburn Heritage Conservation Area are discussed in Chapter 14 (Non-Aboriginal heritage) of the environmental impact statement and also in Section C13.2 of this submissions report. With the implementation of the proposed environmental management measures, the level of impact here has been assessed as negligible.

As stated above, the project would contact owners of properties eligible for pre-construction condition surveys. This would happen during the detailed design phase of the project.

#### Independent Property Impact Assessment Panel

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 monitoring requirements, as required by environmental management measure SG5 (refer to Table D2-1 of this submissions report). The Independent Property Impact Assessment Panel will be independent of both Transport for NSW and property owners.

## **C15.7 Groundwater drawdown and quality**

Issues related to groundwater dependant ecosystems are also addressed in sections B4.16, B12.17, and C20.8 of this submissions report and issues related to groundwater drawdown impacts on surface water flows are also addressed in sections B4.16, B6.3, B11.15.4, C16.6 and C18.7 of this submissions report.

### **C15.7.1 Groundwater drawdown**

#### ***Issue raised***

Submitters raised concerns about groundwater drawdown at particular locations. Specific queries and concerns included:

- Concerns about the level of groundwater drawdown generally, in addition to specific concerns about groundwater drawdown at Artarmon Reserve, Flat Rock Creek and Burnt Bridge Creek
- Requests for a map of potential areas impacted by groundwater drawdown and for the community to be consulted if refined predictions of groundwater levels and drawdown indicate that impacts would be greater than those presented in the environmental impact statement
- Requests for further assessment of groundwater drawdown impacts
- Requests that all extracted and treated groundwater is injected to recharge the source aquifer it came from as a first priority, or discharged to creeks that the groundwater aquifer feeds

- Requests for additional modelling based on the lining of the tunnel beneath Flat Rock Creek as mentioned in the environmental impact statement to be carried out and for confirmation on whether this lining would be implemented to prevent long term groundwater drawdown
- Requests for ongoing groundwater monitoring to be applied, for the data to be made publicly available and to include all sampling and testing results, and for Willoughby City Council to be provided funding to conduct monitoring for 50 years
- Requests for further assessment of groundwater inflow issues related to the tunnel being below sea level under Northbridge
- Requests for the waterproof lining of the tunnels to be extended along the length of the tunnels to reduce groundwater inflows
- Chapter 16 (Geology soils and groundwater) states further investigations are required to determine the potential for groundwater drawdown impacts to bore GW023150 and to identify appropriate mitigation and rectification measures for implementation as required. Requests that Transport for NSW complete and publish mitigation and rectification measures
- Concerns that groundwater inflows would impact on road safety.

### ***Response***

#### Groundwater drawdown and updated predictions

Predicted groundwater drawdown contours for the project at the end of tunnel construction are presented in figures 16-11 and 16-12 of the environmental impact statement. At the end of tunnel construction, the maximum predicted level of groundwater drawdown is predicted to be up to 12 metres at Flat Rock Creek, about 13 metres at Artarmon Park and about four metres at the most impacted section of Burnt Bridge Creek.

Predicted groundwater drawdown contours for the project 100 years after opening (2128) are presented in figures 16-13 and 16-14 of the environmental impact statement. Groundwater drawdown after is expected to be about 17 metres at Artarmon Park and about five metres at the most impacted section of Burnt Bridge Creek. While consistent with these findings overall, revised groundwater modelling carried out as part of this submissions report indicates that groundwater drawdown at these locations is predicted to be less than previously reported in the environmental impact statement. The revised prediction of groundwater drawdown is between three to five metres at both these locations. Further details of the additional investigations carried out and updates made to the groundwater model are discussed in Section A5.1.15 of this submissions report and detailed in Appendix E of this submissions report.

It should be noted that the groundwater modelling presented in the environmental impact statement adopted a conservative approach and is based on unconstrained groundwater inflows into the tunnel and full hydraulic connectivity in the underlying geology.

The degree of drawdown would be dependent on a number of factors including the geology intersected, the hydrogeology and the tunnel design. It should also be noted that the groundwater drawdown predictions are based on a number of conservative assumptions including limited geotechnical investigations and unconstrained inflows into the tunnel.

#### Discharge of treated groundwater

Treated groundwater from construction wastewater treatment plants will be discharged as discussed in Section 6.9.4 of the environmental impact statement:

- Cammeray Golf Course (BL1) – to Willoughby Creek
- Flat Rock Drive (BL2) – to a drainage pit on Flat Rock Drive then to Flat Rock Creek

- Punch Street (BL3) – to Flat Rock Creek near Station Street at Artarmon
- Balgowlah Golf Course (BL10) – to Burnt Bridge Creek
- Wakehurst Parkway east (BL13) – excess treated groundwater not used for environmental management measures on the Wakehurst Parkway Upgrade would be discharged to a drainage channel to be formed at the eastern section of the site (which would drain towards a Wakehurst Golf course dam for reuse by the golf course).

The operational wastewater treatment plant at Artarmon will discharge a portion of its treated water to the local stormwater network and ultimately, to Flat Rock Creek. The remainder would be used for washdowns and deluge testing.

As described above, treated groundwater would be discharged to local waterways. It is not considered practical or cost effective for the project to inject groundwater to its source aquifers; this would particularly be the case during operation when all groundwater would be treated at Artarmon. Injection to the source aquifers would require the transfer of treated groundwater to the source aquifers, some of which would be located several kilometres away on the northern side of Middle Harbour. Additionally, given the relatively low permeability of the Hawkesbury Sandstone aquifer, it is not considered practicable to reinject water at rates and volumes required for the project; such reinjection would involve a large borefield footprint, construction and ongoing maintenance costs, and energy use. Source aquifers are described in Section 16.3.4 of the environmental impact statement. Further information on groundwater movement is provided in the response below.

#### Further assessment of groundwater inflows, groundwater monitoring and management of groundwater inflows

Tunnel inflows and impacts are discussed in Section 16.4.5 of the environmental impact statement.

Maximum groundwater inflow rates would generally occur when new sections of the tunnels are excavated and measures to mitigate inflows (such as tunnel linings) have not yet been installed.

Groundwater inflows into the tunnel were calculated for five time periods during the construction phase. These results are presented in Table 16-11 of the environmental impact statement. These predicted flows are unconstrained, in that no design or construction measures to reduce groundwater inflow have been assumed in the modelling.

Peak inflows of 1.39 litres per second per kilometre (L/s/km) averaged over the whole tunnel were predicted to occur in 2025. The largest predicted inflows would be associated with the mainline and ramp tunnel caverns located in the vicinity of Flat Rock Creek, Northbridge, due to inflows from a palaeovalley at this location, and the areas of potential high inflows associated with the Luna Park fault zones in the vicinity of driven mainline tunnels connecting to the immersed tube tunnels in Middle Harbour.

The existing groundwater monitoring program for both groundwater levels and quality will be continued through construction, in accordance with environmental management measure SG1 (refer to Table D2-1 of this submissions report) along with geotechnical investigations to confirm the nature of underlying rock formations and the level of connectivity between the ground surface and groundwater aquifers.

As more information becomes available on groundwater levels and contamination through ongoing groundwater monitoring, groundwater modelling will be updated to refine the predictions. Inflow predictions will be updated prior to finalising detailed design and will include designed tunnel linings, and the detailed design will be updated based on the updated operational inflow and impact predictions. If refined predictions of groundwater levels and drawdown indicate that impacts would be greater than the impacts presented in the environmental impact statement, feasible and



reasonable mitigation measures will be incorporated into the detailed design and implemented, as required by revised environmental management measure SG2 (refer to Table D2-1 of this submissions report). Outcomes of the groundwater modelling required by revised environmental management measure SG2 (refer to Table D2-1 of this submissions report) will identify any requirements for further groundwater monitoring during the operational phase, as required by environmental management measure SG1 (refer to Table D2-1 of this submissions report). Groundwater monitoring associated with the project would not be the responsibility of Willoughby City Council, as such funding for such tasks is not required.

Measures will be implemented during tunnel construction to ensure that groundwater inflows into each tunnel during the operation phase do not exceed 1L/s/km across any given kilometre, as required by revised environmental management measure SG16 (refer to Table D2-1 of this submissions report). To achieve this, the detailed design will be required to consider appropriate feasible and reasonable mitigation measures, which includes the use of waterproof linings in areas of predicted high tunnel inflows.

Additional modelling incorporating more detailed site information has been conducted since exhibition of the environmental impact statement, as discussed in Section A5.1.15 of this submissions report and detailed in Appendix E of this submissions report. The modelling supports the assessment, findings and mitigation measures detailed in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement.

#### Groundwater drawdown impacts to bore GW023150

Bore GW023150 is recorded as less than two metres deep. Modelling predicts that drawdown at this bore would be up to three metres in 2128 (cumulative case), as described in Section 16.5.2 of the environmental impact statement. If this bore were to rely on shallow groundwater, water availability at this bore could be impacted. There is potential that there may be an error in the record of the depth of GW023150, as described in Section 16.5.2 of the environmental impact statement.

The viability of bore GW023150 will be confirmed prior to construction. If drawdown at the bore exceeds two metres (in accordance with the *NSW Aquifer Interference Policy* (NSW Department of Primary Industries (DPI) (Office of Water), 2012a)) and impacts to the ongoing use of the bore are unacceptable, measures will be taken to 'make good' the impact by restoring the water supply to pre-development levels. The measures taken will be dependent upon the impacts to the bore and will be determined in consultation with the affected licence holder but could include deepening the bore, providing a new bore or providing an alternative water supply, as required by environmental management measure SG3 (refer to Table D2-1 of this submissions report).

#### Impact of tunnel inflows on road safety

Measures will be implemented during tunnel construction to ensure that groundwater inflows into each tunnel during the operation phase do not exceed 1L/s/km across any given kilometre, as required by revised environmental management measure SG16 (refer to Table D2-1 of this submissions report). Drainage within the tunnel would be designed to manage the expected amount of tunnel inflows without affecting the road surface or vehicular safety.

### **C15.7.2 Groundwater quality**

#### ***Issue raised***

Submitters raised concerns about potential impacts of the project on groundwater quality, including:

- Concerns that bushland removed during widening of the Wakehurst Parkway would result in impacts to groundwater quality

- Concerns about impacts to groundwater quality from the migration of contaminants, particularly at Flat Rock Reserve, Balgowlah Golf Course and BP Balgowlah service station site.

### ***Response***

#### **Bushland removal**

Potential impacts on groundwater from the widening of Wakehurst Parkway are discussed above in Section C15.1.1. It is not anticipated that the removal of bushland from the widening of Wakehurst Parkway would impact on groundwater quality. Vegetation removal including the clearing of native vegetation will be further minimised during further design development and construction planning to the extent reasonably practicable, in accordance with revised environmental management measure B6 (refer to Table D2-1 of this submissions report).

Impacts related to surface water quality as a result of bushland removal are presented in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement. Potential surface water quality impacts associated with the removal of bushland would be managed by revised environmental management measure SG9 (refer to Table D2-1 of this submissions report) which outlines requirements for erosion and sediment control measures. It is considered that with the management of surface water quality impacts, this would also further reduce the minimal risk to groundwater quality from the removal of bushland.

#### **Contaminated groundwater migration**

Contaminant migration from contaminated sites during construction and operation is described in Section 16.4.5 and Section 16.5.2 of the environmental impact statement respectively. The assessment considered 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 assessment was based on the water quality guidelines from the *NSW Aquifer Interference Policy* (NSW DPI (Office of Water), 2012a), which states that the beneficial use of a groundwater source 40 metres away from the activity must not be reduced. The sites assessed included Flat Rock Reserve at Northbridge and Balgowlah Golf Course at Balgowlah. The BP service station site at Balgowlah is immediately adjacent to the golf course.

Predicted drawdown at Flat Rock Reserve and Balgowlah Golf Course is outlined in Table 16-12 for the year 2028 (end of construction period) and Table 16-15 for the year 2128 (100 years following commencement of operation). The rate of migration would depend predominantly on the hydraulic conductivity at the area of environmental interest for contamination, contaminant viscosity and the hydraulic gradient at the site.

If contaminants are mobilised from areas next to Balgowlah Golf Course, they would travel towards the tunnel whereas at Flat Rock Drive, the area is almost entirely on top of the tunnel centreline and limited horizontal migration is therefore expected. During construction, tunnel groundwater inflows would be collected and treated at the construction wastewater treatment plants. Discharges from wastewater treatment plants during the construction phase will be required to meet the discharge criteria outlined in revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report). During operation, tunnel groundwater inflows would be collected and treated to meet water quality criteria at the Gore Hill Freeway wastewater treatment plant in Artarmon prior to discharge, in accordance with revised environmental management measure WQ17 (refer to Table D2-1 of this submissions report).



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C16 – Hydrodynamics and water quality

## C16 Hydrodynamics and water quality

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## C16.1 Hydrodynamic impacts

### C16.1.1 Hydrodynamic and dredge plume modelling

#### ***Issue raised***

Submitters raised concerns about Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling), including:

- Concerns that the modelling does not include cumulative impacts brought about by the dredging, piling and barge anchoring activities in Middle Harbour and changes to local tidal flows due to multiple construction and staging sites being in operation at the same time
- Requests were made for dredge plume modelling to consider 98th percentile modelling and to consider data from the construction of Sydney Metro
- Concerns that the dredge plume modelling does not consider the entire 37 week dredging period and that modelling for contaminated sediment was carried out over a period of 1.2 weeks
- Concerns that the modelling has been done on the assumption that the silt curtains have a draught of 12 metres, that assessment of full-length sea curtains has not been carried out and that the modelling does not include a risk assessment model for the loss of base anchoring of the silt curtains
- Requests for the hydrodynamic and dredge plume modelling to be reviewed by an independent professional party.

#### ***Response***

##### Scope of modelling

The scope of the hydrodynamic and dredge plume modelling as described in Section 17.2.4 of the environmental impact statement is further detailed in Section 4 and Section 7 respectively of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling).

The three-dimensional hydrodynamic model of Middle Harbour was developed using MIKE 3 software which simulated currents, water levels and flow characteristics. Modelling of hydrodynamic impacts included consideration of a base case scenario (representing existing conditions) and then modelling of impacts during the construction period of two construction scenarios as described in Section 6.1.1 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling), namely:

- 1) Two temporary cofferdams (Middle Harbour south cofferdam (BL7) and Middle Harbour north cofferdam (BL8)), adjacent dredging activities and associated deep draft silt curtains
- 2) Inclusion of temporary structures for the Spit West Reserve construction support site (BL9).

Discussion on the potential hydrodynamic impacts including potential changes to current speeds on ebb and flood tides from the above construction scenarios is included in Section 17.4.1 of the environmental impact statement. A combined scenario (ie cumulative) with each of the above two construction scenarios was not carried out as part of the environmental impact statement. As indicated in figures included in Section 6.1.2 and Section 6.1.3 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling), potential hydrodynamic impacts and changes to current speeds are localised and it is not anticipated that there would be any further changes to current speeds with the concurrent works in Middle Harbour at the two different support site locations, due to the spatial separation of the two sets of works.

The focus of the dredge plume modelling was to assess potential impacts from the dredging activities associated with the construction of the immersed tube tunnels. While there may be minor

localised disturbance of sediments due to other activities associated with the construction of the project and establishment and operation of the Spit West Reserve construction support site (BL9), the proposed dredging activities are the key potential source of suspended sediment concentrations (turbidity) likely to result from the project. The Spit West Reserve construction support site (BL9) would be largely a floating facility, requiring some temporary piling for mooring of floating work barges and immersed tube tunnel units and no dredging works. Due to the anticipated minor localised disturbance from these other activities, it is unlikely that there would be a discernible increase to the predicted suspended sediment concentrations due to dredging activities. Notwithstanding, assessment of marine water quality impacts from dredging and other activities is provided in Section 17.4.2 of the environmental impact statement and potential impacts will be managed with the implementation of environmental management measures including WQ12, WQ16, B28, B31, B32 and CTT20 (refer to Table D2-1 of this submissions report).

The suspended sediment concentration due to dredging (ie dredge plume) model results are presented as 90th percentile and 95th percentile plots at three vertical layers (surface, middle and bottom) in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). A summary of the results is discussed in Section 17.4.2 of the environmental impact statement and a complete set of percentile suspended sediment concentration plots is provided in Annexure B of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). A summary of suspended sediment concentration statistics in the surface layer at four model extraction locations is provided in Table 7-3 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Interpretation of these results means that at Clive Park/Northbridge, for example, for 99 per cent of the dredge time (ie 99th percentile) suspended sediment concentrations in the surface layer are predicted to be less than 1.71 milligrams per litre. Similarly, for 50 per cent of the dredge time, suspended sediment concentrations in the surface layer at Clive Park/Northbridge would be less than 0.33 milligrams per litre. In other words, the higher the modelled concentrations, the less frequent is their likely occurrence.

In addition to the percentile plots, time series plots of the suspended sediment concentration due to dredging are shown for the dredge duration at the surface layer for 20th, 50th, 90th, 95th and 99th percentiles in Figure 7-7 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). As such, the request to carry out additional 98th percentile plot modelling is not considered to be necessary or required.

The use of 90th percentile and 95th percentile suspended sediment concentration plots is considered industry standard and has informed consideration of turbidity impacts to marine ecology in Appendix T (Technical working paper: Marine ecology). The extent of the dredge plume (two milligrams per litre suspended sediment concentration) would be relatively small, as can be seen by the results presented in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement and Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling), and the dredging program is not anticipated to have a substantial impact on marine water quality or marine ecology.

Where applicable, data from Sydney Metro City & Southwest has been considered (refer to Section 7.2.2 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling)).

#### Modelling timeframe

The dredge plume modelling carried out as part of the environmental impact statement considered the entire 37 week dredging period, as outlined in Section 7 of Appendix P (Technical working

paper: Hydrodynamic and dredge plume modelling). The percentile plots described in the above response relate to:

- The entire 37 weeks of the dredging program
- Weeks one to four of dredging when the backhoe dredge with closed environmental clamshell bucket would be working in soft sediments
- Weeks five to 37 when the backhoe dredge with drum cutter to break up rock and open bucket to load out rock would be working on either side of the Middle Harbour crossing.

With regard to modelling for contaminated sediment over a period of 1.2 weeks, a deposition map for sediment dredged within the first 1.2 weeks is presented in Figure 7-11 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Sediment dredged over this period represents material that is not suitable for offshore disposal (ie material within the top one metre of sediments from the bed of the harbour). The estimated period for dredging may vary subject to size of plant finally selected by the contractor/s during further design development and construction planning for these works. For example, the period may vary from 1.2 to four weeks, subject to the size of plant. However, a period of 1.2 weeks modelled is considered a conservative scenario for potential disturbance of the bed of the harbour and sediment deposition as it equates to the largest plant working in the shortest period of time. The deposition map shows that this material would be contained within the silt curtains and be limited to a thickness of less than five millimetres. A map of deposition on the bed of the harbour two weeks after the completion of the dredging is presented in Figure 7-9 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Figure 7-9 identifies the spatial distribution and magnitude of the deposition which is predicted to occur due to dredging. The two week period after the dredging has finished allows time for any sediment that is in suspension at the end of dredging to settle to the bed of the harbour.

#### Consideration of silt curtains within the modelling

The proposed dredging methodology for the project comprises a variety of measures, including the use of three types of silt curtain. The proposed silt curtains include two deep draft (10-12 metre) silt curtains on either side of the immersed tube tunnel crossing around the dredging activities, a floating silt curtain enclosure (referred to as a 'moon pool') that will be directly attached to the dredge, and shallow (two to three metre) silt curtains that will be installed around ecologically sensitive areas (eg seagrass and rocky reef habitat) along the shoreline. These silt curtains provide three layers of protection to suspended sediments from the dredging works.

The dredging methodology is further outlined in Section 6.4.4 of the environmental impact statement and also detailed in Appendix C1 of this submission report and environmental management measure WQ16 (refer to Table D2-1 of this submissions report).

The use of the two deep draft silt curtains (10-12 metres deep) has been included in the dredge plume modelling as described in Section 7.3 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). It should be noted that the plume modelling was conservative and so did not consider the additional proposed floating silt curtain enclosures ('moon pool') that would be attached to the dredge or the additional shallow draft silt curtains that would be installed along the shorelines at the crossing location to provide protection to nearby ecologically sensitive areas.

The proposed depth of the deep draft silt curtains (10-12 metres) is a balance between restricting the movement of suspended sediments, maintaining tidal flow and being able to adequately hold the silt curtains in place. The proposed silt curtains would not be anchored to the bed of the harbour but rather would be ballasted at their base by the use of heavy chain or the like. There is a risk that full depth silt curtains anchored to the bed would generate greater suspended sediment (turbidity) than

lesser depth curtains, due to additional bed disturbance caused by the general movement/drag of the curtains on the bed of the harbour with tidal currents, and as a result of sediment disturbance caused by their placement, progressive relocation and the ultimate removal of the curtain anchoring devices located on the bed of the harbour, eg anchors and chains. Further discussion on anchoring of silt curtains is provided in Appendix C1 of this submissions report and below in Section C16.2.5.

The use of the two deep draft silt curtains has been demonstrated in the hydrodynamic and dredge plume modelling to be effective in mitigating the movement of suspended sediments from the dredge site. The risk of the sediment suspended by dredging passing below the bottom of the deep draft silt curtains is recognised and directly accounted for in the results of the modelling to predict the suspended sediment concentration.

The use of deep draft silt curtains in Middle Harbour can be considered an increase over normal mitigation measures utilised for dredging works within the wider Sydney Harbour area. Normal maintenance dredging works within Sydney Harbour utilise only 'moon pool' silt curtains in the immediate dredge plant area and shallow draft two to three metres deep silt curtains around the wider dredge works area. These measures are found to be adequate in controlling dredge plumes to acceptable levels. The higher energy hydrodynamic environment with relatively higher current speeds in the wider Sydney Harbour area do not allow the use of deep draft silt curtains for dredging works. The low energy hydrodynamic environment with relatively low current speeds within Middle Harbour allow the project the opportunity to increase the normal level of mitigation for the proposed dredging works by utilising 10-12 metre deep draft silt curtains.

#### Independent review of modelling

The hydrodynamic and dredge plume modelling detailed in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) was carried out by independent specialist Royal HaskoningDHV. The assessment was carried out to meet the requirements of the relevant Secretary's environmental assessment requirements and in accordance with relevant guidelines and current industry best management practice. The modelling has been carried out by experienced, qualified specialists.

Prior to public exhibition, the environmental impact statement including Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling), was 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 Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) was adequate in meeting the Secretary's environmental assessment requirements.

Commissioning of independent reviews are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

### **C16.1.2 Changes to tidal flows and potential hydrodynamic impacts**

#### ***Issue raised***

Submitters raised concerns about impacts to tidal flows and hydrodynamics as a result of the project. Specific concerns included:

- Concerns about the impacts of changing tidal flows as a result of dredging works in Middle Harbour
- Concerns that there is no information provided on the operational hydrodynamic impact on Middle Harbour, including how tidal flow would be impacted and any effect on the foreshore.



## ***Response***

### Changes to tidal flows during construction

The hydrodynamic impact of dredging and construction and establishment of the temporary construction support sites was modelled during the preparation of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) as described above in Section C16.1.1.

Dredging in Middle Harbour would result in potential hydrodynamic impacts due to the use of deep draft silt curtains (10-12 metres deep) at either side of the immersed tube tunnel crossing location where most of the dredging works would occur, as well as the establishment of Middle Harbour south cofferdam (BL7), Middle Harbour north cofferdam (BL8) and Spit West Reserve construction support site (BL9) (refer to Section 17.4.1 of the environmental impact statement).

During the ebb (outgoing) tide, hydrodynamic modelling indicates that the Middle Harbour north cofferdam (BL8) would cause a reduction in current speeds around Seaforth Bluff at all water depths. Beneath the silt curtain there would be an increase in current speeds at the bed of the harbour. Current speeds would also increase at the upper layers of the water column between the bank near Clive Park and the Middle Harbour south cofferdam (BL7).

During the flood (incoming) tide, there would be a decrease in current speed at both cofferdams as well as within and surrounding the silt curtains. There would also be a decrease in current speed along Seaforth Bluff upstream of the Middle Harbour north cofferdam (BL8). An increase in current speed along the bank upstream of the Middle Harbour south cofferdam (BL7) would occur.

Hydrodynamic modelling indicates that there would be a general reduction in current speeds adjacent to the shoreline near the Spit West Reserve construction support site (BL9) as a result of the temporary structures impeding the eddy that forms in this area. The eddy would be redirected, particularly in the surface layers, towards the west resulting in a small area of current speed increase to the west of the immersed tube tunnel unit casting facility.

Due to the existing low energy hydrodynamic environment, the changes in current speeds observed during ebb and flood tides are not expected to have a substantial impact on the surrounding environment.

During both ebb and flood tide, the current reductions would be more pronounced in the surface layer due to the effect of the silt curtains on the upper water column. As these changes are more pronounced in the surface layer it is not expected that any major erosion or accretion of the bed of the harbour would occur in this area. The localised increases in current speeds near the bed of the harbour are not expected to result in a substantial change to the sediment dynamics in this area.

### Operational hydrodynamic impacts to Middle Harbour

The assessment of potential operational impacts to the hydrodynamic environment of Middle Harbour is outlined in Section 17.5.1 of the environmental impact statement. Hydrodynamic modelling of the potential impacts on tidal currents and tidal flushing indicates:

- The changes to currents for both flood and ebb tides as a result of the project would be small and less than those seen through natural variations such as wind driven circulation
- Water levels upstream of the Middle Harbour crossing would not be affected
- The tidal prism of Middle Harbour (ie the volume of water between mean high tide and mean low tide) would be marginally reduced (0.4 per cent decrease from  $5.080 \times 10^6 \text{ m}^3$ )
- Tidal flushing (replacement of water via tidal fluctuations) would take slightly longer for water located upstream and below the level of the sill; however, flushing would remain relatively rapid.

Due to the existing low energy hydrodynamic environment at the Middle Harbour crossing, little to no bedload transport or resuspension of existing sediment is expected to occur where the immersed tube tunnels would be located on the bed of the harbour. Localised increases in current speed are not expected to result in a change to the sediment dynamics near the proposed Middle Harbour crossing. The changes to tidal flows as a result of the project during peak flood and peak ebb tides at the top of the sill and at the surface are shown in Figures 17-8 to 17-11 of the environmental impact statement.

Impacts of tidal flushing are discussed in Section 17.5.1 and Section 17.5.2 of the environmental impact statement and Section 8.1.1 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Tidal flushing upstream of the Middle Harbour crossing has the potential to be affected by the sill that would be created for the immersed tube tunnel. However, as stated above, although tidal flushing would take slightly longer for water located upstream and below the level of the sill, flushing times are still expected to remain relatively rapid. Marine water quality impacts associated with the increased flushing time are addressed in Appendix Q (Technical working paper: Marine water quality).

## **C16.2 Marine water quality**

### **C16.2.1 Adequacy and scope of the marine water quality assessment**

#### ***Issue raised***

Submitters raised concerns about the adequacy and scope of the marine water quality assessment. Specific concerns include:

- Concerns that beaches downstream of Burnt Bridge Creek are not assessed in the water quality assessment
- Concerns that the environmental impact statement understates impacts to Middle Harbour
- Concerns that the Water Quality Management Framework has not been adhered to, especially in relation to Step 2 stakeholder involvement workshops.

#### ***Response***

##### **Beaches downstream of Burnt Bridge Creek**

The beaches downstream of Burnt Bridge Creek include Queenscliff and Manly beaches. The water quality of these beaches would be influenced by stormwater runoff and flows from Manly Lagoon. Manly Lagoon has a catchment of about 18 square kilometres and is fed primarily by Burnt Bridge Creek, Brookvale Creek and Manly Creek (BMT WBM, 2013). The Manly Lagoon catchment is highly urbanised, and it consists of a significant piped stormwater network as illustrated in Annexure A of Appendix R (Technical working paper: Flooding).

The assessment of potential water quality impacts to Burnt Bridge Creek during construction and operation of the project is discussed in sections 17.4.3 and 17.5.3 of the environmental impact statement respectively.

The project will treat wastewater from tunnelling activities and implement erosion and sediment control measures at all construction support sites and surface road upgrades in accordance with revised environmental management measures SG9, WQ11 and WQ14. With the implementation of these environmental management measures, potential pollutant loading to Burnt Bridge Creek during construction would be minimal compared to the existing pollutant loading from Burnt Bridge Creek catchments.

The operational surface water quality assessment at Balgowlah was carried out using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to model the areas likely to be directly affected by the project, to assess the operational impacts against the water quality design targets and standards. The model results for the combined stormwater catchments associated with the surface connections at Balgowlah indicate that there would not be a decrease in the water quality of Burnt Bridge Creek as a result of the operation of the project, as discussed in Section 6.2.1.3 of Appendix O (Technical working paper: Surface water quality and hydrology).

Given the above, the project is not expected to worsen water quality in downstream areas of Burnt Bridge Creek such as at Manly Lagoon and Queenscliff or Manly beaches.

### Impacts to Middle Harbour

The marine water quality assessment in Appendix Q (Technical working paper: Marine water quality) has been prepared to address the Secretary's environmental assessment requirements and has been informed by relevant guidelines and policies as detailed in Section 1.9 of Appendix Q (Technical working paper: Marine water quality). Potential impacts to marine water quality (including that of Middle Harbour) that were assessed include dredging, tunnel construction activities and the operational effects of the tunnel. Predictions of the suspended sediment plumes and sediment deposition likely to be generated by the dredging and construction activities have been simulated and are reported in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Other potential water quality impacts (eg contaminants in sediment mobilised during dredging) were used to inform Appendix T (Technical working paper: Marine ecology).

Consistent with the overall approach to preparing the environmental impact statement described in Section 28.7.2 of the environmental impact statement, the marine water quality assessment was prepared by adopting a conservative scenario approach, which includes an assessment of the worst case impacts using the best available technical and scientific literature to support the assessment findings where required. Potential impacts were also presented in the environmental impact statement as worst case without implementation of the listed environmental management measures.

### Water Quality Management Framework

The water quality assessments presented in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement, Appendix O (Technical working paper: Surface water quality and hydrology) and Appendix Q (Technical working paper: Marine water quality) have been prepared in accordance with the Water Quality Management Framework from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ), 2000), which provides an approach to protect the community values of waterways. The assessments included reviews of existing water quality data, as well as water quality monitoring and visual condition assessments at selected locations in the study area to define the existing water quality conditions. Sites have been classified as sensitive receiving environments and environmental values identified as required. Modelling and assessment of potential impacts during construction and operation to water quality has been carried out with reference to the Australian and New Zealand Governments (ANZG) (2018) and ANZECC/ARMCANZ (2000) water quality guidelines, the water quality design targets and standards, and with regard to the relevant environmental values. Finally, appropriate management measures to mitigate potential hydrology and water quality impacts were identified and are included in Table D2-1 of this submissions report.

With regards to community and stakeholder involvement, extensive consultation has been carried out with the community and various stakeholders throughout the project's development (2017-2020) prior to the exhibition of the environmental impact statement in accordance with the Secretary's environmental assessment requirements, as discussed in Section C6.2 of this submissions report.

Further, consultation has been carried out with a number of community and interest groups through activities such as briefings, meetings, presentations and workshops, as detailed in Section 7.2.6 of the environmental impact statement. Additionally, consultation with a number of community and interest groups has continued during and following exhibition of the environmental impact statement, refer to Section C6.2 of this submissions report for further detail.

Where relevant, water quality related issues raised in consultation have been considered in the preparation and assessments presented in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement, Appendix O (Technical working paper: Surface water quality and hydrology) and Appendix Q (Technical working paper: Marine water quality).

### **C16.2.2 Consideration of impacts to Bantry Bay**

#### ***Issue raised***

Submitters raised concerns that the project has not satisfactorily addressed the Secretary's environmental assessment requirements in regard to describing (and mapping) Bantry Bay as a surface water resource, in describing the potential impacts in the Bantry Bay area, or that appropriate mitigation measures have been provided for its protection.

#### ***Response***

Garigal National Park surrounds the upper reaches of Middle Harbour, including Bantry Bay which is located at the southern limit of Garigal National Park. The catchment draining to Bantry Bay is a deep valley that encompasses two permanent creeks (Bates Creek and an unnamed creek) with steep slopes and high ridges (NSW National Parks and Wildlife Service (NPWS), 2013). Bates Creek flows from Killarney Heights to Bantry Bay and the unnamed creek flows from Forestville to Bantry Bay, with both creeks draining urban areas in the upper reaches before flowing through Garigal National Park, eventually discharging into Bantry Bay. There are also some smaller drainage lines west of the Wakehurst Parkway (within Garigal National Park) that would capture overland flow and drain towards Bantry Bay.

The Bantry Bay catchment is mapped in Figure 17-1 of the environmental impact statement and includes Bates Creek and its tributaries. Bates Creek and its tributaries are also included in a number of figures within Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement and Appendix O (Technical working paper: Surface water quality and hydrology). The mapping of the Bantry Bay catchment is consistent with mapping of other catchments assessed in the environmental impact statement and allows for the relevant level of assessment of the potential water quality impacts as required by the Secretary's environmental assessment requirements.

During construction there is potential for surface water quality impacts to the drainage lines within Garigal National Park that flow towards Bantry Bay, as identified in Table 5-5 of Appendix O (Technical working paper: Surface water quality and hydrology). These potential impacts would be associated with the Wakehurst Parkway surface road works, the Wakehurst Parkway south construction support site (BL12) and Wakehurst Parkway east construction support site (BL13). Potential impacts include:

- Excavations potentially washing into drainage lines, leading to increased levels of turbidity and sediment loads posing risk to Garigal National Park
- Risk to water quality of downstream drainage lines, Manly Dam and Bantry Bay during rainfall if the stockpiles are not managed appropriately
- Risk of movement of sediment off steep slopes during high volume rain events.

The potential impacts listed above will be managed by standard erosion and sediment control measures, as required by revised environmental management measure SG9 (refer to Table D2-1 of this submissions report).

Operational water quality modelling was carried out using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) for all Wakehurst Parkway stormwater catchments. The modelled results are provided in Section 6.2.1.4 and the catchments modelled are mapped in Figure 6-3 of Appendix O (Technical working paper: Surface water quality and hydrology). During operation, given that only a small amount of runoff from the Wakehurst Parkway would drain to Bantry Bay via the drainage lines listed above, and given the implementation of appropriate project water quality controls, there is unlikely to be a decrease in the water quality of these drainage lines and Bantry Bay. The impact on downstream locations is not considered to represent a potential adverse water quality impact as described in Section 6.2.1.4 of Appendix O (Technical working paper: Surface water quality and hydrology) and the project would not decrease the water quality of the Garigal National Park drainage lines, Bantry Bay, Manly Dam or Manly Creek.

Notwithstanding, opportunities for water sensitive urban design will be investigated during detailed design in accordance with environmental management measure WQ5 (refer to Table D2-1 of this submissions report), which refers to consideration of best management practice guidelines such as Transport for NSW's *Water sensitive urban design guideline: Applying water sensitive urban design principles to NSW transport projects* (Roads and Maritime Services, 2017a) when considering these opportunities. Water quality treatment controls for stormwater will be in accordance with environmental management measure WQ6 (refer to Table D2-1 of this submissions report).

### **C16.2.3 Marine water quality impacts**

#### ***Issue raised***

Submitters raised concern over the impact of the project on marine water quality. Specific concerns included:

- Concerns that the disturbance of the bed of the harbour and of contaminated sediment poses a risk to marine water quality and to recreational users of Middle Harbour (including at Sandy Bay, Clontarf Reserve, The Spit, Northbridge Baths and 1st Sailors Bay Sea Scouts Boat Shed). Further, there were requests that Northbridge Baths be rehabilitated
- Concerns that the environmental impact statement indicates that high levels of contaminated sediment would be deposited at Clive Park beach and foreshore and wider bed of the harbour areas nearby
- Concerns about potential pollution of Middle Harbour from:
  - The discharge of wastewater from Balgowlah Golf Course construction support site (BL10)
  - The disturbance of former waste disposal sites and leachate runoff at Flat Rock Drive construction support site (BL2)
  - Contaminated runoff from temporary construction support sites, leading to increased nutrient, sediment, chemical loads, turbidity and potentially increased algal blooms and eutrophication in downstream environments
- Concerns about the potential for cumulative impacts to water quality in Middle Harbour due to Sydney Water sewage overflows and stormwater discharge events.

## **Response**

### **Disturbance of the bed of the harbour at Middle Harbour and impacts to recreational users**

An assessment of the potential marine water quality impacts of the construction of the project is provided in Section 17.4.2 of the environmental impact statement and Appendix Q (Technical working paper: Marine water quality). An overview of the hydrodynamic and dredge plume modelling carried out for the Beaches Link and Gore Hill Freeway Connection project is provided in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). Further assessment is included in Appendix C1 of this submissions report.

As noted in Table 17-7 of the environmental impact statement, the immersed tube tunnel crossing of Middle Harbour would be located in a low energy hydrodynamic environment with relatively low current speeds and little to no expected transport of sediment from the bed of the harbour.

Construction of the immersed tube tunnels would require dredging of the bed of Middle Harbour, which would have the potential to mobilise contaminants and sediments, potentially releasing them into the water column. Dredge plume modelling has been carried out and is outlined in Section 17.4.2 of the environmental impact statement. The results of hydrodynamic modelling for the project indicate that the dredging program would not have a substantial impact on marine water quality. Dredging and construction activities carried out as part of the project are likely to cause short term increases in suspended sediment concentrations. However, due to the rapid re-deposition of suspended sediments in Middle Harbour, impacts on water quality would be temporary and minimal in nature. Also, due to the low energy hydrodynamic environment with relatively low current speeds within Middle Harbour, the depth of floating silt curtains around the main dredging works area can be increased to 10-12 metres, from the more typical two to three metres used within the wider Sydney Harbour area. This increased depth of curtain results in increased mitigation compared to other dredging works carried out regularly within the wider Sydney Harbour area.

Further assessment and modelling included in Appendix C1 of this submissions report concluded that the predicted level of suspended sediment concentrations at locations of interest (such as recreational areas at Sailors Bay and Northbridge Baths) as a result of dredging activities, at the 90th percentile level for both the surface and near-bed, are less than the natural background total suspended sediment value. Therefore, it is not expected that suspended solid concentrations due to dredging would represent a noticeable addition to background (ambient) concentrations.

Deposition of contaminated sediments is not expected at Clive Park beach and foreshore and wider bed of the harbour nearby, as shown in Figure 7-11 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) and discussed above in Section C16.1.1.

Monitoring during the dredging activities would provide data to assess the compliance of the activities with this assessment, in accordance with revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report). A range of management measures have been proposed to mitigate the generation and movement of suspended contaminated sediments due to dredging, and to minimise the impact of these activities on recreational users of Middle Harbour. A full list of environmental management measures for the project can be found in Table D2-1 of this submissions report.

Information on potential impacts to recreational users of Middle Harbour as a result of potential water quality impacts is included in Section C12.2.3 of this submissions report.

Rehabilitation of Northbridge baths is out of scope for this project.

### Potential pollution of Middle Harbour from temporary construction support sites

Potential impacts to marine water quality as a result of contaminated runoff are considered in Section 17.4.2 of the environmental impact statement. Land based construction activities occurring at the Spit West Reserve construction support site (BL9) immediately adjacent to Middle Harbour could potentially result in the release of sediment via runoff to Middle Harbour. There is also potential for spills or leaks of fuels and/or oils from maintenance or re-fuelling of construction plant or equipment or vehicle incidents, which could result in discharges to surrounding waterways and Middle Harbour. The discharge of treated water from onshore construction areas may also affect water quality in Middle Harbour.

Potential surface water quality impacts as a result of activities at temporary construction support sites, including discharges from temporary wastewater treatment plants and surface water runoff would have the potential to impact downstream marine environments and are discussed further in Section C16.3.2 and Section C16.4. This includes the discharge of wastewater from Balgowlah Golf Course construction support site (BL10).

The location of the proposed Flat Rock Drive construction support site (BL2) has the potential for contamination risks given the history of landfill activities in the area. This area poses a moderate potential contamination risk associated with the possible presence of contamination beneath Flat Rock Drive construction support site (BL2) and known groundwater contamination in adjoining areas (Willoughby Leisure Centre and Bicentennial Reserve).

Further site investigations will be carried out on sites with moderate to very high potential contamination risk as identified in Section 6.4 and Figure 5-2 of Appendix M (Technical working paper: Contamination). This includes the Flat Rock Drive construction support site (BL2). Appendix M (Technical working paper: Contamination) documents the Stage 1 contamination investigation carried out for the project. Stage 2 contamination investigations, including additional boreholes and test pits, would be carried out prior to construction activities to assess further the potential for contamination, so that contamination (if present) can be adequately planned for and managed.

The potential impacts discussed above will be effectively managed through the implementation of the proposed environmental management measures and procedures such that impacts on marine water quality would be minimised. Relevant revised environmental management measures include SG8, SG9, SG20 and WQ11 (refer to Table D2-1 of this submissions report).

With the implementation of these standard environmental management measures, potential pollutant loading to the receiving waterways is considered to be low compared to the existing pollutant loading from Willoughby Creek, Flat Rock Creek, Burnt Bridge Creek, Manly Creek and Trefoil Creek catchments. As such, the impacts to downstream environments, such as Middle Harbour, is also considered to be low.

### Cumulative impacts in Middle Harbour from sewage and stormwater discharge events

Water quality impacts not related to the project due to sewage overflows and stormwater discharge from catchment runoff occur in Middle Harbour after heavy rainfall events. At such times, background suspended solids concentrations would be elevated from stormwater discharge and therefore, the contribution to total suspended solids by project dredging suspended sediment concentrations would be proportionally reduced. As demonstrated in Section 3.5 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) (using an example of data measured at Darling Harbour during a notable catchment rainfall event), due to the deep water and efficient tidal flushing, these events generally dissipate within a few days. An example of the naturally high turbidity which occurs within Middle Harbour following heavy rainfall is shown in

Figure 3-8 (Peach Tree Bay) and Figure 3-9 (near Clive Park) of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling), for a heavy event that occurred in early February 2020.

It is considered unlikely that combined impacts due to disturbed contaminated sediment from project dredging and external sewage and stormwater discharge events would be a significant issue, noting also that dredging activities of the soft sediments that are unsuitable for offshore disposal would be expected to be completed within a period of about four weeks as described in Section C16.1.1.

Refer to Appendix C1 of this submissions report for further details.

#### **C16.2.4 Managing marine water quality impacts – general**

##### ***Issue raised***

Submitters raised concerns and requests regarding marine water quality environmental management measures, including:

- Requests for monitoring to be carried out and reporting provided on the monitoring findings at a minimum of six months prior to any site activities and then at six-monthly intervals until 24 months post construction
- Requests that any exceedances of marine water quality criteria are made public, promptly investigated and appropriate mitigation action taken to address the cause
- Requests for water quality monitoring to include a real time alert system available to recreational users
- Requests that management should include measures to remediate the impacts of the release of contaminants into Middle Harbour during storms or due to silt curtain damage during construction
- Concerns that the use of a clamshell style bucket would not stop contaminated sediment from spreading as the buckets are dropped or lifted from the dredging barge, as there is no guarantee that all the contaminated sediments would be contained
- Requests that a remediation plan or budget for compensating for spills, accidents and impacts related to dispersal of contaminated sediments be developed and for contaminated sediments not to be barged out of Middle Harbour past nearby beaches due to the risk of potential spills and leaks
- Concerns that there are no management measures to manage spills, leaks or dispersal of contaminated sediment in Middle Harbour, including spills or leaks during the transportation of dredged contaminated material
- Requests for the mitigation measures to consider the Greater Sydney Harbour Coastal Management Program.

##### ***Response***

##### **Marine water quality monitoring and reporting**

The proposed dredging works, coupled with the environmental management measures and planned monitoring program, represent standard industry best practice for regular maintenance dredging works which are carried out across Sydney Harbour on a regular basis. Further, as discussed in Section C16.1.1, the low energy hydrodynamic environment of Middle Harbour creates suitable conditions for deployment of 10-12 metre deep draft silt curtains, which is part of the proposed construction methodology and adds a further layer of protection against the dispersal of suspended sediments.



Transport for NSW consider the use of the proposed 10-12 metre deep draft silt curtains combined with the environmental clamshell bucket, and other environmental control measures proposed (refer to Section C16.2.5 below for further information) to be an appropriate and effective dredging methodology for the project.

Monitoring during dredging activities will be carried out as part of a dredge monitoring program that will validate the effectiveness of mitigation measures implemented to manage potential impacts on the water quality and sensitive marine vegetation and habitats of Middle Harbour, in accordance with revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report). Environmental management measure WQ12 has been revised as follows:

Monitoring during dredging activities will be carried out to validate the effectiveness of mitigation measures implemented to manage potential impacts on the water quality and sensitive marine vegetation and habitats of Middle Harbour. The use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites to manage any potential impacts, will be included in a dredge monitoring program. The dredge monitoring program will be developed in consultation with an appropriately qualified and experienced specialist, DPI Fisheries and the NSW EPA prior to its implementation.

If an environmental incident does occur, the contractor/s would be required to follow the *Environmental Incident Classification and Reporting Procedure* (Roads and Maritime Services, 2018d), 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.

The environmental management measures related to construction would be included in a construction environmental management plan, as detailed in Section D1 of this submissions report. The plan would 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. The construction environmental management plan and associated sub plans listed in Table D1-1 of this submissions report, such as the dredge management plan, would be developed in consultation with the relevant stakeholders.

Consistent with typical conditions of approval, Transport for NSW and/or the construction contractor/s would be required to publish documents including the construction environmental management plan and associated sub plans, relevant audit and/or compliance tracking reports, and monitoring reports prepared as part of construction of the project. This would be carried out in accordance with the requirements of the project conditions of approval.

### Clamshell bucket

Closed environmental clamshell buckets have been chosen for the removal of contaminated sediment as these types of buckets have been specifically designed for dredging contaminated sediments. They have three advantages compared to conventional open buckets, including, the minimisation of suspended sediment during contact with the harbour bed, minimisation of spill as the bucket is raised through the water column and precision (accurate dredging). Further, dredging operations would be completed with the use of two 10-12 metre deep silt curtains around the entire dredging operation and within a floating silt curtain enclosure (or 'moon pool') that is secured to the dredge barge, as discussed in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) and shown in Figure C16-1 below. 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.

### Dispersal of contaminated sediment and management of spills and leaks

A range of measures are outlined in Table D2-1 of this submissions report to manage potential impacts related to dredging activities including the dispersal of sediment, as discussed in Section C16.2.5. This includes, but is not limited to, the use of a closed environmental clamshell bucket for removal of the surface layer of sediments with elevated contaminant concentrations, the use of silt curtains and the monitoring of dredging activities.

Further, and as discussed above, wastes (including dredged material) will be transported, stored and handled in a manner that prevents pollution of the surrounding environment, as required by environmental management measure WM4 (refer to Table D2-1 of this submissions report).

In order to manage any potential spills or leaks, emergency procedures will be developed to avoid and manage accidental spillages, in accordance with revised environmental management measure SG20 (refer to Table D2-1 of this submissions report) as follows:

Emergency procedures, including material **and washdown area** bunding and appropriately sized spill containment kits, will be developed to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk of human health impacts, **water quality impacts** and contamination of groundwater.

### Greater Sydney Harbour Coastal Management Program

The *Greater Sydney Harbour Estuary Coastal Management Program Scoping Study* (BMT WBM, 2018) was prepared in 2018 to facilitate the development of the coastal management program for Greater Sydney Harbour, as described in Section 17.1.2 of the environmental impact statement. A vision and objectives were presented in the scoping study that are consistent with the *Coastal Management Act 2016* for inclusion in the Greater Sydney Harbour Coastal Management Program. The objectives of the program have been considered as outlined in Table 17-3 of the environmental impact statement. As such, it is considered that the environmental management measures presented in Table D2-1 of this submissions report are consistent with the objectives of the Greater Sydney Harbour Estuary Coastal Management Program.

### **C16.2.5 Managing marine water quality impacts – silt curtains**

#### ***Issue raised***

Submitters raised concerns about the proposed use of silt curtains in managing impacts to marine water quality. Specific concerns and requests included:

- Concerns that construction silt curtains do not reach the bed of the harbour and would therefore be ineffective at containing silt and contaminated resuspended sediments; requests that silt curtains should reach the bed of the harbour and be impermeable
- Concerns that silt curtains may be damaged by watercraft and requests that silt curtains are regularly checked for effectiveness
- Requests that the environmental impact statement recognises events which may cause damage to the silt curtains and that management measures include that dredging work would cease if such an event occurs, until the curtains have been inspected.

#### ***Response***

#### Effectiveness of proposed silt curtains

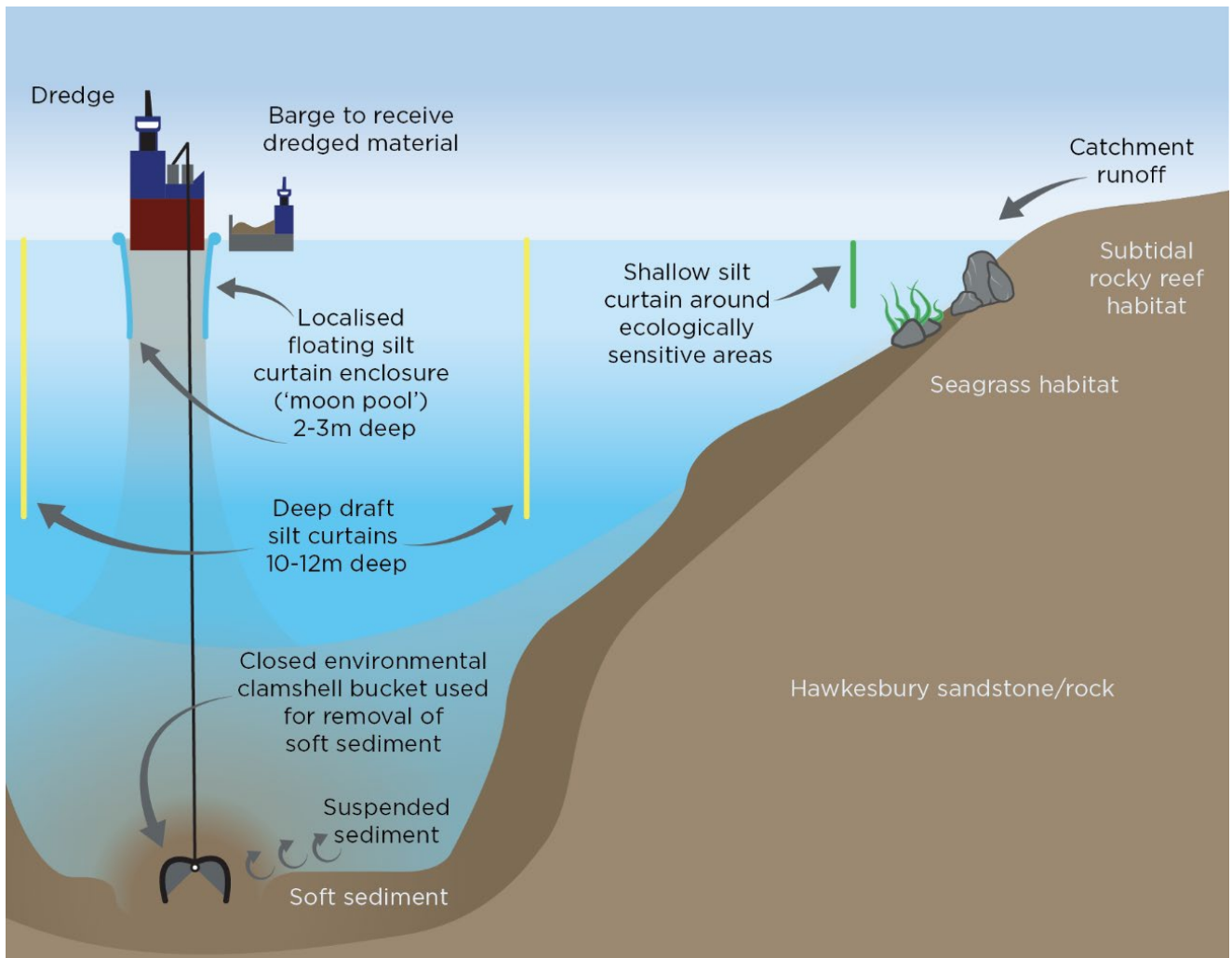
Potential water quality and hydrodynamic impacts due to dredging activities are presented in Section 17.4 of the environmental impact statement, Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) and Appendix Q (Technical working paper: Marine

water quality). The proposed deep draft silt curtains, which would be used around the proposed dredging activities for the Middle Harbour crossing, would extend to a depth of 10-12 metres below the water surface and have been demonstrated in the modelling presented in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) to be effective in mitigating the movement of suspended sediments from the dredge site.

The depth of the silt curtains is a balance between restricting the movement of suspended sediments, maintaining tidal flow and being able to adequately hold the silt curtains in place. There is a risk that full depth silt curtains which are anchored to the bed of the harbour would generate greater suspended sediment (turbidity) than lesser depth curtains, as a result of sediment disturbance caused by the general movement/drag of the curtains on the bed of the harbour with tidal currents, and as a result of sediment disturbance caused by their placement, progressive relocation and the ultimate removal of the curtain anchoring devices located on the harbour bed, for example anchors and chains (refer to Appendix C1 of this submissions report).

A range of management measures are proposed for the project to minimise and manage the generation and movement of suspended sediments due to dredging as detailed in Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling) and Table D2-1 of this submissions report. These are summarised below:

- Restricted working hours, thereby minimising the rate of sediment disturbance. Proposed construction hours are outlined in Table 6-35 of the environmental impact statement
- The use of a closed environmental clamshell bucket, as required by environmental management measure WQ16 (refer to Table D2-1 of this submissions report), for removal of the surface layer of sediments with elevated contaminant concentrations. These buckets have been specifically designed for dredging contaminated sediments and provide three significant advantages compared to conventional open buckets, including minimisation of suspended sediment during contact with the harbour bed, minimisation of spill as the bucket is raised through the water column and precision (accurate dredging). Refer to Figure C16-1 below
- The use of two 10-12 metre deep-draft silt curtains around the entire dredging operation (one on each side of the crossing) as required by environmental management measure WQ16 (refer to Table D2-1 of this submissions report) and as shown in Figure C16-1 below
- The use of an additional shallower silt curtain (sometimes referred to as a 'moon pool'), about two to three metres deep, attached to the dredge barge within which the dredge bucket specifically operates as outlined in Section 6.4.4 of the environmental impact statement and as shown in Figure C16-1 below
- The use of shallow silt curtains around ecologically sensitive areas (eg nearby seagrass and rocky reef habitat) that could be potentially impacted by dredging activities, to provide additional protection, in accordance with revised environmental management measure B31 (refer to Table D2-1 of this submissions report) and as shown in Figure C16-1 below
- Wastes (including dredged material) will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment, in accordance with revised environmental management measure WM4 (refer to Table D2-1 of this submissions report).



**Figure C16-1 Schematic showing the environmental management measures of closed environmental clamshell bucket and three levels of silt curtain for the proposed dredging methodology in Middle Harbour**

Monitoring during dredging activities will be carried out in accordance with revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report). This will include the use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites (eg seagrass habitats) to manage any potential impacts.

In addition, the above measures would be supported by the implementation of a dredge management plan as part of the construction environmental management plan, as described in Section D1 of this submissions report.

Transport for NSW considers that the use of the proposed 10-12 metre deep draft silt curtains combined with the environmental clamshell bucket and other environmental control measures listed above, such as no overflow from transport barges, restricted working hours (thereby minimising the rate of sediment disturbance) and real-time turbidity monitoring, is considered an appropriate and effective dredging methodology for the project.

As such, full length silt curtains anchored to the sea floor are not considered to be required.

### Impermeable silt curtains

Hydrodynamic modelling included the use of impermeable silt curtains, on the basis that they may be installed as impermeable, or may become blinded with fines as discussed in Section 7.2.2 of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling). However, as the environmental impact statement did not make a clear statement about whether the deep draft silt curtains would be permeable or impermeable, a clarification has been provided in Table A5-13 of this submissions report. The clarification confirms the deep draft silt curtains used in the dredge plume model and project construction would be impermeable either by being installed initially as such or by soon becoming 'blinded' by the accumulation of fine sediment particles adhering to the inside of the curtain.

The effectiveness of the proposed 10-12 metre deep draft silt curtains combined with the environmental clamshell bucket and other environmental control measures is discussed in the above responses and considered adequate to manage any potential water quality impacts from dredging activities.

### Maintenance of silt curtains

It is acknowledged that there is potential for silt curtains to be damaged during construction. Silt curtains will be monitored for their effectiveness, particularly following inclement weather and maintenance will be carried out when required, as required by environmental management measure B32 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, records of monitoring and maintenance will be kept.

A navigation channel would be formed between the deep draft (10-12 metre) silt curtains and any other fixed navigation restrictions at the location of the Middle Harbour crossing. The channel would provide safe passage of vessels through the construction zone. The waters where the silt curtains are deployed would be cordoned off from private marine craft to prevent damage to the silt curtains. Controlled navigation channels through the dredge site would be moved progressively as the work zone moves across Middle Harbour.

In addition, the dredging activities would be supported by the implementation of a dredge management plan as part of the construction environmental management plan, as described in Section D1 of this submissions report. As noted in Table D1-1 of this submissions report, the dredging works would be completed under a full time supervision and inspection regime. This would allow for any damage to be identified and corrective actions to be implemented as required.

## **C16.3 Surface water quality**

### **C16.3.1 Assessment of surface water quality impacts**

#### ***Issue raised***

Submitters raised concerns about the adequacy of the surface water quality assessment. Specific concerns and requests included:

- Concerns that the potential impact of increased microplastic loads in the Manly Creek catchment as a result of increased traffic on Wakehurst Parkway has not been considered
- Concerns that wastewater discharges and sedimentation impacts downstream of Burnt Bridge Creek (including at Manly Lagoon) have not been adequately assessed or are underestimated
- Concerns that the description of Burnt Bridge Creek as "substantially degraded" in Appendix N (Technical working paper: Groundwater) and Appendix O (Technical working paper: Surface

water quality and hydrology) is inaccurate as the vegetation surrounding the creek has been returning to a natural state since the creek's realignment 40 years ago

- Requests that a discharge impact assessment for wastewater treatment plants and other water discharge sources be prepared to meet the requirements of the NSW Environment Protection Authority and included in the project submissions report.

### ***Response***

#### **Microplastics in the Manly Creek catchment**

In terms of the existing environment, there are currently no water quality treatment measures provided along Wakehurst Parkway with the exception of operational water quality control infrastructure constructed as part of the Northern Beaches Hospital road upgrade project, as described in Section 17.3.4 of the environmental impact statement.

The provision of water quality treatment measures proposed as part of the project is described in Table 5-10 of the environmental impact statement and Section 6.2.1.4 of Appendix O (Technical working paper: Surface water quality and hydrology) and includes the following:

- Four new water quality basins (one to the west and three to the east of Wakehurst Parkway)
- 18 grass swales
- Two gross pollutant traps.

With the provision of the above infrastructure, it is considered that the risk of microplastics entering the Manly Creek catchment would be reduced compared with the present risk, given the very limited current water quality treatment infrastructure. In addition, there is recent evidence that the level of microplastics in stormwater is reduced when water quality treatment measures are used (Liu et al., 2019).

#### **Potential impacts downstream of Burnt Bridge Creek**

Potential construction impacts, including pollution to waterways such as Burnt Bridge Creek (and downstream of Burnt Bridge Creek), are discussed in Section 17.4.3 of the environmental impact statement. Potential impacts identified include sedimentation impacts and impacts as a result of wastewater discharges from tunnelling activities. Further detail is also provided in Section 5.2 of Appendix O (Technical working paper: Surface water quality and hydrology).

Wastewater from tunnelling activities will be treated in accordance with revised environmental management measure WQ11 and erosion and sediment control measures will be implemented as outlined in Table D2-1 of this submissions report. Potential pollutant loading to Burnt Bridge Creek is considered to be low compared to the existing pollutant loading from its catchment. As a consequence, the project construction is likely to have a negligible influence on whether the NSW water quality objectives of receiving waters are protected (if currently met) or achieved (if currently not met).

Further consideration of downstream impacts, including at Manly Lagoon, and management of wastewater from tunnelling activities is provided in Section C16.2.1 and Section C16.2.3 respectively.

In addition, due to concerns raised by the community and agencies regarding the potential impact of the project on groundwater drawdown and in particular resulting baseflow reductions, revised groundwater modelling has been carried out since exhibition of the environmental impact statement as discussed in Section A5.1.15 of this submissions report. For Burnt Bridge Creek, the revised predicted baseflow reduction is unlikely to influence surface water quality in the creek or affect achieving the nominated water quality objectives of freshwater ecosystems, visual amenity and

secondary contact recreation, as discussed in Section 4.3.2 of Appendix E of this submissions report. Further discussion on reduced baseflows is provided in Section C16.6.

### Description of Burnt Bridge Creek

Burnt Bridge Creek was subject to field surveys during preparation of the environmental impact statement. The location of the field survey sites is provided in Table 2-3 and Figure 2-2 of Annexure D of Appendix S (Technical working paper: Biodiversity development assessment report). The field surveys identified that upstream of the Burnt Bridge Creek Deviation, Burnt Bridge Creek appears to be a mostly natural channel with rocky outcrops and low levels of sedimentation (sandy silt) over bedrock. In this area there are also modified stormwater inflows and culvert crossings present. However, downstream of Burnt Bridge Creek Deviation and our works it was identified that Burnt Bridge Creek is substantially disturbed and modified by historical subdivision, golf course and roadwork construction works and has progressively been degraded, as described in Section 4.1.4 of Appendix O (Technical working paper: Surface water quality and hydrology). This is largely due to the pressures generated from urban areas including a dense sewage system network and many stormwater outlets discharging to the creek (University of Western Sydney, 2004). It is expected that increased stormwater runoff has contributed to the loss of coarse and fine-grained sediments from the channel, leaving a scoured bedrock bed and eroded mud banks. As a result, Burnt Bridge Creek has suffered from poor water quality (from stormwater and wastewater overflows), extensive weed infestation, erosion of creek banks, build-up of sediment and reduced biodiversity.

In addition, as part of the revised groundwater modelling carried out since exhibition of the environmental impact statement (as discussed in the above response), further field surveys of Burnt Bridge Creek were carried out to provide a detailed documentation of the condition of the creek. While there was evidence of active bush regeneration in the upper reaches of Burnt Bridge Creek, it was noted the creek was considered quasi-natural upstream of the project and the riparian condition of the middle and downstream areas of the creek is either partially or highly modified. These findings support the description of Burnt Bridge Creek in the environmental impact statement. Further detail on the description of Burnt Bridge Creek is provided in Section 4.1.1 of Appendix E of this submissions report.

### Discharge impact assessments

The surface water quality and hydrology assessment in Appendix O (Technical working paper: Surface water quality and hydrology) has been prepared to address the Secretary's environmental assessment requirements. As such, the project has been developed with consideration of the *NSW Water Quality and River Flow Objectives* (Department of Environment, Climate Change and Water (DECCW), 2006a; DECCW, 2006b). The objectives are consistent with the Australian *National Water Quality Management Strategy* (Department of Agriculture and Water Resources (DAWR), 2018) and *Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008).

Sediment basin discharge impact assessments will be prepared commensurate with the potential risk and consistent with the Australian Government National Water Quality Management Strategy guidelines and *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) to inform the criteria for discharge from sediment basins, as required by revised environmental management measure WQ14 (refer to Table D2-1 of this submissions report).

With regard to wastewater treatment plant discharges, Transport for NSW has committed to strict discharge criteria for the wastewater treatment plants during the construction and operational phases of the project. During construction, the criteria provided in revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report) will apply. Construction wastewater treatment plants would discharge into moderate to highly disturbed waterways with significant tidal exchange that would provide dilution and mixing, as discussed in

Section 4.6 of Appendix O (Technical working paper: Surface water quality and hydrology). Discharge concentrations would therefore be transient and by meeting the proposed discharge criteria it would be unlikely to result in ecological impacts to downstream water quality. As such, discharge impact assessments are not considered to be required.

During operation, all tunnel inflow discharges will be pumped to and treated by the project wastewater treatment plant at Gore Hill Freeway will be required to meet the criteria described in revised environmental management measure WQ17 (refer to Table D2-1 of this submissions report). The proposed discharge criteria are aligned with the guideline values for slightly to moderately disturbed ecosystems from *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) and are therefore unlikely to pose a risk to the receiving waterway being Flat Rock Creek (which is a moderately to highly disturbed waterway), as discussed in Section 4.6 of Appendix O (Technical working paper: Surface water quality and hydrology). As such, no further assessment of operational discharge is considered to be required.

The project would also comply with any project conditions of approval and environment protection licence conditions that are relevant to discharges.

It should also be noted that the NSW Environment Protection Authority's submission to the project states that the proposed construction wastewater discharges from tunnelling activities are unlikely to pose a risk to the receiving waterways. Refer to Section B1.2 of this submissions report for further detail. Further, it also states that operational discharges are likely to contribute to achieving the environmental values of the receiving waterways.

### **C16.3.2 Surface water quality impacts during construction**

#### ***Issue raised***

Submitters raised concerns about construction impacts on water quality. Specific concerns and requests included:

- Concerns about erosion and sedimentation risks to water quality due to run-off and vegetation clearing, and concerns about how run-off would be managed
- Concerns about contamination risks to waterways, particularly from the Flat Rock Drive construction support site (BL2), the Wakehurst Parkway east construction support site (BL13) (and its discharges to Wakehurst Golf Course), surface works at Wakehurst Parkway and from spills/leaks
- Concerns that the statement that 'temporary sediment basins would be used in catchments where the erosion hazard exceeds 150 cubic metres/year (200 tonnes/year) of soil loss' means it is permissible to pollute waterways with up to 200 tonnes per year of sediment
- Requests for a water quality monitoring program to be implemented by independent consultants before, during and after construction and that water quality monitoring results be made publicly available. Further, concerns were raised that monitoring would not be frequent enough to identify non compliances.

#### ***Response***

##### **Erosion, sedimentation and contamination risks to water quality**

Transport for NSW acknowledges the high levels of community concern in relation to potential impacts to important waterways in areas such as Garigal National Park, Manly Warringah War Memorial State Park and Flat Rock Gully. An extensive and comprehensive set of environmental management measures has been developed to address these concerns and to ensure that impacts are avoided and/or minimised where possible.



Impacts to surface water quality during construction are assessed in Section 17.4.3 of the environmental impact statement. Further detail is provided in Section 5.2 of Appendix O (Technical working paper: Surface water quality and hydrology). Construction activities that could result in potential water quality impacts include the following:

- Stockpiling
- Removal of vegetation
- Establishment of temporary construction support sites
- Earthworks
- Relocation of utilities
- Spills and leaks
- Disturbance of contaminated land or groundwater.

The potential impacts of these activities (erosion and sedimentation, pollution or contamination of downstream surface water and groundwater) will be managed via erosion and sediment control measures at all construction support sites and surface road upgrades, as required by revised environmental management measure SG9 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, erosion and sediment control measures will be implemented in accordance with the principles and requirements in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (DECC, 2008) and relevant guidelines, procedures and specifications of Transport for NSW. A soil conservation specialist will also be engaged for the duration of construction of the project to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans. The soil conservation specialist would ensure professional expertise is applied in managing erosion and sedimentation risks consistent with Transport for NSW's *Erosion and Sedimentation Management Procedure* (RTA, n.d.).

Impacts due to potential spills and leaks at temporary construction support sites or work areas will be managed in accordance with revised environmental management measure SG20 (refer to Table D2-1 of this submissions report). This will involve the development of emergency procedures, including material and washdown area bunding and appropriately sized spill containment kits, to avoid and manage accidental spillages of fuels, chemicals and fluids.

A freshwater quality monitoring program for the construction of the project will be developed and implemented in accordance with environmental management measure WQ10 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, if exceedances of the criteria established under the freshwater monitoring program are detected, a management response will be triggered and appropriate mitigation measures to address the exceedance will be identified and implemented.

All areas disturbed by construction works will be restored as soon as practicable to their existing condition. All areas constructed as new works, such as fill batters, will be landscaped progressively. These works will be carried out in accordance with the urban design and landscape plan and as required by environmental management measures B13 and V11 (refer to Table D2-1 of this submission report).

The above environmental management measures would be supported by the implementation of a soil and water management plan as part of the construction environmental management plan, as described in Section D1 of this submissions report.

### Use of temporary sediment basins

The environmental impact statement states that temporary sediment basins would be used in catchments where the erosion hazard exceeds 150 cubic metres/year (200 tonnes/year) of soil loss in Section 6.5.1. This requirement is in accordance with recommendations made in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004). Temporary sediment basins are an effective sediment control measure used to slow down water velocity and allow coarser and medium-sized sediments to settle out into the bottom of the temporary sediment basin. The final location and size of all temporary sediment basins would be determined during further design development and construction planning. Temporary sediment basins will be adjusted to suit staging of the works ensuring they are kept effective. Alternative erosion and sediment control measures would be implemented in locations where temporary sediment basins cannot be provided because of site, soil and drainage constraints to constructing large scale sediment basins. For these catchments, smaller temporary sediment basins, sediment sumps, mulch bunds, sediment fences or combinations of these would be used. However, to manage potential associated risks, these catchments would also be subject to enhanced erosion control measures and best management practice, such as limiting the size of disturbed land at any one time and ensuring disturbed areas are re-landscaped progressively. Erosion and sediment control measures will be implemented in accordance with the environmental management measures outlined in Table D2-1 of this submissions report.

For the temporary construction sediment basins, the 5-day, 80th or 85th percentile rainfall depth would be used to size the sediment basins as required by the requirements of *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), and as presented in Table 8-2 of Appendix O (Technical working paper: Surface water quality and hydrology). Sediment basin discharge impact assessments, commensurate with the potential risk and consistent with the Australian Government National Water Quality Management Strategy guidelines and *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) will be prepared to inform the criteria for discharge from sediment basins as required by revised environmental management measure WQ14 (refer to Table D2-1 of this submissions report).

### Water quality monitoring

As noted in the above response, a freshwater quality monitoring program for the construction of the project will be developed and implemented, as required by environmental management measure WQ10 (refer to Table D2-1 of this submissions report). The program will be developed in consultation with the Environment Protection Authority, Department of Planning, Industry and Environment (Natural Resources Access Regulator), Department of Planning, Industry and Environment (Water) and relevant councils. Sampling locations and monitoring methodology including frequency and indicators will be in accordance with the *Guideline for Construction Water Quality Monitoring* (Roads and Traffic Authority (RTA), 2003a) and ANZG (2018).

During operation of the project, an operational surface water quality monitoring program will be implemented and carried out in line with the post construction phase requirements of the Roads and Maritime Services *Guideline for Construction Water Quality Monitoring* (RTA, 2003a), as required by environmental management measure WQ18 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, as a minimum, monthly monitoring will be carried out for the first year of operation or until a suitably qualified and experienced independent expert determines that a site has adequately stabilised and stormwater basin discharge criteria are achieved.

As detailed in Section D1 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, who would be responsible for their implementation and monitoring the performance of these measures. The construction environmental management plan and associated sub plans listed in Table D1-1 of this submissions report, including the soil and water management plan, would be developed in consultation with the relevant stakeholders.

Consistent with typical conditions of approval, Transport for NSW and/or the construction contractor/s would be required to publish the construction environmental management plan and associated sub plans, any audit and/or compliance tracking reports and monitoring reports prepared as part of construction of the project.

### **C16.3.3 Surface water quality impacts during operation**

#### ***Issue raised***

Submitters raised concerns about operational impacts on water quality. Specific concerns included:

- Concerns about operational impacts on water quality to downstream waterways, including that operational water quality objectives and design targets will not be met, in addition to concerns that where water quality objectives are not currently being met, the project related discharges would work towards their achievement over time (particularly for nitrogen)
- Concerns that the water quality basins at Wakehurst Parkway are not adequately sized and therefore cannot treat runoff adequately and requests for the environmental impact statement to be revised to provide additional mitigation measures and/or for water sensitive urban design to be incorporated into stormwater management
- Concerns that pools along Manly Creek may assist in holding sediment to which nutrients may be bound, and that this may have water quality impacts to Manly Creek. Further concerns were raised that this contradicts the statement that 'where the design targets cannot be met due to site constraints, water quality treatment will be provided to meet or improve existing conditions to ensure that there is no impact on surface water quality as a result of the project' (Section 17.1.3 of the environmental impact statement)
- Concerns that the project could lead to an increase in impervious surfaces, which could lead to increased levels of heavy metals and other contaminants.

#### ***Response***

##### **Operational water quality impacts and water quality objectives**

During operation of the project all road surfaces would be sealed, and embankments landscaped, as described in Section 17.5.3 of the environmental impact statement. All areas disturbed by construction works will be restored as soon as practicable to their existing condition. All areas constructed as new works, such as fill batters, will be landscaped progressively. These works will be carried out in accordance with the urban design and landscape plan and as required by environmental management measures B13 and V11 in Table D2-1 of this submission report. During vegetation establishment, suitable stabilisation and management measures would be implemented to minimise the potential for erosion and sedimentation impacts at nearby waterways, in accordance with revised environmental management measure SG9 (refer to Table D2-1 of this submissions report). Short term impacts while vegetation becomes established are expected to be manageable with negligible impacts on receiving water quality, with implementation of these controls.

Typically, runoff from upgraded road pavements would contain pollutants such as sediments, litter, nutrients, oils and greases, petrochemicals and heavy metals. The project has also considered the future increases in traffic resulting in increased pollutants from runoff (refer to Table 6-2 of Appendix O (Technical working paper: Surface water quality and hydrology)). There is therefore potential for

water quality to be impacted when runoff is discharged into ultimate receiving waterways and sensitive receiving environments. The project would provide water quality treatment that meets the operational water quality design targets outlined in Table 17-4 of the environmental impact statement, in accordance with environmental management measure WQ6 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, where design targets cannot be met due to design constraints, water quality treatment controls will be provided to meet or improve existing surface water quality, such that impacts on surface water quality would be minimal.

Operational water quality modelling (MUSIC modelling) was carried out to assess the performance of the proposed surface water quality treatment measures against the water quality design targets and standards for the main locations where stormwater would be discharged (Gore Hill Freeway Connection, surface connections at the Burnt Bridge Creek Deviation, Balgowlah and the realigned and upgraded Wakehurst Parkway). It should be noted that MUSIC modelling results presented in the environmental impact statement are preliminary and subject to further design development, as stated in Section 6.2.1 of Appendix O (Technical working paper: Surface water quality and hydrology).

The MUSIC model results indicate that the project would not meet the design targets in all locations as described in Section 17.5.7 of the environmental impact statement, but would still meet or improve existing water quality. The results show that the water quality strategy for the Wakehurst Parkway would not achieve the operational water quality design target for nitrogen. Operational water quality in the wider Balgowlah area is influenced both by the project facilities in and around the portal and the motorway facilities and by new and improved open space and recreation facilities to be provided to the community as separate to the project. The water quality strategy for the wider Balgowlah area including both project and community facilities would not achieve the operational water quality design targets for total suspended solids and total phosphorus. However as stated above, the MUSIC model results are only preliminary and based on these initial results, the surface connections at Balgowlah would not decrease the water quality of Burnt Bridge Creek. The MUSIC model results for Balgowlah are based on both proposed community open space and recreation facilities and project operational facilities. The proposed open space and recreation facilities are subject to confirmation through further community consultation and the final agreed facilities may change the final MUSIC modelling for the Balgowlah golf course area (refer to Section 6.2.1.3 of Appendix O (Technical working paper: Surface water quality and hydrology)).

As required by revised environmental management measure WQ1 (refer to Table D2-1 of this submissions report), the final design for the stormwater harvesting water quality basin at Balgowlah to replace the existing Balgowlah Golf Course stormwater dam will be developed during further design development in consultation with Northern Beaches Council. A suitable location and size for the basin will be determined as part of the dedicated consultation and follow on design process associated with the final layout of the new and improved public open space and recreation facilities at Balgowlah. The new stormwater harvesting water quality basin at Balgowlah will be constructed and operational prior to the decommissioning of the existing Balgowlah Golf Course stormwater dam.

Further discussion on the operational controls for the realigned and upgraded Wakehurst Parkway is provided in the response below.

When operational, the tunnel drainage infrastructure would capture groundwater and stormwater ingress, spills, maintenance wastewater, fire suppressant deluge and other potential water sources. Water intercepted by the tunnel drainage systems would be collected and pumped to the Gore Hill Freeway wastewater treatment plant for treatment prior to discharge to Flat Rock Creek. The Gore Hill Freeway wastewater treatment plant will be designed to treat wastewater generated from tunnel groundwater ingress and rainfall runoff in tunnel portals to comply with the discharge criteria

included in revised environmental management measure WQ17 (refer to Table D2-1 of this submissions report):

- The relevant physical and chemical stressors, the guideline values set out in Tables 3.3.2 and 3.3.3 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000)
- The ANZG (2018) 95 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which would be treated to meet the ANZG (2018) 99 per cent species protection levels
- The draft ANZG default guideline values for iron (in fresh and marine water) and zinc (in marine water).

Where the ANZG (2018) does not provide a default guideline value for a particular pollutant, the approaches set out in the ANZG (2018) for deriving guideline values, using interim guideline values and/or using other lines of evidence such as international scientific literature or water quality guidelines from other countries, will be used.

With the implementation of surface water quality controls to manage impacts arising from surface water runoff and the treatment of wastewater as described above, the overall impacts on ambient water quality are likely to be negligible and the project is likely to have a negligible influence on goals to achieve the NSW quality objectives.

In addition, an operational surface water quality monitoring program will be implemented for the project in accordance with environmental management measure WQ18 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, should discharge criteria from operational stormwater basins be exceeded, a management response will be triggered and appropriate mitigation measures to address the exceedance will be identified and implemented.

#### Wakehurst Parkway water quality basins

The project would provide operational water quality treatment that meets the design targets listed in Table 17-4 of the environmental impact statement, where feasible and reasonable. These targets are as based on typical requirements for pollutant reduction described in the *Draft Managing Urban Stormwater: Council Handbook* (NSW Environment Protection Authority (EPA), 1997). Where the design targets cannot be met due to site constraints, the project would provide water quality treatment to meet or improve existing conditions to ensure that there is no impact on surface water quality as a result of the project.

There are currently no existing water quality control measures along this section of the Wakehurst Parkway, except for controls that form part of the Northern Beaches Hospital road upgrade project at the northern extent of the project footprint, as described in Section 6.2.1.4 of Appendix O (Technical working paper: Surface water quality and hydrology). The existing roadway has no kerbs or formed shoulders and runoff from the roadway is uncontrolled due to the lack of a pit and pipe network.

Water quality treatment measures at the Wakehurst Parkway would improve with the project and would include four new water quality basins (one to the west and three to the east of Wakehurst Parkway), in addition to 18 grass swales and two gross pollutant traps, as described in Table 5-10 of the environmental impact statement and Section 6.2.1.4 of Appendix O (Technical working paper: Surface water quality and hydrology). MUSIC modelling was carried out to assess the performance of the proposed treatment measures against the water quality design targets. The project operational water quality design targets would not be achieved at Wakehurst Parkway at all locations, but it would still meet or improve the existing water quality. Where possible surface water quality controls for the project would be provided so that water is treated to a standard that would

meet the design targets for the project. Where design targets are not able to be met due to site constraints, water quality treatment to meet existing conditions would be provided such that impacts on surface water quality would be minimal.

The project would provide an improvement to water quality when compared to existing conditions, except for total nitrogen as shown in Table 6-6 of Appendix O (Technical working paper: Surface water quality and hydrology). However, the impact of increased total nitrogen is not considered to represent a potential impact to downstream waterways. It should also be noted that some of the assumptions used in the water quality model were conservative in the absence of field tests which would be carried out during further design development. For example, it was assumed that the exfiltration rates for the basins and swales are zero which would need to be confirmed during further design development. The increase in total nitrogen load that is predicted for the project may reduce if field tests confirm that a small exfiltration rate exists for the sub-soils. Based on these results, the Wakehurst Parkway surface road works would not decrease the water quality of the Garigal National Park drainage lines, Bantry Bay, Manly Dam or Manly Creek (refer to Section 6.2.4.1 of Appendix O (Technical working paper: Surface water quality and hydrology)).

Notwithstanding, opportunities for water sensitive urban design will be considered during detailed design, in accordance with environmental management measure WQ5 (refer to Table D2-1 of this submissions report), which refers to consideration of best management practice guidelines such as the *Water sensitive urban design guideline: Applying water sensitive urban design principles to NSW Transport Projects* (Roads and Maritime Services, 2017a). Water quality treatment controls for stormwater will be in accordance with environmental management measure WQ6 (refer to Table D2-1 of this submissions report).

### Manly Creek

As discussed in the above response, it is not anticipated that the water quality of Manly Creek would be decreased during operation of the project, despite pools along Manly Creek that may hold onto some sediment, as described in Section 6.2.5 of Appendix O (Technical working paper: Surface water quality and hydrology). Further, there is not a contradiction with Section 17.1.3 of the environmental impact statement. While the water quality design targets cannot be met due to site constraints (as discussed above), the measures proposed to manage water quality within the Wakehurst Parkway stormwater catchments have been designed to meet or improve existing conditions. As such, it is not anticipated that there would be impacts on the existing surface water quality at Manly Creek as a result of the project.

### Impervious surfaces and stormwater discharges

Impervious surfaces created by the project have the potential to result in additional polluted runoff in the stormwater system. New or modified drainage would be provided along the Gore Hill Freeway, and along modified or new surface roads at Balgowlah, North Balgowlah, Killarney Heights, Seaforth and Frenchs Forest. Also, new water quality basins would be provided at Balgowlah and along Wakehurst Parkway.

The project would provide water quality treatment that meets the design targets listed in Table 17-4 of the environmental impact statement where feasible and reasonable, which are based on typical requirements for pollutant reduction described in *Draft Managing Urban Stormwater – Council Handbook* (NSW EPA, 1997). These targets largely align with the stormwater quality targets established in Sydney Water's *Stormwater quality targets (Version 2)* (Sydney Water, 2020). Where the design targets cannot be met due to site constraints, the project will provide water quality treatment to meet or improve existing conditions to ensure that there is no impact on surface water quality as a result of the project in accordance with environmental management measure WQ6 (refer to Table D2-1 of this submissions report).

The type and design of specific stormwater treatment measures would be refined during further design development including confirmation of performance with modelling, if required.

#### **C16.3.4 Salinity and impacts to drinking water**

##### ***Issue raised***

Submitters raised concerns about the salinity risks to waterways and about potential impacts to drinking water.

##### ***Response***

###### Salinity

The potential for salinity is outlined in Section 16.4.1 of the environmental impact statement and sections 6.3 and 7.3 of Appendix M (Technical working paper: Contamination). Salinity impacts generally occur when salts naturally present in soil or groundwater become concentrated at the surface or in shallow soils generally through transport by rising groundwater, as a consequence of removal of deep rooted vegetation or other activities. Naturally occurring soil salinity is not expected to be encountered within the project footprint because none of the soil landscapes within the project area document salinity as a limitation to the landscape type, as described in Section 16.3.3 of the environmental impact statement. Additionally, construction activities and operation of the project are more likely to lower the groundwater table (refer to Section C15.6 of this submissions report for information relating to groundwater drawdown) rather than raising it above seasonal levels. As such it is unlikely that salinity would represent a risk to surface water (or groundwater) during either construction or operation of the project.

###### Drinking water

Sensitive receiving environment indicators include consideration of whether a catchment falls within a drinking water catchment, as described in Section 3.3.1 of Appendix O (Technical working paper: Surface water quality and hydrology). The project is not located within any drinking water catchments, therefore impacts to drinking water catchments was not considered further in the environmental impact statement.

Manly Dam was previously used as a source of drinking water by Sydney Water as described in Table 17-7 of the environmental impact statement. After being constructed in 1892, it supplied drinking water up until 1933, although was briefly used in 1942 during a period of drought (OEH, 2020). Manly Dam and its catchment are now used for public recreation and not as a source of drinking water for the community.

#### **C16.3.5 Funding for permanent water quality improvement devices**

##### ***Issue raised***

Submitters requested that the NSW Government works with Willoughby City Council and Sydney Water to commit to the improvement of stormwater runoff and associated litter accumulation at Flat Rock Gully, and requested that the project is conditioned to allocate funds to install permanent water quality improvement devices.

##### ***Response***

Programs and allocation of funds for the NSW Government to work with Willoughby Council and Sydney Water to commit to the improvement of stormwater runoff and associated litter accumulation at Flat Rock Gully is outside the scope of this project.

Water quality treatment controls would be installed as described in Chapter 5 (Project description) of the environmental impact statement and will meet the design targets where possible, in accordance with environmental management measure WQ6 (refer to Table D2-1 of this submissions report). Where the design targets cannot be met due to site constraints, water quality treatment controls will be provided to meet or improve existing surface water quality.

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

## **C16.4 Wastewater treatment plants**

### ***Issue raised***

Submitters raised concerns and made requests about the treatment and discharge of wastewater from the construction and operational wastewater treatment plants proposed for the project. Specific concerns and requests included:

- Concerns about water quality impacts due to the discharge of wastewater from the construction wastewater treatment plants and that wastewater treatment plants would be overwhelmed during heavy rain events
- Requests for further information to be provided regarding the wastewater treatment plants, including their locations, length of operation, discharge criteria and method of treatment
- Requests that creek banks are stabilised to minimise potential geomorphology impacts as a result of treated wastewater discharges, and that wastewater discharges to creeks during peak flows are avoided to minimise downstream impacts.

### ***Response***

#### **Construction wastewater treatment plant discharges**

Temporary wastewater treatment plants would be required during construction to treat wastewater generated from tunnel construction activities and groundwater inflows during construction, as described in Section 6.4.2 of the environmental impact statement. Treatment plants would be designed to meet expected tunnel inflow volumes rather than flood or storm events.

The locations of the construction wastewater treatment plants and discharge locations are shown in Figure 17-7 of the environmental impact statement. The potential water quality impacts from wastewater treatment plants during construction are discussed in Section 17.4.3 of the environmental impact statement.

During construction, tunnelling works would result in water being generated from the following sources:

- Groundwater infiltration into tunnelling works (the majority of wastewater collected)
- Rainfall runoff into tunnel portals and ventilation outlet tunnels
- Wash down runoff
- Heat and dust suppression water.

Treatment plants for construction would be designed to meet expected groundwater inflow volumes and other water generating activities listed above, rather than design flood or storm events. With the exception of the rainfall runoff into tunnel portals and ventilation outlet tunnels, rainfall runoff would be managed during construction by the use of temporary sediment basins and the standard erosion and sediment control management and mitigation measures described in the above response. In



addition, temporary catch drains or berm drains would be installed to divert water away from the portals where there is a potential risk of rainfall runoff entering the tunnel portals.

Indicative construction wastewater treatment discharge volumes are presented in Table 17-15 of the environmental impact statement. Discharge quantities are presented as a worst case and exclude progressive installation of tunnel linings to reduce infiltration to below one litre per second per kilometre across any given kilometre. Therefore, the predicted tunnel infiltration, and discharge volumes, would be less than predicted by the modelling.

Reuse of wastewater would be maximised where possible in construction activities as described in Section 17.4.3 of the environmental impact statement. However, it is expected that there would be surplus wastewater which would need to be treated appropriately before discharge to the local stormwater system or directly to a local surface watercourse.

The design of construction wastewater treatment plants would be developed and finalised during detailed construction planning.

Discharges from wastewater treatment plants during the construction phase will be required to meet the following discharge criteria (refer to revised environmental management measure WQ11 in Table D2-1 of this submissions report):

- The relevant physical and chemical stressors, the guideline values set out in Table 3.3.2 and 3.3.3 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, with the exception of those toxicants known to bio-accumulate, which will be treated to meet the ANZG (2018) 95 per cent species protection levels
- The draft ANZG default guideline values for iron (in fresh and marine water) and zinc (in marine water).

Where the ANZG (2018) does not provide a default guideline value for a particular pollutant, the approaches set out in the ANZG (2018) for deriving guideline values, using interim guideline values and/or using other lines of evidence such as international scientific literature or water quality guidelines from other countries, will be used.

The potential pollutant loading from wastewater plant discharges to the receiving waterways is considered to be low compared to the existing pollutant loading from Willoughby Creek, Flat Rock Creek, Burnt Bridge Creek, Manly Creek and Trefoil Creek catchments. Construction of the project is likely to have a negligible influence on whether the NSW quality objectives of receiving waters are protected (if currently met) or achieved (if currently not met).

The bulk of the wastewater treated and available from the Wakehurst Parkway east construction support site (BL13) would be used for activities such as earthworks and pavement material compaction during the Wakehurst Parkway upgrade construction works. Unused wastewater treated and discharged from the Wakehurst Parkway east construction support site (BL13) to the Wakehurst Golf Course dam would be reused by the golf course where practical. In the event that the dam overflows in a heavy rain event, it is unlikely that water quality in Manly Dam would be impacted with implementation of revised environmental management measure WQ11 as described above.

### Location of wastewater treatment plants

There would be five temporary wastewater treatment plants required during construction of the project, as outlined in Section 6.8.2 of the environmental impact statement, which would be located at the following temporary construction support sites:

- Cammeray Golf Course (BL1)
- Flat Rock Drive (BL2)
- Punch Street (BL3)
- Balgowlah Golf Course (BL10)
- Wakehurst Parkway east (BL13).

As mentioned above, the criteria for wastewater discharges from the temporary wastewater treatment plants are committed to in revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report).

The temporary 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, as discussed in Section 17.4.3 of the environmental impact statement. Their design would be developed and finalised during detailed construction planning. It is expected that the temporary wastewater treatment plants would operate during the construction period associated with the tunnelling activities and at least until tunnel fitout and finishing is completed and the operational Gore Hill Freeway wastewater treatment plant is fully commissioned.

Where possible, treated wastewater would be reused during construction (for example for dust suppression and compaction of earthworks and pavements). However, it is expected that there would be a surplus of wastewater, which would need to be treated appropriately before discharge to the local stormwater system or directly to a local surface watercourse. It is expected that the additional creek flows from treated water from the construction wastewater treatment plants could partially feed the surrounding groundwater system, as discussed in Section 17.4.5 of the environmental impact statement.

An operational wastewater treatment plant would be located at the Gore Hill Freeway in Artarmon, as shown in Figure 17-12 of the environmental impact statement. It would treat the following:

- Groundwater ingress into the tunnels
- Deluge water after an event or incident in the tunnels, or during routine testing of emergency systems
- Washdown water
- Spills and leaks.

The criteria for operational wastewater discharges are included in revised environmental management measure WQ17 (refer to Table D2-1 of this submissions report).

The design of the operational wastewater treatment plant would be confirmed during further design development, and it is expected that the plant would operate for the life of the project.

### Geomorphology impacts due to wastewater plant discharges

During construction, groundwater infiltration to the tunnels would be collected, treated and reused as required or discharged to local waterways including Willoughby Creek, Flat Rock Creek and Burnt Bridge Creek.

All of the affected waterways currently receive stormwater inflows and have modified channels which avoid erosion, as discussed in Section 17.3.1 of the environmental impact statement. The upper reaches of Flat Rock Creek in Artarmon consist of a concrete lined (open drain and closed box culvert) stormwater channel. East of Flat Rock Drive, Flat Rock Creek consists of a human made (naturalised) excavated bedrock channel until it enters Tunks Park, where it again flows through an underground box culvert. Burnt Bridge Creek is naturalised upstream with a rock, sand, and mud substrate. Downstream, at the Kitchener Road crossing in Balgowlah, Burnt Bridge Creek consists of a combination of concrete and rock fill construction. Willoughby Creek is a modified concrete and rock channel throughout its entire length.

The construction treated wastewater discharges are not anticipated to alter the geomorphology of Willoughby Creek as the modified concrete and rock channel could handle greater flows during frequent flood events, as described in Section 17.4.4 of the environmental impact statement. The susceptibility of Willoughby Creek to degradation as a result of increased flows is considered to be low due to its current stability and the relatively low level of discharges compared to existing flows.

The predicted cumulative average daily treated wastewater discharges to Flat Rock Creek would be about 0.012 kilolitres per second for about four years. While this estimate does not consider the progressive installation of tunnel linings or reuse of wastewater for construction purposes, this cumulative flow is considered minor compared to the creek flows experienced during a two-year average recurrence interval event, of 0.02 kilolitres per second. In addition, treated construction wastewater discharges are not anticipated to change the form of the creek channel and banks as Flat Rock Creek is able to handle greater flows during frequent flood events, as described in Section 17.4.4 of the environmental impact statement.

The predicted average daily treated wastewater discharges to Burnt Bridge Creek would be about 0.005 kilolitres per second for about four years. While this estimate does not consider the progressive installation of tunnel linings or reuse of wastewater for construction purposes, this cumulative flow is considered negligible compared to the creek flows experienced during a two-year average recurrence interval event of 29.7 kilolitres per second. As such, it is not expected that treated wastewater discharges would change the stability or form of Burnt Bridge Creek channel or banks, as described in Section 17.4.4 of the environmental impact statement.

During operation of the project, water intercepted by the tunnel drainage systems would be collected and treated at the Gore Hill Freeway wastewater treatment plant, as described in Section 17.5.3 of the environmental impact statement. Discharges from the Gore Hill Freeway wastewater treatment plant would be discharged into Flat Rock Creek via the local stormwater system at a flow rate of about 0.016 kilolitres per second (16 litres per second). This rate is lower than the creek flow rate under a two-year average recurrence interval flood event of 0.02 kilolitres per second. It is therefore considered that Flat Rock Creek bed and banks would be able to handle expected wastewater treatment plant flow rates without impacting the creek form and geomorphic processes.

The potential for scour and erosion of watercourse bed and banks will be considered during the design of new discharge outlets, as required by revised environmental management measure WQ8 (refer to Table D2-1 of this submissions report). Further design development will confirm the local stormwater system and/or receiving waterway capacity to receive construction and operational wastewater treatment plant inflows, as required by revised environmental management measure WQ9 (refer to Table D2-1 of this submission report). As part of this environmental management measure, if 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 considered and implemented within the construction footprint where feasible and reasonable.

## C16.5 Geomorphology

### ***Issue raised***

Submitters raised concerns about potential geomorphology impacts, including:

- Concerns that there is no analysis of scouring and increased water velocity at the permanent water quality basin discharge locations or at creeks generally
- Concerns about potential geomorphology impacts as a result of the watercourse redirection at Flat Rock Reserve
- Concerns that more stormwater is likely to move into Flat Rock Gully during rain events due to the construction footprint having impervious/compacted surfaces
- Concerns about and objections to potential geomorphology impacts as result of reduced flows and the localised adjustment of Burnt Bridge Creek, including concerns that it will essentially operate as a stormwater channel
- Concerns that increased runoff from Wakehurst Parkway will result in geomorphology impacts, particularly scour impacts on land in adjacent bushland.

### ***Response***

#### Scouring and increased water velocity at the permanent water quality basin discharge locations and creeks

Drainage works would be designed to include velocity flow dissipation structures in order to prevent scouring of creeks and drainage lines, as described in Section 17.5.5 of the environmental impact statement. The potential for geomorphology impacts as a result of surface water runoff for the project generally is considered negligible as stormwater discharges would be via the stormwater network, as outlined in Section 17.5.5 of the environmental impact statement. The potential for scour and erosion of watercourse bed and banks will be considered during the design, construction and operation of new discharge outlets, as required by revised environmental management measure WQ8 (refer to Table D2-1 of this submissions report). Construction work activities within or next to the watercourses and drainage lines will be minimised as much as reasonably practical to minimise disturbance of sediments in or near the waterway.

#### Aboveground constructed watercourse within Flat Rock Reserve

There is potential for geomorphology impacts due to minor changes to flows and increased risk of sedimentation during installation of the culvert within an aboveground constructed open channel within Flat Rock Reserve, as outlined in Section 17.4.4 of the environmental impact statement. The culvert would be sized to maintain the free flow of water and would be designed with low gradient and scour protection so as to minimise impacts to geomorphology. Installation of culverts would be carried out in accordance with the *Technical Guideline: Temporary Stormwater Drainage for Road Construction* (Roads and Maritime Services, 2011b). Further, in order to ensure flows and velocities are not substantially changed and to avoid downstream erosion and bed and bank stability impacts, the drainage and adjustment works would be staged as required by revised environmental management measure WQ13 (refer to Table D2-1 of this submissions report).

#### Increased stormwater runoff in Flat Rock Gully

Flat Rock Creek is predominantly a concrete lined (open drain and closed box culvert) stormwater channel. Flat Rock Drive construction support site (BL2) is located adjacent to an unnamed constructed open channel bordering the eastern side of the support site. Flat Rock Creek is located within a box culvert in this area (refer to Figure 17-2 of the environmental impact statement). About

150 metres east of Flat Rock Drive the Flat Rock Creek box culvert outlets into a human made (naturalised) excavated bedrock channel followed by a natural bedrock stream until it enters Tunks Park, where it again flows into an underground box culvert. Works associated with the Flat Rock Drive construction support site (BL2) are located about 120 metres upstream of Flat Rock Gully.

The establishment of Flat Rock Drive construction support site (BL2) would require construction of level hardstand areas for site access roads, construction staff parking and other facilities, as described in Section 6.8.2 of the environmental impact statement. The potential for impervious surfaces created by the project increasing the volume and rate of runoff, causing erosion within the instream channel is discussed in Section 17.4.4 of the environmental impact statement. It is noted that the impacts to Flat Rock Creek are considered to have low potential of occurring given the concrete-lined or piped nature of the creek in the vicinity of Flat Rock Drive construction support site (BL2).

Notwithstanding, potential impacts from impervious surfaces at Flat Rock Drive construction support site (BL2) will be managed through the implementation of revised environmental management measures SG9 and WQ8 (refer to Table D2-1 of this submissions report). This will require the implementation of appropriate erosion and sediment controls, including use of energy dissipaters such as check dams where required in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (DECC, 2008). In addition, the potential for scour and erosion of watercourse bed and banks will be considered during the design, construction and operation of new discharge outlets constructed as part of Flat Rock Drive construction support site (BL2), as required by revised environmental management measure WQ8 (refer to Table D2-1 of this submissions report).

#### Localised adjustment of Burnt Bridge Creek

There is potential for geomorphology impacts due to temporary changes in creek flows and velocities within Burnt Bridge Creek downstream of the project while localised adjustments are carried out, as outlined in Section 17.4.4 of the environmental impact statement. In order to minimise potential impacts, the works would be staged as required by revised environmental management measure WQ13 (refer to Table D2-1 of this submissions report). This would ensure creek flows and velocities are not substantially changed and avoid downstream erosion and bed and bank stability impacts. The localised adjustment of Burnt Bridge Creek will be designed with consideration of existing channel conditions and an understanding of existing hydrology to minimise alterations to, and erosion of, the bed and banks, in accordance with environmental management measure WQ4 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, the gradient, sinuosity and channel capacity will be consistent with upstream and downstream sections. The extension to the existing culvert will be designed with a low gradient and scour protection to minimise impacts to geomorphology.

It is unlikely that the reduced flows to Burnt Bridge Creek would result in geomorphology impacts. Further consideration of the potential reduced flows to Burnt Bridge Creek are provided below in Section C16.6.

#### Increased runoff from Wakehurst Parkway

The realignment and upgrade of the Wakehurst Parkway would result in an increased impervious surface area. Increased impervious surface area and disturbance along the Wakehurst Parkway has the potential to increase the risk of erosion and scour within adjacent waterways including Manly Creek, Manly Dam and at the drainage lines crossing Garigal National Park, as discussed in Section 6.2.3 of Appendix O (Technical working paper: Surface water quality and hydrology). With the implementation of appropriate controls, short-term impacts during the establishment period are

expected to be manageable with negligible impacts on receiving water quality. Potential impacts would be managed in accordance with revised environmental management measures SG9, WQ8, WQ15 and F4 (refer to Table D2-1 of this submissions report).

## **C16.6 Water take and baseflows**

### ***Issue raised***

Submitters raised concerns about impacts to water availability and baseflows as a result of the project. Specific concerns included:

- Concerns about water extraction and reduced flows to local waterways
- Concerns that baseflow reductions in the downstream area of Burnt Bridge Creek are unclear
- Concerns that the environmental impact statement does not adequately assess impacts related to flow reductions including reduced oxygenation, algal blooms and eutrophication
- Concerns that environmental management measures regarding reduction in water flows are not provided in the environmental impact statement.

### ***Response***

Water extraction from surface water is proposed at only one location during construction of the project, being the Balgowlah Golf Course stormwater dam. During construction, the Balgowlah Golf Course stormwater dam would initially be retained and maintained for use as construction water and irrigation of Balgowlah Oval by Northern Beaches Council. The size and location of a new stormwater basin will be determined as part of the dedicated consultation and follow on design process associated with the final layout of the new and improved open space and recreation facilities at Balgowlah. The existing Balgowlah Golf Course stormwater dam would not be decommissioned (although it may be slightly modified to allow construction of the access road) until the new stormwater basin at Balgowlah is commissioned, as required by revised environmental management measure WQ1 (refer to Table D2-1 of this submissions report). Refer to the project refinement described in Section A4.8 of this submissions report for further information. Groundwater modelling was based on conservative (worst case) assumptions of no designed tunnel linings installed and that there would be continuous saturation (and hydraulic connectivity) between the tunnel and the shallow water table, as an assessment requirement from the Department of Planning, Industry and Environment and as noted in sections 6.1.3.5 and 6.2.3.5 of Appendix N (Technical working paper: Groundwater) and sections 9.3.1 and 10.2.1 of the associated groundwater modelling report (Annexure F of Appendix N (Technical working paper: Groundwater)). Under these assumptions, all drawdown at tunnel depth would be realised at the surface, which could result in baseflow reduction in watercourses. However, in reality, stratification in the hydrogeological units would limit connectivity between the tunnel and the shallow water table, which would reduce vertical movement of groundwater. This means that not all drawdown at the tunnel would be realised at the surface and therefore, predicted drawdown in the vicinity of watercourses might be substantially reduced, or might not occur at all, which would reduce actual baseflow reductions compared to the predictions. Where the hydraulic connectivity between the tunnel and the shallow water table is poor, the presence or absence of tunnel linings might not have a large effect on overall drawdown.

The maximum groundwater drawdowns and associated impacts predicted by the groundwater modelling, including baseflow reductions, are therefore considered to be conservative and actual impacts are likely to be lower than those predicted in Appendix N (Technical working paper: Groundwater) due to conservative modelling assumptions. It should also be noted that baseflow is only one component of streamflow. Streamflow is the combination of water from several sources

including rainfall run-off, direct rainfall into the stream, discharge from stormwater pipes and groundwater contributions. The proportion of streamflow that comes from groundwater is referred to as groundwater baseflow, or baseflow. Further discussion of streamflow and baseflow is provided in Section 2.1.1 of Appendix E of this submissions report.

Therefore any predicted reductions to baseflow, however conservative, are only related to the groundwater contribution to the overall streamflow and it does not mean that the overall streamflow will reduce by that amount. For example, if groundwater baseflow contributes 20 per cent to streamflow and there is a 50 per cent reduction in groundwater baseflow, then all other things being equal this reduction in groundwater baseflow would result in a 10 per cent reduction in streamflow.

Potential impacts from reduced baseflows to surface waters are discussed in sections 17.4.5 and 17.5.6 of the environmental impact statement which details potential impacts on water availability and surface water flows during construction and operation respectively. Further detail is included in the related technical working papers including Appendix N (Technical working paper: Groundwater) and Appendix O (Technical working paper: Surface water quality and hydrology).

There is the potential for baseflow reductions of more than five per cent to occur at Flat Rock Creek, Quarry Creek and Burnt Bridge Creek at the end of construction and after 100 years of operation of the project, as discussed in Section 6.1.3.5 and Section 6.2.3.5 of Appendix N (Technical working paper: Groundwater). All other waterways are expected to experience impacts of less than five per cent. Potential baseflow impacts at Flat Rock Creek, Quarry Creek and Burnt Bridge Creek are documented in Table 6-5 of Appendix N (Technical working paper: Groundwater) and have been conservatively assessed as:

- Flat Rock Creek – maximum reduction of 43.6 kilolitres (kL)/day (20 per cent reduction) at the end of construction and a maximum reduction of 84.7 kL/day (39 per cent reduction) after 100 years of operation
- Quarry Creek – maximum reduction of 4.1 kL/day (23 per cent reduction) at the end of construction and a maximum reduction of 11.4 kL/day (69 per cent reduction) after 100 years of operation
- Burnt Bridge Creek – maximum reduction of 16.7 kL/day (79 per cent reduction) at the end of construction and a maximum reduction of 16.8 kL/day (96 per cent reduction) after 100 years of operation.

Due to concerns raised by the community and agencies regarding the potential impact of the project on groundwater drawdown and in particular resulting baseflow reductions, revised groundwater modelling has been carried out since exhibition of the environmental impact statement as discussed in Section A5.1.15 of this submissions report. Further information on predicted groundwater baseflow reductions and related environmental impact assessment based on the revised groundwater modelling is provided in Appendix E of this submissions report. Additional field survey of Flat Rock Creek, Quarry Creek and Burnt Bridge Creek was carried out to assess the nature of each creek's streambed and the potential for interaction between creek surface waters and groundwater. This information was used in the revised groundwater modelling. Revised predicted reductions in groundwater baseflow in 2128 of 30 per cent, 63 per cent and 60 per cent in Flat Rock Creek, Quarry Creek and Burnt Bridge Creek respectively are detailed in Table 3-3 of Appendix E of this submissions report. These and other findings of the revised groundwater modelling and associated aquatic ecology, groundwater dependent ecosystems, surface water quality and socio-economic impact assessments are consistent with the findings of the environmental impact statement and confirm that the environmental management measures presented in the environmental impact statement would be sufficient to manage potential impacts.

During construction, groundwater infiltration to the tunnels would be collected, treated and reused as required or discharged to local waterways including Willoughby Creek, Flat Rock Creek, Burnt Bridge Creek and Wakehurst Golf Course Dam. During operation, groundwater infiltration into the tunnels would be collected and treated, with a portion discharged into Flat Rock Creek via the operational wastewater treatment plant located in Artarmon (the remainder would be reused for washdowns and deluge testing). There are no planned construction or operational project discharges of tunnel inflows to Quarry Creek. Construction and operational wastewater treatment plants will be designed to treat wastewater generated from tunnel groundwater inflows to meet the discharge criteria specified in revised environmental management measures WQ11 and WQ17 respectively (refer to Table D2-1 of this submissions report).

The predicted combined discharge quantity to Flat Rock Creek from the Flat Rock Drive construction support site (BL2) and the Punch Street construction support site (BL3) during construction is 1019 kL/day as outlined in Table 5-3 of Appendix O (Technical working paper: Surface water quality and hydrology). The predicted potential discharge quantity to Flat Rock Creek from the Gore Hill Freeway wastewater treatment plant during operation is as a maximum of 1425 kL/day as outlined in Table 6-1 of Appendix O (Technical working paper: Surface water quality and hydrology). Based on this, the project discharges to Flat Rock Creek during both construction and operation would likely offset the loss in baseflow and impacts on water quality and aquatic ecology would be limited.

The predicted discharge quantity to Burnt Bridge Creek from the Balgowlah Golf Course construction support site (BL10) during construction is 428 kL/day, as outlined in Table 5-3 of Appendix O (Technical working paper: Surface water quality and hydrology). Based on this, the project discharges to Burnt Bridge Creek during construction would likely offset the loss in baseflow during construction. The predicted maximum volumetric reduction in baseflow to Burnt Bridge Creek is 16.8 kL/day after 100 years of operation, as outlined in Table 6-10 of Appendix N (Technical working paper: Groundwater). While there are no planned operational project discharges to Burnt Bridge Creek, a review of the *Manly Lagoon Flood Study* (BMT WBM, 2013) indicates that Burnt Bridge Creek is fed by the local stormwater system, indicating a ready supply of streamflow to help maintain water in the creek and offset any impacts from baseflow reduction. As such, the predicted baseflow reductions for Burnt Bridge Creek are unlikely to have any substantial water quality impacts.

Quarry Creek is a small natural estuarine tributary of Flat Rock Creek which drains Cammeray and is described and shown in Table 17-7 and Figure 17-2 of the environmental impact statement. While baseflow reductions to Quarry Creek would not be offset by construction or operational project discharges, due to the very low existing baseflows along Quarry Creek and the existing geomorphology, the predicted baseflow reductions are unlikely to have any substantial hydrodynamic or water quality impacts.

However, and as stated in the environmental impact statement, groundwater drawdown predictions are conservatively based on unconstrained groundwater inflows into the tunnel. As measures will be implemented during tunnel construction to ensure that groundwater inflows into each tunnel during the operation phase do not exceed one litre per second per kilometre across any given kilometre, as required by revised environment management measure SG16 (refer to Table D2-1 of this submissions report), actual baseflow reductions would likely be less than these predictions.

As more information becomes available on groundwater levels and contamination through ongoing groundwater monitoring, groundwater modelling will be updated to refine the predictions, in accordance with revised environmental management measure SG2 (refer to Table D2-1 of this submissions report). Following completion of environmental management measure SG2, a focussed study will be carried out in consultation with the Department of Planning, Industry and Environment



(Environment, Energy and Science Group) to confirm potential groundwater drawdown and associated baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek due to tunnelling, and confirm potential impacts on freshwater ecology in the affected watercourses and nearby groundwater dependent ecosystems, as required by revised environmental management measure SG6 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, where ecological impacts are predicted to be worse than that presented as part of the environmental impact statement/submissions report, feasible and reasonable mitigation measures to address the impacts will be identified in consultation with a suitably qualified and experienced specialist, incorporated into the detailed design, and implemented during construction. The mitigation measures considered will include tunnel linings.

While the focussed study will mainly consider freshwater ecology and confirming the impact assessment within the environmental impact statement and this submissions report, water quality and flow of the abovementioned creeks would be a key part of this consideration.

## **C16.7 Stormwater harvesting schemes and water balance**

### ***Issue raised***

Submitters raised concerns about impacts to water balance as a result of the project. Specific concerns included:

- Concerns about the loss of the stormwater harvesting facility at Cammeray Park
- Concerns about the removal of Balgowlah Golf Course stormwater harvesting dam.

### ***Response***

#### **North Sydney Council stormwater harvesting scheme**

The storage dam at Cammeray Golf Course which is part of North Sydney Council's stormwater harvesting scheme would be directly impacted by the Western Harbour Tunnel and Warringah Freeway Upgrade project, as outlined in Section 17.4.5 of the environmental impact statement.

In accordance with condition E209 of the Western Harbour Tunnel and Warringah Freeway Upgrade project's conditions of approval, a replacement stormwater harvesting dam will be provided within the boundaries of Cammeray Golf Course in consultation with North Sydney Council and Cammeray Golf Club. As part of this condition of approval, if the new stormwater harvesting storage facility is not operational prior to the dewatering of the existing dam, Transport for NSW will pay for all water usage costs associated with the use of the harvesting storage facility/dam incurred by Council or the golf club until the replacement facility is operational. For further information, refer to Section A3.3.3 of the Western Harbour Tunnel and Warringah Freeway Upgrade submissions report (Transport for NSW, 2020k).

#### **Balgowlah Golf Course stormwater harvesting dam**

The Balgowlah Golf Course stormwater harvesting dam currently functions with a dual purpose as stormwater flood detention and as a stormwater harvesting dam for the golf course.

Impacts to the Balgowlah Golf Course stormwater harvesting dam are documented in Section 17.4.5 of the environmental impact statement. The project would impact upon the dam as part of constructing the proposed new access road between Sydney Road and Burnt Bridge Creek Deviation. The environmental impact statement states that the Balgowlah Golf Course stormwater harvesting dam would initially be retained and maintained as construction water and for irrigation of Balgowlah Oval by Northern Beaches Council, and as construction progresses the stormwater harvesting dam would be decommissioned and removed.

Following consultation with Northern Beaches Council that has occurred since exhibition of the environmental impact statement, it has been confirmed that there is an ongoing need for the existing stormwater harvesting scheme. A project refinement has been developed to reflect this change, as described in Section A4.8 of this submissions report. The final design for a stormwater harvesting water quality basin at Balgowlah to replace the existing Balgowlah Golf Course stormwater dam will be developed during further design development in consultation with Northern Beaches Council, as required by revised environmental management measure WQ1 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, a suitable location and size for the basin will be determined as part of the dedicated consultation and follow on design process associated with the final layout of the new and improved public open space and recreation facilities at Balgowlah. The new stormwater basin at Balgowlah will be constructed and operational prior to the decommissioning of the existing Balgowlah Golf Course stormwater dam.

Discussion on the potential biodiversity impacts associated with the removal of the existing Balgowlah Golf Course stormwater harvesting dam are provided in Section C18.3.1 of this submissions report.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C17 – Flooding

## C17 Flooding

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## C17.1 Adequacy of the assessment

### C17.1.1 Design floods considered

#### ***Issue raised***

Submitters raised concerns that some design floods have not been considered in the flooding assessment. Specific concerns include:

- That the flood behaviour for the 1 in 200 and 1 in 500 year flood events has not been addressed in Chapter 18 (Flooding) of the environmental impact statement
- That potential impacts of project operation on flood behaviour under future climate change conditions at Burnt Bridge Creek have been assessed but that the potential impacts of project operation on flood behaviour for the 1% annual exceedance probability (AEP) and probable maximum flood (PMF) events at Burnt Bridge Creek have not been assessed.

#### ***Response***

##### Design floods considered in flooding assessment

The project has assessed the potential impacts of the project on flood behaviour for a full range of flood events, including the 10% AEP, 1% AEP, 0.5% (1 in 200 year), 0.2% (1 in 500 year), and PMF events, in accordance with the Secretary's environmental assessment requirements (refer to Section 18.3 of the environmental impact statement).

The potential impacts of the project on flood behaviour under future climate change conditions are discussed in Section 18.6.5 of the environmental impact statement, whereas the potential impacts of project operation on flood behaviour for storm events up to the 1% AEP and PMF events, including at Burnt Bridge Creek, are discussed in Section 18.6.2 of the environmental impact statement and Section 6.2 of Appendix R (Technical working paper: Flooding).

##### Flooding at Burnt Bridge Creek

The expected extent and depth of flooding in the vicinity of Burnt Bridge Creek for the 1% AEP and PMF events during operation of the project are shown in Figure 6.5 (Sheet 5 of 5) and Figure 6.6 (Sheet 5 of 5) of Appendix R (Technical working paper: Flooding) respectively. Figure 6.6 (Sheet 5 of 5) of Appendix R (Technical working paper: Flooding) has been updated to include an inset at a larger scale to more clearly show potential impacts at Burnt Bridge Creek during the PMF event and is included in Appendix G of this submissions report. A series of figures which show flood behaviour under present day and project operation conditions during the 0.5% AEP and 0.2% AEP events is contained in Annexure B of Appendix R (Technical working paper: Flooding).

For storm events up to a 1% AEP event, along the main arm of Burnt Bridge Creek downstream of the Kitchener Street bridge, peak 10% flood levels would be increased at six residential properties in the range 10-50 millimetres, as outlined in Section 6.2.1.1 of Appendix R (Technical working paper: Flooding).

During more extreme storm events at greater intensity than 1% AEP, the project has the potential to increase peak flood levels by up to about 0.5 metres in up to six existing dwellings that are located immediately upstream of the Burnt Bridge Creek Deviation crossing of Burnt Bridge Creek, as outlined in Section 6.2.1.2 of Appendix R (Technical working paper: Flooding). While floor level survey would be required in order to assess whether the project would significantly increase the flood hazard in the six affected dwellings, it is noted that the depth of above-ground inundation associated with three of the affected dwellings exceeds two metres in a PMF event under present day conditions

Minor increases of up to 50 millimetres in peak flood levels would be experienced at 15 residential properties that are located on either side of the road corridor in Boronia Street, Myrtle Street and Kitchener Street during a PMF event. Larger increases of up to about 600 millimetres could potentially be experienced at six residential properties that are located along the northern side of Kitchener Street and at the western end of Balgowlah Road, noting these larger impacts are confined to the immediate vicinity of Burnt Bridge Creek where it runs through the affected properties.

Transport for NSW is committed to not significantly increase flooding hazard, and during further design development would include appropriate mitigation within the design to ensure that there would not be an unacceptable increase in flood hazard at existing developments and therefore risk to life during floods larger than the 1% AEP. This is reflected in revised environmental management measure F2 (refer to Table D2-1 of this submissions report):

Impact of the project on flood behaviour during operation will be confirmed during further project development. This will include the consideration of future climate change and a partial blockage of the local stormwater drainage system. **The project will be designed such that the flood hazard in existing residential development during floods larger than 1% AEP would not be significantly increased such that there would be an increased risk to life.**

Following exhibition of the environmental impact statement, Transport for NSW is carrying out further refinement of the Reference Design so that, subject to final detailed design and final flood modelling, the impacts upstream of Burnt Bridge Creek Deviation can be minimised to the greatest extent possible. New environmental management measure F10 has been created to reflect Transport for NSW's commitment to minimising and/or eliminating adverse impacts to residential development upstream of the Burnt Bridge Creek Deviation crossing of Burnt Bridge Creek (refer to Table D2-1 of this submissions report):

Opportunities to minimise and/or eliminate adverse impacts in residential development that is located upstream of the Burnt Bridge Creek Deviation for events greater than the 1% AEP event will be investigated during further design development. This would include refinement of road levels at the existing creek crossing of Burnt Bridge Creek, and detailed design of the new stormwater basin at Balgowlah.

For further details on this refinement, refer to Section A4.10 of this submissions report.

### **C17.1.2 Assessment of downstream watercourses and habitats**

#### ***Issue raised***

Submitters raised concerns about flooding impacts to waterways and habitats surrounding the project footprint during construction. Specific concerns include:

- The flooding assessment does not adequately assess potential impacts of flood water runoff on waterways and habitats at Flat Rock Reserve and downstream, including Tunks Park, during construction
- The flooding assessment does not assess potential impacts to watercourses during operation, including at Flat Rock Reserve and watercourses several kilometres downstream from the project.

#### ***Response***

##### **Flooding impacts to waterways and habitats during construction**

A qualitative assessment was carried out in relation to the potential impacts of construction activities on flood behaviour, the key findings of which are summarised in Table 18-2 of the environmental

impact statement. Changes in natural surface levels within the confines of the Flat Rock Drive construction support site (BL2) have the potential to alter flooding patterns in the area.

Detailed construction planning will consider flood risk at construction sites and temporary construction support sites to manage potential impacts to areas downstream of sites, in accordance with environmental management measure F5 (refer to Table D2-1 of this submissions report). This will include:

- a) 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
- b) 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% AEP flood event where reasonable and feasible
- c) Measures to mitigate alterations to local runoff conditions due to construction activities.

In terms of managing potential impacts of flooding on temporary construction support sites, site facilities will be located outside high flood hazard areas based on a 1% AEP flood, in accordance with revised environmental management measure F9 (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% AEP flood extent, in accordance with environmental management measure F8 (refer to Table D2-1 of this submissions report).

#### Flooding impacts to watercourses during operation

The following catchments contribute runoff to the existing drainage systems and waterways that are located within the project footprint (as shown in Figure 18-1 of the environmental impact statement):

- Willoughby Creek
- Flat Rock Creek
- Pearl Bay (within Middle Harbour)
- Burnt Bridge Creek (a sub-catchment of Manly Lagoon)
- Bantry Bay
- Manly Creek (a sub-catchment of Manly Lagoon)
- Trefoil Creek (a sub-catchment of Narrabeen Lagoon).

These catchments drain to either Middle Harbour, Manly Lagoon or Narrabeen Lagoon. Each catchment that drains to and from the project corridor has been assessed, as summarised in Chapter 18 (Flooding) of the environmental impact statement and with further detail provided in Appendix R (Technical working paper: Flooding).

The changes to flood behaviour as a result of the project are described in Section 18.6.2 of the environmental impact statement. In particular, the changes to flood behaviour in the 1% AEP event during operation of the project are shown in Figures 18-9 to 18-14 while the changes in flood depth in the 1% AEP event during operation of the project are shown in Figures 18-15 to 18-20 of the environmental impact statement. External to the road corridor, the project would generally result in a neutral or beneficial effect on flood behaviour for storm events up to 1% AEP in intensity, with a few exceptions (refer to Section 18.6.2 of the environmental impact statement).

Where flood levels in the 1% AEP event are predicted to increase at any residential, commercial and/or industrial buildings as a result of the operation of the project, a floor level survey will be carried out. 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, in accordance with environmental management measure F1 (refer to Table D2-1 of this submissions report). The project will be designed such that the flood hazard in existing residential development during floods larger than 1% AEP would not be significantly increased such that there would be an increased risk to life, in accordance with revised environmental management measure F2 (refer to Table D2-1 of this submissions report).

### **C17.1.3 Contamination mobilised by floodwaters**

#### ***Issue raised***

Submitters raised concerns over the adequacy of the flooding assessment with respect to contamination mobilised by floodwater. Specific concerns include:

- The flooding assessment does not recognise that floodwater and sediment may be from a contaminated source and does not consider potential impacts of flooding over contaminated land
- The flooding assessment does not provide mitigation for the potential risk of existing contamination at Flat Rock Gully being exposed during construction and mobilised by floodwater.

#### ***Response***

Potential impacts of flooding on potentially contaminated land and spoil at temporary construction support sites would be reduced through the implementation of flooding environmental management measure F8 and revised environmental management measure F9 (refer to Table D2-1 of this submissions report). These environmental management measures require that spoil stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 10% AEP flood extent, and that site facilities will be located outside high flood hazard areas based on a 1% AEP event.

The location of the proposed Flat Rock Drive construction support site (BL2) has the potential for contamination risks given the history of landfill activities in the area. This area poses a moderate potential contamination risk associated with the possible presence of contamination beneath the Flat Rock Drive construction support site (BL2) and known groundwater contamination in adjoining areas (Willoughby Leisure Centre and Bicentennial Reserve).

Site investigations will be carried out on sites with moderate to very high potential contamination risk, including the Flat Rock Drive construction support site (BL2), in accordance with revised environmental management measure SG8 (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. The remediation action plan will be prepared in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998). An independent NSW Environmental 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.

Contamination risks during project construction would be managed through the construction environmental management plan, specifically the soil and water management sub-plan (refer to Table D1-1 of this submissions report). Management responses to contaminated soils (if confirmed), including remediation action plans (in accordance with revised environmental management measure SG8), would provide a varied response based on identified risk to human or ecological receptors.



Further, erosion and sediment control measures will be implemented at all construction support sites and surface road upgrades in accordance with the principles and requirements in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (NSW Department of Environment and Climate Change (DECC), 2008) and relevant guidelines, procedures and specifications of Transport for NSW, as required by revised environmental management measure SG9 (refer to Table D2-1 of this submissions report).

Temporary wastewater treatment plants would be required during construction to treat wastewater generated from tunnel construction activities and groundwater inflows during construction, as described in Section 6.4.2 of the environmental impact statement. The locations of the construction wastewater treatment plants and discharge locations are shown in Figure 17-7 of the environmental impact statement. If any potential groundwater contaminants are mobilised they would travel towards the tunnel during construction. Discharges from wastewater treatment plants during the construction phase will be required to meet appropriate discharge criteria, as specified in revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report).

#### **C17.1.4 Potential impacts of erosion and scour**

##### ***Issue raised***

Submitters raised concerns over potential erosion and scouring issues related to the project during construction and operation, including:

- The flooding assessment does not assess potential effects on erosion, siltation, riparian vegetation or a reduction in the stability of river banks or watercourses, as required by the Secretary's environmental assessment requirement 2J
- Concerns that erosion impacts to river banks were not thoroughly assessed and only localised scour along receiving drainage lines has been considered, instead of scour potential and sedimentation across the whole catchment area all the way down to Queenscliff beach.

##### ***Response***

In accordance with the Secretary's environmental assessment requirements, Section 18.5 of the environmental impact statement identifies potential construction impacts that the project could have on erosion, siltation, or the stability of watercourses, while Section 17.4.4 provides further details regarding impacts on geomorphology during construction.

Section 18.6 of the environmental impact statement presents the findings of an assessment of the potential impacts that the project could have on erosion, siltation, or the stability of watercourses during operation of the project. In particular, Section 18.6.3 provides an assessment of scour potential for receiving drainage lines. The potential impact on the geomorphology of watercourses during operation has been assessed in Section 17.5.5 of the environmental impact statement.

Potential impacts on riparian vegetation are included in Section 19.5 of the environmental impact statement.

Potential impacts on erosion, siltation, the stability of watercourses and riparian vegetation during construction and operation will be managed in accordance with environmental management measures provided in Table D2-1 of this submissions report, including:

- The localised adjustment of Burnt Bridge Creek will be designed with consideration of existing channel conditions and an understanding of existing hydrology to minimise alterations to, and erosion of, the bed and banks. The gradient, sinuosity and channel capacity will be consistent with upstream and downstream sections. The extension to the existing culvert will be designed

with a low gradient and scour protection to minimise impacts to geomorphology. Where required, the adjustment will include grade controls and bank stabilisation works to manage anticipated high velocity conditions (environmental management measure WQ4)

- The potential for scour and erosion of watercourse bed and banks will be considered during the design of new discharge outlets. Construction work activities within or next to the watercourses and drainage lines will be minimised as much as reasonably practical to minimise disturbance of sediments in or near the waterway (revised environmental management measure WQ8)
- Measures will be assessed during further design development which are aimed at reducing as far as is practical the risk of increased scour in the receiving drainage lines that are located along Wakehurst Parkway. Further design development will include consideration of the resistance of the soil materials to the hydraulic forces likely to be imposed. Scour countermeasures will also be provided at the outlet of new or upgraded transverse and longitudinal drainage lines, as well as in other areas where the project would otherwise result in unacceptable increases in scour potential (revised environmental management measure F4)
- Erosion and sediment control measures will be implemented at all construction support sites and surface road upgrades in accordance with the principles and requirements in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (DECC, 2008) and relevant guidelines, procedures and specifications of Transport for NSW. A soil conservation specialist will be engaged for the duration of construction of the project to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans (revised environmental management measure SG9)
- During construction, the drainage and adjustment works associated with Burnt Bridge Creek and an existing aboveground constructed open channel within Flat Rock Reserve will be staged to ensure creek flows and velocities are not substantially changed and to avoid downstream erosion and bed and bank stability impacts (revised environmental management measure WQ13)
- Disturbed floodplain environments next to the watercourses and/or along overland drainage lines will be stabilised as soon as practical following disturbance (revised environmental management measure WQ15)
- Aquatic habitats will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (Roads and Traffic Authority (RTA), 2011a) and *Policy and guidelines for fish habitat conservation and management* (NSW Department of Primary Industries (DPI), 2013). This will include flow and sufficient fish passage to be maintained similar to current conditions during instream works where reasonable and feasible (environmental management measure B27)
- During construction, scour protection measures including possible velocity reduction from wastewater treatment plant discharge will be implemented where reasonable and feasible to avoid scour impacts on the marine environment (environmental management measure B30).

### **C17.1.5 Impact of future climate change on flooding to the project**

#### ***Issue raised***

Submitters raised concerns that the flood assessment did not address flooding impacts taking into account sea level rise and storm intensity due to climate change.

#### ***Response***

The potential future climate change influences on flooding have been assessed in Chapter 18 (Flooding) of the environmental impact statement and Appendix R (Technical working paper: Flooding).

The *Floodplain Risk Management Guideline: Practical Considerations of Climate Change* (Department of Environment and Climate Change (DECC), 2007) recommends that sensitivity analyses should be carried out based on increases in rainfall intensities of between 10 and 30 per cent. The 0.5% AEP and 0.2% AEP events have been used as proxies to assess the sensitivity to an increase in rainfall intensity of 10 per cent and 30 per cent, respectively, on the 1% AEP event due to future climate change. These percentages represent the lower and upper bound estimates of future climate change related impacts over the design life of the project.

Sea level rise projections of 0.4 metres by 2050 and 0.9 metres by 2100, as recommended by the NSW Government's *NSW Sea Level Rise Policy Statement* (Department of Environment, Climate Change and Water (DECCW), 2009), have been adopted for assessing the impact future climate change could have on flooding conditions in the vicinity of the project, as summarised in Section 2.3.4 of Appendix R (Technical working paper: Flooding). Impacts on flood behaviour associated with increased rainfall intensities under the future climate change scenario are assessed in Section 18.6.5 of the environmental impact statement and Section 6.5.2 of Appendix R (Technical working paper: Flooding). The assessment found that the project would generally have a similar impact on flood behaviour to that described in Section 18.6.2 of the environmental impact statement for a 1% AEP storm event under present day conditions, except for the following locations which would increase peak post-climate change 1% AEP flood levels:

- Immediately upstream of the Burnt Bridge Creek Deviation crossing of Burnt Bridge Creek, peak post-climate change 1% AEP flood levels could be increased by up to 250 millimetres, with the impacts extending into 11 residential properties located on either side of the watercourse
- Immediately downstream of the Burnt Bridge Creek Deviation crossing of Burnt Bridge Creek, peak post-climate change 1% AEP flood levels could be increased by up to 200 millimetres, noting that no existing or (planned) future development would be impacted as a result of these changes.

The assessment identified that a rise in sea level of up to 0.9 metres would not impact flood behaviour in the vicinity of the project as the associated surface works are located well above areas that are projected to be impacted by rising sea levels (refer to Section 18.6.5 of the environmental impact statement).

The impact of the project on flood behaviour during operation will be confirmed during further project development (refer to revised environmental management measure F2 in Table D2-1 of this submission report). This will include the consideration of future climate change and a partial blockage of the local stormwater drainage system. The project will be designed such that the flood hazard in existing residential development during floods larger than 1% AEP would not be significantly increased such that there would be an increased risk to life. Flood modelling (required by revised environmental management measure F2) will continue to use sea level rise projections and future climate change rainfall projections, in accordance with revised environmental management measure CC1 (refer to Table D2-1 of this submission report).

Floor level surveys will be carried out at residential, commercial and/or industrial buildings where flood levels of the 1% AEP design flood are predicted to increase as a result of operation of the project, in accordance with environmental management measure F1 (refer to Table D2-1 of this submission 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.

### **C17.1.6 Assessment of flooding impacts at Wakehurst Parkway**

#### ***Issue raised***

Submitters raised concerns about the adequacy of the operational flooding assessment at Wakehurst Parkway. Specific concerns and comments include:

- Concerns that the environmental impact statement is not clear about the locations where peak flows would be increased outside the Wakehurst Parkway road corridor for storms up to the 1% AEP event
- The flooding assessment does not assess impacts of increased flow velocity and potential scour caused by discharge from the four new water quality basins along Wakehurst Parkway during operation
- Concerns that information about flood mitigation at Wakehurst Parkway has not been shown publicly.

#### ***Response***

##### Impacts on peak flows external to the Wakehurst Parkway road corridor

Section 18.6.2 of the environmental impact statement presents impacts on flow velocities and the duration of inundation external to the road corridor for storms up to 1% AEP. This section was incorrectly paraphrased from Section 6.2.1.1 of Appendix R (Technical working paper: Flooding).

As outlined in Section 6.2.1.1 of Appendix R (Technical working paper: Flooding), the concentration of flow at discrete locations along the widened section of Wakehurst Parkway has the potential to increase peak flows and the duration of inundation in a number of receiving drainage lines which run to the east and west of the road corridor.

A clarification has been included in Table A5-13 of Part A of this submissions report regarding this typographical error. This clarification does not impact the outcome of the assessment provided in the environmental impact statement.

##### Increased flow velocity and scour

Surface water drainage and management infrastructure, including three new water quality basins to the east of the widened Wakehurst Parkway and one to the west, would be used to address surface water runoff during operation. Drainage infrastructure would be designed to include flow velocity dissipation structures to prevent scouring of creeks and drainage lines along the project corridor.

Measures will be assessed during further design development which are aimed at reducing as far as is practical the risk of increased scour in the receiving drainage lines that are located along the Wakehurst Parkway, in accordance with revised environmental management measure F4 (refer to Table D2-1 of this submissions report). Further design development will include consideration of the resistance of the soil materials to the hydraulic forces likely to be imposed. Scour countermeasures will also be provided at the outlet of new or upgraded transverse and longitudinal drainage lines, as well as in other areas where the project would otherwise result in unacceptable increases in scour potential.

Refer to Section C17.1.4 above for further discussion regarding management of potential erosion and scour impacts.

##### Wakehurst Parkway mitigation

Wakehurst Parkway generally runs along the top of a natural ridge line that is bordered by bushland. As such, flooding is not anticipated to be a major issue in this area. Notwithstanding, proposed

environmental management measures listed in Section 18.8 of the environmental impact statement and provided in Table D2-1 of this submissions report aim to address flooding risks associated with the project, including at Wakehurst Parkway. This includes revised environmental management measure F4, which will be implemented to reduce the risk of increased scour in the receiving drainage lines that are located along the Wakehurst Parkway as discussed above.

## C17.2 Impacts during construction

### *Issue raised*

Submitters raised concerns about flooding impacts during construction, including:

- The Cammeray Golf Course construction support site (BL1) could impact flood behaviour and exacerbate flooding conditions in existing residential development that is already known to experience flooding, specifically along Fall Street at Cremorne
- Potential flooding impact at the Flat Rock Drive construction support site (BL2) during construction
- The construction wastewater discharge at Burnt Bridge Creek would be discharging into a flood prone zone.

### *Response*

#### Impact of temporary construction support sites on flooding 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
- Temporary construction support sites and construction sites would be laid out so that flows are not substantially impeded.

The potential impacts of construction activities on flood behaviour are summarised in Table 18-2 of the environmental impact statement.

In the absence of environmental management measures, the provision of hardstand areas within the confines of the Cammeray Golf Course construction support site (BL1) has the potential to exacerbate flooding conditions in existing residential development that is located along Warringah Road, Fall Street, Cammeray Road and Grafton Street. Consideration would be given to setting an appropriate hydrologic standard for mitigating the impacts of construction activities on flood behaviour, taking into account their temporary nature and the likelihood of a flood of a given AEP occurring during the construction period.

Environmental management measures provided in Table D2-1 of this submissions report will be implemented to manage potential flooding impacts due to construction activities (including the Cammeray Golf Course (BL1) and Flat Rock Drive (BL2) construction support sites), including:

- Detailed construction planning will consider flood risk at construction sites and temporary construction support sites and will include (refer to environmental management measure F5):
  - 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% AEP flood event where reasonable and feasible
- Measures to mitigate alterations to local runoff conditions due to construction activities.
- Spoil stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 10% AEP flood extent (refer to environmental management measure F8)
- Site facilities will be located outside high flood hazard areas based on a 1% AEP flood (refer to revised environmental management measure F9).

#### Construction wastewater discharge at Burnt Bridge Creek

The construction wastewater treatment plant to be located at the Balgowlah Golf Course construction support site (BL10) would discharge into the local stormwater system at Burnt Bridge Creek, as described in Table 17-15 and shown in Figure 17-7 of the environmental impact statement.

Most of the wastewater volumes associated with construction activities would be from groundwater infiltration into the tunnelling works. Average daily treated wastewater discharges into Burnt Bridge Creek would be about 0.005 kilolitres per second for about four years. This flow is considered negligible when compared to creek flows experienced during a 50% AEP (1 in 2 year) event (29.7 kilolitres per second) and is not expected to change the stability or form of Burnt Bridge Creek channel or banks, as provided in Section 17.4.4 of the environmental impact statement.

Further design development will confirm the local stormwater system and/or receiving waterway capacity to receive construction and operational wastewater treatment plant inflows in accordance with revised environmental management measure WQ9 (refer to Table D2-1 of this submissions report). If 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 considered and implemented within the construction footprint where feasible and reasonable.

### **C17.3 Impacts during operation**

#### ***Issue raised***

Submitters raised concerns about flooding impacts during operation. Specific queries, concerns and comments included:

- The project could lead to flooding impacts at Queenscliff Lagoon, Manly Vale and North Manly, which are within flood prone land
- An existing noise wall adjacent to ANZAC Park at Cammeray is structurally unsuitable to retain up to seven metres of floodwater from entering the nearby tunnel portal and residential areas east of the Warringah Freeway
- The project would lead to flooding impacts on the road alongside Narrabeen Lagoon as a result of the widening of Wakehurst Parkway.

#### ***Response***

#### Exacerbated flooding in areas already prone to flooding

Each catchment that drains to and from the project corridor is shown in Figure 18-1 of the environmental impact statement and has been assessed in Chapter 18 (Flooding) of the environmental impact statement. Manly Vale, North Manly and Queenscliff are located within the catchments of Burnt Bridge Creek and Manly Creek.

Flood behaviour in Manly Vale, North Manly and Queenscliff during operation of the project in the 1% AEP event is shown in Figure 18-13 and Figure 18-14 of the environmental impact statement. Changes in flood behaviour as a result of the project in the 1% AEP event are shown in Figure 18-19 and Figure 18-20 of the environmental impact statement, which shows that the project would generally result in a neutral or beneficial effect on flood behaviour in Manly Vale, North Manly and Queenscliff in this storm event during operation of the project.

#### Concrete noise wall at ANZAC Park and tunnel portal protection

Major flooding of the Warringah Freeway during storms up to 1% AEP in intensity is currently prevented by the presence of an existing concrete noise wall which runs along the northern side of ANZAC Park at Cammeray. Existing flooding and drainage characteristics are such that depths of ponding in ANZAC Park are a maximum of about 2.1 metres during a 10% AEP storm event and a maximum of about 3.5 metres during a 1% AEP storm event. Figure 18-15 of the environmental impact statement shows the project would not have an effect on flood behaviour within ANZAC Park.

Overtopping of the noise wall would occur during a PMF event under existing conditions (refer to Section 18.6.1 of the environmental impact statement). A PMF event is a theoretical largest flood resulting from a combination of the most severe meteorological and hydrologic conditions that could conceivably occur in a given area. ANZAC Park would be inundated to a maximum depth of seven metres, while the carriageways of the Warringah Freeway would be inundated over a length of about 350 metres and to a maximum depth of five metres during a PMF event. The flood walls associated with the Western Harbour Tunnel and Warringah Freeway Upgrade project (subject to separate environmental impact assessment and approval) would be designed to prevent the ingress of floodwater to the road tunnels for events up to and including the PMF, which as stated above, overtops the existing noise wall and inundates the road corridor to a maximum depth of five metres.

#### Flooding impacts at Narrabeen Lagoon

The project is located in a separate catchment to that of Narrabeen Lagoon and would therefore not have an impact on flood behaviour at the Narrabeen Lagoon or its catchment. The project also would not impact on flooding of roads next to the Narrabeen Lagoon.

## **C17.4 Environmental management measures**

### ***Issue raised***

Submitters raised concerns about the proposed flooding environmental management measures being inadequate to address the assessed risk.

### ***Response***

The flooding environmental management measures provided in Table D2-1 of this submissions report have been developed to minimise potential impacts during construction and operation, both in relation to flooding impacts on the project and the project's impact on flood behaviour.

Prior to construction, further investigation would be carried out to develop measures which are aimed at mitigating the impacts of construction activities on flood behaviour. Detailed construction planning will consider flood risk at construction sites and temporary construction support sites. This will include, in accordance with environmental management measure F5 (refer to Table D2-1 of this submissions report):

- 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% AEP flood event where reasonable and feasible
- Measures to mitigate alterations to local runoff conditions due to construction activities.

During operation, the flood assessment found that external to the road corridor, the project would generally result in a neutral or beneficial effect on flood behaviour for storm events up to 1% AEP in intensity.

Provided the flood mitigation measures set out in Section 18.8 of the environmental impact assessment (and provided in Table D2-1 of this submissions report) are incorporated into the design of the project, the project would not increase the flood hazard in existing development for all events up to the 1% AEP 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 or dam failure.

To achieve these outcomes, the project has been designed to maintain or reduce flood levels at residential, commercial and industrial properties adjacent to the project footprint for all storms up to the 1% AEP event.

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.

The impact of the project on flood behaviour during operation will be confirmed during further project development in accordance with revised environmental management measure F2 (refer to Table D2-1 of this submissions report). This will include the consideration of future climate change and a partial blockage of the local stormwater drainage system. The project will be designed such that the flood hazard in existing residential development during floods larger than 1% AEP would not be significantly increased such that there would be an increased risk to life.





Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C18 – Biodiversity

## C18 Biodiversity

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## C18.1 Adequacy of the biodiversity assessment

### C18.1.1 Legislative and policy framework

#### **Issue**

Submitters raised concerns about the adequacy and accuracy of the biodiversity assessment meeting legislative assessment requirements, including:

- Concerns the Secretary's environmental assessment requirements for biodiversity have not been sufficiently addressed, including:
  - Consideration of listed species or broader biodiversity in the project corridor
  - Consideration of feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity
  - The use of the phrase "Not applicable" in relation to requesting the application of the variation rules (refer to Secretary's environmental assessment requirement 6(4))
- There is insufficient assessment and mitigation to conclude the project does not require referral to the Australian Government Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999*.

#### **Response**

##### Secretary's environmental assessment requirements

The biodiversity development assessment report (Appendix S (Technical working paper: Biodiversity development assessment report)) has been prepared to meet the requirements of the Secretary's environmental assessment requirements and the *Biodiversity Assessment Method* (Office of Environment and Heritage (OEH), 2017a).

The Secretary's environmental assessment requirements as they relate to biodiversity, and where in the environmental impact statement these have been addressed, are detailed in Table 19-1 of the environmental impact statement. Prior to public exhibition, the environmental impact statement and technical working papers, including the biodiversity development assessment report, the marine ecology assessment (refer to Appendix T (Technical working paper: Marine ecology)) and the freshwater ecology impact assessment (refer to Annexure D of Appendix S (Technical working paper: Biodiversity development assessment report)), were deemed adequate in meeting the Secretary's environmental assessment requirements by the Department of Planning, Industry and Environment and relevant government agencies.

With regard to the specific concerns noted above:

- Consideration of listed species and broader biodiversity in the project corridor: Database searches were carried out for an area within 10 kilometres of the construction footprint, with the likelihood of occurrence of all species within the 10 kilometre radius carried out. Further, the 'assessment area' for the study was determined by applying a buffer of 500 metres to the construction footprint in accordance with the *Biodiversity Assessment Method* (OEH, 2017a). Consideration of the assessment area (that surrounds the subject land) is required as the assessment area may contain biodiversity values that are important for informing the likely habitat suitability of the construction footprint (refer to Section 2.2 and 2.5 of Appendix S (Technical working paper: Biodiversity development assessment report) for further information)
- Consideration of feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity: Opportunities to avoid or minimise biodiversity impacts are discussed in Section 19.4 of the environmental impact statement and Section 4 of Appendix S (Technical

working paper: Biodiversity development assessment report), Section 1.4 of Annexure D Freshwater ecology impact assessment of Appendix S (Technical working paper: Biodiversity development assessment report) and Section 1.8 of Appendix T (Technical working paper: Marine ecology). Also refer to the environmental management measures contained within Table D2-1 of this submissions report

- Use of “Not applicable”: The application of the variation rules under clause 6.4 of the Biodiversity Conservation Regulation 2017 has not been requested by the project, and as such Secretary’s environmental assessment requirement 6(4) is not applicable. As such, “Not applicable” has been stated in Table 19-1 of the environmental impact statement against this item.

Referral under the *Environment Protection and Biodiversity Conservation Act 1999*

Matters of national environmental significance were considered as part of the biodiversity assessment for the project, as discussed in Section 19.5.6 of the environmental impact statement. Threatened species and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* that are known or considered highly likely to occur in the construction footprint and project area/marine biodiversity study area include:

- Magenta Lilly Pilly (*Syzygium paniculatum*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- White-bellied Sea Eagle (*Haliaeetus leucogaster*)
- Subtropical and temperate coastal saltmarsh
- *Posidonia australis* seagrass meadows of the Manning-Hawkesbury ecoregion
- Black Rockcod (*Epinephelus daemeli*)
- White’s Seahorse (*Hippocampus whitei*).

Coastal Upland Swamps in the Sydney Basin Bioregion is an additional matter of national environmental significance which does not occur within the construction footprint but may potentially be impacted by groundwater drawdown as a result of the project.

The significance of impacts on matters of national environmental significance was determined in accordance with the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (Department of the Environment, 2013). The significant impact assessments completed for the above listed threatened species and ecological communities are included in Annexure E of Appendix S (Technical working paper: Biodiversity development assessment report) and Annexure D of Appendix T (Technical working paper: Marine ecology). Where available, approved or draft State or Australian Government recovery plans and/or referral guidelines for the above listed threatened species and ecological communities were considered in determining the potential significance of impacts. Also, and in accordance with the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (Department of the Environment, 2013), mitigation measures were only considered in the significance assessments when the effectiveness of those measures is well-established and there is a high degree of certainty about the avoidance of impacts or the extent to which impacts will be reduced.

The significant impact assessments that have been completed concluded that the project would not have a significant impact on the above listed threatened species and ecological communities. As such, the project does not require referral to the Australian Government Minister for the Environment.

### C18.1.2 Adequacy of assessment

#### ***Issue***

Submitters raised concerns about the adequacy and accuracy of the biodiversity assessment. Specific queries, concerns and comments included:

- Concerns over the adequacy of the assessments, that biodiversity impacts have been understated in the environmental impact statement, and science-based evidence has not been considered
- The biodiversity assessment should be expanded to include a full risk assessment of threatened species and non-threatened species
- Concerns the biodiversity assessment is based on the previous Burnt Bridge Creek Deviation portal design from 2017
- Concern that Section 2.3 of Appendix S (Technical working paper: Biodiversity development assessment report) has not included or referenced Total Earth Care's biodiversity assessment of the Bantry Bay reservoirs for Sydney Water from 2018, which is relevant to the Wakehurst Parkway east construction support site (BL13)
- Concern that Section 2.2.1 of Appendix S (Technical working paper: Biodiversity development assessment report) states that the recently completed Northern Beaches Hospital road upgrade project overlaps with the northern extent of the project area, however, Figure 2-1 does not show this.

#### ***Response***

##### Consideration of biodiversity impacts

The biodiversity development assessment report has been prepared to meet the requirements of the Secretary's environmental assessment requirements and the *Biodiversity Assessment Method* (OEH, 2017a). The report has been certified by an accredited person under Section 6.15 of the *Biodiversity Conservation Act 2016*. Discussion on how the *Biodiversity Assessment Method* requirements have been addressed is provided in Section 1.9 of Appendix S (Technical working paper: Biodiversity development assessment report).

For impacts on biodiversity values that cannot be addressed by the *Biodiversity Assessment Method* (OEH, 2017a), ie issues related to marine and freshwater biodiversity, separate marine and freshwater ecology impact assessments have been prepared to meet the requirements of the Secretary's environmental assessment requirements, relevant Department of Primary Industries (Fisheries) guidelines and policies and *Aquatic Ecology in Environmental Impact Assessment – EIA Guideline Series* (Lincoln Smith, 2003) (refer to Appendix T (Technical working paper: Marine ecology) and Annexure D Freshwater ecology impact assessment of Appendix S (Technical working paper: Biodiversity development assessment report) respectively). These assessments were prepared by a team of suitably qualified professionals as detailed in Section 2.2 of Appendix T (Technical working paper: Marine ecology) and Section 2.1 of Annexure D Freshwater ecology impact assessment of Appendix S (Technical working paper: Biodiversity development assessment report).

Consistent with the overall approach to preparing the environmental impact statement described in Section 28.7.2 of the environmental impact statement, the biodiversity development assessment report and marine and freshwater ecology impact assessments were prepared by adopting a conservative approach, which includes an assessment of worst case impacts and scenarios, and using the best available technical and scientific literature to support the assessment findings where

required. Potential impacts were also presented before the implementation of environmental management measures.

In addition, as discussed in the response above, prior to public exhibition the environmental impact statement, including the biodiversity development assessment report and marine and freshwater ecology impact assessments, were submitted to the Department of Planning, Industry and Environment and relevant government agencies for review as to their adequacy. The review concluded that the environmental impact statement and technical working papers, including the biodiversity development assessment report and marine and freshwater ecology impact assessments, were adequate in meeting the Secretary's environmental assessment requirements.

#### Risk assessment of threatened and non-threatened species

All biodiversity assessment reports have provided a comprehensive assessment of impacts and risks to biodiversity values within and surrounding the construction footprint. While the focus of the reports has been on the assessment of threatened species in accordance with the Secretary's environmental assessment requirements, *Biodiversity Assessment Method* (OEH, 2017a) and other relevant guidelines and policies, non-threatened species are considered due to them utilising similar habitats as threatened species. As such, environmental management measures related to biodiversity and provided in Table D2-1 of this submissions report will also minimise and manage impacts to non-threatened species.

#### Connection to and from Burnt Bridge Creek Deviation

The tunnel connection to and from Burnt Bridge Creek Deviation and associated surface works was redesigned to include various enhancements in response to community and stakeholder feedback received prior to finalisation of the environmental impact statement. Potential impacts on biodiversity of the redesigned connection, as presented in Chapter 5 (Project description) of the environmental impact statement, were assessed within Appendix S (Technical working paper: Biodiversity development assessment report).

The construction footprint associated with the redesigned connection to and from Burnt Bridge Creek Deviation, as shown in Figure 2-1 of Appendix S (Technical working paper: Biodiversity development assessment report), is also consistent with the construction footprint as shown on Figure 6-27 of the environmental impact statement.

As field surveys for the project commenced in May 2016, it is noted that some surveys did occur outside of the construction footprint as shown on figures within Section 2 of Appendix S (Technical working paper: Biodiversity development assessment report) which may be perceived as assessing the previous preferred design for the connection to and from Burnt Bridge Creek Deviation. These areas were included due to the need to survey within the assessment area as described in Section 2.2.2 of Appendix S (Technical working paper: Biodiversity development assessment report) and to identify preliminary constraints to assist in design development and evaluation of the Balgowlah connection alternatives, as described in Section 4.5.5 of the environmental impact statement. Notwithstanding the inclusion of these additional areas, the biodiversity assessment assessed the design as presented in Chapter 5 (Project description) of the environmental impact statement, with the study area including a buffer of 500 metres around the construction footprint, as required by the *Biodiversity Assessment Method* (OEH, 2017a).

#### Consideration of Total Earth Care's biodiversity assessment

The *Biodiversity Assessment – Bantry Bay Reservoirs* (Total Earth Care, 2018) was prepared for Sydney Water. Transport for NSW sourced this document from Sydney Water in June 2019 to assist with preparing for targeted surveys and assessment of Large-eared Pied Bat as outlined within

Appendix S (Technical working paper: Biodiversity development assessment report). The document was reviewed for further detail on the Large-eared Pied Bat calls recorded over the 16 night survey period in May 2018. The review of the document did not provide further information to assist in the targeted surveys.

It should be noted that extensive field surveys carried out for the project included Wakehurst Parkway east construction support site (BL13) and surrounding land, including:

- *Biodiversity Assessment Method* (OEH, 2017a) vegetation integrity plots and vegetation condition transects – refer to Figure 2-3 (map d) of Appendix S (Technical working paper: Biodiversity development assessment report)
- Fauna surveys (eg trapping, hair tubes and remote motion sensing cameras) – refer to Figure 2-4 (map e) of Appendix S (Technical working paper: Biodiversity development assessment report)
- Targeted surveys for Large-eared Pied Bat (eg active and passive anabat surveys, trapping and roost habitat searches) – Figure 2-5 of Appendix S (Technical working paper: Biodiversity development assessment report).

#### Northern Beaches Hospital road upgrade project overlap

Figure 2-1 of Appendix S (Technical working paper: Biodiversity development assessment report) is a small-scale overview of the subject land (ie construction footprint) and assessment area for the project. In accordance with the *Biodiversity Assessment Method* (OEH, 2017a), other features on Figure 2-1 include the relevant Interim Biogeographically Regionalisation of Australia (IBRA) subregion, local government areas, rivers and streams classified according to stream order (Strahler, 1952) and native vegetation cover.

The area of overlap between the project and Northern Beaches Hospital road upgrade project as described in Section 2.2.1 of Appendix S (Technical working paper: Biodiversity development assessment report) is provided in subsequent larger scale figures within the report and is denoted as 'Area not assessed by the BDAR' in figure legends. In addition, the overlap is also included in relevant figures within Chapter 19 (Biodiversity) of the environmental impact statement, eg Figure 19-5 and Figure 19-11.

### **C18.1.3 Adequacy of methodology and surveys**

#### ***Issue***

Submitters raised concerns and comments about the adequacy of the methodology and surveys carried out for the biodiversity assessment and reporting of results, including:

- Concern that the desktop studies and 'walk-throughs' were inadequate to inform the biodiversity assessment
- Concern that no fauna surveys were carried out at Balgowlah Golf Course as it provides fauna habitat including the dam which is known for sightings of the endangered Grey-headed Flying-fox. There are also caves and sandstone overhanging outcrops within the golf course that may provide habitat for threatened fauna including microbats.
- Concern that the inventory of fauna species recorded during field investigations is in a separate unpublished report
- Concern that biodiversity impacts at Aquatic Reserve at Frenchs Forest, Queenscliff Beach/Manly Beach and Clive Park at Northbridge have not been considered
- Concern that the biodiversity assessment does not consider biodiversity impacts from a regional perspective

- Request that the biodiversity assessment be expanded to include checks for tree hollows.

### **Response**

#### Adequacy of desktop studies and fauna surveys

The purpose of the background reviews and determination of candidate species (ie desktop studies) was to inform the field survey methodology and extents, and describe the landscape features in accordance with the *Biodiversity Assessment Method* (OEH, 2017a) as documented within Appendix S (Technical working paper: Biodiversity development assessment report).

The field survey methodology used for the project is detailed in Section 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report) and includes vegetation surveys (Section 2.6.1) and targeted threatened species surveys (Section 2.6.2). Field surveys have followed State and/or Australian Government survey guidelines as listed in Section 2.3 of Appendix S (Technical working paper: Biodiversity development assessment report) as required and were carried out by a by a team of suitably qualified professionals as detailed in Section 2.8 of Appendix S (Technical working paper: Biodiversity development assessment report).

Fauna surveys carried out for the biodiversity assessment are described in Section 2.6.2.2 and threatened species survey locations shown on Figure 2-4 of Appendix S (Technical working paper: Biodiversity development assessment report). The field survey methodology used for biodiversity assessment and extent was initially developed by a background review of relevant information to provide an understanding of ecological values occurring or potentially occurring within the construction footprint and wider region. Reports, vegetation maps, topographic maps, aerial photography and published literature were included in this review (refer to Section 2.4.1 of Appendix S (Technical working paper: Biodiversity development assessment report)). The background review was then supplemented with database searches (including the BioNet Atlas of NSW Wildlife, *Environment Protection and Biodiversity Conservation Act 1999* Protected Matters Search Tool and the Species Profile and Threats Database) and review of the *Biodiversity Assessment Method* (OEH, 2017a) credit calculator to determine candidate species and subsequent confirmation of field survey methodology and extents (refer to sections 2.5 and 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report)).

Both the background reviews and field surveys are key aspects of the overall biodiversity development assessment report which has been prepared to meet the requirements of the Secretary's environmental assessment requirements and the *Biodiversity Assessment Method* (OEH, 2017a). As noted in Section C18.1.1, prior to public exhibition the environmental impact statement and technical working papers, including the biodiversity development assessment report were deemed adequate in meeting the Secretary's environmental assessment requirements by the Department of Planning, Industry and Environment and relevant government agencies.

#### Fauna surveys at Balgowlah Golf Course

Fauna surveys carried out for the biodiversity assessment are described in Section 2.6.2.2 and threatened species survey locations at Balgowlah Golf Course and surrounding land shown on Figure 2-4 (map c) of Appendix S (Technical working paper: Biodiversity development assessment report). The methodology and purpose of the desktop studies and fauna surveys are discussed above.

Due to limited identified ecological value for the whole Balgowlah Golf Course site and presence of highly modified urban exotic/native vegetation, fauna surveys were limited to the riparian corridor of Burnt Bridge Creek (as indicated by Table 2.2 and shown on Figure 2-4 (map c) of Appendix S (Technical working paper: Biodiversity development assessment report)). However, any opportunistic fauna sightings were recorded as described in Section 2.6.2.2.12 of Appendix S



(Technical working paper: Biodiversity development assessment report). Balgowlah Golf Course was identified as potentially offering foraging, nesting and roosting habitat to bats, birds and arboreal mammals, including Grey-headed Flying-fox in Section 3.7.1 of Appendix S (Technical working paper: Biodiversity development assessment report).

The final layout of the new and improved open space and recreational facilities at Balgowlah is subject to a dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council as stated in Section 5.2.13 of the environmental impact statement. As such, the final extent of disturbance and tree removal is not known at this stage. However, pre-clearing surveys for threatened and non-threatened fauna species will be carried out prior to clearing activities, and will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (Roads and Traffic Authority (RTA), 2011a) (refer to revised environmental management measures B14 and environmental management measure B23 in Table D2-1 of this submissions report). This will ensure any potential habitat features that will be disturbed will be checked to minimise the impact on native fauna.

For further discussion on the potential for Balgowlah Golf Course stormwater harvesting dam to provide fauna/foraging habitat, refer to Section B4.23 of this submissions report.

#### Inventory of fauna species

All fauna species recorded during all field investigations carried out for the project by WSP and Arcadis are included in Annexure C of Appendix S (Technical working paper: Biodiversity development assessment report), which formed part of the environmental impact statement documentation.

It was incorrectly stated in Section 2.6.2.2.12 of Appendix S (Technical working paper: Biodiversity development assessment report) that Annexure C only included species recorded by Arcadis and species recorded by WSP were included in *Harbourlink Terrestrial Biodiversity Survey Report* (WSP, 2018) (unpublished). As such, a clarification is included in Table A5-13 of this submissions report.

#### Consideration of Aquatic Reserve, Queenscliff Beach/Manly Beach and Clive Park

Aquatic Reserve at Frenchs Forest and Clive Park at Northbridge are within the assessment area as described in Section 2.2.2 of Appendix S (Technical working paper: Biodiversity development assessment report). However, they are located outside of the construction footprint and would not be directly impacted by the project. Additionally, Aquatic Reserve is located beyond the area investigated for indirect impacts as discussed in Section 5.2 and shown in Figure 5-2 (map b) of Appendix S (Technical working paper: Biodiversity development assessment report). As such, biodiversity impacts have not been documented for these two areas and their associated biodiversity values are not anticipated to be impacted by the project.

Queenscliff Beach/Manly Beach are located well beyond the extents of anticipated terrestrial and marine biodiversity impacts for the project.

#### Biodiversity impacts from a regional perspective

Consideration of the potential biodiversity impacts from the project from a regional perspective has been carried out and documented in Appendix S (Technical working paper: Biodiversity development assessment report) in accordance with the *Biodiversity Assessment Method* (OEH, 2017a). The regions considered include the Sydney Basin Bioregion and the Pittwater Subregion as classified under Interim Biogeographic Regionalisation for Australia (IBRA).

In accordance with the *Biodiversity Assessment Method* (OEH, 2017a), the project was required to identify and assess impacts which are potentially serious and irreversible. The *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH, 2017b) identifies threatened species and ecological communities as most at risk of serious and irreversible impacts, as described in Section 5.3 of Appendix S (Technical working paper: Biodiversity development assessment report).

Duffys Forest endangered ecological community and three threatened microbat species at risk of a serious and irreversible impact were recorded in the construction footprint and were assessed in Section 5.3 of Appendix S (Technical working paper: Biodiversity development assessment report). Only potential impacts to Duffys Forest endangered ecological community were subject to assessment at a regional scale. As part of the assessment of serious and irreversible impact on Duffys Forest endangered ecological community in Section 5.3.1 of Appendix S (Technical working paper: Biodiversity development assessment report), consideration of the project's impact within the Sydney Basin IBRA Bioregion and the Pittwater IBRA Subregion was carried out.

In addition, following consideration of issues raised by Department of Planning, Industry and Environment (Environment, Energy and Science Group) in their submission on the environmental impact statement, a revised serious and irreversible impact assessment for Duffys Forest endangered ecological community has been prepared for the project and is summarised in Section B4.2.2, and included in full in Appendix F1, of this submissions report.

The revised serious and irreversible impact assessment also considers the design refinement associated with the realignment of the Wakehurst Parkway shared user bridge ramps which has reduced impacts to Duffys Forest endangered ecological community by 0.17 hectares (refer to Section A4.3 of this submissions report for details on this refinement). The revised serious and irreversible impact assessment concluded the following:

- There is 28.92 hectares of Duffys Forest endangered ecological community mapped within an area of 1000 hectares surrounding the subject land (compared with 30.72 hectares identified in Appendix S (Technical working paper: Biodiversity development assessment report))
- There is 59.31 hectares of Duffys Forest endangered ecological community mapped within an area of 10,000 hectares surrounding the subject land (compared with 63.61 hectares identified in Appendix S (Technical working paper: Biodiversity development assessment report))
- There is 359.63 hectares of Duffys Forest endangered ecological community mapped within the Pittwater IBRA subregion (compared with the 386.35 hectares identified in Appendix S (Technical working paper: Biodiversity development assessment report)). Together with the 1.21 hectares of Duffys Forest mapped in the subject land, a total of 360.84 hectares of the endangered ecological community has been identified in the Pittwater IBRA subregion. Given that the Duffys Forest endangered ecological community only occurs within the Pittwater IBRA subregion, this figure also represents the total area of Duffys Forest endangered ecological community remaining in NSW
- The removal of 1.21 hectares of Duffys Forest endangered ecological community represents a reduction of 0.34 per cent of the area of the endangered ecological community in the Pittwater IBRA subregion. Following the removal of 1.21 hectares of Duffys Forest endangered ecological community for the project, the total area remaining would be 359.63 hectares
- Of the total of 359.63 hectares of Duffys Forest endangered ecological community mapped within the Pittwater IBRA subregion, 155.04 hectares (43 per cent) is located within Garigal and Ku-ring-gai National Parks.

Also refer to Section A5.1.18 and Appendix F4 of this submission report for a Biodiversity development assessment report roadmap developed to aid stakeholders in understanding updates

to the biodiversity assessment which have occurred since the exhibition of the environmental impact statement.

### Hollow-bearing trees

The presence of hollows was one of the site attributes recorded during vegetation surveys for the project as described in Section 2.6.1 of Appendix S (Technical working paper: Biodiversity development assessment report).

Three hollow-bearing trees were identified during field surveys, as described in Section 19.3.2 of the environmental impact statement. All three were located in proximity to the Wakehurst Parkway. Two are located within the construction footprint and one outside. Pre-clearing surveys will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) in accordance with environmental management measure B16 and revised environmental management measure B14 (refer to Table D2-1 of this submissions report). This will include inspections of hollows and dead timber.

## **C18.1.4 Adequacy of environmental management measures**

### ***Issue raised***

Submitters raised concerns about the adequacy and scope of the biodiversity environmental management measures proposed for the project, including:

- Concerns that the biodiversity environmental management measures lack detail, are inadequate, not guaranteed to occur and that terms like ‘feasible and reasonable’ are subjective
- Concern that design measures required to minimise biodiversity impacts are not detailed in the environmental impact statement.

### ***Response***

#### Detail and robustness of environmental management measures

Appropriate biodiversity environmental management measures are included in Table D2-1 of this submissions report, which have been developed following a detailed assessment of the project and potential construction and operational impacts. Some of the management measures 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 detailed technical biodiversity studies carried out for the project by a team of suitably qualified professionals.

The environmental management measures will minimise adverse biodiversity impacts during construction and operation of the project as far as is practicable. Environmental management measures have been developed with the aim to ensure the best possible biodiversity outcomes are achieved, will adhere to industry standards and guidelines and will meet the relevant legislative requirements. The approach to environmental management would continue to be refined and made more specific as both the design and construction methods are defined in more detail.

Where relevant, the biodiversity environmental management measures have referred to best management practice guidelines and procedures to avoid needing to provide overly detailed management measures. A best management practice guideline frequently referenced is Transport for NSW’s *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a). The *Biodiversity Guidelines* provide a suite of individual guides for managing specific aspects of biodiversity and were developed in consultation with government agencies and biodiversity specialists. It is the intent that where the *Biodiversity Guidelines* are referenced, the

relevant guide would be implemented in full. A copy of the guidelines is provided at: [roads-waterways.transport.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/biodiversity\\_guidelines.pdf](https://roads-waterways.transport.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/biodiversity_guidelines.pdf)

If the project is approved, the NSW Minister for Planning and Public Spaces would issue conditions of approval for the management of key issues. These would need to be adhered to by both Transport for NSW and the contractor/s, in addition to the environmental management measures provided in Table D2-1 of this submissions report. The methodologies and protocols to be implemented in order to comply with these requirements would be documented in a construction environmental management plan and relevant sub-plans (eg a flora and fauna management plan as described in Section D1 of this submissions report), which would be approved by the Secretary of Department of Planning, Industry and Environment prior to construction commencing.

The use of 'reasonable and feasible' is a widely accepted term that is appropriate in respect to environmental management measures. Notwithstanding, Transport for NSW have carried out a review of the environmental management measures provided in the environmental impact statement to minimise the use of the 'reasonable and feasible' (refer to Table D2-1 of this submissions report for revised environmental management measures). Given the current stage of design development, these terms also allow for design refinement and mitigation during further design development and delivery stages.

#### Design measures to minimise biodiversity impacts

The project has been designed to avoid or minimise environmental impacts as detailed in Chapter 4 (Project development and alternatives) and Chapter 19 (Biodiversity) of the environmental impact statement. During project development, a number of elements have been included to avoid and/or minimise impacts on biodiversity during construction and operation of the project, including:

- The Flat Rock Drive construction support site (BL2) was chosen to be located in an area of Flat Rock Reserve which was previously used as a landfill site until 1985. This area contains mostly native revegetation, avoiding impact to surrounding remnant vegetation. Refer to Section 3 of Appendix S (Technical working paper: Biodiversity development assessment report) for further details
- The preferred design for the connection to and from the Burnt Bridge Creek Deviation and surface road works at Balgowlah have reduced impacts to Burnt Bridge Creek to the east and west of Burnt Bridge Creek Deviation, including potentially reduced impact on mature trees in the golf course, compared to other options. Furthermore, direct impact of the Burnt Bridge Creek riparian corridor has been reduced by establishing an exclusion zone around riparian native vegetation adjoining the creek
- The preferred design for the connection to Sydney Road from the Burnt Bridge Creek Deviation avoids the need to demolish and replace the Kitchener Street bridge which reduces potential noise impacts and duration of impacts to the Grey-headed Flying-fox camp at Balgowlah compared to other options
- Impacts to the Duffys Forest endangered ecological community have been avoided as far as possible by optimising the location of the tunnel portals and permanent tunnel support facilities
- Tunnelling has largely avoided impacts to areas supporting groundwater dependent ecosystems, apart from some vegetation at Flat Rock Creek/Quarry Creek that would be subject to potential water table drawdown impacts
- The project design and construction works have been developed to largely avoid direct impacts to seagrass and other sensitive marine habitat areas in Middle Harbour

- The construction methodology for the crossing of Middle Harbour and immersed tube tunnel alignment have been designed to reduce the construction footprint (reducing the volume of dredging required by about 75 per cent compared to an equivalent fully trenched immersed tube tunnel) and avoid dredging of the sandbar at the entrance to Middle Harbour or dredging in the vicinity of the Spit West Reserve construction support site (BL9). The sandbar is considered one of the more sensitive marine habitat areas within Middle Harbour.

In addition to the above, since the exhibition of the environmental impact statement, Transport for NSW has refined the design of the ramps for the new shared user bridge at the northern end of the upgraded and realigned Wakehurst Parkway as outlined in Section A4.3 of this submissions report. The design refinement would improve connectivity and has reduced the area of Duffys Forest endangered ecological community that would be impacted by the project from 1.38 hectares to 1.21 hectares.

Further to the above, key environmental design measures that would be provided as part of the Beaches Link component of the project are summarised in Table 5-10 of the environmental impact statement with the environmental design measures forming part of the Gore Hill Freeway Connection component of the project being provided in Table 5-14 of the environmental impact statement. The main biodiversity design measures include:

- Fauna underpasses, fauna rope crossings, and fauna fencing along Wakehurst Parkway – to minimise and manage impacts to fauna connectivity (refer to Section C18.5 below). Further refinement has occurred to optimise fauna underpasses since the exhibition of the environmental impact statement as detailed in Section A4.4 of this submissions report. Further refinement would continue during further design development in accordance with revised environmental management measures B2 and B3 (refer to Table D2-1 of this submissions report)
- Operational water quality controls (eg swales and basins) – to minimise potential water quality impacts terrestrial and aquatic species and their habitat such as Red-crowned Toadlet (*Pseudophryne australis*) habitat and Climbing Galaxias (*Galaxias brevipinnis*). Operational water quality controls will continue to be refined during further design development in accordance with environmental management measures WQ2, WQ5 and WQ6 (refer to Table D2-1 of this submissions report).

Environmental management measures have been included in Table D2-1 of this submissions report where further design investigation or construction planning is required to confirm the type and extent of design which would minimise potential biodiversity impacts. Key biodiversity environmental management measures which outline further design development requirements include, but are not limited to (refer to Table D2-1 of this submissions report):

- Following completion of environmental management measure SG2, a focused study will be carried out in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science Group) to confirm potential groundwater drawdown and associated baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek due to tunnelling, and confirm potential impacts on freshwater ecology in the affected watercourses and nearby groundwater dependent ecosystems. Where ecological impacts are predicted to be worse than that presented as part of the environmental impact statement/submissions report, feasible and reasonable mitigation measures to address the impacts will be identified in consultation with a suitably qualified and experienced specialist, incorporated into the detailed design, and implemented during construction. The mitigation measures considered will include tunnel linings (refer to revised environmental management measure SG6)
- Permanent waterway crossings and instream drainage infrastructure will be designed in accordance with *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003) to ensure fish passage is maintained along the

waterway during low flows, where reasonable and feasible (refer to new environmental management measure B40)

- The localised adjustment of Burnt Bridge Creek will be designed with consideration of existing channel conditions and an understanding of existing hydrology to minimise alterations to, and erosion of, the bed and banks. The gradient, sinuosity and channel capacity will be consistent with upstream and downstream sections. The extension to the existing culvert will be designed with a low gradient and scour protection to minimise impacts to geomorphology. Where required, the adjustment will include grade controls and bank stabilisation works to manage anticipated high velocity conditions (refer to revised environmental management measure WQ4).

The use of environmental management measures to further develop the design to manage environmental impacts is appropriate given the current stage of design development.

## **C18.2 Terrestrial flora and ecological communities**

### **C18.2.1 Impacts to vegetation communities and non-threatened flora**

#### ***Issue raised***

Submitters raised concerns about impacts to native vegetation and non-threatened flora due to the project, including:

- Concerns over the removal of native vegetation and non-threatened flora within the construction footprint, including at the Cammeray Golf Course (BL1), Flat Rock Drive (BL2), Balgowlah Golf Course (BL10) and Wakehurst Parkway east (BL13) construction support sites, adjacent to Wakehurst Parkway and adjacent to Burnt Bridge Creek
- Requests for a condition of approval to ensure significant and environmentally sensitive vegetation is be retained at the Wakehurst Parkway south construction support site (BL12) and that the whole site is not cleared without a genuine attempt being made to retain significant and environmentally sensitive vegetation
- Concern over impacts on vegetation (in particular native vegetation) adjacent to the construction footprint
- Request for conditions of approval requiring that areas in Manly Warringah War Memorial State Park inhabited by endangered or threatened species to not be cleared
- Concern that the partial lining of Burnt Bridge Creek will impact on surrounding vegetation.

#### ***Response***

##### **Removal of native vegetation and non-threatened flora**

Construction of the project would require the removal of about 15.27 hectares of native vegetation and native revegetation. Due to design refinements carried out in relation to the realignment of the Wakehurst Parkway shared user bridge ramps since exhibition of the environmental impact statement (refer to Section A4.3 of this submissions report), removal of native vegetation as a result of the project has decreased from 15.44 hectares outlined in Section 19.5.1 of the environmental impact statement to 15.27 hectares. The native vegetation impacted by the project includes native vegetation from six plant community types (PCT) (refer to Section B4.4 and Appendix F4 of this submissions report regarding reclassification of PCT 1292 to PCT 1250). Vegetation that would be removed is primarily located adjacent to the Wakehurst Parkway, and within Flat Rock Drive (BL2), Balgowlah Golf Course (BL10), Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites as noted in Section 5.1.3 of Appendix S (Technical working paper: Biodiversity development assessment report).

The project design development process has considered a number of opportunities to avoid or minimise biodiversity impacts through selection of the preferred corridor, refinement of the preferred corridor design and development of construction methodology as described in Section 19.4 of the environmental impact statement. For example, with respect to Wakehurst Parkway, several tunnel portal location options were considered, as outlined in Section 4.5.4 of the environmental impact statement. Of the three portal location options considered (shown in Figure 4-21 of the environmental impact statement), the selected option ('option B') was chosen due to a range of benefits related to connectivity and network performance, constructability and design, community and environment, and economic factors (detailed in Table 4-6 of the environmental impact statement). This included that the portal location option B reduced the potential impact on Duffys Forest endangered ecological community compared to portal location option A. Wakehurst Parkway east construction support site (BL13) was selected based on the tunnel portal location chosen, as described above, in addition to further community consultation (refer to Section 4.5.7 of the environmental impact statement).

Further detail on how the project design and construction methodology has been developed to avoid and minimise impacts on biodiversity is provided in Table 4-1 of Appendix S (Technical working paper: Biodiversity development assessment report).

Factors that were considered in locating the temporary construction support sites are described in Section 4.5.7 of the environmental impact statement. The primary drivers for locating temporary construction support sites included the objective to minimise environmental and community impacts whilst also being suitably located to facilitate construction of the project.

Environmental management measures have been proposed to minimise and/or manage impacts to native vegetation, including revised environmental management measure B6 (refer to Table D2-1 of this submissions report), which will seek to minimise the extent of native vegetation clearing during further design development and construction planning, to the extent reasonably practicable. Other environmental management measures (including new and revised measures) which commit to minimising or managing impacts of vegetation removal include B10 to B16, B22, B23, B41, B43, V9 and V10 (refer to Table D2-1 of this submissions report for the full wording of these environmental management measures). These measures would be supported by the implementation of a flora and fauna management plan as part of the construction environmental management plan as described in Section D1 of this submissions report.

Table C18-1 provides a summary of design initiatives, construction initiatives, and site-specific environment management measures which would minimise vegetation removal with regard to Flat Rock Drive construction support site (BL2) and adjacent to Burnt Bridge Creek specifically.

**Table C18-1 Minimising vegetation removal at Flat Rock Drive construction support site (BL2) and adjacent Burnt Bridge Creek**

| Location  | Initiative/environment management measure(s)   |
|---|--|
| Flat Rock Drive construction support site (BL2) | <p>The majority of the native vegetation that would be impacted at the Flat Rock Drive construction support site (BL2) consists of vegetation that has been planted over the last 20 years as part of the progressive rehabilitation of a former landfill site (refer to Section 3.4.1.1 of Appendix S (Technical working paper: Biodiversity development assessment report)). The temporary construction support site has largely avoided impacting the remnant vegetation and the southern part of the site also includes a large area of cleared, mown exotic grassland.</p> <p>Refinement of the Flat Rock Drive construction support site (BL2) layout during further design development and construction planning will also be carried out to avoid direct impacts on PCT 1841: Coastal Enriched Sandstone Moist Forest,</p> |

| Location           | Initiative/environment management measure(s)  |
|--------------------|---|
|                    | where feasible and reasonable in accordance with environmental management measure B1 (refer to Table D2-1 of this submissions report).  |
| Burnt Bridge Creek | <p>The tunnel connection to and from Burnt Bridge Creek Deviation and associated surface works was redesigned to include for various enhancements in response to community and stakeholder feedback received prior to finalisation of the environmental impact statement. A key enhancement was relocating the tunnel portal further to the south so as to significantly reduce the impacted area of the creek required by staged road upgrade works on Burnt Bridge Creek Deviation.</p> <p>To further reduce impacts on native vegetation, an exclusion zone would be established around riparian vegetation adjoining Burnt Bridge Creek adjacent to the surface road works at Balgowlah, where reasonable and feasible. The exclusion zone would be about 0.90 hectares in area and would contain 0.48 hectares of PCT 1292: Water Gum - Coachwood riparian scrub along sandstone streams, Sydney Basin Bioregion and 0.42 hectares of PCT 1841: Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region. The exclusion zone boundary would be formalised during further construction planning and design development prior to construction commencement.</p> |

The removal of vegetation at Cammeray Golf Course construction support site (BL1) has been assessed and mitigated as part of the environmental impact statement prepared for the Western Harbour Tunnel and Warringah Freeway Upgrade project in 2020 as detailed in Section 19.3.1 of the environmental impact statement. As such, consideration of vegetation within the overlap is not included in the assessment of the Beaches Link and Gore Freeway Connection project.

While no specific design and/or construction initiatives or site-specific environment management measures are provided for the Balgowlah Golf Course construction support site (BL10), Wakehurst Parkway east construction support site (BL13) or Wakehurst Parkway, the general biodiversity management measures described above would apply to minimise the removal of native vegetation where possible. It should be noted that vegetation within Balgowlah Golf Course construction support site (BL10) is mapped as urban exotic/native within Figure 19-3 of the environmental impact statement and generally contains planted native and exotic horticultural specimens or isolated remnant trees within otherwise planted and highly modified areas. The project has identified this residual land at Balgowlah to be re-purposed as new and improved open space and recreation facilities for the community. The final form of this site will be determined through a dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report).

Where vegetation impacts cannot be avoided, offsetting in accordance with the requirements of the NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016*, would be followed. Refer to Section 19.6.1 of the environmental impact statement and Section C18.10 of this submissions report for further details.

Where mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme) are removed as a result of the establishment of construction support sites, they will be replaced at a ratio of 2:1 in accordance with revised environmental management measure V13 (refer to Table D2-1 of this submissions report). Vegetation will be re-established within the construction footprint, where feasible, in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), in accordance with environmental management measure B13 (refer to Table D2-1 of this submissions report).



### Minimising vegetation impacts at Wakehurst Parkway south construction support site (BL12)

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

Section 4.5.7 of the environmental impact statement describes the factors that were considered in locating of the temporary construction support sites. The primary drivers for locating temporary construction support sites included the objective to minimise environmental and community and impacts whilst also being suitably located to facilitate construction of the project. The key factors considered included:

- Locating the temporary construction support sites as close as possible to project construction areas
- Avoiding sensitive environments and community locations where possible
- Avoiding material impacts on heritage sites or items
- Maximising opportunities for direct access to motorways and arterial roads or water transport opportunities for construction traffic, and avoiding the need to use local residential streets if possible
- Minimising direct and indirect property impacts and acquisition requirements, particularly in residential areas.

Wakehurst Parkway south construction support site (BL12) provides an important function in supporting the upgrade of Wakehurst Parkway and also the construction of the cut and cover tunnel and trough and motorway facilities at Wakehurst Parkway. It should be noted that the Wakehurst Parkway south construction support site (BL12) is also located on land owned by Transport for NSW to minimise residential property impacts and impacts to surrounding bushland (as discussed in Chapter 20 (Land use and property) of the environmental impact statement).

While the establishment and operation of this temporary construction support site potentially impacts biodiversity values, a number of environmental management measures have been proposed, to minimise and manage impacts to biodiversity including threatened species and communities, including revised environmental management measure B6, which will seek to minimise the extent of native vegetation clearing during further design development and construction planning, to the extent reasonably practicable. Other environmental management measures (including new and revised measures) which commit to minimising impacts of vegetation removal include B10 to B14, B16, B22, B23, B43 and B45 (refer to Table D2-1 of this submissions report for the full wording of these environmental management measures). These measures would be supported by the implementation of a flora and fauna management plan as described in Section D1 of this submissions report.

### Impacts to native vegetation adjacent to the construction footprint

The project would result in indirect impacts to some areas of native vegetation adjoining the construction footprint as described in Section 19.5.1 of the environmental impact statement, mainly due to fragmentation of vegetation and creation of new edges, which may result in edge effects and could affect fauna habitat adjoining the construction footprint. However, with the exception of Wakehurst Parkway, most of the construction footprint adjoins small, fragmented areas of vegetation within urban areas. This vegetation is often already situated adjacent to an existing cleared edge, such as a road, and is subject to ongoing disturbance and edge effects.

New edges would be created in native vegetation adjacent to the widened Wakehurst Parkway, introducing edge effects into new areas. The extent of the existing edge effects in native vegetation adjoining the Wakehurst Parkway was assessed in Section 5.5.2 of Appendix S (Technical working

paper: Biodiversity development assessment report). This assessment found that edge impacts such as increased weed cover and reduced native ground and shrub cover are largely limited to the area within 20 metres of the Wakehurst Parkway road edge.

A number of environmental management measures (refer to Table D2-1 of this submissions report) will be implemented to minimise potential edge impacts from the project, including re-establishment of vegetation within the construction footprint where feasible (environmental management measure B13), and weed and pathogen management (environmental management measures B25 and revised environmental management measure B26). The re-establishment of vegetation will be supported by the implementation of the urban design and landscape plan as required by environmental management measure V1 (refer to Table D2-1 of this submissions report).

In addition, offsets for indirect impacts such as new edge impacts, have been considered for the project as discussed in Section 19.6.1 of the environmental impact statement. Offset for indirect impacts are in addition to *Biodiversity Assessment Method* (OEH, 2017a) credit obligations and are at the discretion of the NSW Minister for Planning and Public Spaces (NSW DPIE, 2019a). As a result of the design refinement associated with the design of the ramps for the new shared user bridge at the northern end of the upgraded and realigned Wakehurst Parkway (refer to Section A4.3 of this submissions report) and in response to issues raised by the Department of Planning, Industry and Environment (Environment, Energy and Science Group) on the environmental impact statement, a revised biodiversity credit calculation has been carried out for the project (refer to Appendix F2 of this submissions report). As such, the potential required ecosystem credits for indirect impacts from the project is 45 ecosystem credits (reduced from the 50 ecosystem credits reported in the environmental impact statement).

Also refer to Section A5.1.18 and Appendix F4 of this submission report for a Biodiversity development assessment report roadmap developed to aid stakeholders in understanding updates to the biodiversity assessment which have occurred since the exhibition of the environmental impact statement.

#### Impacts to vegetation due to Burnt Bridge Creek works

The indicative extent of the localised adjustment and drainage works at Burnt Bridge Creek is provided in Figure 6-5 of the Appendix O (Technical working paper: Surface water quality and hydrology). The works include extension of the existing box culvert crossing of Burnt Bridge Creek Deviation and inclusion of scour protection at the outlet of the extended culvert.

The design and extent of the scour protection would be subject to further design development. However, it is unlikely to require an impermeable lining which would prevent infiltration. As such, it is unlikely that any remaining existing vegetation or restored vegetation would be impacted by the area required for the localised adjustment and drainage works.

A small area of riparian vegetation would be removed for the localised adjustment and drainage works at Burnt Bridge Creek, as discussed in Section 19.5.3 of the environmental impact statement. Riparian vegetation directly affected would be restored where practicable in accordance with *Guide 3: Reestablishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), in accordance with revised environmental management measure B13 (refer to Table D2-1 of this submissions report), and in accordance with the urban design and landscape plan developed for the project in accordance with environmental management measure V1 (refer to Table D2-1 of this submissions report).

## C18.2.2 Impacts to threatened flora

### ***Issue raised***

Submitters raised concerns about impacts to threatened flora due to the project, including:

- Concern over the loss of threatened flora species from within the construction footprint, specifically in relation to Flat Rock Drive construction support site (BL2), along Wakehurst Parkway, at Wakehurst Parkway east construction support site (BL13), and adjacent to Burnt Bridge Creek
- Concern regarding impacts to:
  - Magenta Lilly Pilly
  - Seaforth Mint Bush (*Prostanthera marifolia*)
  - *Pimelea curviflora* var. *curviflora*, *Tetradlea glandulosa* and Angus's Onion Orchid (*Microtis angusii*)
- Concern that Wollemi Pine (*Wollemia nobilis*) at Balgowlah Golf Course have not been considered.

### ***Response***

#### Loss of threatened flora species from within the construction footprint

The biodiversity assessment indicates that the project would not result in significant impacts to threatened flora species. Five threatened flora species were identified within or adjacent to the construction footprint, as discussed in Section 19.3.1 of the environmental impact statement (refer to figures 19-6 to 19-11 of the environmental impact statement). Of these species, two which are known to occur within the construction footprint (Magenta Lilly Pilly and Netted Bottle Brush (*Callistemon linearifolius*)), were assessed as being potentially impacted by the project. Four Magenta Lilly Pilly and four Netted Bottle Brush are assumed to be planted individuals, whilst one Magenta Lilly Pilly is assumed to be a remnant individual. The planted individuals are located on the north-western edge of the exclusion zone to be established along Burnt Bridge Creek, whilst the remnant individual is located along the Wakehurst Parkway. Refer to the response below for further details on the Magenta Lilly Pilly, including specific environmental management measures to manage impacts.

While the biodiversity assessment indicates that the project would not result in significant impacts to threatened flora species, Transport for NSW is committed to further minimising the removal of vegetation, including clearing of native vegetation and fauna habitat, during further design development and construction planning to the extent reasonably practicable, as required by revised environmental management measure B6 (refer to Table D2-1 of this submissions report).

Environmental management measure B16 (refer to Table D2-1 of this submissions report) requires pre-clearing surveys for threatened flora species to be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a). This guide requires the use of qualified ecologists to conduct flora searches as part of the pre-clearing process. In addition, 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 B12 (refer to Table D2-1 of this submissions report).

The above environmental management measures will also be supported by biodiversity awareness training which will be provided for contractors prior to commencement of construction works in

accordance with new environmental management measure B43 (refer to Table D2-1 of this submissions report). This is to ensure an understanding of potential threatened species, populations and ecological communities that may be impacted during the project, and the environmental management measures proposed to minimise and/or manage potential impacts including the contractor's responsibilities under the unexpected species find procedure included in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a).

These measures would be supported by the implementation of a flora and fauna management plan as part of the construction environmental management plan, as described in Section D1 of this submissions report.

### Magenta Lilly Pilly

As discussed above, four planted and one remnant individual of Magenta Lilly Pilly would potentially be impacted by the project. With regard to the one remnant Magenta Lilly Pilly, the individual is mapped at the edge of the construction footprint, and therefore has been conservatively assessed to be within the construction footprint for the purpose of the assessment. As such, prior to clearing along Wakehurst Parkway, its location will be confirmed in accordance with environmental management measure B15 (refer to Table D2-1 of this submissions report). If the individual is outside the construction footprint, but in close proximity to the boundary, the need for a site-specific exclusion zone will be investigated to minimise potential indirect impacts. Should the individual be within the construction footprint, further design investigation will be carried out to determine if impacts can be avoided where reasonable and feasible.

Two Magenta Lilly Pilly individuals were also recorded about 18 metres to the east of the Flat Rock Drive construction support site (BL2) construction footprint. However, none were identified within the construction footprint. Similarly, no threatened flora species were identified within the Wakehurst Parkway east construction support site (BL13).

The biodiversity environmental management measures (including new and revised measures) outlined above will also minimise and/or manage potential impacts to Magenta Lilly Pilly, including B6, B12, B16 and B43 (refer to Table D2-1 of this submissions report for full wording). These measures would be supported by the implementation of a flora and fauna management plan as part of the construction environmental management plan, as described in Section D1 of this submissions report.

### Seaforth Mint Bush

Targeted and seasonal threatened flora species surveys were carried out within and adjacent to the construction footprint between 2016 and 2020 for species identified as having a high or moderate likelihood of occurrence in areas that may be impacted by the project, as discussed in Section 19.2.1 of the environmental impact statement and detailed in Section 2.6.2.1 of Appendix S (Technical working paper: Biodiversity development assessment report). Detail on the survey effort and timing for identifying Seaforth Mint Bush is provided in Table 2.5 of Appendix S (Technical working paper: Biodiversity development assessment report).

The BioNet database searches that helped inform the process to determine candidate species for field surveys are discussed in Section 2.5 of Appendix S (Biodiversity Development Assessment Report). Following receipt of a number of submissions which raised concerns in regard to Seaforth Mint Bush, a new search of the BioNet database was carried out in March 2021.

At some point in the 12 months prior to March 2021, two NSW herbarium records dating from 2002 and 2008 that were previously identified as *Prostanthera junonis* were reclassified to Seaforth Mint Bush. Neither species is recorded in the construction footprint. One of these individuals is located

about 32 metres to the west of the construction footprint, and whilst Transport for NSW acknowledges this point has a listed accuracy of 50 metres, the location description for this record is 'Western side of Wakehurst Parkway, opposite Seaforth Oval, Seaforth'. As the construction footprint is on the eastern side of Wakehurst Parkway, this supports the conclusion that the location is outside the construction footprint and would not be impacted. Due to Seaforth Mint Bush being a category 3 sensitive species under the Department of Planning, Industry and Environment's *Sensitive Species Data Policy*, it is not possible to map the location data at a scale that is useful in terms of the study area/construction footprint in this submissions report.

As part of the review of BioNet database records, it was also noted the habitat table in Annexure A of Appendix S (Technical working paper: Biodiversity development assessment report) states that the nearest recording of the Seaforth Mint Bush is around one kilometre from the construction footprint. This is an error in Annexure A of Appendix S, and has been clarified in Table A5-13 of this submissions report. The assessment of Seaforth Mint Bush was not based on this distance and was based on the information provided in Section 3.6.1.4.4 of Appendix S (Technical working paper: Biodiversity development assessment report) which considered the closest record to the construction footprint being about 70 metres at Wakehurst Parkway (which was prior to the updated records discussed above).

Despite the updated Seaforth Mint Bush records being closer than the records assessed in the biodiversity assessment, the conclusions remain appropriate. With consideration of the updated records, a serious and irreversible impact assessment is still not required following application of the *Biodiversity Assessment Method* (OEH, 2017a), as the species would not be impacted by the project. Whilst impacts are not anticipated, the following environmental management measures will assist in managing and/or minimising potential risks in relation to any unexpected finds (refer to Table D2-1 of this submissions report):

- The unexpected species finds procedure (as included in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) will be followed if threatened ecological communities, flora or fauna species not assessed in the biodiversity development assessment report are identified in the construction footprint (environmental management measure B12). If Seaforth Mint Bush was encountered within the construction footprint, the unexpected species finds procedure requires that a 'Stop Work' action is initiated. Consultation with the relevant authorities would then be carried out in accordance with the procedure. The requirements of this procedure will ensure that any unexpected species finds will be managed appropriately
- Vegetation will be re-established within the construction footprint, where feasible, in accordance with *Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protection and managing biodiversity on RTA projects* (RTA, 2011a) (environmental management measure B13). Guide 3 requires that local native topsoil is collected and stored for reuse in revegetation works so that any potential seedbanks can be preserved and replanted in situ where possible.

Two new environmental management measures have also been developed for the project which will also assist in managing and/or minimising potential risks. These measures are as follows (refer to Table D2-1 of this submissions report):

- Biodiversity awareness training will be provided for contractors prior to commencement of construction works to ensure an understanding of potential threatened species, populations and ecological communities that may be impacted during the project, and the environmental management measures proposed to minimise and/or manage potential impacts including the contractor's responsibilities under the unexpected species find procedure included in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) (new environmental management measure B43)

- Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) (new environmental management measure B45).

These measures would be supported by the implementation of a flora and fauna management plan as part of the construction environmental management plan described in Section D1 of this submissions report.

#### *Pimelea curviflora* var. *curviflora*, *Tetratheca glandulosa* and Angus's Onion Orchid

Targeted and seasonal surveys for *Tetratheca glandulosa*, *Pimelea curviflora* var. *curviflora* and Angus's Onion Orchid were carried out as detailed in Table 2.5 of Appendix S (Technical working paper: Biodiversity development assessment report). *Tetratheca glandulosa* was recorded during these surveys, about 47 metres from the construction footprint as shown on Figure 3-7 (map e) of Appendix S (Technical working paper: Biodiversity development assessment report). Neither *Pimelea curviflora* var. *curviflorai* or Angus's Onion Orchid were recorded within or adjacent the construction footprint despite multiple surveys being carried out. However, Angus's Onion Orchid was recorded in flower at a reference site (Mona Vale Road, Ingleside) during 2016 surveys.

The BioNet database records of *Tetratheca glandulosa*, *Pimelea curviflora* var. *curviflora* and Angus's Onion Orchid in the locality were also reviewed during preparation of this submissions report for additional records along Wakehurst Parkway. As shown in Figure C18-1, none of the records for *Tetratheca glandulosa* or *Pimelea curviflora* var. *curviflora* are located within the construction footprint. Transport for NSW acknowledge that the locational accuracy of BioNet database record varies, however the location descriptions of most records around the southern end of the Wakehurst Parkway section indicate that the records are south of Judith Street or west of the Wakehurst Parkway. As such, the assessment conclusions for *Tetratheca glandulosa* and *Pimelea curviflora* var. *curviflora* remain appropriate. There have been no new records for Angus's Onion Orchid along Wakehurst Parkway in the vicinity of the project since 2002.

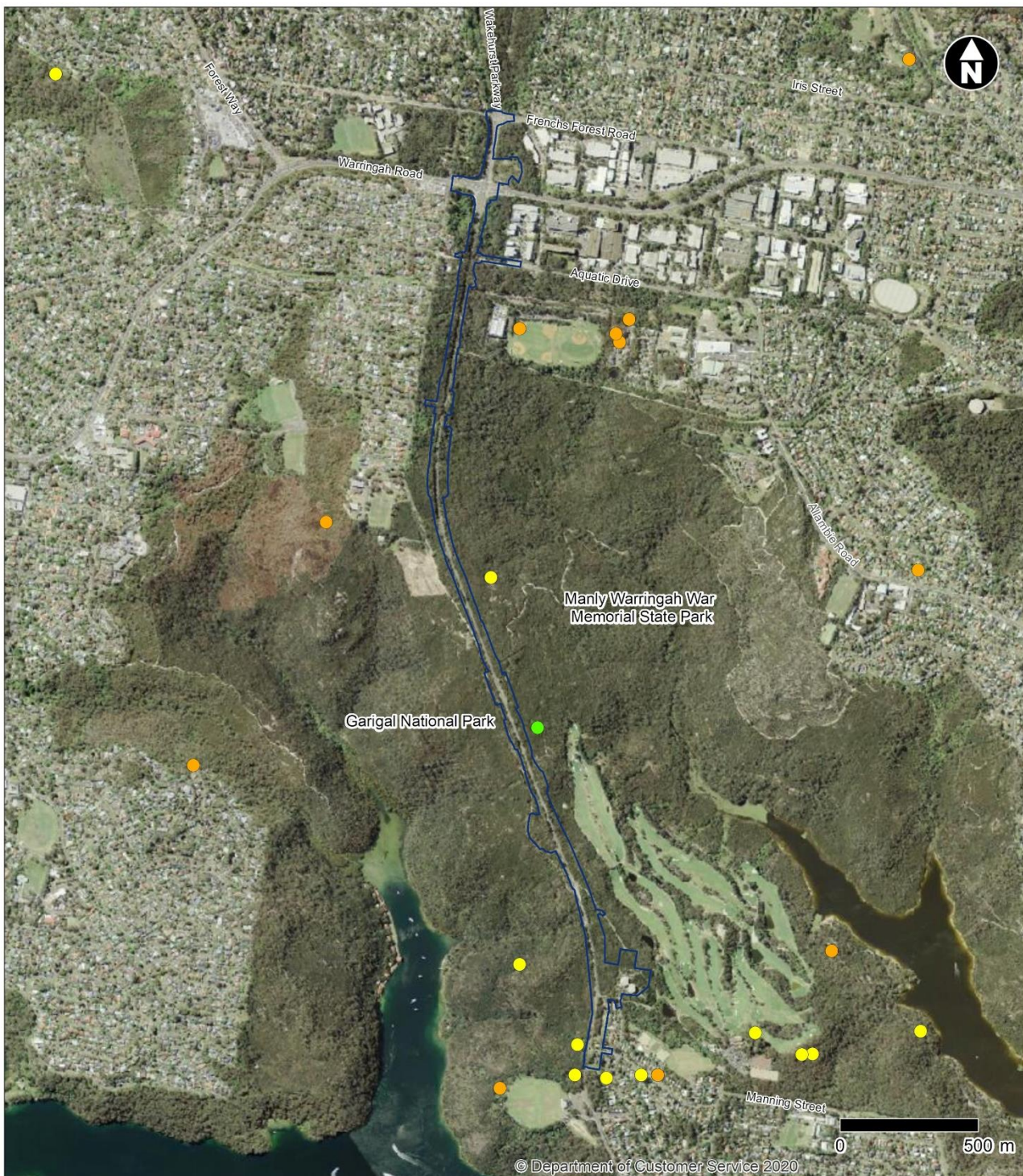
The environmental management measures described in the above response for Seaforth Mint Bush would also apply to *Pimelea curviflora* var. *curviflora*, *Tetratheca glandulosa* and Angus's Onion Orchid.

#### Wollemi Pine at Balgowlah Golf Course

Vegetation surveys at Balgowlah Golf Course and surrounds carried out as part of Appendix S (Technical working paper: Biodiversity development assessment report) were limited to the riparian corridor of Burnt Bridge Creek and did not identify any Wollemi Pine individuals.

However, an arboricultural impact assessment was also carried out for the project and documented in Appendix W (Technical working paper: Arboricultural impact assessment). As part of the assessment, trees were visually assessed by experienced Australian Qualification Framework level five consulting arborists.

Balgowlah Golf Course was assessed as part of Area 4 in the arboricultural impact assessment. No Wollemi Pine were identified in Area 4 (or any other area). Two trees of genus *Araucaria*, which is related to Wollemi Pine and shares morphological characteristics, were identified as being directly impacted by the project in Area 4, with another identified as being potentially impacted. The final layout of the open space and recreation facilities at Balgowlah will be subject to a dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). This would include consideration of which trees would be impacted and/or retained.



**Figure C18-1 BioNet database records of *Tetratheca glandulosa* and *Pimelea curviflora* var. *curviflora* and recordings during field surveys**

### C18.2.3 Impacts to Duffys Forest endangered ecological community

#### ***Issue raised***

Submitters raised concerns and requests about impacts to Duffys Forest endangered ecological community, including:

- Concern about impacts to the Duffys Forest endangered ecological community, including impacts due to surface water changes
- Requests to know what mitigation measures would be in place to protect Duffys Forest endangered ecological community
- Requests that soil be translocated from Duffys Forest endangered ecological community as a mitigation measure (to preserve seedbanks) in consultation with Northern Beaches Council and the National Parks and Wildlife Service. Any translocation should consider impacts related to pathogens such as *Phytophthora cinnamomi*.

#### ***Response***

##### Impacts to Duffys Forest endangered ecological community

The project design development process included a number of opportunities to avoid or minimise impacts to Duffys Forest endangered ecological community by optimising the location of the tunnel portals and permanent tunnel support facilities at the Wakehurst Parkway as described in Section 19.4 of the environmental impact statement. Construction of the project would require the removal of 1.21 hectares of Duffys Forest endangered ecological community, located adjacent to the Wakehurst Parkway between Seaforth and Frenchs Forest. As noted in Section C18.1.4, this has been revised from 1.38 hectares to 1.21 hectares following design refinements to the Wakehurst Parkway shared user bridge in the north of the project (refer to Section A4.3 of this submissions report), reducing the impacts by 0.17 hectares.

Given the endangered ecological community is at risk of a serious and irreversible impact, and in response to questions raised by Department of Planning, Industry and Environment (Environment, Energy and Science Group) a revised serious and irreversible impact assessment for Duffys Forest endangered ecological community in accordance with the assessment criteria set out in Section 10.2 of the *Biodiversity Assessment Method* (OEH, 2017a) has been prepared and is included in Appendix F1 of this submissions report. Also refer to Section A5.1.18 and Appendix F4 of this submission report for a Biodiversity development assessment report roadmap developed to aid stakeholders in understanding updates to the biodiversity assessment which have occurred since the exhibition of the environmental impact statement.

Whilst the project would provide new pavement drainage on either side of the upgraded and realigned Wakehurst Parkway where none currently exists, this is unlikely to significantly impact surface flows to existing patches of Duffys Forest endangered ecological community. In addition, the project would provide an improvement to water quality during operation when compared to existing conditions, except for total nitrogen as discussed in Section 17.5.7 of the environmental impact statement. However, this impact is considered minimal.

Revised environmental management measure B6 will seek to minimise the extent of vegetation clearing during further design development and construction planning, to the extent reasonably practicable (refer to Table D2-1 of this submissions report). In addition, exclusion zones will be implemented during site establishment in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protection and managing biodiversity on RTA projects* (RTA, 2011a). This would ensure retained patches Duffys Forest endangered ecological community within and/or immediately adjacent the construction footprint are protected from inadvertent damage or clearing



during the construction process. The establishment of exclusion zones is included in new environmental management measure B45 (refer to Table D2-1 of this submissions report):

Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a).

Further, new environmental management measure B41 requires the protection and management of an area of the Wakehurst Parkway north construction support site (BL14) that was revegetated with species consistent with Duffys Forest endangered ecological community as part of the Northern Beaches Hospital road upgrade project, as follows (refer to Table D2-1 of this submissions report):

During site establishment of the Wakehurst Parkway north construction support site (BL14), the project will ensure that the revegetated area within the eastern section of the site (planted as part of the Northern Beaches Hospital road upgrade project with species consistent with Duffys Forest endangered ecological community) is fenced adequately so that it is avoided and protected from disturbance during construction. During operation, this revegetation area will continue to be protected and managed.

These measures would be supported by the implementation of a flora and fauna management plan as part of the construction environmental management plan as described in Section D1 of this submissions report.

#### Soil translocation from Duffys Forest endangered ecological community

Vegetation will be re-established within the construction footprint, where feasible, in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protection and managing biodiversity on RTA projects* (RTA, 2011a), as required by environmental management measure B13 (refer to Table D2-1 of this submissions report). *Guide 3: Re-establishment of native vegetation* requires that local native topsoils are collected and stored for reuse in revegetation works so that any potential seedbanks can be preserved and replanted in situ where possible. This would include areas where Duffys Forest endangered ecological community is impacted.

Application of the *Biodiversity Guidelines: Protection and managing biodiversity on RTA projects* (RTA, 2011a) during construction is considered standard practice for Transport for NSW projects.

Pathogens such as *Phytophthora (Phytophthora cinnamomi)* will be managed during construction in accordance with *Guide 7: Pathogen management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) in accordance with revised environmental management measure B26 (refer to Table D2-1 of this submissions report).

### **C18.2.4 Spread of weeds**

#### ***Issue raised***

Submitters raised concerns and requests about the spread of weeds, including:

- Concern over the spread of weeds due to disturbance of topsoil and edge effects, particularly adjacent to Garigal National Park, Manly Warringah War Memorial State Park and temporary construction support sites
- Requests for mitigation measures to be implemented to prevent the spread of weeds
- Concern that vegetated swales along Wakehurst Parkway would introduce weeds to watercourses throughout the area in Manly Warringah War State Memorial Park and Garigal National Park
- Requests that financial provision be made for the long term management of weeds.

### **Response**

Potential impacts due to the spread of weeds and pathogens, as well as edge effects, are assessed in Section 19.5.1 of the environmental impact statement. The areas particularly susceptible to invasion and spread of weeds are along Wakehurst Parkway during earthworks carried out to widen the road, and around Flat Rock Drive construction support site (BL2). As described above in Section C18.2.1 above, the assessment of the extent of edge effects on native vegetation found that edge impacts such as increased weed cover and reduced native ground and shrub cover are largely limited to the area within 20 metres of the Wakehurst Parkway road edge.

To manage the potential invasion and spread of weed species during construction, *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), will be implemented in accordance with environmental management measure B25 (refer to Table D2-1 of this submissions report). This would require preparation of a site weed assessment to identify and map existing weed infestations, and preparation and implementation of a weed management plan which will detail the actions to be carried out to manage weeds during construction. The use of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) would ensure best management practice is applied to minimising and managing the spread of weeds, pathogens and disease. The weed management plan would form part of the flora and fauna management plan as part of the construction environmental management plan as described in Section D1 of this submissions report.

With regard to operational impacts, landscaping of disturbed areas (as well as vegetated swales) will be carried in accordance with the urban design and landscape plan as required by environmental management measure V1 (refer to Table D2-1 of this submissions report). The plan would include identification of vegetation species composition, planting layout and densities in accordance with relevant Transport for NSW guidelines, including controls to minimise weed infestation and spread.

Landscaped areas of the project (including vegetated swales) would be maintained by Transport for NSW, unless arrangements have been made to transfer the management of a landscaped area to an alternative party at which point it would be responsibility of the alternative party to maintain the landscaped area.

Transport for NSW would maintain landscaped areas of the project in accordance with the appropriate Transport for NSW Quality Specifications.

## **C18.3 Terrestrial fauna**

### **C18.3.1 Impacts to fauna and fauna habitat**

#### ***Issue raised***

Submitters raised concerns and requests in relation to direct and indirect impacts to fauna, including:

- Concerns about impacts to fauna and fauna habitat
- Concern that pre-clearing surveys and relocation of fauna prior to vegetation removal would not be effective
- Requests for pre-clearing/demolition inspections for native fauna including threatened species by a suitably qualified ecologist
- Requests for methods and procedures for welfare and relocation of displaced fauna
- Concern that there is no allowance for relocating fauna from Balgowlah Golf Course

- Concerns about the impacts to less mobile fauna that have offspring as they are not adequately assessed in the environmental impact statement
- Concerns about impacts to fauna related to noise, dust and light spill impacts and adequacy of assessment in the environmental impact statement
- Concerns about impacts related to wastewater discharges to creeks and general water quality impacts on terrestrial fauna species
- Concern about potential impacts to terrestrial fauna due to the removal of the Balgowlah Golf Course stormwater harvesting dam
- Concern about the local echidna population at Burnt Bridge Creek, which was not acknowledged in the environmental impact statement, and environmental management measures are needed for their protection
- Concern about the potential release of landfill gases at the Flat Rock Drive construction support site (BL2) impacting nearby wildlife.

### ***Response***

#### **Impacts to fauna habitat and fauna**

The main habitat types impacted by the project include vegetated habitats, human-made structures and built environment (including existing culverts, bridges and buildings), and marine and intertidal habitat as documented in Section 19.5.2 of the environmental impact statement.

The project design development process has considered a number of opportunities to avoid or minimise biodiversity impacts through selection of the preferred corridor, refinement of the preferred corridor design and development of construction methodology as described in Section 19.4 of the environmental impact statement. Further detail on how the project design and construction methodology has been developed to avoid and minimise impacts on biodiversity is provided in Table 4-1 of Appendix S (Technical working paper: Biodiversity development assessment report).

About 20.78 hectares of vegetated habitats would be removed due to the project and are primarily located next to the Wakehurst Parkway and within the Flat Rock Drive (BL2), Balgowlah Golf Course (BL10), Wakehurst Parkway south (BL12), and Wakehurst Parkway east (BL13) construction support sites. Vegetation removal was previously stated to be 20.92 hectares in Appendix S (Technical working paper: Biodiversity development assessment report), however due to design refinement of the Wakehurst Parkway shared user bridge, total vegetation removal has reduced to 20.78 hectares (refer to Section A4.3 for further details).

The removal of flowering and fruiting trees, two hollow-bearing trees, shrubs and ground layer vegetation, and rocky habitat would result in the loss of potential foraging and sheltering habitat. However, these impacts would be negligible since the habitat to be removed does not comprise a significant proportion of habitat available to fauna species in the surrounding terrestrial biodiversity locality or wider bioregion.

Environmental management measures have been proposed to minimise and/or manage impacts to vegetated habitats, including environmental management measures B1 and B6 which will seek to minimise the extent of native vegetation clearing during further design development and construction planning. Other environmental management measures (including new and revised measures) which commit to minimising or managing impacts associated with removal of vegetated habitats include B10 to B14, B22, B23, B41, B43, V9 and V10 (refer to Table D2-1 of this submissions report for the full wording of these environmental management measures). These measures would be supported by the implementation of a flora and fauna management plan as part

of the construction environmental management plan as described in Section D1 of this submissions report.

The increase in fragmentation due to the realignment and upgrade of the Wakehurst Parkway would potentially adversely affect fauna connectivity. Fauna underpasses and rope crossings would be constructed or replaced as part of the project to facilitate the safe crossing of fauna beneath or over the road. The proposed fauna exclusion fencing along both the eastern and western edge of the realigned and upgraded Wakehurst Parkway would prevent fauna from accessing the road and being subjected to vehicle strike. Therefore, impacts due to increased habitat fragmentation as a result of the project would be minimised.

Direct impacts to human-made structures and the built environment would be limited to the alteration of existing bridges and culverts at the surface connections at Artarmon, surface road works at Balgowlah and the realignment and upgrade of the Wakehurst Parkway, which offer limited and marginal potential roosting habitat for some bat species. These works would be temporary and are unlikely to adversely impact such species.

No marine or intertidal habitats that provide potential habitat for terrestrial fauna would be directly impacted by the project.

While the focus of the biodiversity development assessment report has been on the assessment of threatened species in accordance with the Secretary's environmental assessment requirements, *Biodiversity Assessment Method*, and other various guidelines and policies, non-threatened species are considered due to them utilising similar habitats to threatened species. As such, environmental management measures related to biodiversity and provided in Table D2-1 of this submissions report will also minimise and manage impacts to non-threatened species.

#### Pre-clearing surveys and relocation of fauna

Pre-clearing surveys will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), as required by revised environmental management measure B14 and environmental management measure B23 (refer to Table D2-1 of this submissions report). This guide requires the use of qualified ecologists to conduct fauna searches as part of the pre-clearing process. 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 B12 (refer to Table D2-1 of this submissions report). As discussed in Section C18.1 above, the *Biodiversity Guidelines* are best management practice guidelines which have been developed in accordance with government agencies and biodiversity specialists.

Fauna handling, including to relocate fauna, will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), consistent with environmental management measure B22 (refer to Table D2-1 of this submissions report). The guidelines require the use of a licensed wildlife carer and/or ecologist to carry out any fauna handling.

#### Less mobile fauna

Impacts to less mobile fauna species was discussed in Section 19.5.2 of the environmental impact statement and considered in detail in Section 5.1 and 5.2 of Appendix S (Technical working paper: Biodiversity development assessment report).

Less mobile species including amphibians, reptiles, invertebrates and juvenile/nesting birds/mammals and small mammals would be more susceptible to injury or mortality as a result of

the project, as discussed in Section 19.5.2 of the environmental impact statement. Pre-clearing surveys for threatened and non-threatened species will manage potential impacts to less mobile species and will be carried out in accordance with environmental management measures B16 and B23 and revised environmental management measure B14 (refer to Table D2-1 of this submissions report).

#### Impacts to fauna related to noise, dust and light spill

Noise, vibration, dust and light spill impacts on fauna are assessed in Section 19.5.2 of the environmental impact statement and considered in more detail in Section 5.2.3 of Appendix S (Technical working paper: Biodiversity development assessment report).

Construction activities could result in noise, vibration, light spill and dust impacts on nearby habitat throughout the duration of construction. Activities likely to result in these impacts include the realignment and upgrade of the Wakehurst Parkway, around the cut and cover and trough structures of the ramp tunnels, and establishment and operation of temporary construction support sites. Most of the construction areas are located in highly urbanised areas and are subject to ambient noise. Therefore, increases to noise and vibration are not expected to have a significant impact on terrestrial fauna.

Noise, vibration, dust and light impacts to fauna would be managed in accordance with environmental management measures (refer to Table D2-1 of this submissions report). These include, but are not limited to:

- Standard construction air quality mitigation and management measures will be detailed in construction management documentation and implemented during construction, such as (revised environmental management measure AQ1):
  - Dust mitigation measures would be used during construction, such as the use of water tanks/carts and sprinklers where appropriate
  - Selection of equipment to minimise dust generation
  - Covering vehicle loads and minimising exposed areas during construction to manage dust generation
- Designing construction site and operational lighting consistent with the requirements of *Australian Standards and Guidelines 4282 – 2019 Control of the obtrusive effects of outdoor lighting* (revised environmental management measures B4 and V6)
- Developing activity specific controls to manage impacts from high noise and vibration generating activities on Large-eared Pied Bat along the Wakehurst Parkway (revised environmental management measure B7)
- Implementing controls to manage potential noise and vibration from controlled blasting, rock hammering and other potential high noise generating activities along the Wakehurst Parkway where practicable (environmental management measure B21)
- Measures to minimise noise impacts to the Grey-headed Flying-fox camp at Balgowlah (environmental management measures B17 to B20) – refer to Section C18.3.2 below for further information.

Construction activities in Middle Harbour may result in impulsive or continuous noise impacts to Little Penguins. However, Little Penguins typically forage in shallow waters close to the shoreline, areas that the project largely avoids.

### Water quality impacts to fauna species

Runoff from the Wakehurst Parkway construction works has the potential to result in soil erosion and sedimentation impacts downstream if not managed appropriately, including potential impacts to the threatened Red-crowned Toadlet. However, the project includes the provision of temporary (during construction) and permanent water quality control measures along the Wakehurst Parkway.

Potential construction water quality impacts on Red-crowned Toadlet habitat would be managed through the implementation of erosion and sediment control measures. These include implementing erosion and sediment control measures at all construction support sites and surface road upgrades in accordance with the principles and requirements in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (Department of Environment and Climate Change (DECC), 2008) and relevant guidelines, procedures and specifications of Transport for NSW, per revised environmental management measure SG9 (refer to Table D2-1 of this submissions report). In addition, a soil conservation specialist will be engaged to provide advice regarding erosion and sediment control including review of erosion and sediment control plans.

During operation, the relevant project area above the potential Red-crowned Toadlet habitat along the Wakehurst Parkway would be managed by the inclusion of a water quality basin (shown on Figure 5-8 of the environmental impact statement). Water quality modelling indicates the operation of the project would not decrease water quality of nearby ephemeral or unnamed waterways at the Wakehurst Parkway, as discussed in Section 19.5.3 of the environmental impact statement. Further discussion on the potential for operational water quality impacts on Red-crowned Toadlet is provided in Section B4.17.1 of this submissions report in responses to issues raised by the Department of Planning, Industry and Environment (Environment, Energy and Science Group).

Water discharged from construction and operational wastewater treatment plants will meet following discharge criteria as required by environmental management measures (refer to Table D2-1 of this submissions report):

- Discharge from construction wastewater treatment plants will meet the ANZG (2018) 90 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which will be treated to meet the ANZG (2018) 95 per cent species protection levels (revised environmental management measure WQ11)
- The Gore Hill wastewater treatment plants will meet the ANZG (2018) 95 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which will be treated to meet the ANZG (2018) 99 per cent species protection levels (revised environmental management measure WQ17).

The criteria committed to for the project is considered appropriate for waterways that are influenced by urban areas and is unlikely to impact terrestrial fauna species.

### Balgowlah Golf Course stormwater harvesting dam

As discussed in Section C18.1.3 above, there is limited identified ecological value for the whole Balgowlah Golf Course site due to the presence of highly modified urban exotic/native vegetation. As such, fauna surveys were limited to the riparian corridor of Burnt Bridge Creek and did not include consideration of the stormwater harvesting dam. Notwithstanding, Balgowlah Golf Course was identified as potentially offering foraging, nesting and roosting habitat to bats, birds and arboreal mammals, including Grey-headed Flying-fox in Section 3.7.1 of Appendix S (Technical working paper: Biodiversity development assessment report).

The stormwater harvesting dam at Balgowlah Golf Course could provide a water source for terrestrial fauna. However, it is noted that there are also pools in the adjacent section of Burnt Bridge Creek (refer to Section 3.1.3 of Annexure D of Appendix S (Technical working paper: Biodiversity development assessment report) and other large freshwater waterbodies that could be used by more mobile fauna species, such as bats and birds, at Many Dam to the north and Manly Golf Club to the east.

Following exhibition of the environmental impact statement, consultation with Northern Beaches Council has occurred and it has now been confirmed that there is an ongoing need for the stormwater harvesting scheme. As such, a suitable location and size for the basin will be determined as part of the dedicated consultation and follow on design process associated with the final layout of the new and improved public open space and recreation facilities at Balgowlah. The project has also been refined such that the new stormwater harvesting basin would be installed and commissioned before the existing dam is decommissioned (refer to revised environmental management measure WQ1 and Section A4.8 of this submissions report for further details on this refinement).

Given that a replacement stormwater harvesting basin would be provided prior to the existing dam being decommissioned and considering the presence of the alternative freshwater waterbodies nearby, any temporary disturbance on terrestrial fauna due to nearby construction activities and/or the replacement of the stormwater harvesting dam would not be expected to be significant. In addition, it is expected that potential impacts to common native aquatic fauna would be negligible as comparable habitat would be established prior to the existing dam being decommissioned.

#### Consideration and protection of echidnas

The project has been assessed in accordance with the *Biodiversity Assessment Method* (OEH, 2017a) as required by the *Biodiversity Conservation Act 2016* and consistent with the Secretary's environmental assessment requirements. Non-threatened species do not require further assessment in accordance with the *Biodiversity Assessment Method* (OEH, 2017a). Echidnas are not listed as a threatened species under the *Biodiversity Conservation Act 2016*, and as such were not specifically assessed.

While echidnas were not identified during field surveys along Burnt Bridge Creek, the potential impact to echidnas, and other native fauna, would be managed in accordance with the environmental management measures outlined Table D2-1 of this submissions report. This includes environmental management measures B11, B22 and B23 and revised environmental management measure B6.

In addition, and as discussed in Table C18-1, to reduce impacts on native vegetation, an exclusion zone would be established around riparian vegetation adjoining Burnt Bridge Creek adjacent to the surface road works at Balgowlah, where reasonable and feasible. The exclusion zone boundary would be formalised during further construction planning and design development prior to construction commencement and would be about 0.90 hectares in area. This area would assist any local echidna population at Burnt Bridge Creek by maintaining existing vegetation.

#### Landfill gases at Flat Rock Drive construction support site (BL2)

For works proposed at the Flat Rock Drive construction site (BL2), there is a risk of encountering odorous waste material and landfill gases from historical waste landfilling activities in the locality. The review of information carried out to inform Appendix M (Technical working paper: Contamination) identified that prior to 1971, Flat Rock Reserve was infilled with putrescible material and therefore there is potential for putrescible materials to be present at the greater depths of the waste mass. It was also identified that the waste mass beneath Flat Rock Drive construction site

(BL2) and the adjacent Willoughby Leisure Centre and Bicentennial Reserve may present a source of landfill gas.

The geotechnical investigations that were carried out to inform the environmental impact statement did not identify putrescible waste or landfill gases in the vicinity of the locations that would be excavated as part the project (noting that no specific landfill gas monitoring was carried out as part of those investigations, rather routine gas detection did not identify significant amounts of methane, which is a key landfill gas). This indicates that the risk of encountering odorous materials and landfill gases is low. Further detailed geotechnical investigations and targeted ground gas investigations will be carried out in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 1997* to reconfirm if any potentially odorous materials and landfill gases will be encountered by the project site at this location as required by revised environmental management measure SG8 (refer to Table D2-1 of this submissions report). Ground gas investigations will be carried out at the Flat Rock Drive construction site (BL2) in accordance (where applicable) with the *Assessment and management of hazardous ground gases: Contaminated land guidelines* (NSW Environment Protection Authority (EPA), 2020b), as required by revised environmental management measure SG15 (refer to Table D2-1 of this report).

Given the risk and proposed management response, it is unlikely that native fauna would be impacted by landfill gases. Refer to Section C15.2.2 of this submissions report for further details on contamination and landfill gas issues at the Flat Rock Drive construction site (BL2).

### **C18.3.2 Impacts to and management of Grey-headed Flying-fox**

#### ***Issue raised***

Submitters raised concerns and requests in relation to impacts to Grey-headed Flying-fox, including:

- Concern that the assessment of impacts to Grey-headed Flying-fox is not sufficient
- The environmental impact statement does not consider juvenile Grey-headed Flying-fox at the Balgowlah camp who do not forage and could therefore be exposed to noise impacts from night works
- Requests for rock hammering and resurfacing works between September and February to be avoided to minimise impacts to the Grey-headed Flying-fox camp
- Requests for a commitment that there be no direct impact to the Grey-headed Flying-fox camp at Balgowlah
- Concern that management measures would not be effective at protecting the Grey-headed Flying-fox camp at Balgowlah, specifically:
  - Environmental management measure B19 would not avoid impacts to the Grey-headed Flying-fox
  - Environmental management measure B20 does not specify the timing of adaptive management measures that would be implemented to avoid and minimise impacts on Grey-headed Flying-foxes. Further, it is not clear what the trigger point would be to stop work if impacts to the Grey-headed Flying-fox camp occur during construction.

#### ***Response***

##### **Adequacy of Grey-headed Flying-fox assessment**

The biodiversity development assessment report, including the assessment of Grey-headed Flying-fox, has been prepared to meet the requirements of the Secretary's environmental assessment requirements and the *Biodiversity Assessment Method* (OEH, 2017a). Discussion on how the



*Biodiversity Assessment Method* (OEH, 2017a) requirements have been addressed is provided in Section 1.9 of Appendix S (Technical working paper: Biodiversity development assessment report) and the report has been certified by an accredited person under Section 6.15 of the *Biodiversity Conservation Act 2016*.

Detail on the survey effort and timing for Grey-headed Flying-fox surveys is provided in Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report).

Potential impacts to Grey-headed Flying-fox and the Grey-headed Flying-fox camp located in the vegetated area between Balgowlah Road and Burnt Bridge Creek Deviation, about 120 metres from the Kitchener Street construction support site (BL11), have been assessed within Appendix S (Technical working paper: Biodiversity development assessment report). This includes:

- Section 5.1.3 – in regard to removal of Grey-headed Flying-fox habitat, noting no suitable breeding habitat for this species would be removed
- Section 5.2.3 – in regard to noise and vibration impacts at Wakehurst Parkway and Balgowlah
- Section 5.4 – in regard to prescribed biodiversity impacts as required by Section 9.2 of the *Biodiversity Assessment Method* (OEH, 2017a)
- Section 5.5 and Appendix E – in regard to impacts to the Grey-headed Flying fox foraging habitat and preparation of a significant impact assessment as required by the *Environment Protection and Biodiversity Conservation Act 1999*.

The tunnel connection to and from Burnt Bridge Creek Deviation and associated surface works was redesigned to include for various enhancements in response to community and stakeholder feedback received prior to finalisation of the environmental impact statement. A key enhancement was relocating the tunnel portal further to the south so as to significantly reduce the works associated with staged road upgrade works on Burnt Bridge Creek Deviation around Kitchener Street. These redesigns included the removal of noisy works to demolish the existing Kitchener Street bridge, as discussed in Section 4.5.5 and Section 19.4 of the environmental impact statement, as well as Table 4-1 of Appendix S (Technical working paper: Biodiversity development assessment report). These changes have resulted in significant reduction in potential impacts to the Grey-headed Flying-fox camp at Balgowlah.

A number of specific environmental management measures have also been prepared to manage potential impacts on Grey-headed Flying-fox as follows (refer to Table D2-1 of this submissions report):

- Utilising quieter construction methods or temporary noise barriers where feasible and reasonable, to minimise noise impacts to the Grey-headed Flying-fox camp at Balgowlah. Also, arranging the site layout of the Kitchener Street construction support site (BL11) to maximise acoustic shielding and to minimise noise impacts to the Grey-headed Flying-fox camp (revised environmental management measure B17)
- Programming noise intensive works with the potential to impact on the Grey-headed Flying-fox camp to avoid September to February, where feasible and reasonable (revised environmental management measure B18)
- Monitoring of disturbance levels within the Grey-headed Flying-fox camp at Balgowlah during construction activities that result in noise levels at the camp that exceed the preconstruction ambient noise levels by a person experienced in flying-fox behaviour (environmental management measure B19)
- Developing adaptive management measures to minimise noise impacts on Grey-headed Flying-foxes if their behaviour during monitoring suggests that disturbance levels are high (environmental management measure B20).

These measures will be implemented along with other biodiversity environmental management measures provided in Table D2-1 of this submissions report.

#### Consideration of juvenile Grey-headed Flying-fox

Grey-headed Flying-foxes would be sensitive to construction noise when roosting in camp, particularly during the months of August to February, as discussed in Section 5.2.3.2 of Appendix S (Technical working paper: Biodiversity development assessment report). There is potential for females reaching the end of their gestation period or those that have given birth or juveniles to abort young during this period if they become stressed. During the period between September to November, stressed females who have given birth have been known to drop young. Stressed young are also at risk of falling to the ground. There is also potential for juveniles to become easily stressed and fall to the ground in December.

Impacts to Grey-headed Flying-foxes will be managed in accordance with environmental management measures B17 to B20 as discussed above (refer to Table D2-1 of this submissions report). This will include programming noise intensive works to avoid September to February, where feasible and reasonable in accordance with revised environmental management measure B18 (refer to Table D2-1 of this submissions report).

#### Direct impacts to the Grey-headed Flying Fox camp

The Grey-headed Flying-fox camp is located about 120 metres east of the construction footprint, as shown in Figure 19-9 of the environmental impact statement. As such, there would be no direct impact to the Grey-headed Flying-fox camp at Balgowlah.

#### Effectiveness of Grey-headed Flying-fox environmental management measures

Impacts to the Grey-headed Flying-fox camp at Balgowlah will be managed and minimised in accordance with environmental management measures B17 to B20 (refer to Table D2-1 of this submissions report). This would include using quieter construction methods or temporary noise barriers in close proximity to construction works where feasible and reasonable. The Kitchener Street construction support site (BL11) will be arranged in a manner that maximises acoustic shielding to minimise noise impacts to the Grey-headed Flying-fox camp. In addition, noise intensive works with the potential of impacting the Grey-headed Flying-fox camp will be programmed to avoid September to February where feasible and reasonable in accordance with revised environmental management measure B18 (refer to Table D2-1 of this submissions report).

Environmental management measure B19 (refer to Table D2-1 of this submissions report) requires the monitoring of disturbance levels within the Grey-headed Flying-fox camp at Balgowlah during construction activities that results in noise levels that exceed the pre-construction ambient noise levels. Where monitoring suggests that disturbance levels are high, impacts would be minimised through the implementation of adaptive management measures, in accordance with environmental management measure B20 (refer to Table D2-1 of this submissions report). These measures will be developed in consultation with the Department of Planning, Industry and Environment (Environment, Energy and Science) and an appropriately qualified expert in Grey-headed Flying-fox biology and behaviour.

### **C18.3.3 Impacts to threatened microbats**

#### ***Issue raised***

Submitters raised concerns and requests in relation to impacts to threatened microbats, including:

- Concern about the impact to Large-eared Pied Bat, Little Bent-winged Bat (*Miniopterus australis*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*)

- Request for a study of the microbats found in Flat Rock Reserve and their response to disruption caused by noise, vibration and light
- Concern the environmental impact statement does not consider potential impacts to the Large-eared Pied Bat (previously known as the Eastern Bent-winged Bat) which has been identified in previous Sydney Water investigations and also to a population near Primrose Park, Cremorne.

### **Response**

#### Impact to threatened microbats

Details on the methodology used to survey for threatened microbats including roosting habitat assessment and harp trapping is provided in sections 2.6.2.2.2 and 2.6.2.2.3 of Appendix S (Technical working paper: Biodiversity development assessment report). Section 2.6.2.2.2 also provides discussion on the additional targeted surveys for the Large-eared Pied Bat. Where required, surveys were carried out in accordance with '*Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method* (OEH, 2018). Details on the survey effort and timing for threatened microbat surveys is provided in Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report).

Consideration of impacts to threatened microbats such as Large-eared Pied Bat, Little Bent-winged Bat and Large Bent-winged Bat has been provided throughout Appendix S (Technical working paper: Biodiversity development assessment report), including:

- Section 5.1.3 – direct impacts to threatened fauna species habitat
- Section 5.2.3 – in regard to noise and vibration impacts at Wakehurst Parkway
- Section 5.3.2 – assessment of the risk of serious and irreversible impact to Large-eared Pied Bat, Little Bent-winged Bat and Large Bent-winged Bat.
- Section 5.4 – in regard to prescribed biodiversity impacts as required by Section 9.2 of the *Biodiversity Assessment Method* (OEH, 2017a)
- Section 5.5 and Appendix E – preparation of a significant impact assessment for Large-eared Pied Bat as required by the *Environment Protection and Biodiversity Conservation Act 1999*.

No suitable breeding habitat for the Little Bent-winged Bat or the Large Bent-winged bat to which species credit applies was recorded in the construction footprint. Species credits for the Large-eared Pied Bat would be required for the project as described in Section 19.6.1 of the environmental impact statement. Refer to Section C18.10 of this submissions report for further discussion on the delivery of offsets for the project.

There may also be indirect impacts to microbats due to construction activities, for example noise and light spill from temporary construction support sites and from the realignment and upgrade of the Wakehurst Parkway. In particular, there is potential for indirect impacts to Large-eared Pied Bat habitat areas more than 100 metres from the construction footprint due to noise and vibration, light and dust, as discussed in Section 19.5.2 of the environmental impact statement.

A number of specific environmental management measures have been prepared to manage potential impacts to threatened microbats (refer to Table D2-1 of this submissions report):

- Activity-specific controls will be developed to manage impacts from high noise and vibration generating activities (eg controlled blasting and rock hammering) on Large-eared Pied Bat along the Wakehurst Parkway. The controls will be prepared by a suitably qualified and experienced microbat specialist and implemented during surface road works as required (revised environmental management measure B7)

- Pre-clearing surveys for threatened fauna species will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a). Surveys will also include human made structure that have been identified as potentially providing habitat for microbats and are subject to demolition or modification (environmental management measure B23 and revised environmental management measure B14).

Environmental management measures to minimise and/or manage dust, noise, vibration and light impacts to vegetated habitats detailed in Section C18.3.1 above would also be relevant to managing potential impacts to threatened microbats, in particular environmental management measure B21 and revised environmental management measure B7 (refer to Table D2-1 of this submissions report) which require controlled blasting, rock hammering and other potential high noise generating activities along the Wakehurst Parkway to be managed to minimise noise and vibration levels to adjacent fauna habitat where practicable.

#### Large Bent-winged Bat at Flat Rock Drive construction support (BL2)

Surveys and assessment of microbats at Flat Rock Drive construction support site (BL2) have been carried out in accordance with the requirements of the Secretary's environmental assessment requirements and the *Biodiversity Assessment Method* (OEH, 2017a). The Large Bent-winged Bat (previously known as the Eastern Bent-winged Bat) was identified during field studies at the Flat Rock Drive construction support site (BL2), as discussed in Section 19.3.2 of the environmental impact statement. No suitable breeding habitat for the microbats recorded at Flat Rock Drive construction support site (BL2) was identified during targeted seasonal surveys, as discussed in Section 5.1.3 of Appendix S (Technical working paper: Biodiversity development assessment report).

It is likely that vegetated habitat at Flat Rock Drive construction support site (BL2) would only provide potential foraging habitat for microbats. It was also identified that vegetation along Wakehurst Parkway offers potential foraging habitat for the species. Potential impacts to the Large Bent-winged Bat are outlined in Section 19.5.2 of the environmental impact statement. Potential impacts to Large Bent-winged Bats would be managed through the environmental management measures outlined above (refer to Table D2-1 of this submissions report).

### **C18.3.4 Impacts to other terrestrial threatened mammals**

#### ***Issue raised***

Submitters raised concerns in relation to impacts to Southern Brown Bandicoot (*Isodon obesulus obesulus*), Eastern Pygmy-possum (*Cercartetus nanus*) and Brush-tailed Rock-wallaby (*Petrogale penicillata*).

#### ***Response***

##### Southern Brown Bandicoot

The Southern Brown Bandicoot is considered to have a high likelihood of occurrence in the construction footprint as detailed in Table 19-7 of the environmental impact statement. While this species was not recorded in the construction footprint during field surveys, it has previously been recorded in proximity to the construction footprint next to the Wakehurst Parkway. The construction footprint supports potential habitat for the species in native vegetation next to the Wakehurst Parkway.

The realignment and upgrade of the Wakehurst Parkway would increase existing fragmentation of the nearby vegetation, which would potentially adversely affect the movement patterns of a number of threatened terrestrial fauna species known or likely to occur in the area such as the Southern

Brown Bandicoot. Environmental management measures to minimise and/or manage impacts to vegetated habitats detailed in Section C18.3.1 above would be relevant to managing potential impacts to Southern Brown Bandicoot, including impacts due to increased habitat fragmentation. In addition, Southern Brown Bandicoot is considered a target species for the fauna underpasses proposed for the project, providing connectivity between Garigal National Park and the Manly Warringah War Memorial State Park, as included in revised environmental management measure B2 (refer to Table D2-1 of this submissions report).

### Eastern Pygmy-possum

Eastern Pygmy-possums were considered to have a high likelihood to occur in the construction footprint as detailed in Table 19-7 of the environmental impact statement. While BioNet database searches show that the species has been recorded in the Wakehurst Parkway east construction support site (BL13), the Eastern Pygmy-possum was recorded in recent surveys of bushland adjacent to Wakehurst Parkway targeting Koalas (refer to Section B4.8.2 of this submissions report) at several locations further north. This implies the Eastern Pygmy-possum are inhabiting connected bushland along Wakehurst Parkway. This finding is supported by potential foraging and sheltering habitat for this species being present in native vegetation within and adjoining the northern extent of the construction footprint next to Wakehurst Parkway. These vegetated habitats support preferred foraging resources, due to the presence of a variety of banksia, eucalypt and bottlebrush species.

The realignment and upgrade of the Wakehurst Parkway would increase existing fragmentation of the nearby vegetation, which would potentially adversely affect the movement patterns of a number of threatened terrestrial fauna species known or likely to occur in the area such as the Eastern Pygmy-possum. There may also be impacts due to the loss of potential foraging and sheltering habitat associated with vegetation or rocky habitat features to be removed. However, the habitat does not comprise a substantial portion of foraging habitat available in the surrounding terrestrial biodiversity locality or wider bioregion. There may also be indirect impacts due to construction activities, for example noise and light spill from temporary construction support sites. The risk of strike by construction vehicles on site is low as these vehicles are required to travel at slow speeds on internal construction roads for workplace health and safety reasons.

A number of specific environmental management measures have been prepared to manage potential impacts to Eastern Pygmy-possum, and the species is considered a target species for the fauna underpasses and rope crossings proposed for the project as included in revised environmental management measure B2 (refer to Table D2-1 of this submissions report) and listed in Table A4-3 of this submissions report. Other specific environmental management measures include:

- Fauna exclusion fencing will be designed to exclude small fauna species from the road corridor, such as Eastern Pygmy-possum, and will be installed for the full extent of the Wakehurst Parkway within the construction footprint (revised environmental management measure B3)
- Vegetation removal along the Wakehurst Parkway will be timed to avoid the winter breeding period for the Eastern Pygmy possum (May to July), where feasible and reasonable (environmental management measure B10)
- Pre-clearing surveys for threatened fauna species will be carried out in accordance with Guide 1: Pre-clearing process of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a). This will include inspections of hollows and dead timber for Eastern Pygmy-possum (revised environmental management measure B14).

Environmental management measures to minimise and/or manage impacts to vegetated habitats detailed in Section C18.3.1 would also be relevant to managing potential impacts to Eastern Pygmy-possum, in particular environmental management measure B21 (refer to Table D2-1 of this

submissions report) which requires controlled blasting, rock hammering and other potential high noise generating activities along the Wakehurst Parkway will be managed to minimise noise and vibration levels to adjacent fauna habitat where practicable.

Species credits for the Eastern Pygmy-possum would also be required for the project as described in Appendix F2 of this submissions report. Refer to Section C18.10 for further discussion on the delivery of offsets for the project.

### Brush-tailed Rock-wallaby

The Brush-tailed Rock-wallaby was considered to have a low likelihood to occur in the construction footprint as detailed in Annexure A of Appendix S (Technical working paper: Biodiversity development assessment report), with the construction footprint and surrounds not supporting preferred habitat for the species. As such, further assessment of the Brush-tailed Rock-wallaby was not required for the purpose of the assessment.

## **C18.3.5 Impacts to threatened birds and Little Penguin**

### ***Issue raised***

Submitters raised concerns in relation to impacts to threatened birds and Little Penguin, including:

- Concern about impacts to Powerful Owl (*Ninox strenua*), and requests for specific measures to minimise disturbance to habitat associated with the Powerful Owl
- Concern that Northbridge residents have recently heard Powerful Owl calls, however they are not addressed in the environmental impact statement
- Requests for a study (in association with BirdLife Australia's Powerful Owl Project) to determine where the Powerful Owl pair in Flat Rock Gully is roosting, hunting and breeding and the mitigation required to ensure they are not disturbed
- Concern about the impact to Glossy Black-cockatoo (*Calyptorhynchus lathami*), Australasian Bittern (*Botaurus poiciloptilus*), Red Knot (*Calidris canutus*) and White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Requests that the location of the White-bellied Sea-Eagle nest at Middle Harbour be ascertained in consultation with the relevant councils and that plans be developed to mitigate construction noise disturbances particularly during the breeding season
- Concern about impacts to Little Penguins (*Eudyptula minor*). Specific measures to protect Little Penguins are required and concern that the use of a Little Penguin spotter may be ineffective and that slower speeds for construction vessels may be more effective
- Concerns about impacts related to water quality impacts on threatened fauna such as Little Penguins and the White-bellied Sea-Eagle.

### ***Response***

#### Powerful Owl

The Powerful Owl was recorded during field surveys for the project at Hallstrom Park in Willoughby and in bushland adjacent to the Flat Rock Drive construction support site (BL2), in proximity to the construction footprint, as described in Section 3.6.2.4.7 of Appendix S (Technical working paper: Biodiversity development assessment report). Further detail on survey effort and timing for Powerful Owl surveys is provided in Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report). As such, it is considered that additional studies are not required.

Powerful Owls typically nest in a large vertical hollow in a large old tree (at least 150 years old), sometimes in excess of 25 metres above the ground. These trees are usually found growing on a

hillside in heavy forest and may be used intermittently for several years. No hollow-bearing trees that would offer potential nesting habitat to Powerful Owls were identified at Hallstrom Park in Willoughby or Flat Rock Reserve, where the species was recorded. However, the construction footprint of Flat Rock Drive construction support site (BL2) and surrounding area would offer potential foraging habitat for the Powerful Owl, and as such the Powerful Owl has been assessed as having a high likelihood of occurrence in the construction footprint. Environmental management measures to minimise and/or manage impacts to vegetated habitats detailed in Section C18.3.1 would be relevant to managing potential impacts to Powerful Owls, including environmental management measures B1 and B11 and revised environmental management measures B6 and B14 as outlined in Table D2-1 of this submissions report.

#### Glossy Black-cockatoo

Glossy Black-cockatoos were considered to have a high likelihood of occurrence in the construction footprint as detailed in Table 19-7 of the environmental impact statement.

While this species was not recorded in the construction footprint during field surveys, preferred foraging trees species (*Allocasuarina* and *Casuarina* species) occur within areas of native vegetation within and next to the construction footprint. One large hollow-bearing tree that contained a hollow greater than 20 centimetres in diameter was identified in the northern extent of the subject land, near the Wakehurst Parkway. This hollow comprised potential nesting habitat for Glossy Black-Cockatoo. However, no individuals were recorded using this hollow. Details on survey effort and timing for Glossy Black-cockatoo surveys is provided in Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report).

Environmental management measures to minimise and/or manage impacts to vegetated habitats detailed in Section C18.3.1 would be relevant to managing potential impacts to Glossy Black-cockatoo, including environmental management measure B11 and revised environmental management measure B14 (refer to Table D2-1 of this submissions report).

#### Australasian Bittern

The Australasian Bittern was considered to have a low likelihood to occur in the construction footprint as detailed in Annexure A of Appendix S (Technical working paper: Biodiversity development assessment report), as the species was not identified during field surveys and the construction footprint does not support preferred habitat for the species. As such, further assessment of the Australasian Bittern was not required for the purpose of the assessment.

#### Red Knot

The Red Knot was considered to have a low likelihood to occur in the construction footprint as detailed in Annexure A of Appendix S (Technical working paper: Biodiversity development assessment report), as the species was not identified during field surveys and while small areas of highly modified intertidal mudflats and sandflats offer marginal habitat to the species, most of its preferred habitat features were absent from the construction footprint. As such, further assessment of the Red Knot was not required for the purpose of the assessment.

#### White-bellied Sea Eagle

The White-bellied Sea Eagle was considered to have a high likelihood of occurrence in the construction footprint. The species was not recorded during field surveys as outlined in Table 19-7 of the environmental impact statement. However, this species has been previously recorded throughout Middle Harbour. Potential foraging habitat for the species is present in Middle Harbour within the construction footprint, and potential perching habitat is also present around Middle Harbour in trees along the foreshore at The Spit, Seaforth and Clontarf. Details on survey effort and

timing for White-bellied Sea Eagle surveys is provided in Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report).

The closest known nesting site is located in Newington Nature Reserve, next to the Parramatta River, about 13 kilometres west of the construction footprint, as discussed in Section 3.6.2.4.11 of Appendix S (Technical working paper: Biodiversity development assessment report). In the event that a White-bellied Sea Eagle nest is observed it will be managed in accordance with the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), as required by environmental management measures B12 (refer to Table D2-1 of this submissions report).

### Little Penguins

Little Penguins in the Manly Point Area (from just north of Smedley's Point to Cannae Point), are listed as an Endangered Population under the *Biodiversity Conservation Act 2016*.

Little Penguins were considered to have a high likelihood of occurrence in the construction footprint, as outlined in Table 19-7 of the environmental impact statement. While the species was not recorded during field surveys for this project, it has previously been recorded at several locations within Middle Harbour, including The Spit, Long Bay, Sailors Bay and in the main channel of Middle Harbour.

Potential injury and mortality impacts to Little Penguins are outlined in Section 19.5.2 of the environmental impact statement. It was concluded that injury or mortality may occur during construction of the crossing of Middle Harbour or may potentially occur because of collisions with watercraft or barges involved in construction activities. However, Little Penguins typically forage in shallow waters close to the shoreline, areas that the project largely avoids. In addition, Middle Harbour is currently subject to high levels of water traffic. As such, the species may be adapted to avoiding water vessels.

An observer appropriately trained to spot Little Penguins will be used during marine construction activities. A stop-work procedure will be developed in consultation with a suitably qualified and experienced ecologist and implemented upon evidence of the species in the proximity of the works area, in accordance with revised environmental management measure B24 (refer to Table D2-1 of this submissions report). Additionally, Transport for NSW has also committed to new environmental management measure CTT20 (refer to Table D2-1 of this submissions report), which will implement a speed limit of four knots (about 7.5 kilometres per hour) for all marine traffic associated with the project between the Spit Bridge and 100 metres upstream of the Middle Harbour crossing.

The combination of these environmental management measures and controls are considered appropriate to manage potential impacts to Little Penguins, including safeguarding Little Penguins from being impacted by construction vessels.

### Water quality impacts

While construction works in Middle Harbour have the potential to result in water quality impacts, potentially impacting foraging habitat of White-bellied Sea Eagles and Little Penguins, the project has selected a methodology and controls to limit the potential for turbidity impacts and the mobilisation of sediment. These controls include the use of closed environmental clamshell buckets for dredging the upper layers of sediment and the use of floating silt curtains. As such, any potential increase in turbidity and sedimentation of marine waters near construction activities would be likely minimal, localised and temporary. Refer to Section C18.8.4 for further details on marine water quality impacts and management measures.



### C18.3.6 Impacts to terrestrial threatened amphibians and reptiles

#### ***Issue raised***

Submitters raised concerns in relation to impacts to Red-crowned Toadlet and Rosenberg's Goanna (*Varanus rosenbergi*).

#### ***Response***

##### Red-crowned Toadlet

The Red-crowned Toadlet was considered to have a high likelihood of occurrence within the construction footprint, as outlined in Table 19-7 of the environmental impact statement. While the species was not recorded in the construction footprint during field surveys, it was recorded along the Wakehurst Parkway during investigations for the Northern Beaches Hospital road upgrade project. Riparian vegetation associated with unnamed ephemeral watercourses within open forest areas next to the Wakehurst Parkway offers potential sheltering, foraging and breeding habitat for the species.

The main potential impact to Red-crowned Toadlet identified from Appendix S (Technical working paper: Biodiversity development assessment report) was from injury and mortality or from a decrease in water quality. The realignment and upgrade of the Wakehurst Parkway would increase existing fragmentation of the nearby vegetation, which would potentially adversely affect the movement patterns of a number of threatened terrestrial fauna species known or likely to occur in the area such as Red-crowned Toadlet. There may also be impacts due to the loss of potential foraging and sheltering habitat associated with vegetation or rocky habitat features to be removed. However, the habitat does not comprise a substantial portion of foraging habitat available in the surrounding terrestrial biodiversity locality or wider bioregion. There may also be indirect impacts due to construction activities, for example noise and light spill from temporary construction support sites.

To manage the potential risk of injury and mortality, and to provide connectivity between Manly Warringah War Memorial State Park and Garigal National Park, the Red-crowned Toadlet is considered a target species for the fauna underpasses and connectivity strategy proposed for the project as included in revised environmental management measure B2 (refer to Table D2-1 of this submissions report) and listed in Table A4-3 of this submissions report. In addition, environmental management measure B3 has been revised to provide more protection to the species as follows (refer to Table D2-1 of this submissions report):

Fauna exclusion fencing ~~would~~ **will** be designed to exclude small fauna species from the road corridor, such as Eastern Pygmy-possum, and will be installed for the full extent of the Wakehurst Parkway within the construction footprint. **In addition, frog fencing will be added to the fauna exclusion fencing within identified Red-crowned toadlet habitat.** The design specifications of the fauna exclusion fence will be developed during further design development including the need for access gates to manage any fauna on the ~~road side~~ **roadside** of the fauna exclusion fence based on best available knowledge from other Transport for NSW projects, **and in consultation with NSW National Parks and Wildlife Service and Northern Beaches Council.**

Further discussion on managing the potential risk of injury and mortality of Red-crowned Toadlet due to vehicle strike is provided in Section B4.11 of this submissions report.

The management of water quality impacts to Red-crowned Toadlet is discussed above in Section C18.3.1. With the implementation of the environmental management measures to minimise erosion and sedimentation and potential decreases to water quality during construction and

operation as detailed in Table D2-1 of this submissions report, potential impacts to Red-crowned Toadlet are unlikely as discussed in Section 19.5.2 of the environmental impact statement.

### Rosenberg's Goanna

Rosenberg's Goanna was recorded during field surveys for the project within vegetated areas next to the Wakehurst Parkway as outlined in Table 19-7 of the environmental impact statement. Vegetation in this area offers potential foraging and nesting habitat for the species due to the presence of preferred prey species including birds, reptiles and small mammals, while the presence of sandstone boulders, slabs and rock crevices offer sheltering habitat to the species. Termite mounds recorded in proximity to the Wakehurst Parkway also offer preferred nesting habitat to the species. Rosenberg's Goanna may also forage for roadkill along the margins of the Wakehurst Parkway, where fauna mortality due to vehicle strike is high.

The realignment and upgrade of the Wakehurst Parkway would increase existing fragmentation of the nearby vegetation, which would potentially adversely affect the movement patterns of a number of threatened terrestrial fauna species known or likely to occur in the area such as Rosenberg's Goanna. There may also be impacts due to the loss of potential foraging and sheltering habitat associated with vegetation or rocky habitat features to be removed. However, the habitat does not comprise a substantial portion of foraging habitat available in the surrounding terrestrial biodiversity locality or wider bioregion. There may also be indirect impacts due to construction activities, for example noise and light spill from temporary construction support sites, and risk of strike by construction vehicles.

Environmental management measures to minimise and/or manage impacts to vegetated habitats detailed in Section C18.3.1 would be relevant to managing potential impacts to Rosenberg's Goanna. In addition, Rosenberg's Goanna is considered a target species for the fauna underpasses proposed for the project as included in revised environmental management measure B2 (refer to Table D2-1 of this submissions report).

## **C18.4 Consideration of Flat Rock Reserve**

### **C18.4.1 Assessment of Flat Rock Reserve**

#### ***Issue raised***

Submitters raised concerns and comments about the biodiversity assessment of Flat Rock Drive construction support site (BL2) and consideration of Flat Rock Reserve. Submitters were concerned that impacts to fauna were not adequately assessed for the Flat Rock Drive construction support site (BL2), including impacts associated with the diversion of the existing aboveground constructed open channel within Flat Rock Reserve.

#### ***Response***

Consideration and assessment of potential impacts to fauna at Flat Rock Drive construction support site (BL2) has been extensively documented throughout Appendix S (Technical working paper: Biodiversity development assessment report). The assessment of potential impacts to fauna at the Flat Rock Drive construction support site (BL2) has followed the requirements of the Secretary's environmental assessment requirements and the *Biodiversity Assessment Method* (OEH, 2017a).

Fauna surveys, including the survey technique, effort, timing, and target species, carried out for Flat Rock Reserve are documented in Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report). Specific locations where surveys were carried out within Flat Rock Reserve (and Flat Rock Drive construction support site (BL2)) are shown on Figure 2-4 (map b) of Appendix S (Technical working paper: Biodiversity development assessment report).

The associated fauna habitats of Flat Rock Reserve and Flat Rock Drive construction support site (BL2) are documented in Section 3.7 of Appendix S (Technical working paper: Biodiversity development assessment report) and includes detail on vegetated habitat (refer to Figure 3-10 (map b) of Appendix S) and the habitat associated with the existing aboveground constructed open channel within the northern extent of Flat Rock Reserve.

The main potential impact to fauna at the Flat Rock Drive construction support site (BL2) would be the removal of vegetated fauna habitat which provides potential foraging habitat for threatened fauna species recorded next to the temporary construction support site or highly likely to occur. Species included Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Little Bent-winged Bat (*Miniopterus australis*), Varied Sittella (*Daphoenositta chrysoptera*) and Powerful Owl (*Ninox strenua*).

The existing aboveground constructed open channel located within the Flat Rock Drive construction support site (BL2) is included within the vegetated habitat extents as shown in Figure 3-10 (map b) of Appendix S (Technical working paper: Biodiversity development assessment report). As such, the potential impact to fauna from the proposed diversion of the existing aboveground constructed open channel is considered as part of the loss of vegetated habitat from Flat Rock Drive construction support site (BL2).

Several environmental management measures (including new and revised measures) will apply to the establishment and operation of Flat Rock Drive construction support site (BL2) to minimise and manage impacts to fauna including B1, B6, B11 to B14, B22, B23 and B43 (refer to Table D2-1 of this submissions report for the full wording of these environmental management measures). These measures would be supported by the implementation of a flora and fauna management plan as part of the construction environmental management plan as described in Section D1 of this submissions report.

#### **C18.4.2 Consideration of Willoughby City Council's plans**

##### ***Issue raised***

Submitters raised concerns and comments about a lack of consideration of Willoughby City Council's plans with respect to the biodiversity assessment of Flat Rock Drive construction support site (BL2) and consideration of Flat Rock Reserve, including:

- Questions around how Flat Rock Reserve can be impacted and vegetation removed as it is a declared Wildlife Protection Area by Willoughby City Council
- Concern that details from Willoughby City Council's Urban Bushland Plan of Management have not been considered.

##### ***Response***

###### **Wildlife Protection Area designation**

Willoughby City Council has designated selected bushland reserves in the local government area as 'Wildlife Protection Areas'. The *Willoughby's Wildlife Protection Areas* brochure prepared by Willoughby City Council (undated) indicates the Wildlife Protection Area designation is aimed towards protecting wildlife from domesticated animals such as cats and dogs. It is noted that Flat Rock Reserve is assigned a Level 2 designation with residents being allowed to walk their dog on a leash through the reserve. The Wildlife Protection Area designations are intended to manage these areas from domestic animals and as such do not apply to the project activities.

Transport for NSW is seeking approval for the Beaches Link and Gore Hill Freeway Connection project as State significant infrastructure under Part 5, Division 5.2 of the *Environmental Planning*

and Assessment Act 1979. The inclusion and assessment of Flat Rock Drive construction support site (BL2) within the environmental impact statement would allow its establishment and operation following project approval subject to any conditions of approval provided by the NSW Minister for Planning and Public Spaces and environmental management measures included in Table D2-1 of this submissions report.

As discussed in Section C18.1.4 of this submissions report the Flat Rock Drive construction support site (BL2) was chosen to be located in an area which was previously used as a landfill site. This area contains mostly native revegetation, avoiding impact to surrounding remnant vegetation. In addition, the area required and layout of Flat Rock Drive construction support site (BL2) will be refined during further design development and construction planning to avoid direct impacts on PCT 1841, where feasible and reasonable in accordance with environmental management measure B1 (refer to Table D2-1 of this submissions report). Vegetation removal including the clearing of native vegetation and fauna habitat will be further minimised during further design development and construction planning, to the extent reasonably practical in accordance with revised environmental management measure B6 (refer to Table D2-1 of this submissions report).

Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report). The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.

#### Willoughby City Council's Urban Bushland Plan of Management

Whilst Willoughby Council's *Urban Bushland Plan of Management* has not been referenced in the environmental impact statement, the *Flat Rock Gully Reserve Action Plan* (Willoughby City Council, 2018b) was used to inform the environmental impact statement (refer to Section 3.4.1.1 of Appendix S (Technical working paper: Biodiversity development assessment report)). The *Flat Rock Gully Reserve Action Plan* is an outcome of the *Urban Bushland Plan of Management* and the two documents refer to the same native plant lists for Flat Rock Reserve.

### **C18.4.3 Flat Rock Reserve management measures**

#### ***Issue raised***

Submitters requested additional environmental management measures and conditions of approval in relation to Flat Rock Reserve, including:

- Requests for mitigation measures to protect biodiversity from noise, light, and construction traffic impacts at Flat Rock Reserve
- Requests for conditions of approval prescribing the use of fauna exclusion fencing at Flat Rock Reserve to keep terrestrial animals out of the temporary construction support site.

#### ***Response***

While no site-specific environmental management measures are proposed to manage potential impacts on biodiversity at Flat Rock Reserve due to noise, light, and construction traffic, a number of standard environmental management measures would manage and minimise these impacts. At-source noise mitigation would be included as part of Flat Rock Drive construction support site (BL2), including the acoustic shed and temporary noise barriers, which would minimise impacts on the surrounding environment. Construction noise and vibration impacts will be managed as outlined in environmental management measures CNV1 to CNV5 and CNV13 (refer to Table D2-1 of this

submissions report). Refer to Section C18.3.1 for discussion on management of potential noise, dust and light impacts on fauna.

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project. However, while the installation of fauna exclusion fencing is not proposed at the Flat Rock Drive construction support site (BL2), all temporary construction support sites would have appropriate boundary fencing as outlined in Section 6.8.2 of the environmental impact statement. This would typically comprise construction hoarding, security fencing or temporary noise barriers (where required). Although fauna exclusion fencing is not proposed, the boundary fencing would discourage fauna from entering temporary construction support sites. Additionally, the risk of strike by construction vehicles on site is low as these vehicles are required to travel at slow speeds on internal construction roads for workplace health and safety reasons.

In the event that fauna are observed on temporary construction support sites, they would be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), as per environmental management measure B22 (refer to Table D2-1 of this submissions report).

Environmental management measures and procedures related to biodiversity would be included in a flora and fauna management plan as part of the construction environmental management plan for the project, as outlined in Section D1 of this submissions report.

## **C18.5 Fauna connectivity**

### **C18.5.1 Impacts to existing wildlife corridors**

#### ***Issue raised***

Submitters raised concerns in relation to the project's impact on wildlife corridors and wildlife connectivity, including:

- Concern about the impact to the wildlife corridor between Middle Harbour and Lane Cove River Catchments (including Garigal National Park, Middle Harbour, Clive Park, Tunks Park, Northbridge Park, Cliff Avenue Reserve, Flat Rock Reserve, Bicentennial Reserve and Artarmon Reserve)
- Concern about the impact to the wildlife corridor between the Wakehurst Parkway and Manly Lagoon/Manly Beach (including Burnt Bridge Creek, Manly Warringah War Memorial State Park, Manly Dam and Balgowlah Golf Course)
- Concern about the impact to the wildlife corridor between Garigal National Park and the Ku-ring-gai National Park/Hawkesbury River area.

#### ***Response***

The project largely avoids surface impacts to terrestrial biodiversity values by tunnelling as discussed in Section 19.4 of the environmental impact statement. While a number of the wildlife corridors/areas raised in submissions would not be impacted by the project, some further consideration is provided below.

#### **Wildlife corridor between Middle Harbour and Lane Cove River Catchments**

Impacts in this area due to the project are limited to Flat Rock Drive construction support site (BL2) and the Gore Hill Freeway Connection component of the project. The Flat Rock Drive construction support site (BL2) is atop a former landfill site that has been revegetated over the past 20 years by Willoughby City Council and the community. Removal of native revegetation associated with the Flat

Rock Drive construction support site (BL2) is limited to a small portion of Flat Rock Reserve. Vegetation removal for Gore Hill Freeway Connection component of the project would be limited to an edge of Artarmon Reserve adjacent the Gore Hill Freeway. As such, the project is not expected to impact wildlife connectivity between Middle Harbour and Lane Cove River Catchments.

#### Wildlife corridor between the Wakehurst Parkway and Manly Lagoon/Manly Beach

The project includes the realignment and upgrade of the Wakehurst Parkway which would require the clearing of vegetation in road reserve areas along the Wakehurst Parkway, resulting in an increase in the gap between areas of habitat to the east and west, as noted in Table 4-2 of Appendix S (Technical working paper: Biodiversity development assessment report). It should be noted that Wakehurst Parkway is an existing road and therefore presents an existing barrier to wildlife connectivity. While the Wakehurst Parkway would be widened, impacts will be managed with a number of connectivity measures as required by revised environmental management measure B2 (refer to Table D2-1 of this submissions report) and discussed below in Section C18.5.2.

In addition, the project is not expected to impact existing wildlife connectivity at Burnt Bridge Creek and Balgowlah Golf Course. Due to the presence of Burnt Bridge Creek Deviation and existing residential development, the potential for Burnt Bridge Creek and Balgowlah Golf Course forming part of a wildlife corridor is limited. Notwithstanding, works associated with the connection to and from Burnt Bridge Creek Deviation are not anticipated to create additional constraints. Furthermore, as discussed in Table C18-1, to reduce impacts on native vegetation, an exclusion zone is proposed to be established around riparian vegetation adjoining Burnt Bridge Creek adjacent to the surface road works at Balgowlah, where reasonable and feasible.

#### Wildlife corridor between Garigal National Park and the Ku-ring-gai National Park/Hawkesbury River area

The project is located adjacent to Garigal National Park at the Wakehurst Parkway. While the project would not impact this wildlife corridor, it would ensure connectivity impacts are minimised between Garigal National Park and the Manly Warringah War Memorial State Park, as discussed above, which would benefit the wildlife corridor.

### **C18.5.2 Proposed fauna connectivity measures**

#### ***Issue raised***

Submitters raised concerns and requests in relation to the proposed fauna connectivity measures, including:

- Concern that the proposed fauna connectivity measures are insufficient to prevent fauna mortality on Wakehurst Parkway and are not sized appropriately
- Requests for further detail on the proposed fauna exclusion fencing and the material it would be made from. Submitters also requested that all fauna exclusion fencing is built to Transport for NSW fauna fencing requirements, with special provisions for frog species, and that it be implemented prior to construction
- Requests that fauna exclusion fencing includes gates, and that the Wakehurst Parkway median does not include a concrete barrier, to allow fauna to escape in the event of a bushfire
- Requests for a fauna overpass/land bridge to be constructed at the Wakehurst Parkway.

## ***Response***

### **Adequacy of fauna connectivity measures**

The project has included a number of design measures to minimise impacts to fauna connectivity along Wakehurst Parkway and reduce the risk of vehicle strike and fauna mortality as discussed in Section 19.4 of the environmental impact statement and detailed in Section 5.4.4 of Appendix S (Technical working paper: Biodiversity development assessment report). This includes the provision of three new fauna rope crossings and three new fauna underpasses, as well as the replacement of three existing fauna rope crossings that currently span Wakehurst Parkway (refer to Table 5-10 and Figure 5-7, Figure 5-8 and Figure 5-9 of the environmental impact statement).

The underpasses and rope crossings would provide connectivity between Garigal National Park to the west and Manly Warringah War Memorial State Park to the east. Connectivity measures will be designed during further design development in accordance with the *Wildlife Connectivity Guidelines: Managing Wildlife Connectivity of Road Projects (Draft)* (Roads and Maritime Services, 2011c), taking into account best available knowledge, and consider measures to facilitate the crossing of native fauna species including the Eastern Pygmy-possum, Red-crowned Toadlet, Southern Brown Bandicoot and Rosenberg's Goanna, in accordance with revised environmental management measure B2 (refer to Table D2-1 of this submissions report).

The adequacy of fauna connectivity measures is discussed in detail in Section B4.7.1 of this submissions report and summarised below. In addition, further development of the design has resulted in refinements to the proposed fauna underpass design for the project. The design refinements have allowed for further optimisation of two structures to increase their functionality as fauna underpasses. Further information is provided in Section A4.4 of this submissions report.

### **Fauna rope canopy bridges**

Three existing rope bridges would be replaced and lengthened to accommodate the widened road and three additional rope bridges would be installed, evenly spread across the length of Wakehurst Parkway to improve habitat connectivity for arboreal fauna. Refer to Table B4-3 of this submissions report for further details on the proposed fauna rope canopy bridges proposed for the project.

Rope canopy bridges have demonstrated use by most target arboreal fauna species and similar species including Sugar Gilder and Feathertail Gliders, Common Brushtail Possum, Common Ringtail Possum and Antechinus sp. on upgraded sections of the Pacific Highway Upgrade and Hume Highway duplication (Sandpiper Ecological Services, 2018a). Refer to Section B4.7.1 of this submissions report for further detail.

### **Fauna underpasses**

Three fauna underpasses would be provided as part of the project and their type, location and indicative dimensions are detailed in Table B4-6 of this submissions report. Since the development of the environmental impact statement, some refinements to the fauna underpasses have been carried out to potentially result in higher use by target fauna (refer to Section A4.4 of this submissions report).

Fauna usage has been detected in underpasses located at multiple sections of the Pacific Highway Upgrade, which have similar dimensions as that proposed for the project. Usage by species including wallabies, bandicoots, possums, antechinus, echidnas and frogs has been recorded (Sandpiper Ecological Services, 2018a). Refer to Section B4.7.1 of this submissions report for further detail. Therefore, it is considered that the fauna underpasses proposed are suitable for the target species.

### Fauna exclusion fencing

Fauna exclusion fencing for the project will be designed to exclude small fauna species from the road corridor, such as Eastern Pygmy-possum, and will be installed for the full extent of the Wakehurst Parkway within the construction footprint, as required by revised environmental management measure B3 (refer to Table D2-1 of this submissions report). In addition, frog fencing will be added to the fauna exclusion fencing within identified Red-crowned Toadlet habitat. The design specifications of the fauna exclusion fence will be developed during further design development including the need for access gates to manage any fauna on the road side of the fauna exclusion fence based on best available knowledge from other Transport for NSW projects, and in consultation with NSW National Parks and Wildlife Service and Northern Beaches Council.

The proposed fauna crossings provided by the project would provide an escape route for fauna in the event of a bushfire. The three shared user underpasses located along Wakehurst Parkway would also offer an alternative escape route in the event of a fire.

The upgrade and realignment at Wakehurst Parkway would require the construction of a new median concrete barrier between the northbound and southbound lanes due to road safety requirements. However, given the above measures, it is not anticipated that the median concrete barrier would impact on fauna escaping a bushfire.

### Fauna overpass/land bridge at Wakehurst Parkway

As discussed in Section B11.18.5 of this submissions report in response to requests by Northern Beaches Council, there are a number of engineering and environmental constraints to construct a land bridge for fauna connectivity along the section of Wakehurst Parkway to be realigned and upgraded.

A review of a potential land bridge for fauna connectivity was carried out during project development. This review involved consideration of threatened species information provided in Appendix S (Technical working paper: Biodiversity development assessment report), review of the design and fauna connectivity measures proposed for project and technical advice from suitably qualified and experienced ecologists with familiarity of Pacific Highway upgrade projects. The following is a summary of the review findings:

- Terrestrial fauna previously recorded nearby that are most likely to cross Wakehurst Parkway have been proven to successfully use fauna underpasses at various Pacific Highway upgrade projects and other Transport for NSW projects (refer to above response on adequacy of fauna connectivity measures)
- Arboreal fauna previously recorded nearby Wakehurst Parkway (or comparable species) have all been proven to successfully use rope crossings as evidenced on various Pacific Highway upgrade projects
- Given the above, most fauna species previously recorded nearby that are likely to cross Wakehurst Parkway should be able to successfully use the rope crossings and fauna underpasses proposed for the project, especially as fauna exclusion fencing will guide terrestrial fauna towards the underpasses as required by revised environmental management measure B3 (refer to Table D2-1 of this submissions report)
- The spatial requirements for a land bridge would be much greater than those required for underpasses and rope crossings. The existing landform and Wakehurst Parkway alignment generally follow a ridge line with a lack of deep cuttings. As such, large connecting batters would be required to facilitate construction of a land bridge. A land bridge would require expansion of the construction footprint and removal of additional native vegetation and threatened species habitat



- Landscaping of the land bridge and large connecting batters would also likely require several years to be established. As such, initial use of a land bridge would likely be reduced compared to the proposed fauna underpasses.

Given the proven success of underpasses and rope crossings and potential further impacts associated with constructing a land bridge, construction of a land bridge for fauna connectivity was not considered justified.

Transport for NSW considers that the installation of multiple fauna underpass and rope crossings, as proposed for the project, the best opportunity to provide safe and effective fauna connectivity along the upgraded and realigned Wakehurst Parkway. Fauna connectivity measures will be designed during further design development in accordance with the *Wildlife Connectivity Guidelines: Managing wildlife connectivity of road projects* (Draft) (Roads and Maritime Services, 2011c) as required by revised environmental management measure B2 (refer to Table D2-1 of this submissions report).

## C18.6 Aquatic biodiversity

### ***Issue raised***

Submitters raised concerns about impacts to aquatic biodiversity, including:

- A fish and macroinvertebrate sampling study should be conducted for all waterways impacted by the project
- Concern about assessment of and impacts to aquatic fauna, including Climbing Galaxias, eels and turtles
- Concern about aquatic biodiversity impacts at specific locations including Flat Rock Creek, Quarry Creek, Burnt Bridge Creek, Balgowlah Golf Course stormwater harvesting dam, Manly Dam, Manly Creek (including Mermaid Pool) and waterways within Garigal National Park, in addition requests for an evidence-based plan to protect the flora and fauna that are dependent on the above waterways
- Concern that construction wastewater treatment plant discharge and pollutants from construction at Burnt Bridge Creek would impact downstream environments such as Manly Lagoon and Manly Beach, which could impact marine life health
- Concern that there is no allowance for relocating fauna from Balgowlah Golf Course stormwater harvesting dam or Burnt Bridge Creek
- Concern that mitigation measures to protect aquatic biodiversity at Manly Creek and Manly Dam are inadequate
- Concern that upstream of the Balgowlah Golf Course construction support site (BL10) wastewater treatment plant discharge point will not benefit from treated wastewater flows to the creek, resulting in a dislocation of streamflows for aquatic biodiversity
- Concerned about the impact of increased erosion and sedimentation, and disturbance of contaminated material on aquatic biodiversity.

### ***Response***

#### **Fish and macroinvertebrate sampling**

The freshwater ecology impact assessment method is described in Section 19.2.2 of the environmental impact statement. As noted in the above response, the assessment was prepared to meet the requirements of the Secretary's environmental assessment requirements, relevant Department of Primary Industries (Fisheries) guidelines and policies and *Aquatic Ecology in*

*Environmental Impact Assessment – EIA Guideline Series* (Lincoln Smith, 2003) (refer to Annexure D Freshwater ecology impact assessment of Appendix S (Technical working paper: Biodiversity development assessment report)). The assessment included five waterways, and associated tributaries, and two waterbodies within and surrounding the construction footprint. The likelihood of occurrence of aquatic species (including fish macroinvertebrates) was assessed based on the availability of suitable habitat.

Due to concerns raised by the community and agencies regarding the potential impact of the project on groundwater drawdown and in particular resulting reductions in baseflow to creeks, revised groundwater modelling has been carried out since exhibition of the environmental impact statement as discussed in Section A5.1.15 of this submissions report. In conjunction with this revised groundwater modelling, a more detailed ecological assessment has been carried out of the potential effects on aquatic ecosystems due to predicted reductions in baseflow at Flat Rock Creek, Quarry Creek and Burnt Bridge Creek 100 years after the project starts operation (refer to Annexure A of Appendix E of this submissions report). Supplementary freshwater ecology surveys were carried out as part of this assessment and included sampling of fish and macroinvertebrates as discussed in Section 2 of Annexure A of Appendix E of this submissions report. The sampling did not record any native fish species, and macroinvertebrates assemblages at all creeks were either severely or extremely impaired and suffered from severe pollution (in accordance with the AUSRIVAS rapid assessment methodology (Turak et al. 2004)).

#### Assessment of impacts to aquatic fauna

The existing aquatic biodiversity values along and around the project alignment are described in Section 19.3.3 of the environmental impact statement. Type 1 highly sensitive key fish habitat and sensitive receiving environments within and downstream of the construction footprint include Manly Dam, Manly Creek and the natural reaches of Flat Rock Creek.

No threatened freshwater fauna, flora species or ecological communities or endangered populations listed under the *Fisheries Management Act 1994* and/or the *Environment Protection and Biodiversity Conservation Act 1999* have been identified as likely to occur within the aquatic biodiversity study area. No freshwater migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999* are considered likely to occur within the aquatic biodiversity study area. However, the waterways in the aquatic biodiversity study area are considered suitable to support the majority of common and exotic fish species typically found in the Sydney region, including native eels (*Anguilla spp.*) at Burnt Bridge Creek and Eastern Long-necked Turtles (*Chelodina longicollis*) at Manly Dam as discussed in Table 19-8 of the environmental impact statement.

The potential impacts to aquatic fauna due to the project is outlined in Section 19.5.3 of the environmental impact statement and includes direct loss of aquatic habitat, impacts due to hydrological changes and impacts from decreased water quality.

A number of specific environmental management measures have been proposed to manage potential impacts to aquatic fauna species, including (refer to Table D2-1 of this submissions report):

- Dewatering of the stormwater harvesting dam at Balgowlah Golf Course will be carried out with consideration of native fauna and appropriate measures to be implemented to relocate any native aquatic fauna as required (environmental management measure B8)
- Aquatic habitats will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) and the *Policy and guidelines for fish habitat conservation and management* (NSW Department of Primary Industries (DPI), 2013). This will include flow and sufficient fish passage to be maintained similar to current conditions during instream works where reasonable and feasible (environmental management measure B27)

- Temporary and permanent waterway crossings and instream drainage infrastructure will be designed in accordance with *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003) to ensure fish passage is maintained along the waterway during low flows, where reasonable and feasible. Any instream habitat landscaping is to favour habitat requirements of native species (new environmental management measure B40).

In addition to the above, a suite of environmental management measures (including new and revised measures) to minimise erosion and sedimentation, potential decreases to water quality during construction and operation, and a reduced baseflow will also be implemented for the project as detailed in Table D2-1 of this submissions report, including SG6, SG9, WQ6, WQ10, WQ11, WQ15, WQ17 and WQ18. With the implementation of the environmental management measures included Table D2-1 of this submissions report, the likelihood of impacts to aquatic biodiversity (including to eels and turtles) as a result of the project would be low, as described in Section 19.5.3 of the environmental impact statement.

### Climbing Galaxias

The Manly Creek catchment, including the middle and lower reaches of Manly Creek, is home to the only confirmed population of Climbing Galaxias in the Sydney area. Although not a threatened or protected species, the community prepared an action plan for its protection in the Manly Creek catchment (Salkavich et al., 2002). The action plan considers water pollution to be among the threats to this population, particularly from cumulative impacts from various upstream projects such as urban development, but also potentially from construction and operation of the project.

Construction impacts that could result in decreased water quality are discussed in Section 19.5.3 of the environmental impact statement. These impacts will be managed in accordance with the environmental management measures outlined in Table D2-1 of this submissions report (as summarised in the response above) and through the use of temporary sediment basins. These measures would minimise water quality impacts during construction, and pollutant loading in discharge waters is considered to be low compared to the pollutant loading in existing waterways within affected catchments.

Operational phase water quality modelling (MUSIC model) results for the Wakehurst Parkway stormwater catchments shows that the project would result in an overall beneficial water quality outcome during operation, as discussed in Section 19.5.3 of the environmental impact statement. It is noted that there would be a reduction in annual total suspended solid and total phosphorous loads, but an increase in total annual nitrogen loading when compared to the existing conditions. Modelling results from the MUSIC model for the combined Wakehurst Parkway catchment are detailed in Table 6-6 of Appendix O (Technical working paper: Surface water quality and hydrology).

Based on the overall Wakehurst Parkway catchment results, it was concluded in Section 19.5.3 of the environmental impact statement that there would not be an impact to water quality at downstream locations and the project would not decrease the water quality of Manly Creek. As such, impacts to Climbing Galaxias are considered unlikely during either construction or operation of the project.

Further discussion on the potential impacts to Climbing Galaxias are provided in Section B11.18.16 due to concerns raised by Northern Beaches Council in their submission to the environmental impact statement.

### Impacts to aquatic biodiversity at specific locations

Potential impacts to aquatic biodiversity, including at Flat Rock Creek, Burnt Bridge Creek, Quarry Creek, Balgowlah Golf Course stormwater harvesting dam, Manly Dam, Manly Creek (including

Mermaid Pool) and waterways within Garigal National Park, are outlined in Section 19.5.3 of the environmental impact statement and detailed in Section 4 of Annexure D Freshwater ecology impact assessment of Appendix S (Technical working paper: Biodiversity development assessment report). Specific details on each location raised in submissions is provided below.

#### Flat Rock Creek and Quarry Creek

To facilitate the establishment of the Flat Rock Drive construction support site (BL2), the existing aboveground constructed open channel at Flat Rock Reserve would be diverted by 100 metres through a newly constructed culvert. Drainage diversion works would also occur in the very upper reaches of Flat Rock Creek in the Gore Hill/Artarmon area which is in the location where the creek has been largely replaced by concrete channels from previous road upgrade projects. Aquatic habitat impacts associated with this work is anticipated to be minor. Potential impacts to aquatic biodiversity at Flat Rock Creek are expected to be minimal.

Quarry Creek is a small natural estuarine tributary of Flat Rock Creek, no direct impacts to Quarry Creek would occur due to the project.

Potential impacts to aquatic biodiversity at Flat Rock Creek and Quarry Creek due to reduced baseflows are discussed in Section C18.7.1 below.

#### Burnt Bridge Creek

At Burnt Bridge Creek, although portal design adjustments have minimised impacts to the existing creek, localised adjustments are still required to extend the existing box culvert crossing of the Burnt Bridge Creek Deviation, and scour protection would be installed downstream of the culvert extension works. These works may result in the loss of some instream habitat and some small invertebrates.

The instream works at Burnt Bridge Creek would result in a loss of about 60 square metres of Type 2 moderately sensitive key fish habitat. This section of Burnt Bridge Creek has been previously modified, however the work may result in the loss of some small invertebrates, instream macrophytes and unconsolidated sediments. Notwithstanding, the instream works are anticipated to have a minimal and localised impact to instream freshwater habitats. Offsets for aquatic habitat are discussed in Section 19.6.1 of the environmental impact statement and below in Section C18.10.

Instream works would be carried out during low flows and fish passage would be maintained throughout, in accordance with environmental management measure B27 (refer to Table D2-1 of this submissions report). Where practical, native freshwater fauna, including fish and crayfish, would be relocated to a similar habitat along the same waterway prior to the start of the instream works in accordance with *Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) (as required by environmental management measure B22 (refer to Table D2-1 of this submissions report)). Significant or long-term impacts to freshwater ecology are not expected as a result of the project as the adjusted Burnt Bridge Creek would be designed to be a low flow channel which maintains connectivity during low flows, and to promote fish passage.

Potential impacts to aquatic biodiversity at Burnt Bridge Creek due to reduced baseflows are discussed in Section C18.7.1 below.

#### Balgowlah Golf Course stormwater harvesting dam

Balgowlah Golf Course stormwater harvesting dam is of recent construction, disconnected from natural watercourses and is therefore unlikely to provide habitat for native fish. Any dewatering activities will be undertaken in accordance with the *Technical Guideline: Environmental*

*Management of Construction Site Dewatering* (RTA, 2011b), in a manner that prevents pollution of waters. Dewatering of the stormwater harvesting dam at Balgowlah Golf Course will be carried out with consideration of native fauna and appropriate measures will be implemented to relocate native aquatic fauna as required, in accordance with environmental management measure B8 (refer to Table D2-1 of this submissions report).

#### Manly Dam and Manly Creek (including Mermaid Pool)

Manly Dam, Manly Creek (including the Mermaid Pool at Manly Vale) and waterways within Garigal National Park would not be directly impacted. Potential indirect impacts to aquatic biodiversity in these waterways would be limited to impacts from decreases in water quality during construction and operation. Potential construction impacts that could decrease water quality within Manly Creek and Manly Dam are discussed in Section 19.5.3 of the environmental impact statement and detailed in Section 5.2.2 of Appendix O (Technical working paper: Surface water quality and hydrology).

With the implementation of the environmental management measures to minimise erosion and sedimentation and potential decreases to water quality during construction as detailed in Table D2-1 of this submissions report (including environmental management measure WQ14 and revised environmental management measure SG9), impact to aquatic biodiversity is expected to be minimal.

The operational water quality model (MUSIC model) results for the Wakehurst Parkway stormwater catchments show that the project would result in an overall beneficial water quality outcome during operation with a reduction in annual total suspended solid and total phosphorous loads, but an increase in total annual nitrogen loading when compared to the existing conditions. Based on the overall Wakehurst Parkway catchment results, it was concluded in Section 19.5.3 of the environmental impact statement that the impact on downstream locations is not considered to represent a potential adverse water quality impact and the project would not decrease the water quality of Manly Dam or Manly Creek.

Opportunities for water sensitive urban design will be investigated during detailed design as described in environmental management measure WQ5 (refer to Table D2-1 of this submissions report), which refers to consideration of best management practice guidelines such as *Water sensitive urban design guideline: Applying Water Sensitive Urban Design Principles to NSW Transport Projects* (Roads and Maritime Services, 2017a) when considering these opportunities. Water quality treatment controls for stormwater will be in accordance with environmental management measure WQ6 (refer to Table D2-1 of this submissions report). Further discussion on the adequacy of these measures to protect aquatic biodiversity at Manly Creek and Manly Dam is provided in Section C18.1.

#### Evidence-based plan

Table D1-1 of this submissions report provides the likely sub-plans, along with the relevant guidelines or requirements of each plan, which would support the implementation of the overarching construction environmental management plan. This includes the development of a flora and fauna management plan, which would address potential impacts to flora and fauna and the associated environmental management measures. In addition, the soil and water management plan would also indirectly manage potential impacts to flora and fauna.

All sub-plans would be prepared based on the requirements of environmental management measures provided in Table D2-1 of this submissions report. However, and as discussed in Section D1.1, the sub-plan structure may be modified during detailed construction planning to respond more effectively to particular contractor/s or stakeholder requirements.

### Construction wastewater treatment plant discharge

Discharge from the wastewater treatment plants, including at Balgowlah Golf Course construction support site (BL10), will occur once the water is confirmed to be compliant with relevant discharge criteria in revised environmental management measure WQ11 (refer to Table D2-1 of this submissions report). When the water quality criteria are met, the potential contaminant levels in discharged construction wastewater would be sufficiently low that they would not affect the health of waterways or the wildlife that use them.

### Fauna relocation

Pre-clearing surveys will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) as required by environmental management measures B14 and B23 (refer to Table D2-1 of this submissions report). These requirements would apply to all areas that require vegetation clearing, including Balgowlah Golf Course and Burnt Bridge Creek. The relocation of fauna would be carried out in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), consistent with environmental management measure B22 (refer to Table D2-1 of this submissions report). These requirements apply to fauna in either terrestrial or aquatic environments, such as Burnt Bridge Creek.

Dewatering of the stormwater harvesting dam at Balgowlah Golf Course will be carried out with consideration of native fauna and appropriate measures will be implemented to relocate native aquatic fauna as required, in accordance with environmental management measure B8 (refer to Table D2-1 of this submissions report).

### Burnt Bridge Creek water quality due to water treatment plant

As noted in a previous response in this section, revised groundwater modelling has been carried out since exhibition of the environmental impact statement as discussed in Section A5.1.15 of this submissions report.

In conjunction with this revised groundwater modelling, a more detailed ecological assessment has been carried out of the potential effects on the aquatic ecosystem of Burnt Bridge Creek due to predicted reductions in baseflow 100 years after the project starts operation. Summaries of the freshwater ecology investigations carried out is provided in Section 4.1 of Appendix E of this submissions report. Burnt Bridge Creek includes a mixture of shallow and deep pools and cascade/riffle zones in its upper and middle reaches before becoming a concrete-lined culvert that runs through the Balgowlah industrial estate to Manly Lagoon which is estuarine. Upstream of the Burnt Bridge Creek Deviation, the riparian corridor is considered 'quasi natural' and is dominated by native trees and shrubs with frequent long deep pools, riffles and cascades. The riparian condition of the middle and downstream areas of the creek is either partially or highly modified.

The freshwater sections of Burnt Bridge Creek were found to all have depauperate (ie lacking in numbers of variety of species) assemblages of macroinvertebrates, non-existent assemblages of native fish and generally very few, if any, native macrophytes. This is despite the riparian habitat of many parts of the creek being in reasonable if not good condition. Therefore, although much of the freshwater reaches of Burnt Bridge Creek appear healthy, the aquatic biodiversity is considered to be generally poor. The reasons for such poor condition are likely to be a consequence of generally high levels of some nutrients and dissolved metals, regular scouring by stormwater discharges, the presence of a weir, and steep cascades that would prevent some species from colonising the middle to upper reaches.

The wastewater treatment plant for the Balgowlah Golf Course construction support site (BL10) is only proposed for construction. As such, additional flows from treated discharges would be temporary. However, with consideration of the above findings, while the Balgowlah Golf Course construction support site (BL10) wastewater treatment plant discharge point would not provide additional flows for the full length of the waterway during construction, there is limited aquatic biodiversity within the waterway to provide a benefit to.

#### Erosion, sedimentation and disturbance of contaminated material

Water quality impacts as a result of the project are assessed in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement. Potential water quality impacts during construction may potentially arise from soil erosion, siltation and off-site movement of eroded sediments by stormwater into downstream waterways, accidental fuel and chemical spills, as well as potential changes to water quality and flow in nearby waterways if not appropriately managed.

Potential construction water quality impacts will be managed through the implementation of erosion and sediment control measures, in accordance with revised environmental management measures SG9 and WQ14 (refer to Table D2-1 of this submissions report). This includes implementing erosion and sediment control measures in accordance with the principles and requirements in *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Managing Urban Stormwater: Soils and Construction - Volume 2D Main Road Construction* (DECC, 2008) and relevant guidelines, procedures and specifications of Transport for NSW. Further, a soil conservation specialist will be engaged to provide advice regarding erosion and sediment control including review of erosion and sediment control plans.

Disturbance of contaminated material has the potential to result in the mobilisation of sediment and contaminants, which in turn could result in water quality impacts, as discussed in Annexure D Freshwater ecology impact assessment of Appendix S (Technical working paper: Biodiversity development assessment report).

Contaminants which may be mobilised during construction that are within sediment, groundwater or associated with the use of construction plant, equipment and vehicles include nutrients, heavy metals, hydrocarbons, persistent organic pollutants, and contaminants arising from acid sulfate soils. There is currently evidence of heavy metal and nutrient contamination in all receiving waterways. As such, biota are likely to already be exposed to some of these contaminants. Further contributions to contaminant concentrations or the introduction of new contaminants as a result of the project has potential to affect freshwater biota through toxicity (from, for example, heavy metals) and induce algal blooms (from nutrients).

However, taking into account the proposed environmental management measures included in Table D2-1 of this submissions report, such as SG8 (investigation and management of potentially contaminated areas in accordance with the *Contaminated Land Management Act 2008*) and SG9 (erosion and sediment control measures implemented at construction support sites), the likely volumes of such inflows are very small.

## C18.7 Impacts due to groundwater drawdown

### C18.7.1 Groundwater drawdown impacts on aquatic biodiversity

#### ***Issue raised***

Submitters raised concerns about impacts to aquatic biodiversity as a result of groundwater drawdown, including:

- Concern about the effects on aquatic biodiversity of reduced baseflows (including at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek) and that the conclusion that reductions in flows to Burnt Bridge Creek and Quarry Creek is unlikely to result in a complete loss of aquatic habitat is misleading
- Concern about the implications of reduced water flow for the Manly Lagoon including reduced oxygenation and the impact on aquatic biodiversity.

#### ***Response***

##### Reduced baseflow at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek

As noted in Section C18.6 above, additional groundwater modelling and impact assessment has been carried out since exhibition of the environmental impact statement. A clarification is provided in Section A5.1.15 which summarises the additional studies carried out and the overall findings. Further details of the work completed are provided in Appendix E of this submissions report.

In conjunction with this revised groundwater modelling, a more detailed ecological assessment has been carried out of the potential effects on aquatic ecosystems due to predicted reductions in baseflow at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek 100 years after the project starts operation (refer to Annexure A of Appendix E of this submissions report). Also refer to Section A5.1.18 and Appendix F4 of this submission report for a Biodiversity development assessment report roadmap developed to aid stakeholders in understanding updates to the biodiversity assessment which have occurred since the exhibition of the environmental impact statement.

Summaries of the freshwater ecology investigations carried out following exhibition of the environmental impact statement are provided in sections 4.1 and 4.3 of Appendix E of this submissions report respectively. Burnt Bridge Creek includes a mixture of shallow and deep pools and cascade/riffle zones in its upper and middle reaches before becoming a concrete-lined culvert that runs through the Balgowlah industrial estate to Manly Lagoon which is estuarine. Upstream of the Burnt Bridge Creek Deviation, the riparian corridor is considered 'quasi natural' and is dominated by native trees and shrubs with frequent long deep pools, riffles and cascades. The riparian condition of the middle and downstream areas of the creek is either partially or highly modified.

Quarry Creek is a small natural estuarine tributary of Flat Rock Creek which drains from Cammeray. Flat Rock Creek and Quarry Creek also include a mixture of shallow and deep pools and cascade/riffle zones in their upper and middle reaches before reaching the estuarine section downstream of Flat Rock Creek weir. The riparian corridors are densely vegetated with generally native overstorey and an understorey of native and exotic species. The riparian condition of both creeks are either quasi-natural or only partly modified. . Water quality sampling at Flat Rock Creek, Quarry Creek and Burnt Bridge Creek demonstrates that water quality is generally poor due to elevated nutrients and metals.

Stormwater flows have a noticeably large influence on all three creeks, generally resulting in scouring of the bedrock and removing coarse and fine sediments. Very few instream macrophytes were recorded in the creeks and there were no native fish observed or caught. Australian River



Assessment System (AUSRIVAS) analyses indicated macroinvertebrate assemblages at all creeks were either severely or extremely impaired and suffered from severe pollution.

The freshwater sections of Burnt Bridge Creek, Flat Rock Creek and Quarry Creek were found to all have depauperate (ie lacking in numbers of variety of species) assemblages of macroinvertebrates, non-existent assemblages of native fish and generally very few, if any, native macrophytes. This is despite the riparian habitat of many parts of all of the creeks being in reasonable if not good condition and containing mostly native vegetation. Therefore, although much of the freshwater reaches of Burnt Bridge Creek, Flat Rock Creek and Quarry Creek appear healthy, the aquatic ecology is considered to be generally poor. The reasons for such poor condition are likely to be a consequence of generally high levels of some nutrients and dissolved metals in the creeks, regular scouring by stormwater discharges and the presence of weirs in Burnt Bridge Creek and Flat Rock Creek, and steep cascades in all creeks that would prevent some species from colonising the middle to upper reaches.

Consistent with findings reported in the environmental impact statement (refer to Annexure D of Appendix S (Technical working paper: Biodiversity development assessment report)), detailed field investigations confirmed the presence of pool habitats in most reaches of the creeks. Therefore, even in periods of low flow eg in dry periods in summer and considering the revised predictions of groundwater baseflow reductions, it is expected that many of these pools would be deep enough to retain water and therefore aquatic habitat between rainfall events. Also, the predicted reduction in baseflow at Flat Rock Creek is likely to be offset by discharges to the creek from the Gore Hill Freeway operational wastewater treatment plant, as noted in Section 19.5.3 of the environmental impact statement.

Given the above, and the further assessment carried out in Appendix E of this submissions report, it is considered that predictions of changes to groundwater baseflow caused by the project would not substantially alter the flow regime in any of the three creeks to the extent that it would affect instream habitat and that the project would not significantly impact the aquatic ecology of Burnt Bridge Creek, Flat Rock Creek or Quarry Creek. As there are no sensitive species present, there would be no impact on aquatic communities in these creeks, including any threatened freshwater fauna, flora species or ecological communities or endangered populations listed under the *Fisheries Management Act 1994* and/or the *Environment Protection and Biodiversity Conservation Act 1999*.

Notwithstanding, following completion of revised environmental management measure SG2, a focussed study will be carried out in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science Group) to confirm potential groundwater drawdown and associated baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek due to tunnelling, and confirm potential impacts on freshwater ecology in the affected watercourses and nearby groundwater dependent ecosystems, as required by revised environmental management measure SG6 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, where ecological impacts are predicted to be worse than that presented as part of the environmental impact statement/submissions report, feasible and reasonable mitigation measures to address the impacts will be identified in consultation with a suitably qualified and experienced specialist, incorporated into the detailed design, and implemented during construction. The mitigation measures considered will include tunnel linings.

### Manly Lagoon

Manly Lagoon is fed primarily by Burnt Bridge Creek, Brookvale Creek and Manly Creek (BMT WBM, 2013). In addition to these waterways, the Manly Lagoon catchment is highly urbanised and consists of a significant piped stormwater network as illustrated in Annexure A of Appendix R

(Technical working paper: Flooding) and also available at [services.northernbeaches.nsw.gov.au/icongis/index.html](http://services.northernbeaches.nsw.gov.au/icongis/index.html).

As outlined in Section A5.1.15 of this submissions report, additional field investigations and groundwater modelling and analysis has been carried out since exhibition of the environmental impact statement. This has included revised predictions of groundwater drawdown 100 years after the project starts operation, ie 2128 (refer to Table 3-3 of Appendix E of this submissions report). Revised predicted reductions in groundwater baseflow for Burnt Bridge Creek in 2128 are estimated to be 60 per cent, noting that baseflow is only a small proportion of overall streamflow.

While a potential 60 per cent reduction in baseflow to Burnt Bridge Creek has been estimated during operation, it is likely that high flows within the waterway immediately after rainfall events would continue and between rainfall events there would still be some (low) flow along the waterways (refer to Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement). In addition, Burnt Bridge Creek is supplied by a significant piped stormwater network as described above. It is unlikely the hydrology and ecology of Manly Lagoon estuary, its associated/fringing terrestrial vegetation communities (including any threatened ecological communities), coastal wetlands and habitats would be impacted as a result of the potential 60 per cent reduction in baseflow to Burnt Bridge Creek. Downstream habits and Manly Lagoon would still receive flows from Burnt Bridge Creek, in addition to Brookvale Creek and Manly Creek and the piped stormwater network.

As such, it is unlikely Manly Lagoon would be impacted by reduced oxygenation due to the project and the impact on aquatic biodiversity would be negligible.

### **C18.7.2 Groundwater drawdown impacts on terrestrial biodiversity**

#### ***Issue raised***

Submitters raised concerns about impacts to terrestrial biodiversity as a result of groundwater drawdown and the adequacy of the assessment, including:

- Concern that assessment of impacts to groundwater dependent ecosystems is not sufficient
- Concerns about impacts to groundwater dependent ecosystems within, nearby, and remote from the project, particularly in relation to tree growth and stress
- Request that further detailed studies of the impacts of groundwater drawdown on biodiversity are carried out
- Concern that there is no map of the threatened ecological communities that would be impacted by water table drawdown across the project area.

#### ***Response***

##### **Adequacy of the groundwater dependent ecosystems assessment**

The biodiversity development assessment report has been prepared to meet the requirements of the Secretary's environmental assessment requirements and the *Biodiversity Assessment Method* (OEH, 2017a). The methodology used for the assessment of groundwater dependent ecosystems is summarised in Section 19.3.4 of the environmental impact assessment and detailed in Section 3.8 of Appendix S (Technical working paper: Biodiversity development assessment report). Consideration of impacts to groundwater dependent ecosystems is summarised in Section 19.5.4 of the environmental impact statement and detailed in Section 5.6 of Appendix S (Technical working paper: Biodiversity development assessment report).

The assessment draws from the groundwater modelling carried out for the environmental impact statement as described in Appendix N (Technical working paper: Groundwater). The groundwater modelling is based on conservative groundwater assumptions, as discussed in Section C15.7.1 of this submissions report. Consequently, the assessment of potential impacts to groundwater dependant ecosystems would be considered a conservative scenario.

Following consideration of the Department of Planning, Industry and Environment (Environment, Energy and Science Group)'s submission on the environmental impact statement, refinement of groundwater dependent ecosystem mapping has occurred resulting in small areas of Coastal Sandstone Plateau Heath, Estuarine Fringe Forest and Illawarra Gully Wet Forest groundwater dependent ecosystems being identified. These areas are mapped as very small patches within and along the edges of the larger patches of Coastal Sandstone Gully Forest, Sandstone Riparian Scrub and Coastal Sand Forest mapped around Flat Rock Creek. Further discussion and refined mapping is provided in Section B4.16 and Annexure B of Appendix E of this submissions report.

Due to concerns raised by the community and agencies regarding the potential impact of the project on groundwater drawdown and in particular resulting reductions in baseflow to creeks, revised groundwater modelling has been carried out since exhibition of the environmental impact statement as discussed in Section A5.1.15 of this submissions report. In conjunction with this revised groundwater modelling, further assessment has been carried out of potential impacts to groundwater dependent ecosystems due to predicted groundwater drawdown and reductions in baseflow at Flat Rock Creek, Quarry Creek and Burnt Bridge Creek 100 years after the project starts operation (refer to Annexure B of Appendix E of this submissions report). This assessment considered groundwater dependent vegetation communities adjacent to the upper mid reaches of Flat Rock Creek, and a small patch of Coastal Upland Swamp north of Bantry Bay Oval, about 135 metres to the south east of the construction footprint. The assessment concluded that groundwater drawdown due to the operation of the project is not expected to affect these vegetation communities because they are likely supported by rainfall and shallow, perched aquifers. This conclusion is consistent with the findings of the environmental impact statement.

Also refer to Section A5.1.18 and Appendix F4 of this submission report for a Biodiversity development assessment report roadmap developed to aid stakeholders in understanding updates to the biodiversity assessment which have occurred since the exhibition of the environmental impact statement.

#### Groundwater dependent ecosystems within, nearby and remote to the project

As discussed above, impacts to groundwater dependent ecosystems are directly related to groundwater drawdown levels. Therefore, the assessment of potential impacts to groundwater dependent ecosystems presented in Section 19.5.4 of the environmental impact statement is informed by Appendix N (Technical working paper: Groundwater). Potential construction groundwater drawdown impacts are discussed in Section 16.4.5 of the environmental impact statement, with groundwater drawdown contours for the project at the end of tunnel construction (2028) provided in Figure 16-11 and Figure 16-12. Potential operational groundwater drawdown impacts are discussed in Section 16.5.2 of the environmental impact statement, with groundwater drawdown contours for the project during operation (2128) provided in Figure 16-13 and Figure 16-14. Drawdown would be the greatest directly above the tunnel alignment and would decrease towards the drawdown boundary.

Groundwater dependent ecosystems are identified in Section 19.3.4 of the environmental impact statement with additional areas identified for Flat Rock Creek during refinement of mapping as part of this submissions report as discussed above. No groundwater dependent ecosystems are located within the construction footprint.

There are three areas of groundwater dependent ecosystems near the construction footprint which may potentially rely on subsurface groundwater associated with waterways within, or close to the construction footprint. These features are identified in Table 19-9 and Figure 19-12 of the environmental impact statement, with larger scale and refined mapping for Flat Rock Creek provided in Figure B4-7 of this submissions report. The three areas include:

- Upper reaches of Flat Rock Creek at Munro Park, which includes the following mapped ecosystems:
  - Coastal Sandstone Gully Forest
  - Sandstone Riparian Scrub
  - Coastal Sand Forest
  - Coastal Sandstone Plateau Heath
  - Estuarine Fringe Forest
  - Illawarra Gully Wet Forest
- Bates Creek, which includes the following mapped ecosystems:
  - Estuarine Mangrove Forest
  - Seagrass Meadow
  - Coastal Sandstone Gully Forest
- Manly Warringah War Memorial State Park, which includes the following mapped ecosystems:
  - Coastal Sandstone Gully Forest
  - Coastal Sandstone Plateau Heath.

Assessment of potential impacts to groundwater dependent ecosystem is provided in Section 19.5.4 of the environmental impact statement, with additional assessment of groundwater dependent ecosystems adjacent to the upper mid reaches of Flat Rock Creek, and a small patch of Coastal Upland Swamp in the Sydney Basin Bioregion (Coastal Upland Swamp) north of Bantry Bay Oval, about 135 metres to the south east of the construction footprint provided in Annexure B of Appendix E of this submissions report.

No direct impacts to groundwater dependent ecosystems would occur. Some areas of groundwater dependent ecosystems adjoining Flat Rock Creek would be subject to impacts from groundwater drawdown, with worst-case groundwater drawdown impacts of up to four metres predicted by 2028 and 11 metres by 2128. Vegetation growing on the upper slopes of the sandstone ridges next to Flat Rock Creek are likely to be supported by perched aquifers that have formed as part of the stratification and fracturing in the Hawkesbury sandstone, as discussed in Section 4.2 of Annexure B or Appendix E of this submissions report. Drawdown in the regional aquifer is likely to have minor impacts on vegetation health, so the magnitude of risk is small given that the vegetation community is not solely dependent on groundwater. The small alluvial aquifer of Flat Rock Creek and at the Quarry Creek confluence would be recharged by releases from the project water treatment plant into Flat Rock Creek at Artarmon, which would sustain vegetation communities dependent on groundwater in the shallow alluvium.

Coastal Upland Swamp in the Sydney Basin Bioregion is mapped near the construction footprint. It is not mapped as a groundwater dependent ecosystem within the *National Atlas of Groundwater*

*Dependent Ecosystems* (Bureau of Meteorology (BOM), 2018), however it may be sensitive to changes in groundwater flows.

Two areas mapped as Coastal Upland Swamp may be impacted by groundwater drawdown. The closest patch is located about 95 metres west of Wakehurst Parkway in Garigal National Park. Another small area (about 0.07 hectares) was identified north of Bantry Bay Oval, about 135 metres south east of the construction footprint. Both areas are predicted to experience groundwater drawdown of less than one metre by 2028 and 2128. The extent of groundwater dependence of both of these areas of Coastal Upland Swamp, or their connectivity to other areas of groundwater, is not known and therefore the impacts from groundwater drawdown are uncertain. However, it is considered unlikely that groundwater drawdown of less than one metre would result in impacts to most of the area of Coastal Upland Swamp west of Wakehurst Parkway. Due to the small size, urbanised context and modified floristics, including numerous exotic weed species, impacts to the area of Coastal Upland Swamp north of Bantry Bay Oval are not considered to be significant.

It should be noted that the modelling carried out for Appendix N (Technical working paper: Groundwater), and revised since the exhibition of the environmental impact statement (refer to Appendix E of this submissions report), is based on a conservative scenario of an unlined tunnel, unconstrained groundwater inflows and full hydraulic connectivity in the geology (which in reality would be stratified, with disconnect aquifer horizons, limiting the potential for vertical groundwater movement). This means that the sub-surface drawdown at tunnel depth might not result in the same (or any) drawdown in the shallow water table and might reduce actual drawdown substantially compared to predictions. The drawdown impact (if experienced) would be further reduced following implementation of the following environmental management measures (refer to Table D2-1 of this submissions report):

- Groundwater modelling will be updated with ongoing groundwater monitoring to refine inflow predictions and detailed design to consider these predictions and include designed tunnel linings where required (revised environmental management measure SG2)
- Measures will be implemented during tunnel construction to ensure that groundwater inflows during the operation phase do not exceed 1L/s/km across any given kilometre (revised environmental management measure SG16).

Following completion of environmental management measure SG2, a focussed study will be carried out in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science Group) to confirm potential groundwater drawdown and associated baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek due to tunnelling, and confirm potential impacts on freshwater ecology in the affected watercourses and nearby groundwater dependent ecosystems, as required by revised environmental management measure SG6 (refer to Table D2-1 of this submissions report). As part of this environmental management measure, where ecological impacts are predicted to be worse than that presented as part of the environmental impact statement/submissions report, feasible and reasonable mitigation measures to address the impacts will be identified in consultation with a suitably qualified and experienced specialist, incorporated into the detailed design, and implemented during construction. The mitigation measures considered will include tunnel linings.

#### Further detailed studies of the impacts of groundwater drawdown on biodiversity

The impact of groundwater drawdown on biodiversity is included in Section 19.5.4 of the environmental impact statement and detailed in Section 5.6 of Appendix S (Technical working paper: Biodiversity development assessment report).

In addition, as noted in the above response, following the completion of environmental management measure SG2, a focussed study will be carried out in consultation with Department of Planning,

Industry and Environment (Environment, Energy and Science Group) to confirm potential groundwater drawdown and associated baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek due to tunnelling, and confirm potential impacts on freshwater ecology in the affected watercourses and nearby groundwater dependent ecosystems, will be carried out in accordance with revised environmental management measure SG6 (refer to Table D2-1 of this submissions report).

#### Map of the threatened ecological communities impacted by water table drawdown

As discussed above, Figure 16-11 and Figure 16-12 of the environmental impact statement provides groundwater drawdown contours for the project at the end of tunnel construction (2028) whereas Figure 16-13 and Figure 16-14 of the environmental impact statement provides groundwater drawdown contours for the project during operation (2128). All figures show ecosystems dependent on subsurface groundwater in addition to Coastal Upland Swamp, which is listed as Endangered under the *Biodiversity Conservation Act 2016* and *Environment Protection and Biodiversity Conservation Act 1999*.

In addition, updated mapping with groundwater drawdown contours for the project during operation (2128) based on the revised groundwater modelling carried out since exhibition of the environmental impact statement are provided in figures 3-1 and 3-3 of Appendix E of this submissions report. These figures also show ecosystems dependent on subsurface groundwater in addition to Coastal Upland Swamp.

Impacts to other endangered ecological communities from potential water table drawdown are not expected as discussed in Appendix S (Technical working paper: Biodiversity development assessment report).

## **C18.8 Marine biodiversity**

### **C18.8.1 Impacts to marine fauna**

#### ***Issue raised***

Submitters raised concerns and requests regarding impacts to marine fauna, including:

- Concern over impacts to marine fauna species and habitats including threatened species such as White's Seahorse, Black Rockcod and Grey Nurse Shark (*Carcharias Taurus*) during construction and operation of the project
- Concern over the impacts of underwater noise from dredging and piling activities in Middle Harbour
- The environmental impact statement assumes that noise would deter marine animals from approaching the Middle Harbour sites, however it does not account for marine fauna already close to construction sites when noise commences
- Concern over impacts on marine biodiversity due to construction vessel movements and potential vessel strike
- Request for the project to include barriers which would safely exclude marine animals from the Middle Harbour crossing construction footprint.

#### ***Response***

##### Impacts to marine fauna species

A comprehensive assessment of impacts to marine biodiversity within and surrounding the construction footprint has been included in Appendix T (Technical working paper: Marine ecology).

Threatened marine species or populations most likely to be affected by the project are those that reside, forage or transit through areas affected by construction activities. Such species may include the Black Rockcod and White's Seahorse because of their potential to reside in high and medium relief rocky reef, although only a few individuals of these species would occur in the small areas of these habitats where individuals would potentially be harmed. Some marine mammals, marine turtles and sharks (such as Grey Nurse Shark) could also occur in these areas, however these habitats are generally considered suboptimal for these species.

The disturbance of threatened marine species would be temporary and limited to the construction phase of the project, and it is considered that the potential for significant impacts to any threatened species would be minor and would not affect the viability of local populations of listed species. A number of marine biodiversity environmental management measures (including revised environmental management measures) have been included in Table D2-1 of the submissions report to manage potential impacts to the threatened marine species, including B5, B9, B37 and B38. Refer to Section C18.8.2 for discussion regarding minimising disturbance to marine habitat.

While the focus of Appendix T (Technical working paper: Marine ecology) has been on the assessment of threatened marine fauna species, non-threatened fauna species are considered due to them utilising similar habitats to threatened species. As such, environmental management measures related to marine biodiversity and provided in Table D2-1 of this submissions report will also minimise and manage impacts to non-threatened species. Refer to sections of this submissions report for additional detail on:

- Impacts to marine habitat (Section C18.8.2)
- Impacts to seagrass (Section C18.8.3)
- Marine water quality impacts (Section C18.8.4).

During operation of the project, the sill created by the immersed tube tunnels would be steeper than other sills in Middle Harbour. However, the tunnels would be confined to much deeper water than natural sills and are considered not to be an impediment to fish passage.

Additionally, and in response to issues raised by the Department of Planning, Industry and the Environment as well as Northern Beaches Council, further assessment of potential effects of the sill created by the immersed tube tunnels has been carried out since the exhibition of the environmental impact statement. Modelling results of additional water quality assessment, specifically focussing on dissolved oxygen concentrations, and further consideration of the potential impacts to marine fauna are discussed in Section 4 (Assessment of potential effects of the immersed tube tunnel sill) of the preferred infrastructure report.

The modelling shows that the area affected by the lower dissolved oxygen would be confined to an area of deeper water (depth greater than 10 metres) in the deep basin located immediately upstream of the immersed tube tunnels, below the depth of any identified sensitive marine fauna habitats. The magnitude, duration, and spatial scale of the effect of the immersed tube tunnel sill to benthic fauna in these areas would not be measurable beyond natural impacts from the occasionally low dissolved oxygen events. The sensitive Type 1 or Type 2 key fish habitat in the vicinity of the immersed tube tunnel, such as seagrass or rocky reef, are located in shallow water close to the shoreline of Middle Harbour and would be unaffected by any changes in dissolved oxygen. The outcomes of the modelling and additional assessment remain consistent with the findings of the environmental impact statement.

### Underwater noise impacts

Underwater noise caused by piling and dredging during construction of the project may impact fish and shark species as outlined in Section 19.5.5 of the environmental impact statement and detailed in Section 5.2.1.6 of Appendix T (Technical working paper: Marine ecology). Potential impacts may include physical or behavioural impacts to marine species, such as temporary impacts to hearing or organs, changes to foraging behaviour, and changes in the distribution of marine species to avoid underwater noise generated by the project.

Modelling indicates that noise impacts would largely be limited to the immediate location of piling and dredging activities but may extend up to 300 metres from the noise source. As a result, there is the potential to impact on up to 0.09 hectares of seagrass habitat, 1.54 hectares of rocky reef habitat, and 128.73 hectares of deep water and open water habitat. Different species have different tolerances and responses to noise, and it is expected that there would be a range of potential responses, including avoidance. However, the project is not expected to affect the broader ecological functioning or viability of local populations due to the temporary nature of underwater noise impacts. Further, piling methods proposed are similar to those currently used in Sydney Harbour for wharf upgrades and other works and potential impacts would be managed through well-established marine industry methodologies.

Prior to commencement of impact piling appropriate management measures to minimise noise impacts on fish and aquatic organisms will be developed in consultation with a qualified and experienced marine ecologist and implemented during impact piling works in accordance with revised environmental management measure B9 (refer to Table D2-1 of this submissions report). The measures will include investigation and contingency actions should distressed or dead fish be observed within or adjacent to the construction footprint during piling works.

The potential extent of underwater noise at the Middle Harbour crossing construction footprint is provided in Figure 5-4 and Figure 5-5 of Appendix T (Technical working paper: Marine ecology). As such, the underwater noise assessment has considered marine fauna already close to construction sites when noise commences.

As the seagrass and subtidal rocky reef habitats included in Figure 5-4 and Figure 5-5 of Appendix T (Technical working paper: Marine ecology) are potential habitat of the threatened White's Seahorse, pre-construction surveys of potential affected habitat will be carried out by suitably qualified and experienced marine ecologists to search for White's Seahorses (and other Syngnathids) that may be present and relocate them to nearby unaffected habitat in accordance with revised environmental management measure B5 (refer to Table D2-1 of this submissions report). The subtidal rocky reef is also habitat for the Black Rockcod, although very few individuals are expected to occur within the potentially affected areas. In addition, some threatened sharks (ie Grey Nurse Shark) may also occur in the potentially affected areas, although given the marine ecology study area is suboptimal foraging habitat for this species and other threatened shark species, very few individuals would be likely to occur in these areas during construction.

### Construction vessel movements

Vessel strike to marine turtles and marine mammals would be unlikely as individuals are unlikely to occur within the construction footprint and surrounding 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 B37 (refer to Table D2-1 of this submissions report).



An observer appropriately trained to spot Little Penguins will be used during marine construction activities, in accordance with environmental management measure B24 (refer to Table D2-1 of this submissions report). A stop-work procedure will be developed in consultation with by a suitably qualified and experienced ecologist and implemented upon evidence of the species in the proximity of the works area. This would assist in avoiding impacts to Little Penguin individuals.

Additionally, Transport for NSW has committed to new environmental management measure CTT20 (refer to Table D2-1 of this submissions report), which will implement a speed limit of four knots (about 7.5 kilometres per hour) for all marine traffic associated with the project between the Spit Bridge and 100 metres upstream of the Middle Harbour crossing. The combination of these environmental management measures is considered appropriate safeguard marine turtles and marine mammals from being construction vessel strike.

### Marine barriers

The provision of marine barriers to exclude marine animals from the Middle Harbour crossing construction footprint would not be practical and would likely result in greater impacts and disturbance to marine biodiversity than currently assessed.

A number of environmental management measures have been proposed to manage potential impacts to marine fauna within and surrounding the Middle Harbour crossing, including (refer to Table D2-1 of this submissions report):

- Pre-construction surveys of potentially affected marine habitat areas will be carried out in the 24 hour period prior to commencement of works that may impact potential habitat by suitably qualified and experienced marine ecologists to search for White's Seahorses (and other Syngnathids) and relocate them to nearby habitat (revised environmental management measure B5)
- Prior to commencement of impact piling appropriate management measures to minimise noise impacts on fish and aquatic organisms will be developed in consultation with by a suitably qualified and experienced marine ecologist (revised environmental management measure B9)
- A stop work procedure will be developed to mitigate potential impacts to Little Penguins, marine mammals and reptiles within the vicinity of impact piling works, and an observer appropriately trained to spot Little Penguins will be used during marine construction activities (environmental management measure B37 and revised environmental management measure B24).

### **C18.8.2 Impacts to marine habitat**

#### ***Issue raised***

Submitters raised concerns and requests regarding impacts to marine habitats, including:

- Requests for specific measures to minimise disturbance to habitat associated with White's Seahorse
- Requests for further detail on the process intended for reinstatement of natural habitats such as the rocky sill at the edge of Clive Park
- Concerns over the impact to marine habitats in Sydney Harbour and ocean beaches due the project.

#### ***Response***

#### **Removal and reinstatement of marine habitat**

The project has been designed to avoid and minimise potential impacts on marine ecology and has included the development of the design to minimise the construction footprint as far as practicable to

reduce the area of impact to marine vegetation and habitat as discussed in Section 19.4 of the environmental impact statement and Section 1.8 of Appendix T (Technical working paper: Marine ecology).

Environmental management measures (including revised environmental management measures) to minimise disturbance to these habitats include B28 to B33 (refer to Table D2-1 of this submissions report), which includes the implementation of exclusion zones and management of potential impacts due to propeller wash, scour and suspended sediments.

The project would result in the removal medium/high relief rocky reef habitat during the installation of the Middle Harbour north cofferdam (BL8). This habitat has potential to provide habitat for Black Rockcod and White's Seahorse. The removal would be limited to 0.01 hectares and would be reinstated after construction.

Subtidal rocky reef habitat removed along the shoreline at the Middle Harbour north cofferdam (BL8) and intertidal rocky shore, sand and mudflat habitats removed at the Spit West Reserve construction support site (BL9) will be rehabilitated and restored as close as possible to pre-construction conditions to the extent reasonably practicable and in consultation with the Department of Primary Industries (Fisheries) in accordance with revised environmental management measure B34 (refer to Table D2-1 of this submissions report).

The exact design for rehabilitation and mitigation works would be dependent on site constraints and would be determined during further design development. The aim of any rehabilitation is to restore affected habitat as close as possible to preconstruction conditions. Further detail on how reinstatement may be achieved is provided in Section 6.6 of Appendix T (Technical working paper: Marine ecology). Potential approaches include:

- Reinstatement of the intertidal and subtidal rocky reef using natural reef materials, such as the rock removed during construction, so that it would be as similar as possible to pre-existing habitat
- Design of project elements at the nearshore areas of the crossing so that they provide equivalent structural complexity to that of natural intertidal or subtidal rocky reef habitat (ie an artificial reef environment), with guidance provided by the *Environmentally Friendly Seawalls: A Guide to Improving the Environmental Value of Seawalls and Seawall-lined Foreshores in Estuaries* (OEH, 2012).

Dredging would result in the removal of about 3.50 hectares of deep water soft sediment habitat, including the unavoidable loss of about 1.41 hectares of deep water soft sediment habitat where the immersed tube tunnel units at the crossing would be placed. However, the surface of the immersed tube tunnels would be colonised through natural processes and would provide more surface area than the deep water soft sediment habitat it would replace, such that there would be no net loss to key fish habitat.

Pre-construction surveys of potentially affected marine habitat areas to search for White's Seahorse (and other Syngnathids) and relocate them to nearby habitat will be carried out in the 24 hour period prior to commencement of works that may impact potential habitat as required by revised environmental management measure B5 (refer to Table D2-1 of this submissions report).

#### Impact to marine habitats in Sydney Harbour and ocean beaches

The assessment of impacts on marine habitats is detailed in Section 2.7 of Appendix T (Technical working paper: Marine ecology). Apart from direct impacts to habitat within the Middle Harbour construction footprint, the potential spatial extent of impacts, specifically from dredging activities, was guided by the approach provided in the Western Australian Environmental Protection Authority Technical Guidance Document entitled *Environmental Impact Assessment of Marine Dredging*

*Proposals* (WA Environmental Protection Authority (EPA), 2016). This allowed the effects of dredging to be mapped in terms of zones of impact and influence.

The zone of influence and zone of moderate impact during dredging is provided in Figure 5-2 of Appendix T (Technical working paper: Marine ecology). As can be seen, potential impacts are limited to the area surrounding the Middle Harbour construction footprint. As such, impacts to marine habitats in Sydney Harbour and ocean beaches would be negligible due to the project.

### **C18.8.3 Impacts to seagrass**

#### ***Issue raised***

Submitters raised concerns and requests regarding impacts to seagrass, including:

- Requests for detailed mapping of seagrasses for the entire study area immediately prior to construction to ensure exact locations are recorded. If any changes in locations between the environmental impact statement survey and the survey prior to construction, these can be mapped and avoided where possible
- Concern the project has not accounted for the loss of ecosystems that sequester carbon such as seagrasses and mangroves
- Requests for further detail be provided in relation to the proposed implementation of maritime exclusion zones and scope of monitoring in relation to potential seagrass impacts.

#### ***Response***

##### Detailed seagrass mapping

Extensive marine ecology habitat mapping has been carried out as part of preparing the environmental impact statement as detailed in Section 2.4.3 of Appendix T (Technical working paper: Marine ecology). This included:

- Presumptive habitat maps were created for the study area from an orthorectified aerial photograph captured on 6 May 2017
- Potential seagrass and macroalgae beds were then outlined on a preliminary map layer via on-screen digitising at a scale of 1:600 to demarcate likely seagrass and macroalgae bed boundaries as polygons determined from dark areas on the photos and from marine vegetation maps of the harbour previously prepared (Creese et al, 2009)
- Survey points were then overlaid onto polygons to provide a reference for field validation
- Fieldwork was carried out using a combination of underwater towed video camera and/or bathyscope. At each location, the habitat was verified and/or reclassified according to habitat categories, ie seagrass, subtidal rocky reef and intertidal rocky shore
- Following completion of the field survey, polygons drawn in the presumptive maps were reclassified in accordance with the results of the field validation exercise. Any areas which appeared as seagrass or macroalgae in the aerial imagery but were not marine vegetation were removed from the final maps.

Further detail on seagrass surveys is provided in Section 2.4.3.1 of Appendix T (Technical working paper: Marine ecology).

Given the above effort and detailed habitat maps prepared for the project, additional mapping is not considered required at this stage of the project.

### Loss of seagrass and mangroves

As discussed in Section C18.2.1 above, the project design development has sought to minimise the clearing of native vegetation and this will be continued through further design development through implementation of revised environmental management measure B6 (refer to Table D2-1 of this submissions report), which will minimise the loss of habitat.

There is seagrass habitat near the Middle Harbour south (BL7) and Middle Harbour north (BL8) cofferdams and Spit West Reserve construction support site (BL9). With appropriate management of construction activities, including vessel movements, direct impacts to seagrass habitats would be minimal. Exclusion zones will be implemented to avoid disturbance to sensitive marine habitats not proposed to be directly impacted by the project, including seagrass habitats with potential to occur within or next to transit routes and vessel movements, in accordance with environmental management measure B29 (refer to Table D2-1 of this submissions report).

To minimise the potential impact of turbidity (suspended sediment), silt curtains will be installed around seagrass patches within 25 metres of the Middle Harbour cofferdam construction support sites (BL7 and BL8) (revised environmental management measure B31, refer to Table D2-1 of this submissions report). To avoid direct damage to seagrass and subtidal rocky reef from silt curtain movement, there will be a suitable buffer distance between marine habitat and the silt curtain to account for curtain movement due to tides and currents and to prevent shading of the marine vegetation from the silt curtain, in accordance with environmental management measure B33 (refer to Table D2-1 of this submissions report).

The project would not result in any direct impact to mangroves, as outlined in Chapter 19 (Biodiversity) of the environmental impact statement.

### Exclusion zones

Exclusion zones will be implemented to avoid disturbance to sensitive marine habitats not proposed to be directly impacted by the project, in accordance with environmental management measure B29 (refer to Table D2-1 of this submissions report). These include any intertidal sand and mudflats, intertidal rocky shore, subtidal rocky reef and seagrass habitats with potential to occur within or adjacent to transit routes and vessel movements.

A flora and fauna management plan would be implemented as part of the construction environmental management plan, as described in Section D1 of this submissions report. The flora and fauna management plan would include seagrass monitoring and management measures.

## **C18.8.4 Marine water quality impacts**

### ***Issue raised***

Submitters raised concerns and requests regarding water quality impacts to marine ecology, including:

- Requests for modelling to be carried out regarding the impacts of sediment disturbance on marine life
- Concern of increased turbidity impacting marine habitats including seagrass
- Concern that proposed silt curtains will be ineffective and requests that full length silt curtains need to be used during construction to minimise the movement of sediments to sensitive seagrass and mangrove locations, along with real time water quality monitoring
- Requests for the locations of sensitive marine habitats in the vicinity of dredging locations be included in management plans and procedures for mitigating impacts

- Concern regarding disturbance of contaminated material in Middle Harbour
- Concern regarding impacts to marine biodiversity due to contamination and potential fuel leaks on marine biodiversity.

### ***Response***

#### Turbidity and sedimentation

Impacts of sediment disturbance on marine life are assessed in Section 19.5.5 of the environmental impact statement and was based on modelling of changes to hydrodynamics, e-folding times and sedimentation due to project construction and operational activities carried out as part of Appendix P (Technical working paper: Hydrodynamic and dredge plume modelling).

Construction of the project would cause turbidity and sedimentation impacts on about 0.02 hectares of medium relief subtidal rocky reef habitat around the Middle Harbour north cofferdam (BL8). There would also be potential to impact on seagrass and rocky reef habitats in the vicinity of the Middle Harbour south cofferdam (BL7) and Spit West Reserve (BL9) construction support sites. 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 communities.

A range of measures have been developed to mitigate the generation and movement of suspended sediments due to dredging which would manage potential impact to the marine environment, such as nearby patches of seagrass, including:

- Restricted working hours, thereby minimising the rate of sediment disturbance (as outlined in Table 6-35 of the environmental impact statement)
- Use of a closed environmental clamshell bucket for removal of the surface layer of sediments with elevated contaminant concentrations. These buckets have been specifically designed for dredging contaminated sediments (in accordance with environmental management measure WQ16, to Table D2-1 of this submissions report)
- The use of two 10-12 metre deep draft silt curtains around the entire dredging operation (one on each side of the crossing) (in accordance with environmental management measure WQ16, Table D2-1 of this submissions report)
- The use of an additional shallower silt curtain ('Moon pool'), about two to three metres deep, attached to the dredge barge within which the dredge bucket specifically operates (as outlined in Section 6.4.4 of the environmental impact statement, and in accordance with environmental management measure WQ16, Table D2-1 of this submissions report)
- The use of shallow silt curtains around ecologically sensitive areas that could be potentially impacted by dredging activities, to provide additional protection (in accordance with revised environmental management measure B31, Table D2-1 of this submissions report)
- Wastes (including dredge material) will be appropriately transported, stored and handled according to their waste classification and in a manner than prevents pollution of the surrounding environment (in accordance with environmental management measure WM4, Table D2-1 of this submissions report). This would include no overflow of dredged material permitted from transport barges.

A pictorial representation of dredging operations including the use of deep draft, shallow and localised floating silt curtains and the closed environmental clamshell bucket are shown on Figure C16-1 of this submissions report.

It is acknowledged that there is potential for silt curtains to be damaged during construction. Silt curtains will be monitored for their effectiveness, particularly during periods of inclement weather and maintenance will be carried out when required, in accordance with environmental management measure B32 (refer to Table D2-1 of this submissions report).

Discussion on the use of full length silt curtains is provided in Chapter C16 Hydrodynamics and water quality of this submissions report (refer to Section C16.2.5) and detailed in Appendix C1 of this submissions report. In summary, the depth of the silt curtains is a balance between restricting the movement of suspended sediments, maintaining tidal flow, and being able to adequately hold the silt curtains in place. There is a risk that full depth silt curtains which are anchored to the bed of the harbour would generate greater suspended sediment (turbidity) than lesser depth curtains, as a result of sediment disturbance caused by the general movement/drag of the curtains on the bed of the harbour with tidal currents, and as a result of sediment disturbance caused by their placement, progressive relocation and the ultimate removal of the curtain anchoring devices located on the harbour bed. As such, the proposed silt curtain strategy described above is considered to be the optimal solution.

Monitoring during dredging activities will be carried out to validate the effectiveness of mitigation measures implemented to manage potential impacts on the water quality and sensitive marine vegetation and habitats of Middle Harbour in accordance with revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report). This will include the use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites (eg seagrass habitats) to manage any potential impacts.

The above measures would be supported by the implementation of a dredge management plan and flora and fauna management plan as sub-plans of the construction environmental management plan, as described in Section D1 of this submissions report. Extensive marine ecology habitat mapping has been carried out as part of preparing the environmental impact statement as detailed in Section 2.4.3 of Appendix T (Technical working paper: Marine ecology). This habitat mapping would be used to inform the implementation of exclusion zones which are required in accordance with environmental management measure B29 (refer to Table D2-1 of this submissions report) and would be included as part of the dredge management plan.

### Contamination

Sediment sampling discussed in Appendix Q (Technical working paper: Marine water quality) notes that contaminants were found within the top one metre of sediments. The marine contamination reporting was based on geotechnical investigations carried out for the project which included the specific concentrations of contaminants for samples collected informed both Appendix Q (Technical working paper: Marine water quality) and Appendix T (Technical working paper: Marine ecology).

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).

With the implementation of the environmental management measures discussed above minimising the generation and movement of suspended sediments, 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.

## Fuel leaks

There is potential for sediment spills, accidental discharge of contaminated bilge water, and spills of oils or grease during dredging, refuelling or other vessel activities, as discussed in Section 5.2.1.7 of Appendix T (Technical working paper: Marine ecology). Spills would have the potential to impact on seagrass habitats. Potential spills will be managed in accordance with revised environmental management measure SG20 (refer to Table D2-1 of this submissions report) as follows:

Emergency procedures, including material **and washdown area** bunding and appropriately sized spill containment kits, will be developed to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk of human health impacts, **water quality impacts** and contamination of groundwater.

### **C18.8.5 Altered hydrodynamics**

#### ***Issue raised***

Submitters raised concerns about the effects of altered hydrodynamics and tidal patterns on marine biodiversity due to dredging of Middle Harbour and installation of the immersed tunnel.

#### ***Response***

During construction there would be an alteration to hydrodynamics due to the construction of the immersed tube tunnels, cofferdams, silt curtains and temporary wharves. Modelling of temporary changes to tidal current speeds carried out for the project construction phase indicate that while the temporary changes would be relatively large in some locations at some parts of the tidal cycle, substantial impacts are not expected for the key fish habitats within the marine biodiversity study area. These habitats, including Type 1 seagrass and rocky reef habitats, thrive in many other parts of the marine biodiversity study area where natural currents are within the expected modified range. The temporary changes in hydrodynamics are not expected to impact deep water habitats (refer Section 19.5.5 of the environmental impact statement for further information).

During operation, there would be a permanent hydrodynamic alteration due to the installation of the immersed tube tunnel, which would create a sill of about 9.2 metres high above the bed of the harbour at the deepest part of the Middle Harbour crossing location. The presence of the sill has the potential to impact on water quality in the marine environment by reducing the natural flushing of upstream waters, which in turn could promote conditions more favourable to the depletion of dissolved oxygen in the bottom boundary layer and may lead to longer periods of low dissolved oxygen concentrations in the near-bed waters upstream of the immersed tube tunnel. Reduced dissolved oxygen concentrations may result in the mortality to some benthic infauna and epifauna in soft sediment habitat in the deepest parts of the harbour. However, this is not considered to be a major impact given these assemblages are already exposed to similar disturbances naturally and would be expected to be resilient to slight increases in the longevities of these disturbances through rapid recolonisation. Fish and shark species would generally be able to avoid these bottom layers. Any depletion of dissolved oxygen in deeper waters would be rapidly mixed vertically resulting in the project having a negligible effect on dissolved oxygen in surface waters and nearshore environments in which Type 1 and Type 2 key fish habitats are located.

As noted in Section C18.8.1 above, further assessment of potential effects of the sill created by the immersed tube tunnels has been carried out since the exhibition of the environmental impact statement. Modelling results of additional water quality assessment, specifically focussing on dissolved oxygen concentrations, and further consideration of the potential impacts to marine fauna are discussed in Section 4 (Assessment of potential effects of the immersed tube tunnel sill) of the preferred infrastructure report.

The modelling shows that the area affected by the lower dissolved oxygen would be confined to an area of deeper water (depth greater than 10 metres) in the deep basin located immediately upstream of the immersed tube tunnels, below the depth of any identified sensitive marine fauna habitats. The magnitude, duration, and spatial scale of the effect of the immersed tube tunnel sill to benthic fauna in these areas would not be measurable beyond natural impacts from the occasionally low dissolved oxygen events. Similar to the environmental impact statement findings, the sensitive Type 1 or Type 2 key fish habitat in the vicinity of the immersed tube tunnel, such as seagrass or rocky reef, are located in shallow water close to the shoreline of Middle Harbour and would be unaffected by any changes in dissolved oxygen. As such, there would be no requirement for additional offset requirements under the *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013) for managing impacts to marine biodiversity.

The sill created by the immersed tube tunnels would also likely increase the rate of siltation in the deepest waters upstream of the crossing by three to four millimetres per decade. The siltation rate would remain within the range of sedimentation rates for Sydney Harbour and would have a negligible impact on overall sedimentation.

As discussed in Appendix T (Technical working paper: Marine ecology), the project would not have a significant impact on any threatened species, population, endangered ecological community or trigger any key threatening process. The environmental impact statement findings are that project outcomes to biodiversity values in Middle Harbour would be acceptable.

## **C18.9 Monitoring and mitigation**

### **C18.9.1 Additional environmental management measures**

#### ***Issue raised***

Submitters requested additional biodiversity environmental management measures be included for the project, including:

- Requests for nest boxes and rock habitats to be developed prior to construction for displaced fauna
- Requests for all suitable felled trees with hollows, particularly those larger than 20 centimetres, be relocated to nearby areas so they can continue to provide habitat for birds and arboreal mammals. If that is not feasible, then funds should be set aside for new artificial hollows to be made in suitable dead trees nearby or habitat boxes installed. Provision should be made for long term maintenance of this infrastructure
- Requests for a noise wall to be constructed at Cammeray Golf Course to reduce construction noise impacts on fauna
- Requests for mitigation measures to protect biodiversity from changes to the quality and extent of surface water and groundwater
- Requests for a program be developed to restore native wildlife corridors and waterways
- Requests for an independent biodiversity protection commissioner be appointed for the project
- Concern that construction workers would not be able to identify threatened fauna and requested that trained persons be used.



## **Response**

### Artificial and/or created habitat for displaced fauna and reuse of hollows

The removal of fauna habitat is discussed in Section 19.5.2 of the environmental impact statement. Vegetated habitats that would be removed are primarily located next to the Wakehurst Parkway, and within the Flat Rock Drive (BL2), Balgowlah Golf Course (BL10), Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites. With the exception of Balgowlah Golf Course construction support site (BL10), the majority of the areas are located adjacent to intact native vegetation that would be available for displaced fauna during construction. For Balgowlah Golf Course construction support site (BL10), fauna species that would inhabit this area would generally be limited to highly mobile species as described in Section 3.7.1 of Appendix S (Technical working paper: Biodiversity development assessment report). As such, it is expected that any displaced fauna would readily disperse to surrounding small, isolated patches of habitat.

Notwithstanding the above, environmental management measures have been developed to establish habitat, including environmental management measure B13 which requires that vegetation is re-established within the construction footprint, where feasible, in accordance with *Guide 3: Reestablishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) (refer to Table D2-1 of this submissions report). In addition, it is proposed to reuse salvaged logs from the clearing process on site, where reasonable and feasible, as required by revised environmental management measure WM8 (refer to Table D2-1 of this submissions report). Reuse of salvaged logs would be carried out in accordance with *Guide 5: Re-use of woody debris and bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a).

Prior to clearing, local community restoration/rehabilitation groups, Landcare groups, relevant councils and National Parks and Wildlife Service will be consulted with to determine if there is an interest in the reuse of suitable timber and root balls not used by the project for habitat enhancement and rehabilitation work. If there is an interest, Transport for NSW will facilitate collection of native trees (greater than 25-30 centimetres in diameter and three metres in length) and root balls where reasonable and feasible.

With regard to nest boxes, the project would impact two hollow-bearing trees as discussed in Section 19.5.2 of the environmental impact statement. A nest box program would not be implemented as part of the project due to minimal impacts to hollows.

While it is noted a number of threatened species known and considered likely to occur within the construction footprint are associated with rocky habitats in Section 5.4.1 of Appendix S (Technical working paper: Biodiversity development assessment report), this habitat type is present and is readily available throughout the surrounding locality and wider bioregion and it is not proposed to recreate rock habitat removed due to the project.

### Cammeray Golf Course noise wall

Descriptions of the temporary construction support sites is provided in Section 6.8.2 of the environmental impact statement. Where required, temporary noise barriers are proposed to be installed at the Cammeray Golf Course construction support site (BL1). The indicative locations of the temporary noise barriers are broadly around the eastern and northern extents of the site, as identified in Figure 6-30 of the environmental impact statement. This location coincides with potential areas of isolated patches of habitat within Cammeray Golf Course and surrounds.

### Changes to the quality and extent of surface water and groundwater

A number of environmental management measures have been proposed to manage potential changes to the quality and extent of surface water and groundwater as detailed in Table D2-1 of this submissions report. These environmental management measures (including revised environmental management measures) will minimise any associated impact to biodiversity and include:

- Surface water and groundwater quality impacts – SG1, SG9, SG18, SG19, SG20, WQ2, WQ5, WQ6, WQ10, WQ11, WQ14, WQ15, WQ17, WQ18, B8 and B27
- Surface water and groundwater extent impacts – SG2, SG6, SG16, B30, WQ3, WQ8, in addition to treated wastewater discharges from temporary construction support sites identified in Table 17-15 of the environmental impact statement and the Gore Hill Freeway operational wastewater treatment plant contributing to surface water streamflow in the discharge waterways.

Discussion on the changes to the quality and extent of surface water and groundwater and potential impacts on biodiversity are provided in sections C18.6 and C18.7 of this submissions report.

### Native wildlife corridors and waterways restoration

Restoration of native wildlife corridors and waterways outside of the construction footprint is considered out of the scope of the project.

Areas disturbed by the project would be restored in accordance with the environmental management measures outlined in Table D2-1 of this submissions report, including:

- The urban design and landscape plan will detail built and landscape features to be implemented during construction and rehabilitation of disturbed areas during construction of the project (environmental management measure V1)
- All areas disturbed by the project that are not required for operation will be restored to their existing condition or in accordance with the urban design and landscape plan where applicable (environmental management measure V11)
- Where mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme, established under Part 6 of the Biodiversity Conservation Act 2016) are removed as a result of construction, they will be replaced at a ratio of 2:1. The replacement trees will consist of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees) where available and subject to the urban design and landscape plan. Where replacement trees cannot be accommodated within the operational footprint of the project, consultation will be carried out with adjacent government land owners and the relevant local council (where appropriate) to determine if they can accommodate the replacement tree(s) (revised environmental management measure V13) Vegetation will be re-established within the construction footprint, where feasible, in accordance with *Guide 3: Reestablishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a) (environmental management measure B13)
- A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah. This process will start in advance of construction commencing. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space (revised environmental management measure LP4)
- Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community. The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be

implemented as soon as practicable at the completion of construction (new environmental management measures LP8).

In addition, site-specific landscaping would be provided at the approaches to the fauna underpasses proposed for the project to increase their effectiveness. Consideration would be given to planting of feed species for target species, such as banksias for Eastern Pygmy-possum outside of any fauna fencing as described in Section 5.4.4 of Appendix S (Technical working paper: Biodiversity development assessment report).

The potential for scour and erosion of watercourse bed and banks will be considered during the design of new discharge outlets, in accordance with revised environmental management measure WQ8 (refer to Table D2-1 of this submissions report). Construction work activities within or next to the watercourses and drainage lines will be minimised as much as reasonably practical to minimise disturbance of sediments in or near the waterway. Disturbed floodplain environments next to the watercourses and/or along overland drainage lines will be stabilised as soon as practical following disturbance as required by revised environmental management measure WQ15 (refer to Table D2-1 of this submissions report).

Further, the localised adjustment and drainage works associated with Burnt Bridge Creek will be designed with consideration of existing channel conditions and an understanding of existing hydrology to minimise alterations to, and erosion of, the bed and banks. The gradient, sinuosity and channel capacity will be consistent with upstream and downstream sections. The extension to the existing culvert will be designed with a low gradient and scour protection to minimise impacts to geomorphology. Where required, the adjustment will include grade controls and bank stabilisation works to manage anticipated high velocity conditions (refer to environmental management measure WQ4 in Table D2-1 of this submissions report). Further discussion on the rehabilitation of these waterways is provided Section B6 (refer to Section B6.2.2 of this submissions report).

Marine areas, such as subtidal rocky reef habitat removed along the shoreline at the Middle Harbour north cofferdam (BL8) and intertidal rocky shore, sand and mudflat habitats removed at the Spit West Reserve construction support site (BL9), will be restored as close as possible to their existing condition consistent with revised environmental management measure B34 (refer to Table D2-1 of this submissions report).

#### Independent biodiversity protection commissioner

As discussed in Section C18.1.1 of this submissions report, all the biodiversity assessments carried for the project have been prepared in accordance with requirements of the Secretary's environmental assessment requirements, relevant legalisation, government agency guidelines and policies, and best management practice guidelines.

In addition, prior to public exhibition the environmental impact statement was submitted to the Department of Planning, Industry and Environment and relevant government agencies for review as to its adequacy. The review concluded that the environmental impact statement was adequate in meeting the Secretary's environmental assessment requirements.

If the project is approved, the NSW Minister for Planning and Public Spaces would issue conditions of approval for the management of key issues. These would need to be adhered to by both Transport for NSW and the construction contractor/s, in addition to the environmental management measures provided in Table D2-1 of this submissions report.

Transport for NSW and the contractor/s would be responsible for implementing the conditions of approval, and Transport for NSW would monitor the contractor's compliance. In addition to Transport for NSW's own monitoring and auditing of compliance, the conditions of approval would also likely specify the appointment of an independent environmental representative who would

regularly monitor the compliance with and implementation of key project commitments, including mitigation measures. A regular monthly report would be prepared by the environmental representative for the Department of Planning, Infrastructure and Environment and other government agencies, if required. The environmental representative would be a suitably qualified and experienced person who was not involved in the preparation of the environmental impact statement and is independent from Transport for NSW and the companies involved in the design and construction of the project.

In addition, the conditions of approval would also likely specify requirements for independent audits of the project.

Given the above, the need for an independent biodiversity protection commissioner is not considered necessary for the project.

### Fauna identification

Vegetation removal will be carried out in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a), consistent with environmental management measure B11 (refer to Table D2-1 of this submissions report). *Guide 4: Clearing of vegetation and removal of bushrock* includes the requirement for a licensed wildlife carer or ecologist to be on site during any habitat removal.

Further, new environmental management measure B43 has been developed in relation to training contractor/s in biodiversity awareness (refer to Table D2-1 of this submissions report):

Biodiversity awareness training will be provided for contractors prior to commencement of construction works to ensure an understanding of potential threatened species, populations and ecological communities that may be impacted during the project, and the environmental management measures proposed to minimise and/or manage potential impacts including the contractor's responsibilities under the unexpected species find procedure included in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011a).

## **C18.9.2 Monitoring**

### ***Issue raised***

Submitters raised concerns and requests regarding biodiversity monitoring, including:

- Concerns that monitoring of fauna during operation is not proposed and request for ongoing monitoring and maintenance of ecological corridors, including monitoring ecosystems for a minimum of 50 years
- Concerns that there is to be no marine ecology monitoring during construction and request for such monitoring to include sensitive marine habits and biota in Middle Harbour during construction.

### ***Response***

#### Terrestrial biodiversity monitoring

An ecological monitoring program will be developed in consultation with Environment, Energy and Science Group and Northern Beaches Council to determine the effectiveness of the proposed fauna connectivity measures and threatened species mitigation developed from implementing revised environmental management measures B2 and B3 (refer to Table D2-1 of this submissions report). Accordingly, new environmental management measure B44 has been developed as follows (refer to Table D2-1 of this submissions report):

Monitoring will occur during pre-construction, construction and post-construction phases of the project to determine the effectiveness of the proposed fauna connectivity measures and exclusion fencing to be provided as part of the project.

Pre-construction baseline monitoring will commence prior to project construction works impacting fauna habitat adjacent to the Wakehurst Parkway and include adequate sampling of threatened and protected targeted fauna species in line with relevant guidelines.

A construction/post-construction ecological monitoring program will be developed prior to construction in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science Group) and Northern Beaches Council. The program will include monitoring of targeted fauna species, threatened or protected species, and pest species, in addition to key performance criteria that trigger the need for and feasibility of potential corrective actions. The program will consider the pre-construction baseline monitoring results and ecological monitoring data collected for the Northern Beaches Hospital road upgrade project where relevant.

Post-construction monitoring will extend for 10 years after the opening of the project.

Requirements for maintenance of landscaping associated with the fauna underpasses is discussed in Section C18.2.4 of this submissions report. Maintenance requirements for fauna crossings and fauna exclusion fencing will be developed during further design development and incorporated into an Operational Environmental Management Plan or existing Environmental Management System as relevant in accordance with revised environmental management measure B2 (refer to Table D2-1 of this submissions report). Further detail has been provided in Section B4.14.1 of this submissions report, including the likely the maintenance requirements for the project based on typical maintenance requirements and inspections from other Transport for NSW projects which include similar fauna connectivity measures.

Landscaped areas of the project would be maintained by Transport for NSW, unless arrangements have been made to transfer the management of a landscaped area to an alternative party at which point it would be responsibility of the alternative party to maintain the landscaped area.

#### Marine ecology monitoring

Table D1-1 of this submissions report provides the likely sub-plans, along with the relevant guidelines or requirements of each plan, which would support the implementation of the overarching construction environmental management plan. This includes the development of a flora and fauna management plan, which would address, but is not limited to, seagrass monitoring and management measures.

All sub-plans would be prepared based on the requirements of environmental management measures provided in Table D2-1 of this submissions report which address impacts to marine vegetation and sensitive habitat. However, and as discussed in Section D1.1, the sub-plan structure may be modified during detailed construction planning to respond more effectively to particular contractor/s or stakeholder requirements.

As discussed above in Section C18.8.4, monitoring of dredge activities will also be carried out for the project in accordance with revised environmental management measure WQ12 (refer to Table D2-1 of this submissions report). This will include the use of real-time turbidity monitoring at both potential impact and background locations, as well as adoption of a tiered (trigger level) management approach for sensitive sites (eg subtidal rocky reef and seagrass habitats) to manage any potential impacts.

The above measure will be supported by the implementation of a dredge management plan as part of the construction environmental management plan as described in Section D1 of this submissions report.

## C18.10 Biodiversity offsets

### *Issue raised*

Submitters raised concerns and requests about biodiversity offsets that included:

- Concern that biodiversity offsetting has not been clearly outlined in the environmental impact statement and requested detail on where offsetting would occur
- Concern that if biodiversity offsets do not occur in areas local to the project the result will be a net loss of local biodiversity
- Concern that biodiversity offsets are not appropriate to compensate for the loss of biodiversity as a result of the project
- Requests that biodiversity offsets be conditioned to be based on a worst-case scenario
- Requests that that biodiversity offsets be agreed before removal of trees near Wakehurst Parkway
- Requests that offsets are purchased and maintained in the biobanking system in perpetuity, at a ratio of greater than 1:1
- Requests offsets are located in the Northern Beaches local government area including purchasing land the Local Aboriginal Land Council own around the Wakehurst Parkway and Oxford Falls area, or from three privately owned blocks of land in the Redhill area of Cromer
- Requests that Transport for NSW work with Northern Beaches Council and relevant stakeholders to examine the options to offsetting impacts adjacent to areas of direct and indirect impact within the Manly Warringah War Memorial State Park.

### *Response*

The NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016*, has been applied to the project. Under the NSW Biodiversity Offsets Scheme, an accredited assessor must apply the *Biodiversity Assessment Method* (OEH, 2017a) to the project. The *Biodiversity Assessment Method* (OEH, 2017a) is established under Section 6.7 of the *Biodiversity Conservation Act 2016*. The purpose of the *Biodiversity Assessment Method* (OEH, 2017a) is to assess impacts on threatened species and threatened ecological communities, and their habitats, and the impact on biodiversity values, where required under the *Biodiversity Conservation Act 2016*. Appendix S (Technical working paper: Biodiversity development assessment report) has been prepared consistent with the process outlined in the *Biodiversity Assessment Method* (OEH, 2017a) and the offsets calculated are an outcome of this process and meet the Secretary's environmental assessment requirements.

The biodiversity offset requirements for the project are discussed Section 19.6.1 of the environmental impact statement and detailed in Section 7 of Appendix S (Technical working paper: Biodiversity development assessment report). The ecosystem system and species credit requirements for offsets required under the NSW Biodiversity Offsets Scheme due to direct or potential indirect impacts of the project on vegetation/habitat is provided in Section 7.1 of Appendix S (Technical working paper: Biodiversity development assessment report).

Transport for NSW's approach to the delivery of the offsets required under the NSW Biodiversity Offsets Scheme is discussed in Section 7.3 of Appendix S (Technical working paper: Biodiversity development assessment report). It is noted the options for offsetting under the NSW Biodiversity Offsets Scheme and available to the project include one or more of the following:

- Purchase and retirement of an appropriate number and class of like-for-like biodiversity credits from landholders participating in the Biodiversity Offset Scheme

- Payment to the NSW Biodiversity Conservation Fund administered by the Biodiversity Conservation Trust. Under this model the Biodiversity Conservation Trust takes on the responsibility for purchasing the required credits.

Consistent with the requirements of Section 7.14(4) of the *Biodiversity Conservation Act 2016*, offsets must be achieved prior to the commencement of construction impacts on biodiversity values.

In regard of aquatic fish habitat offsets, Transport for NSW has applied the requirements of the *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013) that significant environmental impacts (direct and indirect) are to be offset by environmental compensation, as outlined in Section 7.2 of Appendix S (Technical working paper: Biodiversity development assessment report).

The potential impact associated with Burnt Bridge Creek (Type 2 key fish habitat) is the only aquatic biodiversity impact of the project that required consideration of offsetting. Transport for NSW have elected to pay for the value of the habitat lost as the preferred option for offsetting aquatic fish habitat impacted at Burnt Bridge Creek (per requirements of *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013)).

For offsets relating to aquatic biodiversity, the project would offset on a minimum 2:1 basis for key fish habitat lost in accordance with the *Policy and guidelines for fish habitat conservation and management* (NSW DPI, 2013).

Offsetting of marine fish habitats is not anticipated as a result of the project. Refer to Section 7 of Appendix T (Technical working paper: Marine ecology) for details regarding the offset strategy for impacts to marine fish habitats.

## **C18.11 Other biodiversity impacts**

### ***Issue raised***

Submitters raised other general concerns about potential impacts to biodiversity surrounding the project, including:

- Concerns about impacts to biodiversity due to emissions from surrounding unfiltered ventilation outlets
- Concerns about potential impacts to biodiversity as a result of climate change impacts generated by the project
- Concerns about the impact of the project in combination with increased frequency of droughts and bushfires.

### ***Response***

#### **Biodiversity impacts from ventilation outlets**

The air quality impact assessment demonstrates that under predicted traffic conditions the contribution of tunnel ventilation outlets to pollutant concentrations was negligible for sensitive receivers, as presented in Chapter 12 (Air quality) of the environmental impact statement.

In addition, and consistent with other recent motorway tunnel projects in NSW, the ventilation outlets for the project have been designed to improve dispersion and lower ground level concentrations of vehicle emissions compared to existing lower ground level concentrations of vehicle emissions by:

- Moving the point of release further away from sensitive receivers at ground level, giving more time and distance for emissions to dilute

- Moving the point of release higher in the atmosphere where dispersion is improved by more turbulence and stronger winds.

While flora and fauna surrounding the project weren't specifically assessed as sensitive receivers, based on the above, potential operational air quality impacts to biodiversity would be considered negligible. For further discussion regarding the design of ventilation outlets refer to Section C11.4.6 of this submissions report.

#### Biodiversity impacts from climate change

The estimated construction stage emissions of the project represent about 0.6 per cent of NSW emissions and about 0.13 per cent of Australia's national emissions compared to a 2018 baseline as detailed in Section 26.2.3 of the environmental impact statement. Due to the indirect nature of Scope 3 emissions, a proportion of these emissions may be generated interstate or internationally.

The estimated operation phase emissions of the project represent about 0.03 and 0.04 per cent of projected NSW emissions in 2027 and 2037 respectively, and 0.01 per cent of Australia's projected national emissions in both 2027 and 2037 as detailed in Section 26.2.4 of the environmental impact statement. While these percentage contributions are small within the NSW and national contexts, environmental management measures have been developed to ensure greenhouse gas is addressed effectively during further design development and construction (refer to environmental management measures GHG1 and GHG2 in Table D2-1 of this submissions report). Given the above, the risk of the project increasing the impacts of climate change on biodiversity is considered to be low.

At a state-wide level, the NSW Government is committed to effective action on climate change and is guided by the *NSW Climate Change Policy Framework* which outlines long-term objectives to achieve net-zero emissions by 2050 and to make NSW more resilient to a changing climate.

#### Biodiversity impacts of the project in combination with increased frequency of droughts and bushfires

An increased frequency of droughts and bushfires are likely projected impacts from climate change. As discussed in the above response, the risk of the project increasing the impacts of climate change on biodiversity is considered to be low.

However, the project has included environmental management measures to address bushfire risk of the project during construction and operation, particularly for the Wakehurst Parkway section of the project (refer to environmental management measures HR3 to HR8 in Table D2-1 of the environmental impact statement). These measures would assist in managing bushfires and their potential impact to surrounding biodiversity.

In addition, and as discussed above in Section C18.5.2, the proposed fauna crossings for the project would provide escape routes for fauna in the event of a bushfire. The three shared user underpasses located along Wakehurst Parkway would also offer an alternative escape route in the event of a fire.





Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C19 – Land use and property

## C19 Land use and property

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## **C19.1 Adequacy and accuracy of assessment**

### ***Issue raised***

Submitters raised concerns that the project has not adequately assessed potential land use and property impacts, including loss of public open space at Cammeray and Balgowlah golf courses and that no offset measures are proposed.

### ***Response***

The project has been designed and developed to minimise property acquisitions and prioritise the use of Transport for NSW and other State owned land, including Crown land, Sydney Water land and council land, where possible. Notwithstanding this, some temporary leases and permanent acquisition of private property would be required.

An assessment of the project's impacts on land use and property, including impacts to and the loss of public open space during construction and operation is provided in Chapter 20 (Land use and property) and Chapter 21 (Socio-economics) of the environmental impact statement. The assessment of the project impacts on land use and property was carried out in accordance with relevant legislation and guidelines and the Secretary's environmental assessment requirements (refer to Table 20-1 and Table 21-1 of the environmental impact statement).

Changes to public open space as a result of the project are described in Section 20.4.2 of the environmental impact statement. The majority of public open space used during construction of the project would not be required to operate the project. Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate condition in accordance with environmental management measure LP5 (refer to Table D2-1 of this submissions report). This will take into consideration the location, land use characteristics, area and adjacent land uses or in accordance with the urban design and landscape plan where applicable. Rehabilitation will be carried out in consultation with the relevant landowner, the local council and community (where appropriate). Permanent changes in public open space during operation of the project would be limited to the Cammeray and Balgowlah golf courses and Artarmon Park.

The Cammeray Golf Course would be reconfigured and managed to provide an equivalent standard golf course, albeit in a modified form, or the provision of works to offset the loss in standards. Transport for NSW proposes to address the potential impacts to the Cammeray Golf Course as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project as discussed in Table 20-5 of the environmental impact statement. Transport for NSW would continue its collaborative engagement with Cammeray Golf Club to allow the golf course to continue operating as a nine hole golf course during construction and operation of the project.

Changes at Artarmon Park would be limited to the conversion of a portion of steeply sloping land adjacent to the Gore Hill Freeway to project infrastructure. The remainder of the land affected by construction would be reinstated after construction and is not expected to impact on the long-term use of Artarmon Park.

At the Wakehurst Parkway east construction support site (BL13), Transport for NSW would acquire a portion of the Bantry Bay Reservoir site from Sydney Water to use during construction of the project. This land would be rehabilitated and revegetated as soon as practicable after construction and would be handed over to Northern Beaches Council to manage for use by the community as public open space, as part of the Manly Warringah War Memorial State Park. This would add about 4000 square metres of new public space to the Manly Warringah War Memorial State Park.

The changes at Balgowlah Golf Course as a result of the project would preclude its continued operation. However, through engagement with Northern Beaches Council as part of the project, the potential was identified for the residual land to be developed as new and improved public open space and recreation facilities that better addresses the areas' current and future recreational needs, as described in Table 20-6 of the environmental impact statement. The project would progressively return an area equivalent to about 90 per cent of the current open space to the community as new and improved public open space and recreation facilities.

Transport for NSW has endeavoured to minimise the impacts of the project on public open space, whilst also minimising the need for property acquisitions. To offset the loss of public open space as a result of the project, Transport for NSW would convert the open space at Balgowlah Golf Course to be freely accessible to all members of the public and have facilities with a broader recreation use (rather than being limited to use as a golf course).

An additional specific offset of public open space is not considered necessary as:

- The loss of public open space as a result of the project is relatively small
- Improvements would be made to existing open space at the Balgowlah golf course through the establishment of new and improved public open space and recreation facilities
- The project includes the provision of new public open space at Seaforth (discussed further in Section C19.4 of this submissions report)
- Final residual land from the project would be confirmed through further design development
- There are challenges involved in identifying additional suitable lands in the vicinity of the project which could be turned into viable open space and recreation areas.

The loss of public open space is discussed further in Section C19.3 of this submissions report.

## **C19.2 Access to public open space and sport and recreation facilities**

### ***Issue raised***

Submitters raised concern about impacts on access to the natural environment and sport and recreation facilities at the following locations during construction:

- Open green space in North Balgowlah
- Balgowlah Oval
- Flat Rock Reserve
- Willoughby Leisure Centre
- Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group and Northbridge Amateur Swimming Club
- Mountain bike trails near Wakehurst Parkway.

### ***Response***

Potential direct and indirect impacts during construction on social infrastructure within and surrounding the project area, including public open space and sport and recreation facilities, are discussed in Section 21.4.4 of the environmental impact statement. Potential impacts on access and connectivity during construction are described in Section 21.4.8 of the environmental impact statement and are described below.

### North Balgowlah

The project would not result in any direct impacts to public open space or sport and recreation facilities in North Balgowlah. Temporary changes to local access and traffic disruptions and delays due to construction activities and increased construction traffic may temporarily impact access to these areas and/or facilities during construction.

### Balgowlah Golf Course

During construction, a portion of land currently occupied by the Balgowlah Golf Course would be utilised for the operation of the Balgowlah Golf Course construction support site (BL10) and for the construction of a new access road, motorway facility and ventilation outlet. The temporary construction support site would occupy part of the land (about 28 per cent). Residual land not used for construction, primarily to the east and north of the new access road, would progressively become available as new and improved open space and recreation facilities, subject to the completion of a dedicated consultation process led by Transport for NSW and Northern Beaches Council, and involving the local community as described in Section 20.4.2 of the environmental impact statement. To facilitate this, the golf course would be permanently closed at the start of construction. Members of the golf club would be required to use alternative facilities, including Wakehurst Golf Course, Manly Golf Course and Warringah Golf Course, all of which are located within two kilometres of Balgowlah Golf Course. The project would return an area equivalent to around 90 per cent of the current open space to the community as new and improved public open space and recreation facilities.

### Balgowlah Oval

The existing Balgowlah Scout Hall and Balgowlah Oval and cricket nets would remain operational throughout construction until the new and improved open space and recreation facilities at the Balgowlah Golf Course are commissioned, as shown in Figure 6-38 of the environmental impact statement. Construction of the new access road and the new and improved open space and recreation facilities would be staged (refer to Section 6.6 of the environmental impact statement), so that current access to the existing Balgowlah Oval would be maintained until the new and improved open space and recreation facilities are operational. Further detail on the staging of these works and the provision of access to Balgowlah Oval is outlined in Section B11.19.7 of this submissions report.

### Flat Rock Reserve

A small portion of Flat Rock Reserve would be temporarily leased for use as the Flat Rock Drive construction support site (BL2). The temporary construction support site would result in the temporary loss of access to and use of land within the construction footprint, temporarily disrupting the use of this land for public open space and recreation activities. Public access to areas of the reserve outside of the Flat Rock Drive construction support site (BL2) would be maintained at all times during construction and rehabilitation works. Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community, in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report). The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.

### Willoughby Leisure Centre

The project would not result in any direct impacts to public open space or sport and recreation facilities at the Willoughby Leisure Centre, Bicentennial Reserve or Flat Rock Baseball Diamond.

Rather, the location for the Flat Rock Drive construction support site (BL2) was selected to avoid impacts to this public open space and recreation facilities (for further detail refer to Section 2 (Flat Rock Drive temporary construction support site (BL2) options analysis)) of the preferred infrastructure report). Temporary changes to local access and traffic disruptions and delays due to construction activities and increased construction traffic may temporarily impact access to these areas and/or facilities during construction.

#### Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group and Northbridge Amateur Swimming Club

The project would not result in any direct impacts on land access to the Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group or Northbridge Amateur Swimming Club. Temporary changes to local access, traffic disruptions and delays due to construction activities and increased construction traffic in the Warringah Freeway and surrounds area may temporarily impact access to these clubs during construction. Marine access to the Northbridge Sailing Club and 1<sup>st</sup> Northbridge Sea Scout Group would be impacted by navigation restrictions at the construction crossing in Middle Harbour during the construction period. Recreational users, such as boating, sailing, rowing and kayaking, would be allowed to travel through the construction crossing in a controlled manner, ensuring the safety of both waterway users and the project team. This would result in the slowing of maritime traffic, potentially affecting recreational movements and resulting in potential access restrictions for maritime users and sailing course relocation impacts for Northbridge Sailing Club.

Some sailing courses may not be readily relocated due to seasonal wind influences, resulting in these courses needing to be de-commissioned for the construction period. Construction of the project would also require up to six short term closures, including two full and four partial closures, of Middle Harbour between Northbridge and Seaforth Bluff for periods of 24 to 48 hours each to install the immersed tube tunnel units. These closures would normally occur on weekdays to limit the disturbance to users of Middle Harbour.

During full closures of Middle Harbour, no boating traffic would be able to pass the location of the Middle Harbour crossing. During partial closure of Middle Harbour, navigational restrictions would prohibit larger vessels from crossing the harbour between Northbridge and Seaforth Bluff. Smaller vessels passing through may require escort vessels to be provided. This would potentially affect recreational movements and access and connectivity for sporting clubs associated with Middle Harbour, including Northbridge Sailing Club and 1<sup>st</sup> Northbridge Sea Scout Group. The proposed construction work in Middle Harbour would not impact use of Middle Harbour and access to Northbridge Baths for recreational swimming, as discussed in Section C20.4.2 of this submissions report. Transport for NSW would continue to work closely with the various Middle Harbour maritime clubs and recreational users to make alternate arrangements to avoid and reduce impacts from proposed maritime works where possible. The following environmental management measures (refer to Table D2-1 of this submissions report) will be implemented to help minimise impacts to Middle Harbour recreational users:

- Construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic, including near the Spit Bridge, where possible (refer to revised environmental management measure CTT4)
- Middle Harbour closures would occur on weekdays to limit the disturbance to harbour recreational users, community groups and clubs. The community will be notified in advance of proposed transport network changes, and maritime restrictions through appropriate media and other appropriate forms of community liaison (refer to environmental management measure CTT7)

- Consultation will be carried out with surrounding water based users of Middle Harbour including Mosman Rowing Club, 1<sup>st</sup> Northbridge Sea Scout Group, 1<sup>st</sup> Sailors Bay Sea Scouts and Northbridge Sailing Club to develop reasonable and feasible management measures to minimise construction impacts (refer to revised environmental management measure CTT16)
- All construction vessels including stationary barges and transport vessels will be fitted with and use automatic identification systems (refer to new environmental management measure CTT17)
- All structures occupying part of the waterway or any exclusion marker placed in the water will be adequately lit. This includes temporary wharves, jetties, cofferdams, dredgers, and the temporary mooring facility (refer to new environmental management measure CTT18)
- A navigation channel delineated with marker buoys will be formed on the approach to d'Albora Marina at The Spit adjacent to the Spit West Reserve construction support site (BL9) (refer to new environmental management measure CTT19)
- A speed limit of four knots for all marine traffic will be implemented between the Spit Bridge and 100 metres upstream of the Middle Harbour crossing to minimise the impact of vessel wash and reduce vessel speed to ensure the safety of mariners (refer to new environmental management measure CTT20)
- The Spit West Reserve construction support site (BL9) will not impact the land based approach or water based approach to the Mosman Rowing Club. The channel on approach to Mosman Rowing Club will be 30 metres (100 feet) wide and will be delineated with marker buoys (refer to new environmental management measure CTT21).

#### Mountain bike trail network near Wakehurst Parkway

Temporary and permanent adjustment of some of the mountain bike trails on either side of the Wakehurst Parkway would be required, as described in Section 21.4.8 of the environmental impact statement. Since exhibition of the environmental impact statement, Transport for NSW has proposed a number of design refinements to reduce potential impacts on the mountain bike trail network at Wakehurst Parkway. The project refinements and potential impacts to the mountain bike trail network are outlined in Section A4.5 of this submissions report. Greater detail of the mountain bike trails in relation to the construction footprint and operational features of the project are shown in Figure A4-I to Figure A4-L in Part A of this submissions report.

Where possible, during further design development Transport for NSW would refine the design of the project and seek to avoid or otherwise minimise impacts to the mountain bike trail network. Where impacts cannot be avoided, minor detour routes would be implemented and advanced notification of track closures provided at key locations. Access to the mountain bike trail network would be maintained throughout construction and operation.

Current east-west connections on the mountain bike networks across Wakehurst Parkway would no longer be possible following the commencement of construction, as a new median concrete barrier would be constructed between the northbound and southbound lanes. Instead, east-west connections would be facilitated by the new shared user underpasses and relocated shared user bridge across Wakehurst Parkway that would be provided as part of the project. Transport for NSW would continue to consult with Northern Beaches Council and relevant mountain biking associations during further design development of the project to avoid or otherwise minimise impacts to the mountain bike trail network where possible.

#### Other active transport connections

Construction of the project may result in changes to active transport routes in the vicinity of the public open space and sport and recreation facilities mentioned above, as shown in Figure 8-9, Figure 8-10, Figure 8-12, Figure 8-15, Figure 8-18 and Figure 8-19 of the environmental impact

statement. Potential impacts include detours to pedestrian and cyclist routes within Flat Rock Reserve and Wakehurst Parkway and the provision of a temporary shared user path within Balgowlah Golf Course and a signalised pedestrian crossing at the entrance of the Balgowlah Golf Course construction support site (BL10). The extension of the existing shared user underpass beneath the Burnt Bridge Creek Deviation at Burnt Bridge Creek would be staged to maintain access at all times.

Direct impacts to existing pedestrian and cycling facilities will be minimised to the extent reasonably practicable, and any detours and adjustments will be designed with consideration of user safety and convenience, in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report). A range of environmental management measures detailed in Table D2-1 of this submissions report will be incorporated into the traffic management plan for the project to maintain safe access for pedestrians, cyclists and road users to public open space and sport and recreation facilities during construction of the project. Measures will include communicating changes in advance of proposed transport network changes (environmental management measure CTT7) and ensuring appropriate adjustments and changes are put in place before existing facilities are closed or pedestrian and cyclist access routes are modified.

Ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction works and the temporary construction support sites about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measure SE2 (refer to Table D2-1 of this submissions report).

## **C19.3 Impacts and management of public open space**

### **C19.3.1 Direct and indirect impacts on public open space**

#### ***Issue raised***

Submitters made requests in relation to impacts on public open spaces and recreational areas, including walking trails/corridors, golf courses, parks and foreshores/beaches. Specific requests include:

- Requests for Cammeray Golf Course and Balgowlah Golf Course to be fully reinstated and returned for public use after construction
- Requests that the project result in a net increase in usable open space, with replacement space provided in the general vicinity of the loss
- Requests to consider alternative locations for the operational and motorway facilities, including placing the facilities underground or on top of the motorway, and providing green spaces on top of underground facilities to maximise green space.

#### ***Response***

##### **Impacts on public open space and recreational areas**

Transport for NSW recognises that parks and open space areas play an essential role in the health and wellbeing of local communities. Given the desire to minimise acquisition of private property, some public land, including public open space areas, would be required to facilitate construction of the project, resulting in the temporary occupation or permanent acquisition of public open space.

An assessment of the project's impacts on land use and property, including impacts to public open space during construction and operation is provided in Chapter 20 (Land use and property) of the environmental impact statement.



The following public open space areas would be impacted during construction and operation as discussed in Section 20.4.2 of the environmental impact statement:

- Cammeray Golf Course
- Flat Rock Reserve
- Artarmon Park
- Spit West Reserve
- Balgowlah Golf Course.

Changes in public open space during operation of the project would be limited to the Cammeray and Balgowlah golf courses and Artarmon 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 condition, in consultation with the relevant landowner, the local council and community (where appropriate), in accordance with environmental management measure LP5 and in the case of Flat Rock Reserve, in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report).

Further discussion of open space impacts is provided in Section C19.1 of this submissions report.

#### Cammeray Golf Course

A portion of Cammeray Golf Course would be occupied by temporary construction support sites and permanent operational infrastructure for the Western Harbour Tunnel and Beaches Link program of works. The changes at Cammeray Golf Course would be managed to address the impacts of the program of works and provide an equivalent standard golf course or the provision of works to offset the loss in standards, during the construction and operational phases of the project.

Transport for NSW proposes to address the potential impacts to the Cammeray Golf Course as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project. Transport for NSW is consulting with the golf club, and the Department of Planning, Industry and Environment (Crown Lands) and North Sydney Council (the trustee) to achieve this. At the completion of construction, some land at the site would be used on an ongoing basis for the operation of permanent project infrastructure. This area would be smaller than the footprint required during construction. The adjoining Cammeray Park sportsground, tennis club, croquet club and skate park would remain operational during construction and operation and would not be directly impacted.

#### Balgowlah Golf Course

The proposed changes at the Balgowlah Golf Course during construction of the project, including the establishment and operation of the Balgowlah Golf Course construction support site (BL10), mean that land would no longer be available as a golf course during construction or operation of the project.

Engagement with Northern Beaches Council has identified the opportunity for the Balgowlah Golf Course construction support site (BL10) and the residual golf course land to be developed as new and improved public open space and recreation facilities that better address the local government area's current and future needs, as discussed in Table 20-4 and Table 20-6 of the environmental impact statement. This public open space would be freely accessible to all members of the public, with facilities that have a broader recreation use (rather than being limited to use as a golf course).

A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council in the development of this important public space.

Along with residual land from properties acquired along Dudley Street, the project would progressively return an area, equivalent to around 90 per cent of the current open space, to the community as new and improved public open space and recreation facilities (refer to Figure 20-11 of the environmental impact statement).

#### Achieving a net increase in usable open/green space

Transport for NSW has endeavoured to minimise the impacts of the project on public open space, whilst also minimising the need for property acquisitions. To offset the loss of public open space as a result of the project, Transport for NSW would convert the open space at Balgowlah Golf Course to be freely accessible to all members of the public with facilities that have a broader recreation use (rather than being limited to use as a golf course), as discussed in Section C19.1 of this submissions report. In addition, Transport for NSW would acquire, rehabilitate and revegetate a portion of land used as part of the Wakehurst Parkway east construction support site (BL13) and hand it over to Northern Beaches Council to manage for use by the community as part of the Manly Warringah War Memorial State Park (refer to Table 20-5 of the environmental impact statement). This would add about 4000 square metres of new public open space to the Manly Warringah War Memorial State Park.

#### Undergrounding of operational facilities

Beaches Link proposes to locate the following operational facilities on the surface:

- Motorway facilities at Warringah Freeway, Gore Hill Freeway, Burnt Bridge Creek Deviation and Wakehurst Parkway, which would house axial fans to supply and extract air to and from the tunnel via ventilation tunnels
- A motorway control centre at the Gore Hill Freeway, within the Artarmon industrial area, which would be continuously staffed and used to monitor, and if necessary, respond to, conditions in the tunnels and on surface road connections
- Tunnel support facilities at the Gore Hill Freeway, within the Artarmon industrial area, and next to the intersection of the Wakehurst Parkway and Warringah Road at Frenchs Forest. These would include a maintenance facility, incident recovery centre and materials storage.

The locations of the motorway facilities have been chosen to minimise impacts on the adjacent landscape. The design of the motorway facilities 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. The motorway facilities would be developed as an integral component of the larger open space component, as noted in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment). Housing the facilities underground would introduce safety risks during access and maintenance of the fans within the facilities. While the alternate design may provide a superior urban design outcome by reducing permanent visual impacts, it would likely provide negligible additional open space that would be accessible by the community, as the land immediately above the below ground buildings would be required for project infrastructure and to provide maintenance access from the surface to the tunnel. Further, while it may be possible to locate the motorway facilities at Warringah

Freeway, Gore Hill Freeway, Burnt Bridge Creek Deviation and Wakehurst Parkway either wholly or partially underground, analysis of major construction and cost impacts associated with this option ultimately resulted in it not being pursued.

The motorway control centre would be located adjacent to Reserve Road and the Gore Hill Freeway, on a site currently occupied by commercial properties. As this building would be staffed continuously it is not appropriate to locate it underground, rather the building would be architecturally designed to integrate with the surrounding industrial context. Transport for NSW would continue to explore opportunities to further minimise the physical footprint and visual impact of this structure during further design development. This could include for example, the collocation of the Beaches Link motorway control centre and the Western Harbour Tunnel motorway control centre on land owned by Transport for NSW, if this opportunity would minimise the physical footprint and visual impact of these structures.

The tunnel support facilities have been located within the Artarmon industrial area and next to the intersection of the Wakehurst Parkway and Warringah Road at Frenchs Forest, which are areas that are or were occupied by commercial properties or a temporary construction support site for the Northern Beaches Hospital road upgrade project. As these facilities would include maintenance facilities, an incident recovery centre and materials storage areas, it is not appropriate to locate them underground. The Artarmon tunnel support facilities have been located to be congruous with the existing industrial context of the precinct. At Wakehurst Parkway, the tunnel support facilities have also been located to generally be congruous with the existing visual environment, with additional screening proposed in the form of a vegetative buffer along Wakehurst Parkway and Warringah Road to further improve views.

### **C19.3.2 Flat Rock Reserve**

#### ***Issue raised***

Submitters raised concerns and made requests regarding the impact to and management of Flat Rock Reserve due to the Flat Rock Drive construction support site (BL2). Specific concerns and requests include:

- Concerns about the long-term use of the Flat Rock Drive construction support site (BL2) and if further consultation with the community would be carried out
- Concerns that the Flat Rock Drive construction support site (BL2) would be re-purposed for sport and recreation instead of being rehabilitated and re-established into an equivalent state, with a request that the project consider the *Flat Rock Gully Reserve Action Plan* (Willoughby City Council, 2018b)
- Requests that Willoughby City Council be allocated sufficient funds to maintain replacement vegetation on land under their control for a minimum of 10 years.

#### ***Response***

##### **Flat Rock Drive construction support site (BL2)**

Transport for NSW undertook a comprehensive options analysis process in identifying the Flat Rock Drive construction support site (BL2) as a preferred temporary construction support site. This process considered environmental, social, traffic, property and construction impacts, as summarised in Section 4.5.7 of the environmental impact statement and Section 2 (Flat Rock Drive temporary construction support site (BL2) options analysis) of the preferred infrastructure report. A detailed comparison of the current location for the Flat Rock Drive construction support site (BL2) and the alternative option at the Flat Rock Baseball Diamond is included in Section 2 (Flat Rock Drive

temporary construction support site (BL2) options analysis) of the preferred infrastructure report. The comparison identified the current location as the preferred option due to a:

- Reduced impact to the community as there would be no impact to organised sporting facilities within Bicentennial Reserve and informal recreation at Flat Rock Reserve would still be feasible throughout construction of the project
- Reduced risk of contamination impacts when compared to the alternative option, including a lower human health risk associated with the exposure to the potential release of landfill gases
- The requirement for less land to be temporarily leased from Willoughby City Council.

If the project did not have a mid-tunnel construction site in this area, the length of required tunnelling would increase the construction program of the project by 18-24 months, significantly extending the duration of construction-related impacts on the community.

The temporary construction support site would be on council owned land that is zoned for environmental conservation as outlined in Section 20.4.2 of the environmental impact statement.

A small portion of Flat Rock Reserve would be temporarily leased for use as the Flat Rock Drive construction support site (BL2). At the end of construction, the impacted portion of the reserve would be rehabilitated and returned to an equivalent state as soon as practicable in consultation with Willoughby City Council and the community. The temporary use of this land would have a negligible impact on the continued use of the wider Flat Rock Reserve area for public open space use, as access to the wider Flat Rock Reserve area would be maintained at all times during the construction and rehabilitation works (refer to Section C19.2 of this submissions report). Land affected by construction is therefore not expected to impact on the long-term use of Flat Rock Reserve as public open space.

Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report). The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.

Future engagement as part of the project would be carried out in accordance with Appendix E (Community consultation framework) which has been prepared to guide the planning and delivery of communication and stakeholder engagement activities across the project. Further engagement would occur with the community regarding traffic management including property access and pedestrian access, landscaping and urban design matters, construction activities including out of hours works and noise and vibration mitigation and management.

The *Draft Flat Rock Gully Reserve Action Plan* (Willoughby City Council, 2018c) was considered in the environmental impact statement, as identified in Section 3.4.1.1 of Appendix S (Technical working paper: Biodiversity development assessment report). The document has since been finalised, following its consideration in Appendix S (Technical working paper: Biodiversity development assessment report).

#### Maintenance of rehabilitated areas

During further design development and the construction phase of the project, Transport for NSW would continue to proactively consult with Willoughby City Council on the allocation of management of rehabilitated and landscaped areas. Rehabilitated and landscaped areas of the project would be maintained by Transport for NSW, until arrangements have been made to transfer the landscaped

area to an alternative party, at which point it would be the responsibility of the alternative party to manage and maintain the landscaped area.

## **C19.4 Wakehurst Parkway temporary construction support sites**

### ***Issue raised***

Submitters raised the following concerns and requests about impacts from the Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites and potential impacts to Manly Warringah War Memorial State Park:

- Requests that the Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites be surveyed prior to any excavation so the topography of each site can be restored as close to its original condition as possible
- Concerns about the permanent land use changes after construction at the Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites
- Concerns that the Manly Warringah War Memorial State Park may not be returned for public use after construction of the project.

### ***Response***

The Wakehurst Parkway south construction support site (BL12) would occupy land east of Wakehurst Parkway between a point just south of Judith Street and the northern end of Kirkwood Street at Seaforth, as shown in Figure 6-40 of the environmental impact statement. The temporary construction support site would be located on land owned by Transport for NSW that is zoned and used for low density residential development, as outlined in Section 20.4.2 of the environmental impact statement. The temporary construction support site would temporarily change the existing land use from low density residential to construction infrastructure. At the completion of construction, residual land at the temporary construction support site will be rehabilitated as soon as practicable to an appropriate condition, taking into consideration the location, land use characteristics, area and adjacent land uses or in accordance with the urban design and landscape plan where applicable, as required by environmental management measure LP5 (refer to Table D2-1 of this submissions report). Reinstatement of the site may require the replacement of boundary fences for existing residential properties along Kirkwood Street located adjacent to the site. Any future development on the affected land would be subject to separate assessment and approval in accordance with the *Environmental Planning and Assessment Act 1979* and is beyond the scope of this project.

The Wakehurst Parkway east construction support site (BL13) would occupy three portions of land east of Wakehurst Parkway and north of Kirkwood Street, as shown in Figure 6-41 of the environmental impact statement. One portion of land surrounds the main Bantry Bay Reservoir site, mostly north of the existing water tanks, and would be leased by Transport for NSW from Sydney Water. The site would be used as a temporary construction support site for the duration of construction. The temporary occupation of this land would not affect the existing land use zoning that is applicable to the site. Sydney Water facility operations and the on-site Telstra tower would remain operational for the duration of construction activities at the site. All existing structures would be protected. The land to be leased will be rehabilitated in accordance with environmental management measure LP5 (refer to Table D2-1 of this submissions report) and in consultation with Sydney Water and returned to the landowner at the completion of construction.

The other portion of the Wakehurst Parkway east construction support site (BL13) would be located wholly on vacant non-operational Sydney Water owned land immediately north of the existing water tanks zoned for low density residential. Transport for NSW would acquire this non-operational part

of the Bantry Bay Reservoir site from Sydney Water. This land will be rehabilitated and revegetated as soon as practicable after construction (in accordance with environmental management measure LP5 in Table D2-1 of this submissions report) and would be handed over to Northern Beaches Council to manage for use by the community as part of the Manly Warringah War Memorial State Park. This would add about 4000 square metres of new public space to the Manly Warringah War Memorial State Park.

A smaller portion of land required for the access road to and from the temporary construction support site forms part of the Manly Warringah War Memorial State Park, which is Crown land and managed by Northern Beaches Council. This land will be leased, and rehabilitated (as per environmental management measure LP5 in Table D2-1 of this submissions report) and returned to Northern Beaches Council at the end of construction.

## **C19.5 Easements**

### ***Issue raised***

Submitters raised concerns that areas impacted by the project would require access easements that would require approval to be sought before any improvements and/or development can be made and/or carried out on the easement land, and that access approval would take four to seven months to be finalised.

### ***Response***

The project would involve the temporary use and permanent acquisition of properties. In some cases, easements may be required over land in or adjacent to the project, to facilitate the permanent placement of underground utilities. Any easements that are likely to be required over land for the project's operation would be determined during further design development and/or prior to commencement of operation, in consultation with the landowner, to ensure any impacts to private property access are minimised. The process for obtaining easements over land would be similar for private and publicly owned land. The *Land Acquisition (Just Terms Compensation) Act 1991* provides that compensation is not payable for easements unless specific circumstances as detailed in the Act apply. Appendix C of the *Roads and Maritime Services Land acquisition Information Guide* (Roads and Maritime Services, 2014) sets out in detail the compensation provisions of the *Land Acquisition (Just Terms Compensation) Act 1991* relating to easement acquisition.

Suitable access arrangements would be implemented in consultation with affected property owners and/or lease holders/tenants.

## **C19.6 Property acquisition and compensation**

### **C19.6.1 Property acquisition**

#### ***Issue raised***

Submitters raised concerns about property acquisition and compensation. Specific concerns, suggestions and requests include:

- Concerns about the full acquisition of 41 properties for the project
- Suggestions to compulsorily acquire properties near the Balgowlah Golf Course
- Requests that options for compulsory acquisition be at current market value

- Suggestions to implement 'just terms' compensation through amendments to the *Land Acquisition (Just Terms Compensation) Act 1991* or implementing the Transport for NSW guidelines for compensation of residential properties within the vicinity of the project
- Concerns about potential substratum acquisition
- Concerns that substratum acquisition can change due to the geological uncertainty associated with the project.

### **Response**

#### Acquisition of surface properties

The project has been designed and developed to minimise property acquisitions and prioritise the use of Transport for NSW and other State owned land, including Crown land, Sydney Water land and council land, where possible. Notwithstanding this, some temporary use and permanent acquisition of properties would be required as discussed in Section 20.4.1 of the environmental impact statement.

Overall, it is anticipated that the project would require acquisition of land from 54 properties (excluding land owned by Transport for NSW) as summarised in Table 20-2 of the environmental impact statement. Of these, 41 properties would be acquired in full. Affected properties, including property acquisitions at Balgowlah, are shown in Figure 20-6 to Figure 20-10 of the environmental impact statement. The impacts of property acquisition are further discussed in Section 20.4.1 of the environmental impact statement.

Land acquisition for the project will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, the *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime Services, 2014) and *Fact sheet: Property acquisition of subsurface lands* (Roads and Maritime Services, 2015d), and in accordance with the land acquisition reforms announced by the NSW Government in 2016, as required by environmental management measure LP3 (refer to Table D2-1 of this submissions report).

Transport for NSW will appoint a Personal Manager – Acquisition to help landowners and residents who may be affected by acquisition for the project in accordance with environmental management measure LP3 (refer to Table D2-1 of this submissions report). The Personal Manager – Acquisition will be in regular contact with these individuals to provide updates on the project and respond to questions and queries. Should acquisition for the project be confirmed for a particular property, the Personal Manager – Acquisition will work with the affected landowners and residents to offer assistance and support throughout the acquisition and relocation process.

Transport for NSW has commenced consultation with affected property owners about the acquisition process and potential adjustments required to properties. Consultation with affected residents and the community would be ongoing throughout the further design development and construction phases in accordance with Appendix E (Community consultation framework).

#### Substratum acquisition

The construction and operation of the project would require the acquisition of land below the surface of the ground (substratum acquisition) to accommodate construction of 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*.

Where substratum acquisition is required, Transport for NSW would contact owners of affected properties. The *Land Acquisition (Just Terms Compensation) Act 1991* provides that compensation is not payable for substratum acquisition of land unless specific circumstances as detailed in the Act

apply. Appendix C of the *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime Services, 2014) sets out in detail the compensation provisions of the *Land Acquisition (Just Terms Compensation) Act 1991* relating to substratum acquisition.

In some circumstances, the introduction of the tunnels and associated substratum acquisition has the potential to limit development above the tunnels as discussed in Section 20.4.1 of the environmental impact statement. For example, depending on the depth of the tunnels, the ability to construct basement levels in buildings above the tunnels may be restricted. However, this is generally only the case where the tunnel depth is shallow, near tunnel portals (described in Chapter 5 (Project description) of the environmental impact statement). Otherwise, substratum acquisition does not generally affect the future use of property at the surface.

## **C19.6.2 Property value and compensation**

### ***Issue raised***

Submitters raised concerns about property value and compensation. Specific concerns and requests include:

- Concerns that the project would have a negative impact on property values
- Requests that compensation be provided to the community for impacts on land use and property that would result from the project
- Requests to declare political associations and the value of benefits associated with land and property that would benefit from the project
- Requests that residents along Kirkwood Street at Seaforth be allowed to lease their properties to Transport for NSW for the duration of construction works due to the significant impacts.

### ***Response***

#### Property values

Consideration of changes in property values within the project area has been provided in Section 21.4.1 of the environmental impact statement and Section 6.1.3 of Appendix U (Technical working paper: Socio-economic assessment). Changes to property values, both positive and negative, 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 things such as employment and social infrastructure. Generally, the long term improvements of the project in amenity, road safety, traffic connectivity and active transport options would likely have a positive influence on the property values of surrounding communities. Based on this, the assessment concluded that it is likely that broader external factors would influence property values more than perceived or actual impacts resulting from a road upgrade, including the project.

#### Political affiliations and beneficiaries

Land acquisition for the project will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, the *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime Services, 2014) and *Fact sheet: Property acquisition of subsurface lands* (Roads and Maritime Services, 2015d), and in accordance with the land acquisition reforms announced by the NSW Government in 2016, as required by environmental management measure LP3 (refer to Table D2-1 of this submissions report). The *Land Acquisition (Just Terms Compensation) Act 1991* outlines matters that are to be considered when assessing compensation including the market value of the property (as unaffected by the project), special value and any increase or decrease in the value of adjoining or severed land (as affected by the project).



The location of operational infrastructure has been developed with consideration of existing land use zones and future development to minimise permanent impacts, as discuss in Section 20.4.2 of the environmental impact statement. Any future development of residual land would be subject to separate assessment and approval in accordance with the *Environmental Planning and Assessment Act 1979*.

### Compensation

Financial compensation is not considered a reasonable and feasible environmental management measure to manage impacts of the project. Environmental management measures to avoid, minimise or manage land use and property impacts as a result of the project are detailed in Table D2-1 of this submissions report.

Transport for NSW has carried out an extensive community engagement program to date to identify issues, potential environmental management strategies, design refinements and opportunities to improve project outcomes which were presented in the environmental impact statement. Consultation on the project would continue throughout the remainder of the planning process and into the construction period, with a view to further minimising project impacts wherever possible. Appendix E (Community consultation framework) provides the framework to engage and consult with community and stakeholders on the project and to receive and respond to feedback during project development, delivery and operation, in accordance with environmental management measure SE3 in Table D2-1 of this submissions report. Further detail on consultation completed with community and interest groups during and following exhibition of the environmental impact statement, including a summary of feedback is provided in sections A2.3 and A2.4 of this submissions report.

A complaints management system would also be developed and implemented before the start of construction activities for the project, as outlined in Section 3 of Appendix E (Community consultation framework). Transport for NSW would ensure a number of different mechanisms are provided to receive and address community enquiries and complaints for the duration of construction, including a toll-free telephone number(s) through which complaints and enquiries can be registered. The toll free project hotline would operate 24/7 during construction and continue for 12 months after the project opens.

### Leasing of land

Anticipated lease agreements required for the project are identified in Table 20-3 of the environmental impact statement and would mainly be required for temporary construction support sites. Transport for NSW currently owns a number of properties at Seaforth between the Wakehurst Parkway, Kirkwood Street and Judith Street that were acquired in the 1970s and 1980s for the Warringah Transport Corridor that was proposed at the time. These properties are vacant lots and would be utilised to facilitate this project.

The leasing of additional properties not required for construction or operation of the project is not considered a reasonable and feasible environmental management measure to manage impacts of the project. Environmental management measures to avoid, minimise or manage impacts as a result of the project are detailed in Table D2-1 of this submissions report.

## C19.7 Land use impacts

### ***Issue raised***

Submitters raised concerns regarding potential air quality impacts on developments above 30 metres and requests that further consideration at rezoning or development application stage would be required.

### ***Response***

The project would involve the operation of ventilation outlets at the Warringah Freeway, Gore Hill Freeway, Burnt Bridge Creek Deviation and Wakehurst Parkway.

The air quality impact assessment (refer to Chapter 12 (Air quality) of the environmental impact statement) and the human health impact assessment (refer to Chapter 13 (Human health) of the environmental impact statement) demonstrate that operation of the motorway facilities and ventilation outlets would not result in unacceptable air quality impacts or an unacceptable impact to human health for any existing building or future buildings (including elevated receptors up to a height of 20 metres) in the vicinity of the proposed ventilation outlets. This finding is supported by additional air quality modelling carried out for this submissions report (refer to Section B1.5.4 of this submissions report) which indicates that predicted exceedances of air quality criteria for particulate matter at elevated receptors are due to elevated background levels, and that the predicted contribution from the ventilation outlets would be negligible.

There may be potential impacts for future buildings above 20 metres in height and within 300 metres of the outlets that would need to be considered by the relevant local council as part of future development applications (refer to Chapter 12 (Air quality) of the environmental impact statement). These potential impacts and potential implications for existing and future land use planning in the vicinity of these ventilation outlets (for example, those receivers within multi-storey residential buildings) are detailed in Table 20-7 of the environmental impact statement, including land use zones and applicable height restrictions, if any, in areas within a distance of 300 metres around the project ventilation outlets.

Transport for NSW will provide data to Northern Beaches Council, North Sydney Council, Willoughby City Council and the Department of Planning, Industry and Environment (as appropriate), detailing pollution concentrations at various heights and distances from the ventilation outlets to facilitate the planning of and assessment of new development in areas within a distance of 300 metres around the ventilation outlets which would be within a potential three-dimensional zone of affectation (buffer volume) in accordance with revised environmental management measure LP7 (refer to Table D2-1 of this submissions report). Subsequently, any proposed development within 300 metres of the ventilation outlets would require a separate assessment. This is not unusual and would be carried out once further design development has occurred.

## C19.8 Residual land

### ***Issue raised***

Submitters raised concerns about residual land. Specific concerns included:

- Surplus land and residual land are not clearly defined for the project
- Residual land bounded by Judith Street and Kirkwood Street within the Wakehurst Parkway south construction support site (BL12) has not been considered as part of the assessment, including any future development of open space and residual land at these properties.

### **Response**

Residual land comprises lots that are created either when a property is only partially acquired to construct or operate the project or when land acquired to facilitate construction of the project is not required for the operational phase of the project. The identification of residual land for the project would be confirmed during further design development and construction planning. However the three areas of residual land anticipated to be created by the project are at Cammeray Golf Course, Balgowlah Golf Course and Killarney Heights as outlined in Section 20.4.1 of the environmental impact statement.

Appropriate strategies for the ongoing management and/or divestment of the residual land will consider the location, land use characteristics, area and adjacent land uses in accordance with environmental management measure LP2 (refer to Table D2-1 of this submissions report).

Transport for NSW currently owns a number of properties at Seaforth between the Wakehurst Parkway, Kirkwood Street and Judith Street that were acquired in the 1970s and 1980s for the Warringah Transport Corridor that was proposed at the time. The properties are vacant lots and would be utilised to facilitate the project as mentioned in Section 20.4.1 of the environmental impact statement. However, as they are historical acquisitions and were not acquired specifically to facilitate this project, they are not included in Table 20-2 in the environmental impact assessment. At the completion of construction, residual land in this area would be rehabilitated and reinstated and made available for other uses. Any future development on the affected land and residual land beyond that included in the project description (refer to Chapter 5 (Project description) of the environmental impact statement) would be subject to separate assessment and approval in accordance with the *Environmental Planning and Assessment Act 1979* and is beyond the scope of this project.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C20 – Socio-economics

## C20 Socio-economic

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## C20.1 Adequacy and accuracy

### C20.1.1 Adequacy of assessment

#### ***Issue raised***

Submitters raised concerns about the adequacy of the socio-economic assessment. Specific queries, concerns and comments include:

- Concerns that the socio-economic assessment in the environmental impact statement was not impartial in its assessment
- Concerns that the social importance and contribution to community health of open spaces including Bicentennial Reserve, the Baseball Diamond, Flat Rock Reserve and Tunks Park has not been recognised in the environmental impact statement. This includes concern that the environmental impact statement has not considered an increase in the use of open space due to an increase in people working from home due to COVID-19
- Concerns that some educational facilities have been mislabelled as places of worship in the environmental impact statement.

#### ***Response***

##### Socio-economic assessment methodology

The socio-economic assessment of the project, including the assessment methodology, is summarised in Chapter 21 (Socio-economics) of the environmental impact statement and provided in Appendix U (Technical working paper: Socio-economic assessment). The socio-economic assessment was developed in accordance with the *Environmental Impact Assessment Practice Note EIA-N05: Socio-economic Assessment January 2020* (Transport for NSW, 2020c). The practice note provides a framework for assessing the socio-economic impacts of transport projects carried out by or on behalf of Transport for NSW to ensure impact assessments are consistently completed to a high standard, and are properly integrated with other environmental assessments, design development and management processes.

The socio-economic assessment methodology includes the consideration of both the potential benefits and impacts of the project by identifying and evaluating changes to existing socio-economic and business conditions and values due to the project's construction and operation. However, it is noted that while benefits are discussed in the assessment, only negative impacts have been assigned a level of significance in accordance with the process outlined in *Environmental Impact Assessment Practice Note EIA-N05: Socio-economic Assessment January 2020* (Transport for NSW, 2020c).

The socio-economic assessment was informed by a business impact assessment that forms Annexure A of Appendix U (Technical working paper: Socio-economic assessment). A business survey was conducted, to understand how businesses near the project currently operate and the main issues, perceptions and concerns of businesses relating to the project's construction and operation. The business surveys were conducted in local centres considered to be more susceptible to the project's direct or indirect construction and/or operation impacts.

A key component of the socio-economic assessment is understanding community values. The *Environmental Impact Assessment Practice Note EIA-N05: Socio-economic Assessment January 2020* (Transport for NSW, 2020c) notes that the community itself owns community values, with places and features of importance specific to individual communities. It recommends that information on community values is sourced directly and notes that 'Community consultation,

including broad consultation carried out for the project and targeted consultation carried out for the socio-economic impact assessment, is the best source of information on community values'. As such, the socio-economic assessment has drawn upon consultation with the community for the project to identify community values, as discussed in Section 21.3.3 of the environmental impact assessment and Section 4.5 of Appendix U (Technical working paper: Socio-economic assessment), which informed the assessment.

By following the procedures of the *Environmental Impact Assessment Practice Note EIA-N05: Socio-economic Assessment January 2020* (Transport for NSW, 2020c), the socio-economic assessment of the project is considered to provide a balanced assessment of the project's benefits and impacts to the community.

### Recognition of open space

The social importance and contribution to community health and wellbeing of existing open spaces within the project footprint is recognised by Transport for NSW and discussed in Section 21.3.3 of the environmental impact statement. Potential impacts to community health and wellbeing due to construction and operation of the project are assessed in Section 21.4.5 and 21.5.4 of the environmental impact statement and Section 6.7 of Appendix U (Technical working paper: Socio-economic assessment), including consideration of public open space.

While some public open space areas would be impacted during construction, including Cammeray Golf Course, Flat Rock Reserve, Artarmon Park, Spit West Reserve and Balgowlah Golf Course, alternative green spaces are available in the project area and are accessible by the community. As such, the potential effect 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 Artarmon Park could potentially relocate activities to Artarmon Reserve.

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 after construction. Land subject to temporary use, including areas of public open space (with the exception of Balgowlah Golf Course), will be rehabilitated as soon as practicable to an appropriate condition, taking into consideration the location, land use characteristics, area and adjacent land uses or in accordance with the urban design and landscape plan where applicable (refer to environmental management measure LP5 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.

About 90 per cent of the current open space at Balgowlah will be re-purposed as new and improved open space and recreation facilities for the community, as described in Section 5.2.13 of the environmental impact statement. A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input into the final layout of the new and improved open space and recreation facilities at Balgowlah, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report).

Transport for NSW will also work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community, in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report). The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.

With regard to the impact of the COVID-19 pandemic on the utilisation of open space, the COVID-19 pandemic is an unprecedented event that has changed the way people work and their travel patterns, while creating some uncertainty about the future of the NSW economy, as described in Section 3.1 of the environmental impact statement. The *Public Spaces: Streets as Shared Spaces – Engagement Report* (NSW DPIE, 2020d) indicates that in mid-2020 people were spending more time in public spaces than prior to COVID-19 restrictions. However, as described above, the impact to open spaces during construction of the project would be minimal and temporary. During operation of the project, the majority of open space required during construction would be rehabilitated and returned to an equivalent state, whilst new and improved open space and recreation facilities would be provided at Balgowlah. For further discussion on the effect of COVID-19 on modelling carried out for the environmental impact statement, refer to Section A5.1.17 of this submissions report.

#### Educational facilities mislabelled as places of worship

It is noted that in Chapter 10 (Operational noise and vibration) of the environmental impact statement and Appendix G (Technical working paper: Noise and vibration), St Cecilia's Catholic Primary School in Balgowlah was incorrectly listed as a place of worship. This receiver should be listed as a school. St Cecilia's church located on the corner of Wanganella Street and White Street should be listed separately as a place of worship. This is provided as a clarification in Table A5-13 of this submissions report.

Notwithstanding, the noise management levels for non-residential receivers set in accordance with the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009) (provided in Table 10-4 of the environmental impact statement) indicate that the noise management level for a place of worship and school classroom is the same (45 dB(A)). Environmental management measures outlined in Table D2-1 of this submissions report which are relevant to schools will apply to St Cecilia's Catholic Primary School.

### **C20.1.2 Adequacy of the response to impacts**

#### ***Issue raised***

Submitters raised concerns about the adequacy of the response to managing operational impacts in the socio-economic assessment. Specific concerns include:

- Concerns that the environmental impact statement does not outline strategies for enhancing healthy, cohesive, and inclusive communities
- Concerns that the project does not sufficiently explore alternative approaches to avoid the negative impacts on standard of living for many local residents in Northern Beaches.

#### ***Response***

#### Strategies for enhancing healthy, cohesive and inclusive communities

Community cohesion is discussed in Section 21.3.3 of the environmental impact statement. Community cohesion refers to the connections and relationships between individuals, groups and neighbourhoods, and is encouraged by the existence of local social infrastructure, a sense of local identity, and opportunities for community participation. Community cohesion is encouraged by connectivity or discouraged by barriers to movement as described in Chapter 20 (Land use and property) of the environmental impact statement. Many road corridors and arterial roads within the study area of the socio-economic assessment create existing barriers, both real and perceived, to local movement and connectivity and form boundaries to neighbourhoods, pedestrian and cycle movements and to some local centres. The factors that give rise to a cohesive community would also be supportive of community health and wellbeing and inclusivity.



The project presents considerable benefits for local communities, in particular the Northern Beaches and North Shore areas, as detailed in Chapter 3 (Strategic context and project need) of the environmental impact statement. This includes:

- Reduced traffic demands across Middle Harbour with the project in 2037, including:
  - Peak period traffic demand on Military Road and Spit Road would decrease as a result of the project, by up to 11 per cent and 33 per cent respectively
  - Peak period traffic demand on Warringah Road would decrease as a result of the project by up to 23 per cent
  - Peak period traffic demand on Mona Vale Road would decrease by up to eight per cent as a result of the project
  - Daily traffic demand on Eastern Valley Way would decrease substantially as a result of the project, by up to 40 per cent.
- Improved travel speeds on the above routes as a result of the overall reduction in traffic, delivering improved travel times for road users
- Enhanced reliability and improved network resilience of the road network across Sydney
- Improved in east-west access between the Northern Beaches and employment centres such as Chatswood and Macquarie Park, and north-south journeys including to and from the Sydney Sydney CBD due to the provision of new road capacity and connectivity
- Improved access and connectivity to community services and facilities within the study area for local residents, through travel time savings and improved travel time reliability
- By providing additional motorway capacity and bypassing communities underground, the reduction in through traffic volumes would result in reduced noise and improved amenity in local streets. This includes reduced through traffic on Eastern Valley Way and down through Willoughby, Naremburn, Cammeray and Northbridge
- Reduced rat-run traffic and congestion on existing surface roads including Miller Street (Camberay), Brook Street (Naremburn), Eastern Valley Way (Northbridge), Frenchs Forest Road (Seaforth) and the Ourimbah Road corridor
- Public transport benefits, including improved travel times, with existing services benefiting from reduced traffic demand on key arterial bus corridors including the Warringah Road/Eastern Valley Way corridor. The reduced vehicle congestion on Warringah Road between Frenchs Forest and Roseville would support the possible implementation of a proposed rapid bus service, similar in nature to that of the existing B-Line between Dee Why and Chatswood. The project also provides the opportunity for express bus services through the Beaches Link tunnels
- Increased availability of public open space and passive and active recreation facilities for the community, helping to address the current shortfall in recreation facilities in the Northern Beaches Council area
- Enabling of local businesses to have better and more efficient access to Greater Sydney, making it easier to move goods and provide services, as well as bringing employees and businesses closer together
- Improved pedestrian and cyclist accessibility and connectivity of active transport routes, which would bring long-term benefits for community cohesion.

Appendix U (Technical working paper: Socio-economic assessment) has been developed in accordance with the Secretary's environmental assessment requirements, which does not specify the need for strategies to enhance communities. Given the benefits delivered by the project, and the nature of social impacts predicted, it is not considered to be required for the project.

### Consideration of alternatives to minimise impacts on standard of living

A range of strategic and design alternatives to the project were considered and are discussed in Chapter 4 (Project development and alternatives) of the environmental impact statement. The project was selected as the preferred project because it would best address the strategic need for a new transport corridor to connect the Northern Beaches to Greater Sydney.

Construction of the project would potentially cause a range of temporary impacts to communities located near to temporary construction support sites and construction sites in relation to traffic, access, noise, dust and visual amenity. An assessment of how these potential impacts would affect the social and economic environment is provided in Section 21.4 of the environmental impact statement. These impacts will be temporary and will be minimised by implementing the environmental management measures outlined in Table D2-1 of this submissions report.

The project would result in a range of benefits for Northern Beaches residents, as discussed above. Operational socio-economic impacts of the project are discussed in Section 21.5 of the environmental impact statement. A key overarching and widespread positive impact of the operation of the project is the improved access and connectivity it would provide, which would help to reduce travel time for individuals, families and the wider community, increase time available for leisure, and improve access to employment opportunities within convenient commuting times. The project would reduce pressure on the congested Spit Road/Military Road and Warringah Road corridors, leading to faster and more reliable journeys to, from and around the Northern Beaches and North Shore; enable local businesses to have better and more efficient access to Greater Sydney, making it easier to move goods and provide services; enable express bus services between Northern Beaches and strategic centres across Sydney; and return local streets to communities by moving traffic underground, freeing up local town centres. These overarching benefits of the project means that it is likely to contribute to an overall improvement in the standard of living on the Northern Beaches.

## **C20.2 Property impacts and acquisition**

### ***Issue raised***

Submitters raised concerns over the property impacts due to the project. Specific queries, comments and concerns include:

- Concerns that the project would have a negative impact on property values within the project corridor due to construction activities, loss of green space, and reduced amenity
- Concerns that the project would lock families into mortgage stress during the construction period if properties become more difficult to sell
- Concerns that substratum acquisition is likely to cause financial stress particularly given economic uncertainty following the COVID-19 pandemic.

### ***Response***

#### Property values

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.

### Substratum acquisition

Substratum acquisition is discussed in Section C19.6.1 of this submissions report and Section 20.4.1 of the environmental impact statement. 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. It is noted that substratum acquisition does not generally affect the future use of property at the surface, apart from where the tunnel depth is shallow near tunnel portals. 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 *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime Services, 2014) sets out in detail the compensation provisions of the Act relating to substratum acquisition.

Substratum acquisition would occur once the tunnel alignment is confirmed during further design development. Affected property owners would be contacted to confirm subsurface property acquisition is required and this would occur progressively, according to the design and construction program.

The potential social impacts of substratum acquisition are considered in Section 21.4.1 of the environmental impact statement and Section 6.1.3 of Appendix U (Technical working paper: Socio-economic assessment). It is recognised that the sensitivity of affected properties is considered to be moderate due to uncertainty about potential impacts due to substratum acquisition, however, the magnitude of the change is negligible.

## **C20.3 Equity**

### ***Issue raised***

Submitters raised concerns about social equity in the project. These include:

- Concerns that the project would have a disproportionate impact on residents in the Balgowlah and Seaforth areas
- Concerns that the project would primarily benefit communities south of Spit Bridge who would not be impacted by the project's long construction duration
- Concerns that the project would provide no benefit to the Northern Beaches community but would come at a great social cost to residents of the area, including enduring construction traffic impacts for the duration of the construction works
- Concerns that Naremburn/Cammeray areas would experience construction impacts but no operational benefits, whilst Mosman, the Northern Beaches and Cremorne experience no construction impacts but would experience operational benefits.

### ***Response***

Given the size of the project and that it comprises tunnels with surface connections at the ends of the tunnels only, it is inevitable that the impacts of the project are not spread evenly across the entire project area. The construction impacts of the project would be greatest around the surface road works, proposed temporary construction support sites and tunnel entry/exit portals, which are discussed in Chapter 6 (Construction) of the environmental impact statement. This includes potential noise, traffic, air quality, visual amenity and social impacts, which have been assessed in the relevant chapters of the environmental impact statement. Environmental management

measures, as discussed throughout this submissions report, are proposed to minimise the impacts to communities that are directly or indirectly affected by the construction the project (refer to Table D2-1 of this submissions report).

The project provides many strategic benefits, as outlined in Chapter 3 (Strategic context and project need) of the environmental impact statement. Some of the key benefits of the project, which would be experienced by the community, include:

- Improved travel times and access to work, business and leisure activities between the Northern Beaches and other areas of Sydney. This would include both trips that use the new tunnels and trips on surface roads that are less congested than they would otherwise be without the project
- Facilitation (in conjunction with the Western Harbour Tunnel and Warringah Freeway Upgrade project) of greater access to jobs, schools and health care within 30 minutes of people's homes by public transport on the Northern Beaches
- The opportunity for new express bus service routes, which would also substantially reduce travel times and increase the 30-minute public transport catchments between the Northern Beaches and key strategic centres and interchange locations such as Sydney CBD, North Sydney, St Leonards, Chatswood and Macquarie Park
- New and improved public open space and recreation facilities at Balgowlah
- Reduced through traffic along the Spit Road/Military Road corridor, which would reduce local traffic congestion and improve amenity, benefiting communities between the Warringah Freeway and Spit Bridge including Neutral Bay, Cremorne and Mosman
- Reduced through traffic along the Warringah Road/Eastern Valley Way corridor, which would reduce local traffic congestion and improve amenity, benefiting the communities of Cammeray and Naremburn.

Additional benefits of the project are also discussed in Section C20.1.2 above.

## **C20.4 Social infrastructure**

### **C20.4.1 Impacts to sport and recreation facilities**

#### ***Issue raised***

Submitters raised concerns about the impacts of the project on sport and recreation facilities. These include:

- Concerns about the negative impacts of construction activities on sport and recreation facilities, including limiting the use of facilities
- Concerns that construction activities would mean that a large part of the Cammeray Golf Course is unusable
- Concerns about the loss of recreational areas and facilities at Flat Rock Reserve, Willoughby Leisure Centre, Bicentennial Reserve Oval, Spit West Reserve and Manly Warringah War Memorial State Park
- Concerns about the negative impact on green space at Flat Rock Reserve, which would be unable to be used for recreation due to the project
- Requests that Balgowlah Oval remain open until new sporting fields are complete, and that there is adequate relocation of cricket nets and other facilities so children have continued access
- Concerns that there are no planned improvements to local area facilities such as parks

- Concerns that the environmental impact statement includes statements about the decline of golf in the Northern Beaches area, based on a 2017 report by the council administrator which no longer represents the current situation
- Concerns that while the environmental impact statement suggests three alternative clubs for existing members of the Balgowlah Golf Club, these clubs have closed their books to new members, and are private clubs with waiting lists and high fees
- Recommendations that the loss of Balgowlah Golf Course be offset by investment in a new golf facility within a reasonable distance.

### **Response**

#### Impacts on sporting grounds and recreation facilities

Sport, recreation and leisure facilities near the project are shown in Figure 21-3 to Figure 21-10 of the environmental impact statement. A number of sport, recreation and leisure facilities are located near surface works and temporary construction support sites at Artarmon, Cammeray, Willoughby, The Spit, Balgowlah and Frenchs Forest.

Potential impacts to sport, recreation and leisure facilities are discussed in Table 21-5 of the environmental impact statement, and will be managed through relevant environmental management measures provided in Table D2-1 of this submissions report).

#### Cammeray Golf Course

Impact on land within Cammeray Golf Course would initially result from the establishment of infrastructure required to support the Western Harbour Tunnel and Warringah Freeway Upgrade project. Part of the site would be later adjusted to support the establishment of the Cammeray Golf Course construction support site (BL1) and infrastructure required for the project. Both the Beaches Link and Gore Hill Freeway Connection project and the Western Harbour Tunnel and Warringah Freeway Upgrade project have been designed and developed to minimise impacts to Cammeray Golf Course as discussed in Table 20-4 of the environmental impact statement. The project would not impact on the feasibility of Cammeray Golf Course to operate as a nine-hole golf course or for public recreation and open space purposes, either during construction or operation. However, construction and the longer-term operation of project support infrastructure at Cammeray would require reconfiguration of the golf course including changes to some holes on the golf course.

Transport for NSW would continue its collaborative engagement with Cammeray Golf Club on this matter. Changes to the golf course during construction may impact on the use and enjoyment of the golf course for some members, potentially resulting in some members and golfers accessing alternative golf courses. During construction, increased noise, dust and construction traffic may impact on the amenity of the golf course for some users and may deter some people from using the golf course during the construction period. These impacts will be managed through the noise, air quality and traffic environmental management measures outlined in Table D2-1 of this submissions report.

The adjoining Cammeray Park sportsground, tennis club, croquet club and skate park would remain operational during construction and would not be directly impacted during construction of the project.

After construction, areas of the golf course not required for permanent project infrastructure would be reinstated and rehabilitated, including replacement trees and landscaping.

### Flat Rock Reserve

A small portion of Flat Rock Reserve would be temporarily leased for use as the Flat Rock Drive construction support site (BL2), resulting in the temporary loss of access to and use of land within the construction footprint, and temporarily disrupting the use of this land for informal recreation.

Public access to areas of the reserve outside of the Flat Rock Drive construction support site (BL2) would be maintained during construction. The existing shared user path would be temporarily realigned along the western perimeter of the temporary construction support site, resulting in an additional travel distance of up to 100 metres (refer to Figure 8-10 in the environmental impact statement). Pedestrian pathways on the eastern perimeter of the site would be maintained with two minor, temporary diversions required.

The amenity of other areas outside of the Flat Rock Drive construction support site (BL2) would be diminished during construction and may detract from the enjoyment of people visiting accessible parts of the parks or nearby facilities.

Following construction, areas affected by construction and not required for the ongoing operation of the project would be rehabilitated and returned to Willoughby City Council. Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community in accordance with new environmental management measure LP8 (refer to Table D2-1 of this submissions report). The site will be rehabilitated in line with the land use zoning. Vegetation and landscaping will be determined in consultation with Willoughby City Council and the community and will be implemented as soon as practicable at the completion of construction.

### Willoughby Leisure Centre and Bicentennial Reserve Oval

The project would not impact use of the Willoughby Leisure Centre or Bicentennial Reserve Oval.

### Spit West Reserve

During construction, a portion of waterfront open space at Spit West Reserve would be temporarily leased for use as the Spit West Reserve construction support site (BL9). Part of the reserve would be unavailable for public use for a period of about 48 months. The existing shared user path along the foreshore of Middle Harbour and Spit West Reserve would be temporarily diverted around the temporary construction support site. The amenity of Spit West Reserve would be diminished during construction and may detract from the enjoyment of people visiting accessible parts of the reserve or nearby facilities. These impacts would be temporary, with the affected areas of the reserve rehabilitated and landscaped following construction.

The Spit West Reserve construction support site (BL9) has been reconfigured to reduce impacts on recreation areas at Spit West Reserve. Details of the reconfiguration and associated improvements are provided in Section 3 (Spit West Reserve temporary construction support site (BL9) reconfiguration) of the preferred infrastructure report.

### Balgowlah Golf Course and Balgowlah Oval

Land currently owned by the State of NSW and occupied by the Balgowlah Golf Course and Golf Club would be temporarily leased for use as the Balgowlah Golf Course construction support site (BL10). The temporary construction support site would occupy about 28 per cent of the land during construction of the project and the golf course would be permanently closed at the start of construction. About 90 per cent of the golf course would not be required for permanent project facilities and this land would be progressively re-purposed when no longer needed for construction work as new and improved public open space and recreation facilities. A dedicated consultation

process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report).

The existing Balgowlah Oval would remain operational throughout construction until a new facility (should it be determined through the dedicated consultation process that a new Balgowlah Oval is to be constructed) is commissioned, it would not form part of the Balgowlah Golf Course construction support site (BL10).

#### Manly Warringah War Memorial State Park

A small area of land within Manly Warringah War Memorial State Park would be leased for the access road to and from the Wakehurst Parkway east construction support site (BL13). This portion of land would be rehabilitated and revegetated as soon as practicable after construction and returned to Northern Beaches Council. Another smaller impact on the Manly Warringah War Memorial State Park would occur to land on the east side of the access road where there is a need to adjust the access to the transmission line maintenance track so it can be accessed from the new road alignment after works are complete. As the area of Manly Warringah War Memorial State Park that would be directly impacted by the proposed Wakehurst Parkway east construction support site (BL13) is small and located on the edge of the park, its temporary use for the project is unlikely to impact recreational use of the park.

#### New and improved social infrastructure

A number of opportunities for new and improved public space have been included as part of the project as discussed in Section 5.2.13 of the environmental impact statement.

The project would progressively return an area, equivalent to around 90 per cent of the current open space at Balgowlah Golf Course, to the community as new and improved public open space and recreation facilities, as outlined above. A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved open space and recreation facilities at Balgowlah in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). Residual land, primarily to the east and north of the new access road, would progressively become available through the construction period, which would facilitate re-purposing it to the new and improved open space and recreation facilities. This would allow it to be handed over progressively for use by the community.

Land at Killarney Heights, currently owned by Sydney Water and zoned as R2 Low density residential area, would be acquired by Transport for NSW for use as part of the Wakehurst Parkway east construction support site (BL13). As this site would not be required on a permanent basis to operate the project, the project has identified the opportunity to rehabilitate and revegetate the area as soon as practicable after construction completion for use by the community as part of the Manly Warringah War Memorial State Park (this land would be handed over to Northern Beaches Council to manage). This would add about 4100 square metres of new public space to the Manly Warringah War Memorial State Park.

The project would also provide a new shared path along the Wakehurst Parkway between Seaforth and Frenchs Forest. The new shared user path provides greater connectivity for residents to Seaforth Oval, and includes a new bridge over a drainage culvert and fauna underpass (constructed as part of Northern Beaches Hospital road upgrade project), about 150 metres south of the intersection with Warringah Road.

In addition to the shared path along the Wakehurst Parkway, three new shared user underpasses beneath the Wakehurst and a new shared used bridge to replace the existing pedestrian bridge across the Wakehurst Parkway would also be provided by the project. These new active transport facilities would improve linkages between Garigal National Park and Manly Warringah War Memorial State Park.

#### Golf club membership on the Northern Beaches

Data on membership of Balgowlah Golf Club is provided in Section 4.3.2 of Appendix U (Technical working paper: Socio-economic assessment). It notes that the golf club had about 311 members in 2015, down from 576 members in 2006, which represents an average decline in membership of 6.6 per cent annually to 2015. This data was based on the *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b), which is discussed in Table 27-4 of the environmental impact statement. This strategy is a 15-year plan for the management and long-term planning of sporting facilities on the Northern Beaches. The draft strategy was placed on public exhibition in May 2017 and feedback sought from the community and considered by Northern Beaches Council.

The *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b) was informed by the *Northern Beaches Sportsgrounds and Golf Courses Discussion Paper* (Northern Beaches Council, 2017c) which was prepared in response to independent analyses commissioned by Northern Beaches Council to review sportsgrounds supply and demand, and assess the feasibility of golf courses on the Northern Beaches. The discussion paper included strategic directions for addressing a shortfall in sporting fields across the local area including the potential conversion of existing golf courses to provide additional sporting grounds and parkland areas.

Planning for the Beaches Link and Gore Hill Freeway Connection project has been ongoing for several years and during this time Transport for NSW has engaged extensively with Northern Beaches Council as the trustee of the Crown Land that Balgowlah Golf Course occupies. Northern Beaches Council has expressed their support for the project (refer to Section B11.1 of this submissions report) and has not raised any concerns in relation to the closure of Balgowlah Golf Course.

#### Alternative clubs for existing members of the Balgowlah Golf Club

Alternative golf clubs for existing members of the Balgowlah Golf Club are discussed in Table 21-5 of the environmental impact statement and Section 4.3.2 and Table 6-4 of Appendix U (Technical working paper: Socio-economic assessment). The assessment identified that the permanent closure of the Balgowlah Golf Course would require members and visitors of the golf club to access golf courses elsewhere, including Wakehurst Golf Course, Manly Golf Course and Warringah Golf Course, all located within two kilometres of Balgowlah Golf Course.

Wakehurst Golf Course and Warringah Golf Course in particular are viable alternative golfing venues for current members of Balgowlah Golf Club given they are public golf courses located within two kilometres of Balgowlah Golf Course. It is acknowledged that the suggestion of Manly Golf Club as an alternative for current members of Balgowlah Golf Club may be less appropriate given it is a private golf club with a high joining fee and an annual membership fee that is substantially higher than that of Balgowlah Golf Club.

While more distant (about seven kilometres away), another alternative golf course for some existing members of Balgowlah Golf Club is Long Reef Golf Course, which is a public 18-hole golf course.



## C20.4.2 Impacts to water-based recreational activities

### ***Issue raised***

Submitters raised concerns about the impacts of the project on water-based recreational activities. These include:

- Concern about impacts of the project on recreation facilities used for fishing, boating and swimming including at Northbridge Baths, Tunks Park, Clontarf, Manly Lagoon and Manly Warringah War Memorial State Park
- Concern that construction activities and maritime exclusion zones would have an impact on Mosman Rowing Club and Northbridge Sailing Club, impacting their viability
- Request that Northbridge Sailing Club be given assistance to keep members both during and after construction
- Request that disruption to community activities such as sailing should be minimised where possible
- Concern that the community would be unable to enjoy recreational use of the waterways for years due to construction works at Middle Harbour and potential exposure to contaminants.

### ***Response***

#### Impacts of the project on recreation facilities used for fishing, boating and swimming

The construction of the project would have indirect impacts on fishing, boating and swimming at Middle Harbour, as discussed in Section 21.4.4 of the environmental impact statement.

Middle Harbour provides for informal and formal recreational opportunities, such as boating, fishing, sailing, rowing and kayaking.

During construction, maritime speed restrictions and controlled access through the Middle Harbour construction site would be required. Recreational users, such as boating, sailing, rowing and kayaking would be allowed to travel through the site in a controlled manner ensuring the safety of both the waterway user and the project team. The sensitivity of social infrastructure to amenity impacts is considered moderate with some ability of social infrastructure to adapt to change. The magnitude of the impact is also considered moderate given the duration of potential construction impacts, resulting in the overall significance of amenity impacts at social infrastructure being moderate. Consultation will be carried out with surrounding water-based users of Middle Harbour to develop reasonable and feasible management measures to minimise construction impacts, as required by revised environmental management measure CTT16 (refer to Table D2-1 of this submissions report).

There would be a requirement for four partial and two full planned closures of 24 to 48 hours each of Middle Harbour between Northbridge and Seaforth Bluff, to facilitate lowering of the immersed tube tunnel units. These limited partial and full closures would occur on weekdays to limit the disturbance to harbour recreational users, community groups and clubs.

Construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic where possible, in accordance with revised environmental management measure CTT4 (refer to Table D2-1 of this submissions report). During full closure of Middle Harbour, no boating traffic would be able to pass the location of the Middle Harbour crossing. During the partial closure of Middle Harbour, navigational restrictions would prohibit larger vessels from crossing the harbour between Northbridge and Seaforth Bluff. Smaller vessels passing through may require escort vessels to be provided. This would result in periods of traffic disruptions, potentially

affecting recreational movements and access and connectivity for sporting clubs associated with Middle Harbour.

Middle Harbour provides for recreational swimming including at Northbridge Baths, Clontarf Beach and Tunks Park. The proposed dredging work in Middle Harbour would not impact use of Middle Harbour for recreational swimming, as discussed in Section C20.4.1 of this submissions report.

The project would involve in-water construction activities within Middle Harbour that have the potential to impact recreational activities that involve immersion in the water, as discussed in Section 13.4.2 of the environmental impact statement. Underwater noise and vibration from some construction activities (for example, installation of piles and dredging) has potential to cause sound pressure levels that may affect people diving or swimming. The areas affected by elevated underwater noise levels due to project activities would be managed during construction to minimise the risk of potential amenity and health impacts divers and swimmers. This will include monitoring during key stages of impact piling activities at each location to measure underwater noise levels and compare against acoustic thresholds to confirm the extent of areas that need to be managed and to confirm appropriate management measures, in accordance with revised environmental management measure HH1 (refer to Table D2-1 of this submissions report). A proactive communication strategy will be implemented to inform water users and other potential stakeholders of the potential impacts and risks, in accordance with revised environmental management measure HH2 (refer to Table D2-1 of this submissions report).

The project would not impact recreational activities at Manly Dam within Manly Warringah War Memorial State Park or at Manly Lagoon.

#### Impact of the project on Mosman Rowing Club and Northbridge Sailing Club

The potential impacts of the project on Northbridge Sailing Club and Mosman Rowing Club are discussed in Section 21.4.7 of the environmental impact statement. Recreational users of Middle Harbour would be allowed to travel through the construction site in a controlled manner ensuring the safety of both waterway users and the construction team. These controlled navigation restrictions would occur during the whole of the construction period. This would result in the slowing of maritime traffic potentially affecting recreational movements and resulting in potential access restrictions for Mosman Rowing Club. Rowers would be restricted to a controlled navigation channel through the construction crossing. The controlled navigation restrictions would also potentially result in sailing course relocation impacts for Northbridge Sailing Club. Some sailing courses may not be readily relocated due to seasonal wind influences resulting in several sailing courses which currently use the crossing construction area potentially needing to be de-commissioned for the construction period.

Construction of the project would also require up to six short term closures, including two full and four partial closures, of Middle Harbour between Northbridge and Seaforth Bluff for periods of 12 to 48 hours each to install the immersed tube tunnel units. These closures would normally occur on weekdays to limit the disturbance to users of Middle Harbour. During full closures of Middle Harbour, no boating traffic would be able to pass the location of the Middle Harbour tunnel crossing. During partial closures of Middle Harbour, navigational restrictions may require escort vessels to be provided for smaller vessels passing through the construction site. This would potentially result in access and connectivity impacts for Mosman Rowing Club and sailing course limitations through the crossing construction area for Northbridge Sailing Club as described above.

Project vessels and recreational users would be required to follow the law of the sea to ensure safety of all maritime users, including that vessels restricted in their ability to manoeuvre have right of way. A clarification has been included in Table A5-13 correcting a statement included in Section

6.9 of Annexure A of Appendix F (Technical working paper: Traffic and transport) regarding the right of way of maritime vessels.

Interference with training routes used by members of the Mosman Rowing Club and course layouts used by members of Northbridge Sailing Club have the potential to result in existing members joining an alternative club.

Transport for NSW would continue to work closely with the various Middle Harbour maritime clubs and recreational users to make alternate arrangements to avoid and reduce impacts from proposed maritime works where possible. The following environmental management measures (refer to Table D2-1 of this submissions report) will be implemented to help minimise impacts to Middle Harbour recreational users:

- Construction vessels will be required to operate in a manner that minimises wash within Middle Harbour (revised environmental management measure CTT3)
- Construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic, including near the Spit Bridge, where possible (revised environmental management measure CTT4)
- Consultation will be carried out with surrounding water based users of Middle Harbour including Mosman Rowing Club and Northbridge Sailing Club to develop reasonable and feasible management measures to minimise construction impacts (revised environmental management measure CTT16)
- A navigation channel delineated with marker buoys will be formed on the approach to d'Albora Marina at The Spit adjacent to the Spit West Reserve construction support site (BL9) (new environmental management measure CTT19)
- The Spit West Reserve construction support site (BL9) will not impact the land based approach or water based approach to the Mosman Rowing Club. The channel on approach to Mosman Rowing Club will be 30 metres (100 feet) wide and will be delineated with marker buoys (new environmental management measure CTT21).

#### Potential exposure to contaminants in Middle Harbour

The relevant parameter for assessing the potential health impact is the concentration of suspended solids, which influences the aesthetic quality of the waterbody. Health related impacts due to proposed dredging activities in Middle Harbour are addressed in Section 13.4.3 of the environmental impact statement. Dredge plume modelling is detailed in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement, which provides predictions of suspended solid concentrations in the vicinity of the dredging sites.

The behaviour of sediment-bound contaminants when resuspended into the water column has been previously assessed (Geotechnical Assessments, 2015) for other construction projects (Sydney Metro City & Southwest) which determined that contaminants are likely to remain bound to sediment particles and not be released into the water column.

Dredging of softer sediments would involve the use of multiple silt curtains and a backhoe dredge with a closed clamshell bucket attachment to minimise the risk of sediment being mobilised into the water. This control in conjunction with the behaviour of sediment-bound contaminants as described above means it is unlikely that water quality would be significantly impacted by contaminants mobilised by dredging and other marine construction activities. With the proposed management measures in place, it is expected there would be negligible impacts to human health associated with recreational exposures in areas surrounding the proposed works.

Further information regarding the health impacts on recreational use of dredging activities proposed in Middle Harbour has been prepared and is provided in Appendix C1 of this submissions report. The risk of the proposed dredging works resulting in the release of contaminants into the water column is also discussed in Appendix C1 of this submissions report.

### **C20.4.3 Impacts to active transport**

#### ***Issue raised***

Submitters raised concerns about the impacts of the project on active transport infrastructure including:

- Concern about impacts of the project on the Gore Hill Freeway shared user path, and that the alternate bike route proposed through the Artarmon industrial area is on a busy road which is used by heavy vehicles
- Concern that construction work would impact on cycling and walking for residents of Artarmon
- Concern that the project will negatively impact the shared user path at the Wakehurst Parkway
- Concern that the project will negatively impact mountain bike trails on both sides of the Wakehurst Parkway, which are integral to the local trail network and are used heavily
- Request that the project provides support and funding to upgrade and re-align where necessary the existing track that connects the Engravings track to Seaforth Oval
- Request for all trail re-alignments to be designed and implemented by companies that specialise in creating mountain biking and walking trails to ensure the trails are fit for purpose and meet the needs of end users.

#### ***Response***

##### **Impacts to the Gore Hill Freeway shared user path**

Impacts to the Gore Hill Freeway shared user path during construction of the project are discussed in Section 8.4.2 of the environmental impact statement. The proposed temporary adjustment of the shared user path along Gore Hill Freeway between Reserve Road and Station Street would divert users via Station Street, Francis Street, Lambs Road, Cleg Street, and Reserve Road, resulting in an additional travel distance of about 550 metres. Existing (2016) peak hour traffic data for Cleg Street east of Herbert Street is provided in Table 8-7 of the environmental impact statement and indicates a low proportion of heavy vehicle use (up to two per cent) during peak periods. The detour would be alongside the Punch Street construction support site (BL3) at the corner of Lambs Road and Cleg Street, and alongside the Dickson Avenue construction support site (BL4) along Dickson Avenue and Reserve Road.

The project is continuing to engage with key stakeholders within Transport for NSW and external interested parties such as bike groups with respect to this proposed detour.

Transport for NSW is continuing to develop the design and construction planning in the Gore Hill Freeway area, including detailed staging of the work. The contractor/s would finalise and complete plans for staging the work during further design development and construction planning. At this time appropriate sequencing of the work in the Gore Hill Freeway area would be confirmed, including cut and cover work and water quality basin upgrade work in and near Punch Street which impact the existing shared user path along the Gore Hill Freeway. The intention is to plan this work so as to reduce the length, duration and impact of the detour.

Advance notification will be provided to the community regarding the detour of this section of the Gore Hill Freeway shared user path, in accordance with environmental management measure CTT7

(refer to Table D2-1 of this submissions report). The detour will be designed with consideration of user safety and convenience, in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report). Vehicle movements to and from construction sites will be managed to ensure pedestrian, cyclist and road user safety, in accordance with environmental management measure CTT9 (refer to Table D2-1 of this submissions report).

#### Impacts to active transport at Artarmon

Impacts to active transport at Artarmon are discussed in in Section 21.4.8 and Section 8.4.2 of the environmental impact statement, and Section 6.8.1 of Appendix U (Technical working paper: Socio-economic assessment). Temporary closures and adjustment of pedestrian and cycle paths at Artarmon are shown in Figure 8-12 of the environmental impact statement and would include:

- Northern abutment works on the Hampden Road bridge over the Gore Hill Freeway which would impact cyclists who currently travel on the road shoulder on either side of Hampden Road. During construction, one lane in each direction would be provided and cyclists would be required to travel on-road in traffic. Pedestrians would be temporarily diverted to the western footpath of the bridge. Impacts would be minor given that these works are short in duration
- Temporary adjustment of the southern footpath on Punch Street adjacent to the Punch Street construction support site (BL3) boundary. Pedestrians would be temporarily diverted via Cleg Street resulting in an increase in travel distance of about 70 metres, which is considered a minor impact
- Temporary adjustment of the shared user path along Gore Hill Freeway between Reserve Road and Station Street, as discussed above.

Periodic diversions of pedestrians to footpaths opposite construction activities or use of traffic control may also be required to ensure the safety of pedestrians, particularly on Punch Street, Dickson Avenue and Reserve Road.

These temporary modifications to the active transport network at Artarmon would cause a minor inconvenience to cyclists and pedestrians. Targeted engagement with affected residents would be carried out before and throughout the construction works in accordance with the relevant community and stakeholder engagement protocols for the project.

The community will be notified in advance of proposed transport network changes, through appropriate media and other appropriate forms of community liaison, in accordance with environmental management measure CTT7 (refer to Table D2-1 of this submissions report). Any detours and adjustments will be designed with consideration of user safety and convenience, in accordance with revised environmental management measure CTT15 (refer to Table D2-1 of this submissions report).

#### Impacts to the shared user path along the Wakehurst Parkway

Impacts to the shared user path along the Wakehurst Parkway during construction of the project are discussed in Section 8.4.5 of the environmental impact statement.

The existing shared user path adjacent to the Wakehurst Parkway north construction support site (BL14) would be temporarily impacted during the use of the site. Affected areas would include the off-road shared user paths along the Wakehurst Parkway, north of Warringah Road which may require minor detours (refer to Figure 8-19 in the environmental impact statement). Pedestrian and cyclist access would be maintained during construction and the increase in travel distance would be negligible.

The project would improve cyclist and pedestrian connectivity along the project corridor through increased provision of dedicated cyclist and pedestrian links. This includes the construction of a new

shared user path along the Wakehurst Parkway between Seaforth and Frenchs Forest, with three new shared user underpasses and connections to existing bus stops, paths and surface trails at key locations, as described in Table 5-9 of the environmental impact statement. Additionally, the shared user path bridge over the Wakehurst Parkway connecting the Warringah Aquatic Centre and Bantry Bay Road would be replaced with a new and lengthened overpass constructed as part of the project. As well as providing safety benefits to pedestrians and cyclists, it is anticipated that these improvements in connectivity would encourage greater use of existing infrastructure by pedestrians and cyclists.

#### Impacts to mountain bike trails adjacent to the Wakehurst Parkway

Impacts to walking and mountain bike trails adjacent to the Wakehurst Parkway during construction of the project are discussed in Section 8.4.5 of the environmental impact statement.

The project would require a temporary adjustment to some of the mountain bike tracks on either side of the Wakehurst Parkway, as identified in Section 21.4.8 of the environmental impact statement. Where possible, Transport for NSW would refine the design of the project and seek to avoid or otherwise minimise impacts to the mountain bike trail network. Where impacts cannot be avoided, minor detour routes would be implemented including some staging of trail adjustments to align with construction staging of the Wakehurst Parkway upgrade works. Advanced notification of track closures would be provided at key locations. Construction of the three permanent shared user path underpasses proposed along the Wakehurst Parkway would be prioritised where feasible.

Based on feedback and concerns expressed by Northern Beaches Council, community and bike interest groups in submissions on the environmental impact statement, Transport for NSW has carried out further investigations to identify potential impacts. Refer to Section A4.5 and Section B11.20.1 of this submissions report for further details of potential impacts to mountain bike trails as a result of conflicts with the construction footprint or operational facilities.

Transport for NSW would continue to consult with Northern Beaches Council and relevant mountain biking associations during the detailed design of the project regarding potential impacts to the Manly Warringah War Memorial State Park mountain bike trail network at the Wakehurst Parkway.

The Timber Getters Track connects the Engravings Track to Seaforth Oval. The project would not directly impact the Timber Getters Track, this section of the Engravings Track, or Seaforth Oval. Therefore, no realignment or upgrade of this track is proposed as part of the project.

#### **C20.4.4 Impacts on local schools and community facilities**

##### ***Issue raised***

Submitters raised concerns about the impacts of the project on schools and community facilities:

- Concerns about the negative impacts of construction activities on local schools and community facilities
- Concerns about negative impacts of construction on educational outcomes at Northern Beaches Secondary College Balgowlah Boys Campus, including student and staff retention. Requests were also made for:
  - Consideration of moving Northern Beaches Secondary College Balgowlah Boys Campus temporarily to avoid impacts to the school
  - Measures to be put in place to protect students at Northern Beaches Secondary College Balgowlah Boys Campus

- Funding to be provided to Northern Beaches Secondary College Balgowlah Boys Campus for the relocation of exams, including transport to an offsite location.

### **Response**

Schools and community facilities near the project are shown in Figure 21-3 to Figure 21-10 of the environmental impact statement. A number of schools and community facilities are located near surface road works and/or temporary construction support sites at Cammeray and Balgowlah, including the Northern Beaches Secondary College Balgowlah Boys Campus.

Potential construction impacts on schools and community facilities are discussed in Section 21.4.4 of the environmental impact statement. Students, teachers and visitors at the schools would potentially experience temporary amenity impacts due to increased noise and on occasion, dust from construction activities at temporary construction support sites and surface work areas. Increased construction traffic may impact on perceptions of safety for children and students. Users of community facilities may also experience potential impacts on amenity due to the presence of nearby construction infrastructure and associated construction noise.

During construction, the main priority is to maintain the safety of the public in and around the construction sites and the immediate areas adjacent to the sites. Vehicle movements to and from construction sites, including those near schools (including Northern Beaches Secondary College Balgowlah Boys Campus) will be managed to ensure pedestrian, cyclist and road user safety, in accordance with environmental management measure CTT9 (refer to Table D2-1 of this submissions report). Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past temporary construction support sites and construction site access points and on the surrounding network in accordance with environmental management measure CTT10 (refer to Table D2-1 of this submissions report). This will be supplemented by variable message signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes.

These traffic environmental management measures, in addition to other best practice approaches to managing construction traffic, noise, dust, urban design and visual amenity, and hazards and risks would ensure that the identified impacts are avoided or reduced. Further discussion and details of approaches to managing these specific issues are provided in Section C7 (Construction traffic and transport), C9 (Construction noise and vibration), C11 (Air quality), C19 (Land use and property), C21 (Urban design and visual amenity) and C22 (Hazards and risks) of this submissions report.

Ongoing engagement will be carried out with representatives of schools and community facility user groups located near surface works, temporary construction support sites and above the tunnel alignment about the timing and duration of construction works and management of potential impacts in accordance with environmental management measure SE2 (refer to Table D2-1 of this submissions report). This would include comprehensive early planning around specific events such as final year exams to ensure a minimum of disruption and inconvenience during these periods. Consultation for the project will be carried out in accordance with the Community Consultation Framework provided in Appendix E of the environmental impact statement, as required by environmental management measure SE3 (refer to Table D2-1 of this submissions report). The framework includes a procedure to receive and address community enquiries and complaints for the duration of construction.

Temporary relocation of Northern Beaches Secondary College Balgowlah Boys Campus, including during exam periods, or additional funding is not proposed and not considered necessary.

## C20.5 Impacts to community values

### C20.5.1 Impacts to community values during construction

#### ***Issue raised***

Submitters raised concerns regarding impacts to community values during construction of the project. Specific queries, comments and concerns include:

- Concerns about the impacts on quality of life and community values as a result of increased noise, vibration, and increased traffic congestion for local communities at Northbridge, Willoughby, Balgowlah, Seaforth, North Balgowlah, and the North Sydney local government area during construction
- Concerns that construction work would create barriers and lead to further fragmentation of the communities at Cammeray and Naremburn
- Concerns about impacts to the community due to construction activities over a number of years
- Concerns that the concentration of construction sites in a small area at Balgowlah, North Balgowlah and Seaforth would have an impact on the amenity of residential areas.

#### ***Response***

##### Community values

Community values that are likely to be important to local and regional communities within Greater Sydney are identified in Section 21.3.3 of the environmental impact statement. Potential impacts to community values during construction are assessed in Section 21.4.5 of the environmental impact statement and may include changes to local amenity near temporary construction support sites due to noise, vibration and dust.

These changes may impact on people's use and enjoyment of their homes, workplaces and public spaces. Any delays and disruptions caused by temporary changes to local access and connectivity may inconvenience or cause frustration for some motorists and public transport users.

The potential impacts to community values during construction will be temporary and will be mitigated in accordance with the environmental management measures in Table D2-1 of this submissions report, including:

- A construction noise and vibration management plan will be developed for the project which will include relevant criteria and management levels in relation to noise and vibration, standard and additional mitigation measures, protocols to manage works required outside standard construction hours, and the approach to managing construction noise impacts (refer to revised environmental management measure CNV1 for full wording)
- The community will be notified in advance of proposed transport network changes, and maritime restrictions through appropriate media and other appropriate forms of community liaison (refer to environmental management measure CTT7)
- Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by variable message signs to advise all road users of potential delays, traffic diversions, speed restrictions or alternative routes (refer to environmental management measure CTT10)
- Where impacts to private property access are unavoidable during construction, landowners or lease holders/tenants where appropriate will be consulted in advance to develop appropriate alternative access arrangements (refer to revised environmental management measure LP6).



A construction environmental management plan, and associated sub-plans, would be prepared for the project, as outlined in Section 28.5.1 of the environmental impact statement. All relevant environmental management measures included in Table D2-1 of this submissions report will be adopted and incorporated into the management plans. Refer to Section D1.1 of this submission report for further information on the construction environmental management plan and associated sub-plans.

### Community fragmentation at Cammeray and Naremburn

Community cohesion is encouraged by connectivity or discouraged by barriers to movement. It is acknowledged that the Warringah Freeway creates an existing barrier between Cammeray and parts of Naremburn. However, there would be no changes to vehicle travel routes between Cammeray and Naremburn during construction of the project. Access in and out of the Flat Rock Drive construction support site (BL2) would be via a temporary signalised intersection at Flat Rock Drive. Indicative construction vehicle routes associated with the site is shown on Figure 5-11 of Appendix F (Technical working paper: Traffic and transport). Given that Flat Rock Drive/Brook Street is a regional sub-arterial road, this corridor is considered to be an appropriate route for construction vehicles, and avoids use of local streets in the area.

As a regional road, this corridor already carries a significant amount of traffic, with 720 vehicles northbound (nine per cent of which are heavy vehicles) and 2070 southbound (two per cent heavy vehicles) during the morning peak hour, and 1660 vehicles northbound (two per cent heavy vehicles) and 1020 southbound (six per cent heavy vehicles) during the evening peak hour (refer to Table 4-5 of Appendix F (Technical working paper: Traffic and transport)). While additional light and heavy vehicle traffic would be generated as a result of the project, it is considered that this would not materially change existing traffic conditions nor present additional safety or connectivity issues for road users.

Construction impacts to Flat Rock Reserve as a result of the Flat Rock Drive construction support site (BL2) are discussed in Section C20.4.1 of this submissions report. The overall significance of these changes on active transport is considered low and limited to minor increases in travel distance and time. These changes are not considered likely to impact on connectivity. Following construction, the diverted shared path would be reinstated and areas of Flat Rock Reserve affected by construction would be rehabilitated in consultation with Willoughby City Council and the community and returned to Council (refer to Section C20.5.2 of this submissions report).

Key construction traffic issues would be addressed in the traffic management plan once detailed design aspects have been developed, and tailored strategies have been employed. The traffic management plan will incorporate relevant environmental management measures for applicable activities during construction, which include the following measures to ensure connectivity and safety of the community during construction:

- The community will be notified in advance of proposed transport network changes, and maritime restrictions through appropriate media and other appropriate forms of community liaison (refer to environmental management measure CTT7)
- Vehicle movements to and from construction sites will be managed to ensure pedestrian, cyclist and road user 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 (refer to environmental management measure CTT9)
- Directional signage, barriers and/or linemarking will be used as required to direct and guide motorists, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by variable message signs to advise all road users of potential delays,

traffic diversions, speed restrictions or alternative routes (refer to environmental management measure CTT10).

#### Impacts to the community due to construction over a number of years

Submissions received during the display of the environmental impact statement raised concerns regarding construction fatigue and the importance of minimising cumulative impacts.

The potential impacts of construction on communities are discussed in Section 21.4.5 of the environmental impact statement. The nature of potential impacts to communities would depend on the type of construction works occurring nearby. An indicative construction program identifying when key construction activities would occur and how long these activities would take is provided in Table 6-3 of the environmental impact statement. This program identifies when key construction activities would occur across all construction sites.

It is acknowledged that construction fatigue can arise from extended periods of construction, and duration of impacts for stakeholders is one of the considerations when assessing the extent and impact of construction fatigue. Ongoing engagement will be carried out with relevant stakeholders to manage potential impacts, in accordance with environmental management measures provided in Table D2-1 of this submissions report.

Transport for NSW would continue to consult with affected communities to make them aware of the progress of the construction works and when adverse impacts are likely to occur. Consultation for the project will be carried out in accordance with the Community Consultation Framework provided in Appendix E of the environmental impact statement, as required by environmental management measure SE3 (refer to Table D2-1 of this submissions report). The framework includes a procedure to receive and address community enquiries and complaints for the duration of construction. It is also noted that cumulative construction noise impacts at each temporary construction support site have been assessed in the relevant sections within Section 5 of Appendix G (Technical working paper: Noise and vibration). This includes consideration of nearby construction works related to this project and other major projects in the vicinity. Construction noise impacts, including cumulative noise impacts, will be managed through environmental management measures (including new and revised measures) CNV1 to CNV15 (refer to Table D2-1 of this submissions report).

Chapter 5 (Project description) of the environmental impact statement describes the scope of the Beaches Link and Gore Hill Freeway Connection and notes the project may be staged, depending on future project decisions on the delivery of the project. As a result of further planning and procurement packaging, Transport for NSW has elected to stage the project. Section A4.9 provides details of the project staging plans. Enabling and early works to facilitate site establishment is expected to commence prior to construction of the main works to respond to market trends on contractor availability. Whilst construction activities may commence sooner than previously anticipated in some areas, construction activities in other areas may commence later than previously anticipated. Final construction methodologies and staging plans would be prepared by the contractor/s, once appointed. The staging plans would be based on further design development and refinement of the construction method.

#### Impact of temporary construction support sites at Balgowlah, North Balgowlah and Seaforth

Four temporary construction support sites are proposed in the Balgowlah, North Balgowlah and Seaforth area:

- Balgowlah Golf Course construction support site (BL10) – tunnel support, surface works support including works to construct new and improved open space and recreation facilities and project management, refer to Figure 6-38, Table 6-25 and Table 6-26 of the environmental impact statement

- Kitchener Street construction support site (BL11) – surface works support, refer to Figure 6-39, Table 6-27 and Table 6-28 of the environmental impact statement
- Wakehurst Parkway south construction support site (BL12) – surface works support including works to support the Wakehurst Parkway upgrade, construction of the cut and cover tunnel and trough and motorway facilities at the Wakehurst Parkway, refer to Figure 6-40, Table 6-29 and Table 6-30 of the environmental impact statement. This site would also provide office support for the Wakehurst Parkway east construction support site (BL13)
- Wakehurst Parkway east construction support site (BL13) – tunnel support and project management, refer to Figure 6-41, Table 6-31 and Table 6-32 of the environmental impact statement.

These temporary construction support sites would operate concurrently during construction. Work at the Balgowlah Golf Course construction support site (BL10) would likely extend for a further year after completion of tunnel and surface works to facilitate the new and improved open space and recreation facilities proposed at this site.

Each of the temporary construction support sites would serve a different function, as indicated above, and the nature of impacts would differ accordingly. The volume of heavy vehicle traffic to and from these sites would also differ. Balgowlah Golf Course construction support site (BL10) is predicted to have a peak of 495 daily heavy vehicle movements, compared to a peak of 275 daily heavy vehicle movements at Wakehurst Parkway east construction support site (BL13), 15 daily heavy vehicle movements at Wakehurst Parkway south construction support site (BL12) and 10 daily heavy vehicle movements at Kitchener Street construction support site (BL11).

All of the temporary construction support sites would generate noise, have the potential to generate dust and light spill and would result in a reduction in visual amenity. However, these impacts would be limited to the area surrounding each temporary construction site. Some residents living between Balgowlah Golf Course (BL10) and Kitchener Street (BL11) construction support sites would experience impacts from both sites, and similarly some residents located near to both the Wakehurst Parkway south (BL12) and Wakehurst Parkway north (BL13) construction support sites would experience impacts from both of these sites. The environmental impact statement considered the potential for residents to experience impacts from multiple temporary construction support sites and surface road works, and environmental management measures have been considered accordingly (refer to Table D2-1 of this submissions report).

Impacts to local character and visual amenity during construction of the project are discussed in Section 21.4.5 of the environmental impact statement. Potential impacts on community values during construction may be experienced by communities within the precinct areas due to temporary adverse changes in visual amenity and local character due to the presence of temporary construction support sites and surface works, infrastructure, and clearing of vegetation within the construction footprint. These impacts would be short term.

The implementation of the environmental management measures outlined in Table D2-1 of this submissions report, in conjunction with ongoing consultation with local communities, will assist in managing and mitigating the potential impacts of temporary construction support sites on communities, including those in the Balgowlah, North Balgowlah and Seaforth areas.

## **C20.5.2 Impacts to community values during operation**

### ***Issue raised***

Submitters raised concerns regarding impacts to community values and amenity during operation of the project. Specific queries, comments and concerns include:

- Concerns about the impacts on residents' quality of life and community values as a result of increased noise, vibration, and increased traffic congestion for local communities in Northbridge, Willoughby, Balgowlah, Seaforth, North Balgowlah, and the North Sydney local government area during operation
- Concerns that operation of the project would create barriers and lead to further fragmentation of the communities at Cammeray and Naremburn
- Concerns that the project would incentivise green field development and lead to further residential development on the Northern Beaches, resulting in population increase and overcrowding and providing little benefit to existing residents.

### ***Response***

#### Community values

Community values that are likely to be important to local and regional communities within Greater Sydney are identified in Section 21.3.3 of the environmental impact statement and are discussed in Section C20.5.1 of this submissions report. Potential impacts to community values during operation are assessed in Section 21.5.4 of the environmental impact statement. The operation of the project would provide an overarching benefit to communities near to the project of improved access and connectivity to destinations across the Greater Sydney region. In many locations the project would also reduce localised traffic congestion by reducing through traffic demand and consequent congestion and queuing from surface roads, as demonstrated in Appendix F (Technical working paper: Traffic and transport).

The operation of the project is predicted to reduce traffic on Eastern Valley Way by almost 40 per cent or 13,000 vehicles per day at commencement of operation in 2027, from about 33,000 vehicles per day in the 'Do minimum 2027' scenario to 20,000 vehicles per day in the 'Do something cumulative 2027' scenario (refer to Table 9-4 of the environmental impact statement). The operation of the project is also predicted to reduce traffic on Brook Street north of Merrenburn Avenue by about 18 per cent or 6500 vehicles per day at commencement of operation in 2027, from about 35,500 vehicles per day in the 'Do minimum 2027' scenario to 29,000 vehicles per day in the 'Do something cumulative 2027' scenario (refer to Table 9-4 of the environmental impact statement). These reductions in arterial road traffic on the lower North Shore would reduce traffic congestion and noise, improve amenity at Northbridge centre and Willoughby centre, and would improve access to and from Northbridge and Willoughby.

A key benefit of the project to communities at Balgowlah, Seaforth and North Balgowlah and in the North Sydney local government area would be increased connectivity due to improved travel times for trips to and from Greater Sydney via the Beaches Link tunnel and Western Harbour Tunnel. In addition, the operational traffic assessment for the project indicates that these areas would also benefit from reduced traffic demand on existing key corridors as a result of the project, providing local operational benefits and improved amenity (refer to Chapter 9 (Operational traffic and transport) of the environmental impact statement). Predicted travel time savings along key road network corridors, including trips to and from North Sydney and Balgowlah, in the AM and PM peak periods are provided in Figure 9-3 and Figure 9-4 respectively of the environmental impact statement. Improved accessibility and connectivity as a result of improved travel times is likely to provide long-term benefits for community cohesion.

Another key benefit of the operation of the project would be the new and improved open space and recreation facilities at Balgowlah, which would improve access to sport and recreation facilities for surrounding communities. Increased availability of public open space and passive and active recreation facilities would impact positively on local amenity in this area.

The operation of the project may result in change to traffic noise levels near to the access road to the Burnt Bridge Creek Deviation on ramp and off ramp. For local roads within the project area in Balgowlah, North Balgowlah and Seaforth where predicted increases in traffic are likely to result in exceedances of the relevant road traffic noise criteria, traffic calming measures with the aim of limiting potential road traffic noise increases to no more than 2 dB(A) will be investigated in consultation with Northern Beaches Council and implemented in accordance with revised environmental management measure ONV3 (refer to Table D2-1 of this submissions report), whilst the need for at-property treatments will be confirmed during further design development. However, it should be noted that traffic noise in other nearby areas would decrease, such as along Manly Road and the broader Spit Road-Military Road corridor.

#### Potential for future development

Future development of the Northern Beaches is guided by the *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a), as discussed in Section 3.1 of the environmental impact statement. The plan divides the city into districts, with the project located in the North District. In 2016, the North District was home to 886,550 residents (or 19 per cent of Greater Sydney's population), which is forecast to increase by 18 per cent by 2036. An additional 92,000 dwellings will be required in the North District to accommodate this forecast population growth (Greater Sydney Commission, 2018a). Northern Beaches Council has prepared a local housing strategy that identifies how it will provide an additional 12,000 dwellings between 2021 and 2036 to accommodate the forecast increase in the local population. Northern Beaches Council sought community feedback on the *Draft Northern Beaches Local Housing Strategy* (Northern Beaches Council, 2021a) in early 2021.

The Greater Sydney Commission's *Greater Sydney Region Plan* focuses on concentrating jobs and education facilities around strategic centres. Within the North District, this includes Frenchs Forest, Chatswood, St Leonards and North Sydney. The Greater Sydney Commission lists Frenchs Forest as a key catalyst to attract complementary health services and develop as a major employment hub for the Northern Beaches. This has been supported by the Northern Beaches Hospital road upgrade project, which has improved access to the Northern Beaches Hospital and increased the capacity of the broader road network, particularly along Warringah Road.

The *Greater Sydney Region Plan – A Metropolis of Three Cities* 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. On this basis the Beaches Link and Gore Hill Freeway Connection project provides the opportunity to accommodate the transport demand and mitigate the transport impacts of future development in the Northern Beaches, such as in Frenchs Forest.

The traffic modelling prepared for the project took into consideration planned population and employment demand and growth throughout Sydney over the next 20 years, as discussed in Section 9.2.2 of the environmental impact assessment. Therefore, the predicted travel time savings

that the project would deliver already account for future population and employment growth in Greater Sydney including on the Northern Beaches.

## **C20.6 Economic impacts**

### ***Issue raised***

Submitters raised concerns over the economic impact of the project. Specific queries, comments and concerns include:

- Concerns that there has been no economic assessment of construction impacts to the local community of Balgowlah
- Concerns that the project will increase the cost of commuting from the Northern Beaches to the city and other areas of Sydney due to tolling
- Concerns that the project does not compensate drivers of commercial vehicles for tolling which would increase their costs and would be passed on to the consumer, resulting in an increase in cost of living
- Concerns that impacts to human health as a result of the project would be costly and draw on public health resources and hospitals
- Concerns that the construction jobs generated by this project would be short term, and jobs generated would not benefit those in North Sydney, Willoughby or the Northern Beaches based on the demographics of the area.

### ***Response***

#### Economic impacts of construction to the Balgowlah community

During construction, the project would benefit employment through direct employment opportunities on the project and indirect employment opportunities in businesses and industries that support this construction. The Balgowlah community would be potential beneficiaries of these local employment opportunities.

Businesses across the project area may be affected during construction 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 business revenue may vary (positively or negatively). These impacts may be an inconvenience for businesses affected although they would be temporary in nature as the duration of construction activities at some temporary construction support sites would be comparatively less than the overall construction program. There may also be benefits for businesses due to increased passing trade and business exposure.

Increased passing trade from construction workers and construction vehicles is predicted for a number of business clusters located near the temporary construction support sites, including the Balgowlah Golf Course construction support site (BL10). Vehicle diversions are also expected to increase traffic along Sydney Road, leading to an increase in passing trade. Demand for services at business centres including at Balgowlah and Seaforth is expected to increase, with the largest beneficiaries likely to be convenience retail and the food and beverage industry.

During construction, visual amenity would be affected by the removal of vegetation and the introduction of temporary construction support sites, equipment and other visible elements such as hoardings and fencing. This is most likely to impact on those retail, personal service providers, cafes and restaurants that rely on the pleasantness and quality of an environment to attract customers. Important aspects of visual amenity which may be affected include access to natural daylight, clear

sightlines and permeability to the surrounding landscapes. Businesses that rely on storefront exposure to attract customers may be affected by reduced visibility or safety concerns of customers as a result of the presence of construction machinery and materials. The temporary reduction in amenity at the Balgowlah Centre would be low, and moderate-low at the Seaforth Centre.

The closure of Balgowlah Golf Course would result in a loss of employment. However, there are few co-dependencies or synergies between the golf course and businesses that would remain operational at the Balgowlah Centre and the Seaforth Centre. Therefore, the operation of remaining businesses is not expected to be substantially affected by the closure of the golf course.

Other potential impacts to businesses within the Balgowlah Centre and the Seaforth Centre were assessed as of low or negligible significance. This included potential impacts to employee and customer access, servicing of and deliveries to businesses, and impacts to employee productivity and communication due to construction noise.

For further details on the potential economic and business construction impacts of the project, refer to Section 21.4.6 and Section 21.4.7 respectively of the environmental impact statement.

#### Increase in the cost of commuting

Tolling infrastructure has been included as part of this environmental assessment to provide the NSW Government with the option to apply tolls to traffic using the Beaches Link tunnels. The decision to apply a toll to a road is a NSW Government decision and is not made at the project level.

The economic impact of road tolling is discussed in Section 13.5.4 and Section 21.5.5 of the environmental impact statement. The use of a toll road can also increase the cost of living and can exacerbate social inequality. Specifically, the impact of road tolls on households can be assessed as a function of household income, urban spatial structure, and available mobility choices. Depending on the travel routes of individuals and the individual economic situation, there would be a proportion of the population that avoids the use of tollways due to affordability.

In July 2018, 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. This was expanded in July 2019 to also provide half-priced vehicle registration for eligible road users. It is noted that the toll relief initiative is a broader NSW Government initiative, and that there are conditions of eligibility to be met.

The management of tolling across NSW is outside the scope of this project. As with all tolled motorway projects, alternative toll-free routes using existing surface roads and public transport options always exist for commuters.

#### Commercial and freight costs

Commercial and freight transport businesses would benefit from the operation of the project because it would:

- Relieve congestion on the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors
- Enable faster, more reliable journeys on all road corridors crossing Middle Harbour
- Improve access to key commercial and employment centres including the Sydney CBD, North Sydney, Artarmon, St Leonards, Macquarie Park and other strategic centres
- Provide an alternative to existing arterial connections by providing a new free flow harbour crossing link between the Northern Beaches and the Greater Sydney region

- Enhance the resilience of the road network by providing additional road network capacity and alternate north-south and east-west linkages to reduce congestion and potential gridlock in the event of incidents on the road network.

The project would encourage heavy and commercial vehicle movements into the tunnel, due to increased efficiencies and reduced freight costs through increased travel speeds and reliability and reduced travel distances.

The transport modelling carried out for the project highlighted that the project would result in substantial potential benefits for freight and commercial vehicle movements. 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.

#### Economic cost of human health impacts

A human health impact assessment due to operation of the project is provided in Section 13.5 of the environmental impact statement, with further discussion also included in Chapter C12 of this submissions report. The operation of the project is not expected to have any significant health impacts. Public safety is anticipated to improve as a result of improvements to road safety with reduced traffic volumes along key road transport corridors. New or upgraded pedestrian and cyclist infrastructure is anticipated to encourage increased active transport, with associated improvements in community health and wellbeing.

#### Construction employment opportunities

Employment opportunities relating to the construction of the project are discussed in Section 21.4.6 of the environmental impact statement. During construction, the project would provide direct employment opportunities on the project and indirect employment opportunities in businesses and industries that support this construction. The project is expected to support up to 7500 full time equivalent job years (direct employment) during construction, including construction workers and professional and administration staff. About 2350 full time equivalent jobs (2000 for Beaches Link and 350 for the Gore Hill Freeway Connection) would be expected to be supported during peak construction. Indirect employment opportunities would be generated across local, regional and national businesses in industries that support construction such as manufacturing and services.

The construction workforce would generally be sourced from across the Greater Sydney region. It is expected that there would be capacity within the regional labour force for the project.

The number and types of jobs generated would vary across this period based on the works being carried out. Like most construction projects, some of the jobs generated during the construction of the project would be temporary employment positions that exist only for the duration of the construction works or part thereof. There would also be many jobs that are likely to be carried out by full time employees of businesses that are contracted to carry out specific tasks on the project.

Employment for the project will be informed by a workforce strategy that includes strategies to increase employment and training opportunities for groups such as Aboriginal people, women, young people and the unemployed, to help maximise employment benefits of the project, in accordance with environmental management measure SE4 (refer to Table D2-1 of this submissions report).



## C20.7 Impacts to local businesses and industry

### C20.7.1 Local businesses and industry

#### ***Issue raised***

- Concerns regarding the impact of changed traffic flow to local and small businesses which rely on passing trade during construction and operation in Mosman, Neutral Bay, Cammeray and Cremorne
- Concerns about traffic congestion during construction affecting businesses along Flat Rock Drive.

#### ***Response***

Transport for NSW acknowledge that a project of this scale would have an impact upon the local community during both construction and operation of the project.

Issues relating to changes in passing trade during construction are discussed in Section 21.4.7 of the environmental impact statement. Construction of the project would result in changes to vehicle, pedestrian and cyclist flows that could influence the level of passing trade. Some businesses could benefit due to passing trade being re-directed to them, while some businesses may be disadvantaged as traffic is diverted away, or as they become less attractive to passing trade due to construction impacts. Increased passing trade from construction workers and construction vehicles is predicted for business clusters located near the temporary construction support sites.

Transport for NSW is committed to continuing to engage with businesses that may be potentially impacted by construction activities. Specific consultation will be carried out with businesses potentially impacted during construction, in accordance with environmental management measure BU2 (refer to Table D2-1 of this submissions report). Consultation will aim to identify specific potential construction impacts for individual businesses. 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, as required by environmental management measure BU3 (refer to Table D2-1 of this submissions report).

Operation of the project would reduce through traffic from the Spit Road/Military Road corridor, which would reduce traffic congestion in this corridor and improve travel times and amenity, as discussed in Section 6.5.3 of Appendix U (Technical working paper: Socio-economic assessment). Analysis of the modelled forecast traffic demand across Middle Harbour with the project in 2037 indicates that peak period traffic demand on Military Road and Spit Road would decrease as a result of the project, by up to 11 per cent and 33 per cent respectively, as noted in Section 3.6.1 of the environmental impact statement.

This would have beneficial impacts for customers and employees accessing the centres along Military Road through Mosman, Cremorne, Spit Junction and Neutral Bay. However, this redistribution of traffic flow may also result in a reduction in passing trade for some businesses along this corridor. These centres generally have a strong local catchment, with the opportunity that the trade catchments would increase due to the reduction in congestion, improved accessibility and enhanced amenity. Considering this, any potential reduction in passing trade would likely be offset by an increase to the trade catchment and improved amenity potentially encouraging further patrons, as described in Section 6.5.3 of Appendix U (Technical working paper: Socio-economic assessment).

Flat Rock Drive/Brook Street is a sub-arterial road with two lanes in each direction and up to nine per cent heavy vehicles in the AM peak. As such, it is considered that these streets would be able to safely accommodate construction traffic, as discussed in Section C7.3 of this submissions report. Flat Rock Drive/Brook Street has development along its southern half only, which is almost exclusively residential. The only business directly accessed from Flat Rock Drive/Brook Street is the Naremburn Early Learning Centre, at the end of a cul-de-sac in Donnelly Street, at the southern end of Brook Street. During the morning and evening peak hours, Donnelly Street has left-in, left-out only access to Brook Street and access is therefore unlikely to be impacted during the project's construction. Therefore, no additional impacts are expected.

### **C20.7.2 Maritime businesses**

#### ***Issue raised***

Submitters raised concerns over impacts to maritime businesses during both construction and operation of the project, including:

- Concern about the disruption to maritime traffic due to investigative and construction works, and the impacts this would have on local businesses including maritime businesses such as Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group and Northbridge Amateur Swimming Club
- Concern about the financial impacts of the project on recreational user groups including Northbridge Sailing Club, Middle Harbour 16ft Skiff Club, and Middle Harbour Yacht Club
- Concern about potential impacts of the project on the financial viability of businesses, community associations and clubs including Balgowlah Suns Junior AFL Club, Mosman Rowing Club, Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group, 1<sup>st</sup> Sailors Bay Sea Scouts, and Northbridge Amateur Swimming Club.

#### ***Response***

During construction, maritime businesses and waterway users would experience temporary changes to access and short-term impacts on amenity. Impacts resulting from changes to maritime traffic on businesses have been addressed in sections 21.4.7 and 21.4.8 of the environmental impact statement.

Business harbour users, such as boat hire businesses and commercial boats, would experience a minor increase in travel time resulting from imposed speed restrictions during construction of the project in Middle Harbour. However, the significance of impacts is considered to be negligible given the existing four knot (nautical miles per hour, on-water) speed limit west of the Spit Bridge. Exclusion zones would be set up around the temporary cofferdams in Middle Harbour, while there would also be some restrictions to vessel movements during dredging and piling activities. Additional travel times and impacts on vessel movements may increase travel costs and reduce efficiencies. Overall, the significance of potential impacts on maritime transport during construction would be low. Project vessels and recreational users would be required to follow the law of the sea to ensure safety of all maritime users, including that vessels restricted in their ability to manoeuvre have right of way.

Interference with training routes used by members of the Mosman Rowing Club, course layouts for Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group, Seaforth Moth Sailing Club or kayak routes have the potential to result in existing members joining an alternative club. Similar impacts could occur for other recreational users of Middle Harbour, depending on their location. Any impacts on these clubs may also have indirect impacts on cafes in The Spit, which are often visited by club members after training. Increased wash from barge and construction vessel movements between Spit West Reserve and the cofferdams and dredging works may also disrupt boat and kayak users.

While there may be temporary impacts to some maritime businesses during construction, there is not expected to be a lasting impact on businesses. Any effects would be experienced at an individual business level, with no discernible changes to the overall performance of the broader maritime industry.

The duration of peak construction works in Middle Harbour would be relatively short. Impacts to waterway users have been reduced by minimising movement of moorings, limiting closures and maintaining access to the foreshore where feasible, as discussed in Section 21.4.8 of the environmental impact statement. Businesses and users would be able to adapt to the change with minimal disruptions to the way they operate or use the waterway.

Recreational waterway users would be able to adapt to the change with minimal disruptions to the way they operate or use the waterway.

Transport for NSW would continue to work closely with the various Middle Harbour maritime clubs and recreational users to make alternate arrangements to avoid and reduce impacts from proposed maritime works where possible, as discussed in Section C20.4.2 of this submissions report. Maritime traffic impacts to maritime businesses will be managed through the implementation of environmental management measures (refer to Table D2-1 of this submissions report), including:

- Construction vessels will be required to operate in a manner that minimises wash within Middle Harbour (refer to revised environmental management measure CTT3)
- Construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic, including near the Spit Bridge, where possible (refer to revised environmental management measure CTT4)
- Consultation will be carried out with surrounding water-based users of Middle Harbour including Mosman Rowing Club and Northbridge Sailing Club to develop reasonable and feasible management measures to minimise construction impacts (refer to revised environmental management measure CTT16)
- A navigation channel delineated with marker buoys will be formed on the approach to d'Albora Marina at The Spit adjacent to the Spit West Reserve construction support site (BL9) (refer to new environmental management measure CTT19)
- The Spit West Reserve construction support site (BL9) will not impact the land-based approach or water based approach to the Mosman Rowing Club. The channel on approach to Mosman Rowing Club will be 30 metres (100 feet) wide and will be delineated with marker buoys (refer to new environmental management measure CTT21).

Since the exhibition of the environmental impact statement, engagement with a number of the maritime businesses and waterway users discussed above has been carried out. This has included Mosman Rowing Club, Northbridge Sailing Club, 1<sup>st</sup> Northbridge Sea Scout Group and 1<sup>st</sup> Sailors Bay Sea Scouts. Further information on the engagement is provided in Section A2.4 of this submissions report.

Northbridge Amateur Swimming Club is based at Northbridge Baths. The proposed construction work in Middle Harbour would not impact use of Middle Harbour for recreational swimming, as outlined in Section C20.4.2.

A detailed response to issues raised by the community on marine water quality is provided in Appendix C1 of this submissions report. It notes that the predicted level of suspended sediment concentrations at locations of interest (such as recreational areas at Sailors Bay and Northbridge Baths) as a result of dredging activities, at the 90<sup>th</sup> percentile level for both the surface and near-bed, are less than the natural background total suspended sediment value. Therefore, it is not

expected that suspended solid concentrations due to dredging would represent a noticeable addition to background concentrations.

Further review of potential recreational exposures that may occur during proposed dredging activities is provided in Appendix C2 of this submissions report. It indicates that all maximum (or worst-case) concentrations of chemicals in water, as a result of the presence of suspended sediments or dissolved phase concentrations from dredging activities, are well below recreational water guidelines. On this basis, there are no risk issues of concern for recreational use of areas surrounding the project in relation to exposure to chemicals derived from proposed dredging activities.

## **C20.8 Environmental management measures**

### ***Issue raised***

A number of comments and suggestions were made regarding proposed environmental management measures for consideration. These include:

- Concerns that measures to minimise community concern regarding project impacts are lacking
- Concerns that moorings at Seaforth to be relocated to the west would congest the harbour width between Castlecrag and Seaforth. Suggestion that instead the moorings be relocated to Long Bay. Alternative suggestion that if moorings are relocated to the west, that dinghy racing inside the mooring fields be allowed
- Suggestions for an additional study to be carried out to confirm the importance of groundwater dependent ecosystems to the local community
- Suggestions the NSW Government should mitigate the loss of vibrancy in the Northbridge area by investing in the Northbridge Local Centres Strategy
- Requests for compensation to be provided to local businesses and communities that are forced to shut down, move out of their home, or are unable to rent their home, are damaged or need to spend on their properties to have a livable, safe space or viable business as a result of the project.

### ***Response***

#### **Environmental management measures**

The design, construction and operation of the project will be carried out in accordance with the environmental management measures detailed in Table D2-1 of this submissions report. Implementation of these measures will avoid, manage, mitigate, offset and/or monitor impacts during construction and operation of the project. These include best practice construction environmental planning and management techniques. Further management opportunities are likely to be identified during further design development and construction planning and in consultation with communities and relevant stakeholders.

Should the project be approved, the Department of Planning, Industry and Environment will issue conditions of approval for the management of key issues. Transport for NSW and the appointed contractor/s must comply with all requirements of the conditions of approval for the project. This will 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.

### Relocation of moorings in Middle Harbour

Impacts to moorings during construction of the project are discussed in Section 8.4.3 and Section 21.4.8 of the environmental impact statement. The establishment of the Middle Harbour north cofferdam construction support site (BL8) would require the temporary relocation of about 10 swing moorings below Seaforth Bluff. Relocated moorings would be relocated elsewhere in Middle Harbour in consultation with the lease holders during construction and would be restored to their original position on completion of the project and therefore the impact on recreational boat users due to the displaced moorings would be minor. Transport for NSW will consult with the owners and/or leaseholders and/or licence holders of jetties and moorings that require temporary relocation to determine alternative arrangements, as required by revised environmental management measure CTT2 (refer to Table D2-1 of this submissions report). All efforts will be made to relocate facilities as close to their original locations as possible.

Further, consultation will be carried out with surrounding water based users of Middle Harbour including Mosman Rowing Club, 1<sup>st</sup> Northbridge Sea Scout Group, 1<sup>st</sup> Sailors Bay Sea Scouts and Northbridge Sailing Club to develop reasonable and feasible management measures to minimise construction impacts, in accordance with revised environmental management measure CTT16 (refer to Table D2-1 of this submissions report).

### Community values of groundwater dependent ecosystems

Impacts to groundwater dependent ecosystems are discussed in Section 19.5.4 of the environmental impact statement. No direct impacts on groundwater dependent ecosystems would occur as a result of the project. Some areas of Coastal Sandstone Gully Forest, Sandstone Riparian Scrub, Coastal Sand Forest, Coastal Sandstone Plateau Heath<sup>1</sup>, Estuarine Fringe Forest<sup>1</sup> and Illawarra Gully Wet Forest<sup>1</sup> adjoining Flat Rock Creek would be subject to groundwater drawdown as identified in the environmental impact statement. It should be noted that the groundwater drawdown is considered to be overestimated because the groundwater model was developed using inherently conservative assumptions, including that there would be no constraint on groundwater inflows to the tunnels and that there is full hydraulic connectivity between the tunnels and surface aquifers, as discussed in Section C15.7.1 of this submissions report. Measures will be implemented during tunnel construction to ensure that groundwater inflows into each tunnel during the operation phase do not exceed one litre per second per kilometre across any given kilometre, as required by revised environmental management measure SG16 (refer to Table D2-1 of this submissions report). In addition, fracturing of sandstone would mean less than 100 per cent hydraulic conductivity in the rocks.

The level of groundwater dependency of this vegetation is unclear; however, it is likely that it is able to draw on surface water in Flat Rock Creek and soil moisture to prevent drying out of the community, except in dry periods where there is no recharge from rainfall or surface runoff. Further investigation and analysis of groundwater dependent ecosystems and the potential impacts from predicted groundwater baseflow reductions is provided in Annexure B of Appendix E of this submissions report. A clarification is also provided in Section A5.1.15 which describes the different components of streamflow, of which groundwater baseflow is one component.

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<sup>1</sup> Denotes additional groundwater dependent ecosystems mapped in response to the Department of Planning, Industry and Environment (Environment, Energy and Science Group)'s submission on the environmental impact statement.

A focussed study to confirm potential groundwater drawdown and associated baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek will be carried out in accordance with revised environmental management measure SG6 (refer to Table D2-1 of this submissions report). Feasible and reasonable management measures to address unacceptable ecological impacts will be identified, incorporated into the detailed design, and implemented during construction, if such impacts are predicted.

Community values are discussed in Section 21.3.3 of the environmental impact statement. Groundwater dependent ecosystems are not specifically identified as a feature that is likely to be important to local and regional communities within Greater Sydney. However, the groundwater dependent ecosystems near to the project area are in open space areas, reserves and parks such as Munro Park and Manly Warringah War Memorial State Park, which are valued by local and regional communities for their landscape amenity, heritage and recreational values.

No additional study is proposed to establish the value that the local community places on groundwater dependent ecosystems.

#### Northbridge Centre

The operation of the project would result in a reduction in through traffic on Eastern Valley Way by up to 30 per cent in 2037, as discussed in Section 9.4.1 and Section 21.5.1 of the environmental impact statement. Northbridge Centre would benefit from reduced traffic congestion and improved road safety during operation of the project.

Implementation of, or investment (by the NSW Government) in, the *Draft Willoughby Local Centres Strategy to 2036* (Willoughby City Council, 2019), of which the Northbridge Local Centres Strategy is a part of, is outside the scope of the project.

#### Compensation for impacts

Compensation for impacts caused by the project is only payable where temporary use and/or permanent acquisition of property is required, as discussed in Section 20.4.1 of the environmental impact statement. Land acquisition will occur in accordance with environmental management measure LP3 (refer to Table D2-1 of this submissions report). Where businesses are affected by property acquisition, or lease cessation, the acquisition and compensation process will be in accordance with revised environmental management measure BU1 (refer to Table D2-1 of this submissions report).



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C21 – Urban design and visual amenity

## C21 Urban design and visual amenity

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| C21.5.2 | Increases in traffic.....                     | C21-24 |



## C21.1 Adequacy and accuracy of the assessment

### ***Issue raised***

Submitters raised concerns about the adequacy and accuracy of the urban design and visual amenity assessment. Specific concerns and requests include:

- Concerns that the artist's impressions used in the environmental impact statement are not comprehensive or to scale, and in some cases are misleading, including the depictions of tree loss, temporary construction support sites, ventilation outlets and motorway facilities
- Requests that additional artist's impressions be prepared
- Concerns that the level of detail of proposed landscape treatment is insufficient, particularly at Pickworth Avenue and Paris Street in Balgowlah
- Concerns that potential lighting impacts at night during construction have not been adequately assessed, including street lighting impacts at Wakehurst Parkway
- Concerns that the concepts of 'urban renewal' and 'post-construction rehabilitation' have been used interchangeably (inappropriately), and requests that an estimated timeframe be provided for any post-construction rehabilitation works
- Requests that the project should be consistent with the NSW Government's policy *Greener Places*, Objective 32 (The Greater Sydney Green Grid) in the Greater Sydney Commission's strategy *A Metropolis of Three Cities* and the NSW Government's *50-Year Vision for Sydney's Open Space and Parklands initiative*
- Concerns that the environmental impact statement does not provide information on Crime Prevention Through Environmental Design principles that would be applied to the project, especially at the temporary construction support sites to prevent vandalism, graffiti and delinquency.

### ***Response***

#### Artist's impressions

As required by the Secretary's environmental assessment requirements, artist's impressions and perspective drawings of the project at key receiver locations have been prepared to illustrate the project and are included in Section 22.7 of the environmental impact statement and Section 4 and Section 5 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). The artist's impressions show viewpoints which were identified and selected for each precinct along the project alignment, in accordance with *Environmental Impact Assessment Practice Note EIA-N04 – Guideline for Landscape Character and Visual Impact Assessment* (Transport for NSW, 2020b). Viewpoints were selected to show:

- A range of receiver types including public and private domain views (eg residents, motorists and users of public open space)
- A range of view types including elevated, panoramic and filtered views
- A range of viewing distances from the project
- Key or protected views identified in planning documents.

For each precinct, the viewpoints in the artist's impressions show key project features, including shared user paths, motorway facilities, ventilation outlets, ramp tunnels and access roads, one and 10 years after completion of construction. The artist's impressions also illustrate the effects of anticipated vegetation growth and screening over these periods. The scale of works and structures are illustrated at a strategic level at this stage as further design development has not yet occurred,

with a greater level of detail to be confirmed in these later design stages. The images do not include a scale bar due to the perspective nature of the images. However, features within the images are scaled approximately and relatively, ie the size of cars, people and buildings are approximately to scale and relative to each other.

Transport for NSW consider that sufficient artist's impressions have been used to communicate key features and changes expected from the project, in accordance with the Secretary's environmental assessment requirements. The urban design and landscape plan will be further developed during further design development and will include detail on the urban and landscape design with additional further developed visuals, cross sections and plans (refer to environmental management measure V1 in Table D2-1 of this submissions report). This plan will be made available to the public for feedback.

### Landscape treatments at Balgowlah

Transport for NSW has developed a strategic urban design framework for the project to inform the urban design and establish benchmarks for achieving a well-planned and integrated road alignment through a high-quality urban design. The framework is provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment), and would inform further design development.

Proposed landscaping would be provided along and around surface road works, including around tunnel portals and bridges, and around operational ancillary infrastructure as shown in Figure 22-1 to Figure 22-4 of the environmental impact statement.

Landscaping would be designed and implemented with the aims of:

- Minimising the visual and landscape impacts of the project
- Integrating the project into the surrounding visual catchment
- Improving local and regional amenity
- Maximising the use of native species, including consideration of current and future climate conditions
- Providing opportunity for improvements in urban ecosystems.

Where possible, trees will be protected or pruned rather than removed (refer to revised environmental management measure V10 in Table D2-1 of this submissions report). Where mature amenity trees are removed as a result of construction, they will be replaced at a ratio of 2:1 in accordance with revised environmental management measure V13 (refer to Table D2-1 of this submissions report).

The urban design principles identified for the Balgowlah precinct seek to ensure that infrastructure elements are well integrated into the wider precinct. The current images and plans illustrate a strategic design which would be refined and further developed in later design development stages. The urban design and landscape plan will be further developed during further design development and implemented in line with the strategic urban design framework for the project and will detail landscape features to be implemented during construction, as well as the rehabilitation of disturbed areas during construction of the project (refer to environmental management measure V1 in Table D2-1 of this submissions report). The urban design and landscape plan will be made available to the public for feedback.

### Assessment of night lighting impacts

Broad assessments of the potential night lighting impacts during construction and operation of the project are provided in Section 22.6 and Section 22.7 respectively of the environmental impact statement. Night lighting impacts are also addressed in Section C21.5.1 below. Impacts to key visual receivers have been individually assessed and include neighbouring residential properties, users of recreational space and motorists in local streets.

The assessment of night lighting impacts is based on assumptions that have been made with regard to the types and extent of lighting likely to be installed for both the construction and operation phases, consistent with applicable guidelines.

During 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* (Standards Australia, 2019a), in accordance with revised environmental management measure V6 (refer to Table D2-1 of this submissions report).

A detailed operational lighting concept would be developed during further design development, based around the considerations identified in the assessment for the project. It would be developed in accordance with Australian/New Zealand Standard *AS/NZS 1158.4-2015 Lighting for roads and public spaces* (Standards Australia, 2015a), Australian Standard *AS 2560.1:2018 Sports lighting general principles* (Standards Australia, 2018b), *AS 4282-2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019a) and Australian/New Zealand Standard *AS/NZS 60598.1-2017 Luminaires General requirements and tests* (Standards Australia, 2017).

### Urban renewal and rehabilitation

The principles of urban renewal and rehabilitation have been applied in different contexts in the environmental impact statement. Urban renewal and liveability are both part of the urban design objectives for the project, with the aim to create opportunities for urban regeneration and landscape improvements and active transport and public transport upgrades along the project corridor. These urban renewal opportunities would provide high levels of urban amenity and liveability as discussed in Section 22.2.1 of the environmental impact statement.

Information on the rehabilitation of land following construction is provided in Chapter 19 (Land use and property) of the environmental impact statement. Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate condition, taking into consideration the location, land use characteristics, area and adjacent land uses or in accordance with the urban design and landscape plan where applicable (refer to environmental management measures LP5 and V1 in Table D2-1 of this submissions report). Rehabilitation will be carried out in consultation with the relevant landowner, the local council and community (where appropriate), as discussed in Section C19.1 of this submissions report.

### NSW Government strategic plans and policies

The project has been developed to align with the objectives of a number of strategic plans prepared at a State level, including the *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018a), as outlined in Section 3.7 of the environmental impact statement.

The *Sydney Green Grid* (Government Architect NSW, 2017b) is an integral part of the Greater Sydney Regional Plan (refer to Objective 32 of *A Metropolis of Three Cities*) and is the NSW Government's long-term vision for a network of high quality green spaces in Greater Sydney that connect centres, public transport and public spaces to green infrastructure and landscape features. In support of this vision the NSW Government developed *Greener Places: An urban green*

*infrastructure design framework for New South Wales* (Government Architect NSW, 2020), a design framework to guide the design, planning and delivery of green infrastructure across NSW. Green infrastructure is defined as the network of green spaces, natural systems and semi-natural systems, including parks, rivers, bushland and private gardens, that are strategically planned, designed and managed to support good quality of life in the urban environment. In addition to this design framework, the NSW Government announced its *50-Year Vision for Greater Sydney's Open Space and Parklands* (NSW Department of Planning, Infrastructure and Environment (DPIE), 2021b) in May 2021, which aims to establish greener streets, higher quality parklands and more green connections that support healthy people and communities.

The strategic urban design for the project has been prepared in consideration of the urban design principles of *Beyond the Pavement* (Transport for NSW, 2020a), which supports the approach established in *Greener Places: An urban green infrastructure design framework for New South Wales* (Government Architect NSW, 2020), *Sydney Green Grid* (Government Architect NSW, 2017b) and *50-Year Vision for Greater Sydney's Open Space and Parklands* (NSW DPIE, 2021b). Project opportunities to ensure the design, planning, construction and management of the project responds to the natural environment are identified in Section 3.3.6 of Appendix V (Technical working paper: Urban design, landscape character and visual impact) including:

- Incorporate green infrastructure initiatives into landscape treatments where feasible, to enable the objectives of the NSW Government Architect's policy *Greener Places*
- Increase tree planting along roads and shared user paths where feasible to increase tree canopy cover for shade, shelter and animal habitat
- Increase urban tree canopy where feasible
- Incorporate tree planting of native species for shade and shelter to shared user paths
- Provide screen planting to soften form of infrastructure elements where feasible
- Trim rather than remove trees where feasible in consultation with a qualified and experienced arborist
- Selecting appropriate species in consultation with relevant councils and other stakeholders and using local and native species where appropriate to ensure integration with the existing landscape
- Ensure landscape treatments and species would be able to survive the conditions encountered within motorway boundaries
- Ensure existing bushland and biodiversity is protected where feasible
- Ensure environmentally sensitive areas and waterways are protected where feasible
- Ensure planting and maintenance proposals address land ownership and asset management considerations.

In Balgowlah, the project would return an area equivalent to around 90 per cent of the current open space to the community as new and improved public open space and recreation facilities. A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input into the final layout of the new and improved open space and recreation facilities at Balgowlah, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). This consultation will be separate to the consultation for the environmental impact statement and is expected to start after planning approval and in advance of construction commencing. Further information is provided in Section A2.5 of this submissions report. In addition, an area north of the Bantry Bay Reservoir, to be used as part of the Wakehurst Parkway east construction support site

(BL13), would be transferred to the Manly Warringah War Memorial State Park after it has been rehabilitated upon completion of construction (refer to Section 5.2.13 of the environmental impact statement). This would add about 4000 square metres of new public space to the Manly Warringah War Memorial State Park.

The project would also deliver improved active transport infrastructure to connect people to public open space, including a new shared path along Wakehurst Parkway with overpass links to the new Northern Beaches Hospital precinct, and shared user underpasses provided beneath Wakehurst Parkway to provide safe connections between Garigal National Park and Manly Warringah War Memorial State Park. Additional shared pathways would be provided in and around the new and improved public open space recreation facilities at Balgowlah, integrating with existing paths to nearby commercial areas and neighbourhoods. Realignment and reconstruction of the shared user path along the southern side of the Gore Hill Freeway would also be provided.

Further, Transport for NSW is committed to replacing and offsetting vegetation removed as part of the project. All areas disturbed by construction and not required for operation of the project will be restored as soon as practicable to their existing condition, or in accordance with the urban design and landscape plan where applicable, in accordance with environmental management measure V11 (refer to Table D2-1 of this submissions report). Vegetation removal will be further minimised during further design development and construction planning to the extent reasonably practicable, in accordance with revised environmental management measure B6 (refer to Table D2-1 of this submissions report). Existing trees adjacent to the works will be retained and protected where possible to screen construction works (refer to environmental management measure V9 in Table D2-1 of this submissions report). Where possible, trees will be protected or pruned rather than removed (refer to revised environmental management measure V10 in Table D2-1 of this submissions report). Where mature amenity trees are removed as a result of construction, they will be replaced at a ratio of 2:1 in accordance with revised environmental management measure V13 (refer to Table D2-1 of this submissions report).

### Crime Prevention Through Environmental Design

Crime Prevention Through Environmental Design is a multi-disciplinary design approach that aims to find solutions that deter criminal behaviour and unsafe situations, specifically in an urban environment. Crime Prevention Through Environmental Design principles are fundamental to the project's strategic urban design framework, as outlined in Table 22-3 of the environmental impact statement, and would be implemented wherever the project interfaces with the public domain. Specific Crime Prevention Through Environmental Design principles would be further developed for surface operational infrastructure during future design development stages of the project to limit the potential for antisocial behaviour and maximise safety for the public and site workers. Key Crime Prevention Through Environmental Design principles that would be considered for incorporation into the project include:

- **Vulnerability:** the public domain would be designed and managed to reduce vulnerability by providing well-lit, visible places and pedestrian and cyclist systems and routes to important places. The design and management of places would avoid creating or maintaining hidden spaces close to pedestrian/cyclist travel routes and provide a variety of available routes
- **Legibility:** the public domain would be designed, detailed and managed to make it easy to navigate and understand for users, especially pedestrians and cyclists, without compromising on variety, interest and safety
- **Territoriality:** designing and managing spaces and buildings to define clearly legitimate boundaries between private, semi-private, community group and public space

- Ownership of the outcomes: promoting a feeling of individual and community ownership of the public domain and associated built environments to encourage a level of shared responsibility for their security
- Management: the public domain would be designed and detailed to minimise damage and the need for undue maintenance, without undermining the aesthetic and functional qualities that make the places attractive to the community. Systems of both regular and reactive maintenance and repair would be implemented to maintain the quality of the places. A regular auditing system of Crime Prevention Through Environmental Design issues in the public domain would be implemented
- Surveillance: the public domain and buildings would be designed and managed to maximise the potential for passive surveillance.

Key project locations where Crime Prevention Through Environmental Design principles would be applied include the new and improved public open space and recreation facilities and new access road at Balgowlah, the realigned and widened Wakehurst Parkway, the Wakehurst Parkway shared user bridge and the shared user underpasses at Burnt Bridge Creek and Wakehurst Parkway, as outlined in Section 3.4.11 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). Urban design requirements related to Crime Prevention Through Environmental Design that would be considered in these locations include:

- Allowance for natural surveillance that keeps potential intruders under observation where feasible
- Tree species selection and landscape treatments that maximise clear sightlines in areas of high public use
- Design of the public realm as a clutter-free environment
- Effective lighting of public spaces that eliminates dark spaces
- Lighting that is consistent and of a quality to enhance CCTV imagery and designed to Australian Standards
- The design of all public spaces to avoid blind/dark corners that may provide hiding or ambush spots
- Design which allows for easy maintenance of a high level of amenity that discourages unwanted behaviour
- Urban and landscape treatments to be placed and located outside of clear zones and to maintain sightlines
- Use of wire rope or other barrier systems to allow planting in closer proximity to the road corridor
- Design of all structures to incorporate easy maintenance access where required.

During construction, site hoarding and perimeter site areas will be maintained regularly to include the prompt removal of graffiti, in accordance with environmental management measure V5 (refer to Table D2-1 of this submissions report). While not mentioned specifically in terms of the temporary construction support sites, the following Crime Prevention Through Environmental Design principles would be adhered to in the planning of the sites, where feasible:

- Layouts that facilitate passive surveillance that keeps potential intruders under observation
- Elimination of blind/dark corners which may provide hiding or ambush spots
- Effective lighting to public spaces that eliminates dark spaces (and facilitates passive surveillance).

## C21.2 Urban design

### *Issue raised*

Submitters raised concerns about urban design aspects of the project. Specific concerns, suggestions and requests include:

- Concerns that the proposed works at Flat Rock Reserve would impact the character of Willoughby
- Concerns about the potential impact of the project on the character of residential areas and the broader Northern Beaches
- Requests that urban design opportunities be investigated across the areas impacted by the project to improve amenity in the public domain through footpath widening, parks, amenity upgrades and other public domain improvements
- Concerns that the urban design for the project would not reflect the character of the local area
- Suggestions to improve walking and cycling tracks where trees are being removed
- Requests that the design of Wakehurst Parkway preserve the current natural aesthetic
- Suggestions to use crushed sandstone as a contoured base for the re-establishment of native vegetation
- Suggestions to consider the use of vertical gardens and other landscape options to minimise the visual impact of the proposed ventilation outlets
- Suggestions to include green walls in the urban design for the project.

### *Response*

#### Flat Rock Reserve

The potential impacts of the proposed works on the landscape character at Flat Rock Reserve are discussed in Section 22.6.2 of the environmental impact statement.

The Flat Rock Drive construction support site (BL2) would be located within Flat Rock Reserve. High impacts are anticipated on the Flat Rock Reserve open space landscape character zone (LCZ 2) east of Flat Rock Drive, as a result of vegetation removal, the introduction of new built form such as the acoustic shed and construction equipment, and the diversion of existing walking and cycling trails during construction. Moderate impacts on landscape character are expected for the Residential landscape character zone (LCZ 1), due to its distance from, but limited views of, the temporary construction support site. Moderate to low impacts are anticipated for the Sports precinct landscape character zone (LCZ 3), due to the presence of screening vegetation along the western side of Flat Rock Drive, and for the Flat Rock Drive Road corridor landscape character zone (LCZ 4), as a result of the temporary reduction in vegetation along the eastern side of the road.

Following construction, the site would be re-vegetated, subject to consultation with Willoughby City Council and the community. Residual impacts may remain until planted vegetation has matured, however residual impacts are considered minor and following maturity, there would be no permanent impacts to the landscape character of the site.

Transport for NSW will work closely with Willoughby City Council on its preferred final form of the Flat Rock Drive construction support site (BL2) in consultation with the local community, as required by the new environmental management measure LP8 (refer to Table D2-1 of this submissions report). Vegetation and landscaping will be determined in consultation with Willoughby City Council

and the community and will be implemented as soon as practicable at the completion of construction.

### Northern Beaches and other residential areas

The potential impacts of the project on the landscape character of residential areas and the broader Northern Beaches are discussed in sections 22.6.1, 22.6.2 and 22.7.1 of the environmental impact statement.

In the majority of landscape character zones in residential areas and the broader Northern Beaches, impacts ranging from negligible to moderate are expected during construction, due to activities such as vegetation removal, earthworks, surface roadworks, increased vehicle movements and the presence of equipment and temporary noise walls. Although potential landscape character impacts of a high to moderate rating are anticipated for the following, such impacts are expected to be temporary in nature and localised: the Cammeray residential (LCZ 3) and Cremorne and Neutral Bay residential (LCZ 4) landscape character zones in the North Sydney precinct, the Balgowlah Golf Course open space landscape character zone (LCZ 3) in the Balgowlah precinct, and the Seaforth residential (LCZ 2), Wakehurst Parkway road corridor (LCZ 3) and Remnant bushland (LCZ 4) landscape character zones in the Wakehurst Parkway precinct.

Moderate, moderate to low or low impacts are anticipated for the majority of the landscape character zones in the Balgowlah precinct during operation. As replacement planting matures, the impact on landscape character is likely to diminish from that assessed. However, a high to moderate impact is anticipated for the Balgowlah Golf Course open space landscape character zone (LCZ 3) during operation, due to the clearing of vegetation, remodelling of parts of the existing landform and introduction of new built form elements such as the access road and associated retaining walls.

In the Wakehurst Parkway precinct, moderate and moderate to low impacts are expected for the Wakehurst Parkway road corridor (LCZ 3) and Seaforth residential (LCZ 2) landscape character zones respectively during operation. Despite the removal of vegetation either side of Wakehurst Parkway, the density of replacement planting in this area would retain its bushland character, especially as replacement planting matures. A high to moderate impact is expected for the Remnant bushland landscape character zone (LCZ 4) surrounding the Wakehurst Parkway road corridor during operation, due to the widening of the road and removal of vegetation.

In the Artarmon residential (LCZ 4), Cammeray residential (LCZ 3) and Cremorne and Neutral Bay residential (LCZ 4) landscape character zones in the North Sydney and Artarmon precincts, moderate or moderate to low landscape character impacts are anticipated during operation. Some of these impacts are likely to reduce over time as replacement planting matures and partially screens the new built form of the project. Much of the built form of the project in these precincts would be consistent with the existing major infrastructure of the Warringah Freeway and Gore Hill Freeway road corridors.

Potential landscape character impacts during construction will be managed through the implementation of environmental management measures V2-V4 and V7-V13 outlined in Table D2-1 of this submissions report. The majority of the temporary construction support sites and other sites utilised during construction that are not required for operational infrastructure would be rehabilitated following the completion of construction works. As such, there would be no permanent landscape character impacts at the temporary construction support sites.

Landscape character impacts will be mitigated during operation through the implementation of environmental management measures in line with the strategic urban design framework (refer to Section 22.2 of the environmental impact statement) and the urban design and landscape plan that



will be developed for the project (refer to environmental management measure V1 in Table D2-1 of this submissions report).

The new and improved public open space and recreation facilities at Balgowlah would be designed in accordance with the urban design principles established for the project (outlined in Table 22-3 of the environmental impact statement), so that the new and reinstated landscapes are appropriate to the local conditions and provide improved amenity. A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved public open space and recreation facilities, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report).

Based on this, it can be expected that landscape character impact ratings would improve in residential areas and the broader Northern Beaches over time, as buildings and other infrastructure associated with the project (designed in accordance with the strategic urban design framework) blend into the surrounding environment as landscaping matures.

#### Urban design, landscape character and visual impact assessment and the urban design framework

An urban design, landscape character and visual impact assessment has been prepared for the project and is provided in Appendix V (Technical working paper: Urban design, landscape character and visual impact) and summarised in Chapter 22 (Urban design and visual amenity) of the environmental impact statement. Potential impacts on landscape character and visual amenity are described in Section 22.6 and Section 22.7 of the environmental impact statement.

Transport for NSW has developed a strategic urban design framework for the Beaches Link and Gore Hill Freeway Connection project to inform the urban design and establish benchmarks for achieving a well-planned and integrated road alignment through a high-quality urban design, as discussed in Section 22.2 of the environmental impact statement.

The urban design framework has been informed by numerous NSW Government policies including *Beyond the Pavement 2020* (Transport for NSW, 2020a), which helps set the urban design direction for road projects within NSW, defining project outcomes and the criteria for success; and *Better Placed* (Government Architect NSW, 2017b), 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, 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, as noted in Section 22.1 of the environmental impact statement. In addition, a design review panel has been established for the project to provide independent review and advice throughout the design development.

The urban design vision and urban design objectives for the project are outlined in Section 22.2.1 and Table 22-2 of the environmental impact statement. The 'integrated design' objective aims to "provide an integrated urban design approach that thoughtfully seams the Beaches Link and Gore Hill Freeway Connection to its surrounding urban and landscape interfaces." The strategic urban design framework thereby includes a range of urban design principles that would integrate project elements into the character of the local area. These principles are outlined in Table 22-3 of the environmental impact statement and include:

- Visually integrate earthworks into their landscape setting as much as possible, keeping engineered structures to a minimum, eg design earthworks to fit into the surrounding landscape setting wherever feasible, gently rounding formations at the top and bottom of slopes to ensure a natural transition into adjacent landforms

- Visually integrate noise walls, retaining walls and flood walls into the road corridor and urban/landscape setting as part of a coordinated whole-of-corridor design, eg ensure that the design of the noise walls and retaining walls blends into the surrounding environment and provide landscaping to reduce the apparent scale and visual impact of the noise walls and retaining walls
- Deliver portals and trough structures that are visually appealing, sensitive to their context, reflect the above ground environment and provide a legible, self-explaining journey which enables awareness of location, eg provide attractive, welcoming tunnel entrances that fit into the local built and natural environment by using materials, colours, landscaping and external feature lighting to reduce the visual impact of the tunnel portals
- Minimise the physical footprint and visual impact of motorway facilities, ventilation outlets and motorway control centre while ensuring they are designed as high quality pieces of well integrated architecture, eg reduce the visual scale of the facilities by using landscape planting, different materials and layering on the façade of the buildings and making the purpose of the buildings apparent to the public
- Deliver elegant road bridges that integrate all architectural and engineering systems requirements while minimising visual impacts, eg design road bridges with smooth, clean lines and minimal traffic signage
- Deliver well designed and attractive shared user bridges that provide safe access for all pedestrians and cyclists, eg use materials and a design that would have an attractive visual impact and complement existing shared user bridges nearby
- Provide new and reinstated landscapes that are appropriate to the local conditions, consistent with the existing varied character of the project, provide opportunities to increase canopy cover wherever possible and provide improved public realm amenity, eg source species for landscaping from local council approved species lists where available and retain and protect existing vegetation where possible
- Deliver a road corridor and associated infrastructure/public domain that presents a consistent palette of high-quality materials representative of the project image and local context, eg select materials that are consistent with the local setting, adjacent developments and wider project design elements and minimise visual clutter
- Deliver a corridor and public domain which provides connection with country and incorporates heritage and cultural contexts into the project, eg incorporate appropriate Aboriginal heritage interpretation into the project urban design and landscape plan.

Further detail, including the proposed approach to achieving these principles and examples, is provided in Section 3.4 of Appendix V (Technical working paper: Urban design, landscape character and visual impact).

The urban design and landscape plan will be further developed during further design development and implemented in line with the strategic urban design framework for the project and appropriate operational mitigation measures (refer to environmental management measure V1 in Table D2-1 of this submissions report). The urban design and landscape plan will detail built and landscape features to be implemented during construction and rehabilitation of disturbed areas during construction of the project. The urban design and landscape plan will be made available to the public for feedback.

### Active transport improvements

New and improved active transport infrastructure proposed by the project is outlined in Section 5.2.8 and Section 9.4 of the environmental impact assessment. The consideration of additional active transport infrastructure is discussed in Section C4.3 of this submissions report.

The project design development process has considered a number of opportunities to avoid or minimise vegetation removal through the selection of the preferred corridor, refinement of the preferred corridor design and development of the construction methodology as described in Section 19.4 of the environmental impact statement. Following completion of construction, land areas no longer required for construction, including areas of new public open space, will be rehabilitated in accordance with the urban design and landscape plan where applicable (refer to environmental management measure LP5 in Table D2-1 of this submissions report). Rehabilitation will be carried out in consultation with the relevant landowner, the local council and community (where appropriate), including through consultation on the urban design and landscape plan, and feedback may be provided on a range of issues including the provision of active transport infrastructure.

### Natural aesthetic at Wakehurst Parkway

Potential operational impacts on the landscape and visual character of Wakehurst Parkway are discussed in Section 22.7.1 and Section 22.7.2 of the environmental impact statement.

Moderate impacts are anticipated on the landscape and visual character of the Wakehurst Parkway road corridor (at LCZ 3 and Viewpoints 3 and 6 shown in Figure 22-8 of the environmental impact statement), due to the reduced scenic nature associated with the increased scale of the road corridor, the introduction of new built form (including the motorway facilities, ventilation outlet, noise walls and retaining walls) and the removal of vegetation along the road corridor as part of the project. A comparison of the existing and proposed views to the south and north along Wakehurst Parkway is provided in Figure 22-26 to Figure 22-29 of the environmental impact statement.

The project development to date has sought to limit clearing of native vegetation along Wakehurst Parkway. Existing trees adjacent to Wakehurst Parkway will be retained and protected where possible or pruned rather than removed, in accordance with environmental management measures V9 and V10 in Table D2-1 of this submissions report. The retention of foreground vegetation, where possible, to the south of the motorway facilities on Wakehurst Parkway would help to screen views from the southern approach, including for dwellings along Kirkwood Street. Vegetation removal will be further minimised during further design development and construction planning to the extent reasonably practicable, in accordance with revised environmental management measure B6 (refer to Table D2-1 of this submissions report).

As discussed elsewhere in this section, the urban design for the project would aim to integrate the new built form along the Wakehurst Parkway road corridor into the existing landscape setting and increase tree canopy cover where possible. Revegetation and planting, including tree planting, would be carried out along Wakehurst Parkway and would be included in the urban design and landscape plan that will be developed for the project in accordance with environmental management measure V1 (refer to Table D2-1 of this submissions report). Urban design requirements for Wakehurst Parkway include the requirement to reinstate removed vegetation with native species and to ensure species selection is in accordance with Northern Beaches Council guidelines (refer to Section 4.9.6 of Appendix V (Technical working paper: Urban design, landscape character and visual impact)). Despite the removal of vegetation either side of Wakehurst Parkway, the density of replacement planting in this area would retain its bushland character, especially as replacement planting matures.

### Suggestions for landscaping concepts

Transport for NSW has developed a strategic urban design framework for the Beaches Link and Gore Hill Freeway Connection project to inform the urban design and establish benchmarks for achieving a well-planned and integrated road alignment through a high-quality urban design, as outlined in Section 22.2 of the environmental impact statement.

The urban design requirements for the project would assist in integrating operational infrastructure of the project (such as the motorway facilities and ventilation outlets) into the surrounding landscape through the appropriate selection of materials and screen planting. Specifically, the framework includes the requirement to design ventilation outlets so as to minimise their visual impact, as discussed in Section 3.4.6 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). This involves using design treatments that visually minimise the dimensions of the ventilation outlets while considering the local built environment, important local views and valued places. The strategic urban design framework for the project also includes the requirement to use different materials and layering of façade elements as well as landscaping, to soften the scale of operational infrastructure and screen views.

The strategic urban design framework and other operational mitigation measures will guide the urban design and landscape plan for the project, which will be further developed during further design development. The plan will detail landscape features to be implemented during construction and rehabilitation of disturbed areas during construction of the project. It will be made available to the public for feedback in accordance with environmental management measure V1 (refer to Table D2-1 of this submissions report) and would consider a variety of materials, textures and finishes which are sympathetic to the local environment in which the project features are located.

Transport for NSW would install landscaped elements of the project in accordance with the appropriate Transport for NSW Quality Specifications, including materials which would be used.

### **C21.3 Tree removal and replacement**

#### ***Issue raised***

Submitters raised concerns and requests about tree removal, including:

- Concerns over the extent of tree removal proposed for the project, especially at Flat Rock Reserve, Balgowlah Golf Course, Cammeray Golf Course, Burnt Bridge Creek and along Wakehurst Parkway
- Concerns over the visual impact on the frontage of Sydney Road along the boundary of Northern Beaches Secondary College Balgowlah Boys Campus due to tree removal
- Requests that trees are maintained or trimmed rather than removed
- Concerns that replacement planting would not match the total number of trees removed
- Requests that replacement planting should be planted as early as possible to minimise operational visual impacts and should include mature trees rather than young saplings
- Requests that more trees be planted and that the replacement of trees be consistent with the Willoughby City Council tree policy which requires that three trees be planted for each tree removed.

#### ***Response***

##### **Tree removal and replacement**

The project design development process has considered a number of opportunities to avoid or minimise vegetation removal through the selection of the preferred corridor, refinement of the preferred corridor design and development of the construction methodology, as described in Section 19.4 of the environmental impact statement. Vegetation removal for the project will be further minimised during further design development and construction planning to the extent reasonably practicable, in accordance with revised environmental management measure B6 (refer to Table D2-1 of this submissions report).

The removal of vegetation in each precinct, including trees, is discussed in Section 22.6 and Section 22.7 of the environmental impact statement, with further detail presented in Appendix W (Technical working paper: Arboricultural impact assessment). Maps showing the locations of all trees potentially impacted by and in close proximity to the project, as well as details of these trees (including species, health, significance, retention value and potential impact), are provided in Annexures B to K of Appendix W (Technical working paper: Arboricultural impact assessment).

Transport for NSW is committed to replacing and offsetting vegetation removed as part of the project. Existing trees adjacent to the works will be retained and protected where possible to screen construction works in accordance with environmental management measure V9 (refer to Table D2-1 of this submissions report). Where possible, trees will be protected or pruned rather than removed and pruning works will be supervised by a qualified arborist as required by revised environmental management measure V10 (refer to Table D2-1 of this submissions report).

All areas disturbed by construction and not required for operation of the project will be restored as soon as practicable to their existing condition or in accordance with the urban design and landscape plan where applicable, in accordance with environmental management measure V11 (refer to Table D2-1 of this submissions report). Early planting works will be considered to provide a screening buffer that has time to mature before the project is fully operational (refer to environmental management measure V12 in Table D2-1 of this submissions report).

Where mature amenity trees are removed as a result of construction, they will be replaced in accordance with revised environmental management measure V13 (refer to Table D2-1 of this submissions report):

Where mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016*) are removed as a result of construction, they will be replaced at a ratio of 2:1. The replacement trees will consist of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees) where available and subject to the urban design and landscape plan. Where replacement trees cannot be accommodated within the operational footprint of the project, consultation will be carried out with adjacent government land owners and the relevant local council (where appropriate) to determine if they can accommodate the replacement tree(s).

#### Willoughby City Council tree policy

Transport for NSW has committed to the replacement of mature amenity trees removed as a result of construction, at a ratio of 2:1 in accordance with revised environmental management measure V13 (refer to Table D2-1 of this submissions report). The replacement trees will consist of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees) where available and subject to the urban design and landscape plan. Where replacement trees cannot be accommodated within the operational footprint of the project, consultation will be carried out with adjacent government land owners and the relevant local council (where appropriate) to determine if they can accommodate the replacement trees. The urban design and landscape plan will be made available to the public for feedback in accordance with environmental management measure V1 (refer to Table D2-1 of this submissions report).

Rehabilitation, re-vegetation and landscaping will be implemented as soon as practicable at the completion of construction, in accordance with environmental management measures V11 and LP5 (refer to Table D2-1 of this submissions report).

### Tree clearing along Sydney Road

The results of a preliminary arboricultural assessment are presented in Appendix W (Technical working paper: Arboricultural impact assessment). Annexure H of Appendix W (Technical working paper: Arboricultural impact assessment) contains maps showing the assessment of tree impacts along Sydney Road (refer to Area 4).

The closest works to the frontage of the Northern Beaches Secondary College Balgowlah Boys Campus are the proposed adjustments at the intersection of the new access road and Sydney Road and the installation of traffic lights. The majority of the trees screening the Northern Beaches Secondary College Balgowlah Boys Campus are located within the boundary of the school and would not be removed by the works, however some localised pruning of the canopy and roots of these trees may be required.

During further design development the project would aim to minimise tree impacts where feasible. The retention and protection of trees and their replacement where possible is addressed by environmental management measures V9, V10 and V13 (refer to Table D2-1 of this submissions report).

## **C21.4 Visual amenity – construction**

### ***Issue raised***

Submitters raised concerns about impacts on visual amenity during construction. Specific concerns and requests include:

- Concerns about the visual impact of the temporary construction support sites
- Concerns that construction will result in night lighting impacts
- Requests that all temporary structures be removed at the end of construction works
- Requests that acoustic sheds be of neutral colour and design to minimise visual impacts.

### ***Response***

#### Visual impacts of temporary construction support sites

Potential visual impacts of the temporary construction support sites are discussed in Section 22.6.3 and Section 22.6.4 of the environmental impact statement.

Visual impacts during construction would result from vegetation clearing, site hoardings and fences, visibility of machinery, increased vehicle movements and the introduction of activities at surface work sites and temporary construction support sites into the existing landscape. The level of impact would however be different at each receiver, depending on factors such as:

- The sensitivity of the receiver
- Time of day/night
- Bulk form/scale of the construction works, site hoardings and construction equipment, in comparison to other non-project built form and infrastructure in the area
- Visibility of the works from the receiver location and potential screening by intervening features
- Distance from the site
- The duration of the view.

Overall, construction impacts would be temporary in nature and localised to the specific areas in which they are likely to occur. A suite of environmental management measures is proposed to

mitigate the potential adverse visual impacts during construction. These measures are outlined in Table D2-1 of this submissions report and include:

- Developing temporary construction support sites to minimise visual impacts to the extent reasonably practicable (refer to revised environmental management measure V2)
- Locating storage areas and associated works in cleared or otherwise disturbed areas to the extent reasonably practicable (refer to revised environmental management measure V3)
- Site hoardings will be in neutral colours and designs, in proximity to open space, to help them blend into surrounding environment (refer to environmental management measure V4)
- Site hoarding and perimeter site areas will be maintained regularly to include the prompt removal of graffiti (refer to environmental management measure V5)
- Site lighting will be designed to minimise glare issues and light spillage into adjoining properties and be generally consistent with the requirements of Australian/New Zealand Standard *AS/NZS 4282-2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019a) (refer to revised environmental management measure V6)
- Hoardings and temporary noise walls will be erected as early as possible within the site establishment phase to provide visual screening (refer to environmental management measure V7)
- High quality fencing suitable for parks and public spaces will be used where temporary construction support sites are located in close proximity to sensitive residential receivers and users of recreational space (refer to environmental management measure V8)
- Existing trees adjacent to the works will be retained and protected where possible to screen construction works (refer to environmental management measure V9)
- Early planting works will be considered to provide a screening buffer that has time to mature before the project is fully operational (refer to environmental management measure V12).

Temporary construction support sites will be rehabilitated as soon as practicable and revegetated in accordance with environmental management measures V1, V11 and LP5 (refer to Table D2-1 of this submissions report).

#### Night lighting impacts during construction

An assessment of night lighting impacts during construction was completed as part the environmental impact statement, with the methodology for conducting the night lighting assessment summarised in Section 22.3.4 of the environmental impact statement and the potential impacts at identified receivers described in section 22.6.3 and 22.6.4 of the environmental impact statement.

The Flat Rock Drive construction support site (BL2) would be in use 24 hours a day with an associated increase in light emissions that would result in some temporary impacts to surrounding receivers, including moderate night time impacts for receivers at residential properties in Pyalla Street (Viewpoint 1) and Calbina Road (Viewpoint 6), which are located above the temporary construction support site. The impacts of night lighting would be low or negligible for all other viewpoints assessed. The Flat Rock Drive construction support site (BL2) would be located primarily at road level with visual impacts largely contained to Flat Rock Drive itself.

The Middle Harbour south cofferdam (BL7), Middle Harbour north cofferdam (BL8) and Spit West Reserve (BL9) construction support sites would support the construction of the immersed tube tunnel units, including a casting facility for the units at the Spit West Reserve construction support site (BL9). Certain activities at the Middle Harbour south cofferdam (BL7) and Middle Harbour north cofferdam (BL8) construction support sites may be carried out up to 24 hours per day, including the dewatering of cofferdams. At the Spit West Reserve (BL9) construction support site, support works

(immersion and installation) for the immersed tube tunnel installation would be required on approximately six occasions for continuous periods lasting between 24 to 48 hours for each unit. Night time visual impacts would be low for receivers at Spit West Reserve (Viewpoint 2) and Seaforth Crescent dwellings (Viewpoint 3) and negligible for all other viewpoints assessed, since the level of night time lighting emittance is expected to be minimal.

Site lighting will be designed to minimise glare issues and light spillage into adjoining properties and be generally consistent with the requirements of Australian/New Zealand Standard *AS/NZS 4282-2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019a) in accordance with revised environmental management measure V6 (refer to Table D2-1 of this submissions report).

#### Removal of temporary structures post-construction

All temporary structures used for construction such as acoustic sheds, plant and equipment would be removed following the end of construction works. Therefore, temporary structures are not expected to cause any permanent impacts following the completion of construction.

All temporary construction support sites disturbed by construction and not required for operation will be restored as soon as practicable to their existing condition or in accordance with the urban design and landscape plan where applicable, as required by environmental management measure V11 (refer to Table D2-1 of this submissions report).

#### Acoustic sheds

Acoustic sheds would be installed at the Cammeray Golf Course (BL1), Flat Rock Drive (BL2), Punch Street (BL3), Balgowlah Golf Course (BL10) and Wakehurst Parkway east (BL13) construction support sites, as outlined in Section 6.8.2 of the environmental impact statement. Temporary visual impacts of a high and high to moderate rating are anticipated at viewpoints near these temporary construction support sites, as a result of the introduction of new built form, including the acoustic sheds, increased vehicle movements and the presence of equipment and plant during construction of the project (refer to section 22.6.3 and 22.6.4 of the environmental impact statement).

The acoustic sheds have been located close to construction areas and away from community locations, where possible, in order to minimise visual impacts. Temporary construction support sites will be developed to minimise visual impacts for adjacent receivers to the extent reasonably practicable, in accordance with revised environmental management measure V2 (refer to Table D2-1 of this submissions report).

## **C21.5 Visual amenity – operation**

### **C21.5.1 Operational infrastructure**

#### ***Issue raised***

Submitters raised concerns about the impact of operational infrastructure on visual amenity. Specific concerns, suggestions, requests and objections include:

- Suggestions to house operational facilities in existing buildings or be purpose built in existing urban environments such as industrial areas rather than requiring removal of vegetation in greenfield sites
- Concerns about impacts on visual amenity due to the proposed motorway facilities, particularly at Balgowlah Golf Course and Cammeray Golf Course as the motorway facilities at these locations would be visible from a distance



- Requests alternative locations for operational and ancillary facilities required at Balgowlah, including placing the facilities over the tunnel portal at Balgowlah, straddling over the Burnt Bridge Creek Deviation from the tunnel portal to the existing Balgowlah Golf Course at Balgowlah, or using the land made available by the 34 residential properties to be acquired on Dudley Street
- Concerns that North Sydney would become a less attractive and less pedestrian-friendly urban environment as a result of the project
- Requests modifications to the project design that would protect and improve the built environment in North Sydney
- Concerns about the visual impact of the proposed tunnel portals, additional traffic lanes and new intersection at Burnt Bridge Creek Deviation in Balgowlah
- Objections to the proposed car park at Balgowlah Golf Course due to the visual amenity impacts at residential properties nearby
- Concerns about the visual impacts of the widened Wakehurst Parkway on receivers in Manly Warringah War Memorial State Park, Garigal National Park and Bantry Bay
- Concerns about the impacts of lighting along the widened Wakehurst Parkway and at the proposed new and improved public open space and recreation facilities at Balgowlah Golf Course.

### ***Response***

#### General approach to siting of operational facilities

Operational facilities and ancillary infrastructure are discussed in Section 5.2.7 of the environmental impact statement. The locations of operational facilities and ancillary infrastructure have been developed in consideration of required space to house the facilities, existing land uses, future development to minimise permanent impacts (including minimising property acquisitions and associated disruptions, especially private residential dwellings), and maximisation of operational efficiencies through close proximity to the tunnels. Locating operational facilities at temporary construction support sites would minimise disturbance to local communities by minimising the project footprint.

#### Housing operational facilities in existing buildings

Retrofitting existing buildings to support operational requirements would reduce efficiencies and increase project costs. The visual impact of the proposed operational facilities would be reduced through a unified architectural design ensuring that they are designed to read as coherent parts of the surrounding environment. This would be achieved through the provision of appropriate materials and finishes and vegetated screenings where required and appropriate. The urban design and landscape plan will be further developed during further design development and implemented in line with the strategic urban design framework for the project and appropriate operational mitigation measures as per environmental management measure V1 (refer to Table D2-1 of this submissions report).

#### Visibility of motorway facilities in North Sydney and Balgowlah precincts

The strategic urban design framework and other operational mitigation measures would guide the design of the motorway facilities, seeking to minimise the footprint and visual impact of the structures which would be designed as high quality pieces of well integrated architecture. The design would seek to reduce the perceived scale of the facilities and integrate them into the surrounding landscape through articulation of building form (ie breaking the form and surface of large uninteresting or oppressive buildings up into smaller interesting components, eg differentiating

adjoining sides of the building with a change in material, colour, texture or pattern), selection of materials colour and finish, the use of cladding to provide visual interest and designing supporting infrastructure (such as substations, water tanks) that complement the facilities.

Visual impacts of the proposed operational facilities, including the motorway facilities, are described for each precinct in Section 22.7.2 of the environmental impact statement and in more detail in Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment).

The level of impact at each receiver would vary by location depending on the following factors:

- The sensitivity of the receiver
- Time of day/night
- The form and scale of the infrastructure and consistency with other infrastructure in the area
- Visibility of the infrastructure from the receiver location and potential screening by intervening features
- Distance from the infrastructure
- The duration of the view.

At Cammeray Golf Course, the presence of screening vegetation along the boundary of the golf course would assist in filtering or blocking many views of the ventilation outlet and motorway facilities from street level and from more distant locations. In addition, the impact on more distant, district views of the ventilation outlet would be somewhat reduced by the presence of existing vertical elements within the view, including the North Sydney sewer outlet and the Neutral Bay/North Sydney CBD towers.

High to moderate visual impacts are expected for residential receivers at Jeaffreson Jackson Reserve (Viewpoint 2) and Ernest Street (Viewpoint 12) with clear views of the proposed built elements of the project, including the motorway facilities, substation and ventilation outlet. Users of the Cammeray Golf Course club house (Viewpoint 8) with clear views of the motorway facilities are also anticipated to experience high to moderate visual impacts. Impacts are likely to reduce as replacement planting matures and screens some parts of the motorway facilities. A comparison of the existing view north east over Warringah Freeway from Jeaffreson Jackson Reserve (Viewpoint 2) with the expected views of the project is provided in Figure 22-11 to Figure 22-13 of the environmental impact statement. Existing and proposed views from Ernest Street dwellings north to the Cammeray Golf Course (Viewpoint 12) are shown in Figure 22-14 to Figure 22-16 of the environmental impact statement.

Moderate visual impacts are expected for residential properties along Morden Street (Viewpoint 3) and Carter Street (Viewpoint 5) that have elevated views over Cammeray Park. Although the presence of retained foreground vegetation would likely assist in reducing the amount of proposed built form visible, views of the upper sections of the motorway facilities and ventilation outlet are still likely above the tree line. Users of the Cammeray Golf Course footpath (Viewpoint 9) with clear views of the motorway facilities are also anticipated to experience moderate visual impacts.

The removal of vegetation by the Western Harbour Tunnel and Warringah Freeway Upgrade project along the road corridor is likely to increase visibility of both existing and proposed infrastructure for receivers in proximity to the Warringah Freeway. Replacement screening vegetation would reduce these impacts over time as the vegetation matures. Moderate visual impacts are therefore also expected for Warringah Road residential receivers (Viewpoint 4) and users of the Cammeray Park sports facilities (Viewpoint 10), Warringah Freeway near Ernest Street (Viewpoint 11) and Ernest Street bridge (Viewpoint 13).

The retention of screening vegetation along the boundary of Cammeray Park would help to reduce visual impacts of new built form from street level viewpoints surrounding the park. Moderate to low visual impacts are therefore expected for residential receivers at Green Park and Warwick Avenue (Viewpoint 6). Moderate to low impacts are also anticipated for users of the Falcon Street shared user bridge (Viewpoint 14) and Miller Street bridge (Viewpoint 15), whereas impacts on views from St Leonards Park Bon Andrews Oval (Viewpoint 1) and Park Avenue (Viewpoint 7) are expected to be negligible.

The motorway facilities building at Balgowlah Golf Course would be buried approximately eight metres into the ground, with only one level (approximately eight metres) above ground to assist integration of the building with the surrounding residential neighbourhood and the new and improved public open space and recreation facilities. The design of the eastern and western elevations of the building would differ to integrate the building with the road corridor and open space setting.

Residential receivers at Pickworth Avenue (Viewpoint 6) along the eastern side of the Balgowlah Golf Course are expected to experience high to moderate visual impacts, due to their close proximity and direct views of the motorway facilities, ventilation outlet and new and improved public open space and recreation facilities. Screen planting along the golf course boundary would reduce these impacts over time and early planting of this vegetation would provide a more mature buffer before the project is fully operational in accordance with environmental management measure V12 (refer to Table D2-1 of this submissions report). A comparison of the existing view west from Pickworth Avenue towards the motorway facilities and ventilation outlet at Burnt Bridge Creek Deviation with the expected views of the project is provided in Figure 22-20 to Figure 22-22 of the environmental impact statement.

Residential receivers in close proximity to the Balgowlah Golf Course along the eastern and western boundaries, including the southern end of Paris Street (Viewpoint 5) and users of Balgowlah Oval (Viewpoint 7) are expected to experience moderate visual impacts due to the introduction of new built form within Balgowlah Golf Course and the removal of vegetation along Burnt Bridge Creek and within the golf course. At night time, these impacts would be high to moderate. However, impacts would be lessened as the overall parkland character of the golf course is retained. Moderate visual impacts are also expected for residential receivers along Serpentine Crescent (Viewpoint 3) and users of the shared user path along Burnt Bridge Creek Deviation (Viewpoint 4), due to the removal of vegetation and the visibility of the new built form of the project. Replacement planting along the road corridor and Burnt Bridge Creek would likely assist in reducing these impacts over time and the new built form in these locations would generally be consistent with the existing road environment. Early planting of this replacement vegetation will be considered to provide a more mature buffer before the project is fully operational in accordance with environmental management measure V12 (refer to Table D2-1 of this submissions report).

Moderate to low impacts are expected for users of Hope Street (Viewpoint 2) due to the presence of an existing noise wall and vegetation. Low visual impacts are expected for receivers at Burnt Bridge Creek Deviation (Viewpoint 1) as the project works would generally be consistent with the existing environment.

The motorway facilities have been designed to integrate into the surrounding built and natural environment in accordance with the urban design framework, as outlined in Section 3.3.3 of Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment). The design of the motorway facilities would continue to progress during further design development, with the urban design and landscape plan to be further developed in line with the strategic urban design framework for the project and appropriate operational mitigation measures, in accordance with environmental management measure V1 (refer to Table D2-1 of this submissions

report). The plan will detail built features, including the motorway facilities, and will be made available to the public for feedback.

### North Sydney

Project elements proposed within the North Sydney precinct are outlined in Section 22.5.1 of the environmental impact statement and include:

- A motorway facility building within the Cammeray Golf Course site
- A ventilation outlet next to Ernest Street within the Warringah Freeway corridor. The ventilation outlet at the Warringah Freeway would be constructed as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project, with fitout and the ventilation tunnel connection of this structure completed by the Beaches Link and Gore Hill Freeway Connection project
- Entry and exit portals for the Beaches Link tunnel within the Warringah Freeway road corridor
- Associated road widening, trough structures and retaining walls within the Warringah Freeway.

These elements are shown in Figure 4.3 and Figure 4.5 of Appendix V (Technical working paper: Urban design, landscape character and visual impact). The visual impacts of the project within the North Sydney precinct would generally be moderate to low since much of the built form of the project (including portals, motorway facilities and ventilation outlet) would be consistent with the existing major infrastructure of the Warringah Freeway road corridor. The largest visual impacts would be experienced by residential and public open space receivers in close proximity to the motorway facilities within the Cammeray Golf Course and elevated receivers that have clear views of the project, as described in the response above.

Changes to the active transport network, including pedestrian pathways, within North Sydney would be due to the Warringah Freeway Upgrade component of the Western Harbour Tunnel and Warringah Freeway Upgrade project and are outlined in Section 9.4.2 of the environmental impact statement. The potential visual and traffic impacts of these changes have been assessed in the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement.

The proposed road integration works in the North Sydney area have been developed in the context of the growing North Sydney CBD environment. The works proposed by the project in the area 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. The proposed works are considered to provide an equitable and balanced outcome from the perspective of maintaining 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 (NSITP or North Sydney Program), as described in Section 9.1.1 of the environmental impact statement. 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. Led by Transport for NSW since 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 of works, integrate with the North Sydney CBD in a manner that supports the globally connected 'Harbour CBD' and enables delivery of befitting place-based outcomes.

The development of the North Sydney Program is ongoing, with validation of the vision for North Sydney currently underway with several scenarios being considered to support the place-based outcomes.

To minimise the impact of the Western Harbour Tunnel and Beaches Link program of works on the North Sydney CBD, planning and design to date has been developed to:

- Adopt 'movement and place' principles to help reprioritise access and support efficient connections for traffic, pedestrians, and other transport customers. These principles aim to allocate road space in a way that improves the liveability of places, considering that the needs and expectations of transport customers and communities change for different types of street environments
- Continue to provide motorway access only via existing major road corridors
- Focus on the utilisation of existing road space to maintain network efficiency and balance the needs of all road users while minimising road widenings and impacts on existing footpaths and street trees
- Ensure operational impacts are minimised (and critical performance issues avoided), by spreading the demand generated by new infrastructure across multiple locations
- Provide network efficiencies and safer outcomes by simplifying network operations, prioritising strategic movements, and minimising conflicts.

The proposed network integration works would result in a resilient network that can accommodate key road transport users, while at the same time promoting walking, cycling and public transport access to and within the North Sydney CBD. In the event that road transport demand is lower or demands otherwise differ as land use and transport developments mature, this approach would also provide flexibility to adjust the future transport network in response to customer needs.

Transport for NSW would continue to work with North Sydney Council and key stakeholders through agreed governance structures to investigate options to improve movement and place outcomes within North Sydney through the North Sydney Program, further leveraging the strategic benefits of the Western Harbour Tunnel and Beaches Link program of works.

#### Visual impacts at Burnt Bridge Creek Deviation

The potential visual impacts of the proposed project elements within the Balgowlah precinct are discussed in Section 22.7.2 of the environmental impact statement and shown in Figure 22-20 to Figure 22-25 of the environmental impact statement.

Visual impacts of the project within the Balgowlah precinct would generally be moderate to low since much of the built form of the project would be consistent with the existing road infrastructure of the Burnt Bridge Creek Deviation corridor. Residential receivers in Serpentine Crescent (Viewpoint 3) and users of the shared user path along Burnt Bridge Creek Deviation (Viewpoint 4) would experience moderate visual impacts during the daytime due to the removal of vegetation and the visibility of the new built form of the project. Moderate to low impacts are expected for residential receivers in Hope Street (Viewpoint 2) due to the presence of an existing noise wall and vegetation blocking views towards the road corridor. In addition, low visual impacts are expected for residents along Serpentine Crescent (Viewpoint 3) and Hope Street (Viewpoint 2) during the night time, due to increased light emitting from the road corridor and the tunnel portal at night.

Replacement planting on top of the tunnel portals, along the widened road corridor and along Burnt Bridge Creek would likely assist in reducing these impacts over time and the new built form in these locations would generally be consistent with the existing road environment. Early revegetation works will occur along the project boundaries where feasible, ensuring an extended time period for

planting establishment to provide visual screening and improve public amenity, in accordance with environmental management measure V12 (refer to Table D2-1 of this submissions report). Where possible, trees will be protected or pruned rather than removed, as required by revised environmental management measure V10 (refer to Table D2-1 of this submissions report).

The project has sought to minimise visual impacts of project elements from the earliest stages of the design process, to deliver tunnel portals, surface connections and other operational infrastructure that are visually appealing, sensitive to their context, reflect the above ground environment and provide a legible self-explaining journey. The design of the operational infrastructure would continue to progress during further design development, with the urban design and landscape plan to be further developed in line with the strategic urban design framework for the project and appropriate operational mitigation measures, in accordance with environmental management measure V1 (refer to Table D2-1 of this submissions report). The plan will detail built features, including the tunnel portals, surface connections and landscaping, and will be made available to the public for feedback.

#### New and improved public open space and recreation facilities at Balgowlah

The layout of the new and improved public open space and recreation facilities at Balgowlah, including associated car parking, as shown in Figure 5-28 of the environmental impact statement, is indicative and would be subject to further consultation.

Based on the indicative layout, residential receivers at Pickworth Avenue (Viewpoint 6) are expected to experience high to moderate visual impacts during the daytime and high visual impacts at night time, due to their close proximity and direct views of the new and improved public open space and recreation facilities and new access road, and the change from the more natural setting of Balgowlah Golf Course. Screen planting along the golf course boundary would reduce these impacts over time.

A dedicated consultation process jointly led by Transport for NSW and Northern Beaches Council will take place to give the community an opportunity to provide input on the final layout of the new and improved public open space and recreation facilities at Balgowlah, in accordance with revised environmental management measure LP4 (refer to Table D2-1 of this submissions report). This process will start in advance of construction commencing. As part of this consultation process, a community reference group will be established, with representative stakeholder groups and the community, to support Transport for NSW and Northern Beaches Council with the development of this important public space.

#### Wakehurst Parkway

Local and district views of the Wakehurst Parkway road corridor are currently generally constrained by dense vegetation, with filtered local views available from Seaforth Oval and residential dwellings to the east of the corridor (refer to Appendix V (Technical working paper: Urban design, landscape character and visual impact assessment)). The elevated nature of the area allows for some distant district views, including from elevated lookouts within Garigal National Park.

The potential visual impacts during the operation of the project within the Wakehurst Parkway precinct are discussed in Section 22.7.2 of the environmental impact statement. Viewpoints in the Wakehurst Parkway precinct with the potential to be visually affected by some element of the project were selected through desktop study and site visits and are shown in Figure 22-8 of the environmental impact statement. Views from Manly Warringah War Memorial State Park are not expected to be impacted by operational infrastructure proposed for the project.

Moderate impacts are expected for residential receivers at Killarney Heights (Viewpoint 8) near Bantry Bay, since the top of the ventilation outlet at Wakehurst Parkway may be discernible above

the treeline, forming a new built form element within the view. However, the long viewing distance and panoramic nature of the view ensures the ventilation outlet would form a relatively small part of the wider view frame.

A negligible visual impact is expected from Bantry Bluff, an elevated viewpoint within Garigal National Park (Viewpoint 7) where receivers have far reaching views over the densely vegetated slopes of Bantry Bay. The top of the Beaches Link ventilation outlet at Wakehurst Parkway may also be discernible above the treeline although again due to the long viewing distance and panoramic nature of the view, it would form only a very small element within the wider view frame.

Users of the Engravings walking track (Viewpoint 5), that runs parallel to the western edge of Wakehurst Parkway, are expected to be moderately impacted by the proposed drainage basin and road widening, due to the associated vegetation removal near some areas of the track, remodelling of the landform for the drainage basin and increased exposure to the Wakehurst Parkway road corridor.

Over time, replacement planting would assist in reducing visual impacts for the majority of receivers impacted in the Wakehurst Parkway precinct. The density of replacement planting in this area would ensure that a bushland character would likely still dominate in this precinct, especially as replacement planting matures. Vegetation removal will be further minimised during further design development and construction planning to the extent reasonably practicable, in accordance with environmental management measures B6, V9 and V10 (refer to Table D2-1 of this submissions report). Early planting works will be considered to ensure that vegetation has time to mature before the project is operational, in accordance with environmental management measure V12 (refer to Table D2-1 of this submissions report).

#### Night lighting impacts

Night lighting impacts during operation are discussed in Section 22.7.2 of the environmental impact statement.

The Wakehurst Parkway precinct currently has low night time light emissions, with the greatest source being cars on Wakehurst Parkway. The widened road corridor and the removal of vegetation along the boundary of the road may expose residential receivers along Kirkwood Street (Viewpoint 4) to slightly increased light emittance resulting in a low impact, however these impacts would likely reduce as replacement screening vegetation matures, as discussed in Section 22.7.2 of the environmental impact statement. Low visual impacts are also expected along Wakehurst Parkway (south) (Viewpoint 3) due to the presence of lighting at the ventilation outlet. However, this view would only be experienced for a relatively short duration and in a localised position while new vegetation is maturing. Negligible night time visual impacts are expected for all other viewpoints as summarised in Table 22-24 of the environmental impact statement.

The Balgowlah precinct also currently has relatively low night time light emissions with very few light sources located within the Balgowlah Golf Course area. The proposed new and improved public open space and recreation facilities and the new access road within the Balgowlah Golf Course would result in an increase in night time lighting during operation. The most impacted receivers would be residential receivers located along the eastern boundary of the Balgowlah Golf Course, such as receivers in Pickworth Avenue (Viewpoint 6) and Paris Street (Viewpoint 5). These properties would likely have increased visibility of street lighting and vehicle headlights along the new access road, resulting in high and high to moderate night time visual impacts.

A detailed operational lighting concept would be developed during further design development, based around the considerations identified in the assessment for the project. It would be developed in accordance with Australian/New Zealand Standard AS/NZS 1158.4-2015 *Lighting for roads and*

*public spaces* (Standards Australia, 2015a), Australian Standard AS 2560.1:2018 *Sports lighting general principles* (Standards Australia, 2018b), Australian/New Zealand Standard AS/NZS 4282-2019 *Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019a) and Australian/New Zealand Standard AS/NZS 60598 *Luminaires General requirements and tests* (Standards Australia, 2017).

### **C21.5.2 Increases in traffic**

#### ***Issue raised***

Submitters raised concern about impacts on visual amenity due to the predicted increase in traffic in local neighbourhoods around North Sydney and Cammeray.

#### ***Response***

The detailed transport modelling process which has been adopted by Transport for NSW and reviewed and endorsed by subject matter experts does not indicate that the project would result in significant additional traffic around the North Sydney and Cammeray areas, as discussed in Section 9.4.2 of the environmental impact statement.

The Western Harbour Tunnel and Beaches Link program of works is expected to transfer a significant volume of through traffic, currently on surface roads, underground. In addition, reduced congestion on the motorway and arterial road network would provide flow-on benefits to the adjoining local road network including reduced traffic queues and consequent rat-running in local areas. Reduced congestion on the arterial and local road networks, including reduced rat-running, would result in improvements including visual amenity, physical safety, air quality and noise levels, as well as facilitating improved pedestrian access and activity.

Transport for NSW is part of the North Sydney Program, a multi-agency collaboration with 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 2018, this program aims to deliver a shared place-based vision for the North Sydney CBD. The North Sydney Program is further discussed in Section C21.5.1 above.





Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C22 – Hazards and risks

## C22 Hazards and risks

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## C22.1 Adequacy of the hazards and risks assessment

### ***Issue raised***

Submitters raised concerns about the adequacy of the hazards and risks assessment. Specific concerns and requests include:

- Concerns that the risk assessment for the project, including health and safety risks, is incomplete
- Concerns that safety risks have not been fully scoped in the assessment
- Concerns that the bushfire assessment is not accurate
- Requests that further assessment is carried out in relation to pollution impacts that may arise from an emergency involving smoke or gas release (or any other contaminant).

### ***Response***

#### Risk assessment

The assessment of hazards and risks for the project focused on those hazards with the potential to adversely affect the surrounding environment and general public in accordance with the Secretary's environmental assessment requirements. Relevant policies and guidelines have been used in the assessment of potential hazards and risks that could arise during construction and operation of the project, as noted in Section 23.1 of the environmental impact statement. Issues have been assessed objectively and thoroughly.

The implementation of environmental management measures for the project, identified in Table D2-1 of this submissions report, will avoid to the greatest extent possible risks to public safety and achieve the desired performance outcomes in relation to the hazards identified for the project. Management measures relating to other potential environmental hazards resulting from the construction or operation of the project are considered and addressed in the relevant chapters of the environmental impact statement. In addition, the construction environmental management plan for the project would be prepared in accordance with *QA Specification G36: Environmental Protection* (Transport for NSW, 2020d) as discussed in Section 28.5.1 of the environmental impact statement. This specification requires the construction contractor/s to carry out an environmental risk assessment workshop to develop risk mitigation and management strategies to eliminate or reduce the risk exposure prior to construction.

#### Safety risks

Safety risks associated with the project are addressed in relevant chapters of the environmental impact statement based on the Secretary's environmental assessment requirements. Specifically, Secretary's environmental assessment requirement 3 Health and Safety 2(f) requires the environmental impact statement to "assess the likely risks of the project to public safety, paying particular attention to pedestrian safety, subsidence risks, bushfire risks and the handling and use of dangerous goods". These requirements have been addressed in the environmental impact statement as follows, and as outlined in Appendix A (Secretary's environmental assessment requirements checklist):

- Public and pedestrian safety is discussed in Chapter 8 (Construction traffic and transport), Section 8.4, Chapter 13 (Human health), Section 13.4, Section 13.5, Chapter 9 (Operational traffic and transport) and Section 9.4 of the environmental impact statement. An assessment of the impacts of potential traffic incidents during operation is provided in Section 23.3.3 of the environmental impact statement

- An assessment of potential ground movement (subsidence) associated with the project is provided in Chapter 16 (Geology, soils and groundwater) and Section 16.4.2 of the environmental impact statement. Ground movement due to construction activities is also discussed in Section 23.2.3 of the environmental impact statement
- An assessment of bushfire risks relating to construction and operation is presented in sections 23.2.6 and 23.3.5 of the environmental impact statement respectively
- The handling and use of dangerous goods during construction and operation is described in sections 23.2.1 and 23.3.1 of the environmental impact statement respectively.

### Bushfire assessment

A bushfire risk assessment was carried out to assess potential bushfire implications of the project, and is documented in Section 23.2.6 of the environmental impact statement. The bushfire risk assessment was carried out in accordance with the relevant policies and guidelines outlined in Section 23.1 of the environmental impact statement, including:

- *Planning for Bushfire Protection: A guide for councils, planners, fire authorities and developers* (NSW Rural Fire Service (NSW RFS), 2019)
- *Bush Fire Risk Management Planning Guidelines for Bush Fire Management Committees* (NSW RFS, 2008)
- *Garigal National Park Fire Management Strategy* (Department of Environment and Conservation (DEC), 2006b)
- *Manly Warringah War Memorial Park Fire Regime Management Plan* (Eco Logical Australia, 2006)
- Bushfire prone land mapping developed and published by the relevant local councils
- Relevant bushfire risk management plans including:
  - *Mosman North Sydney Willoughby Bush Fire Risk Management Plan 2017–2022* (Mosman North Sydney Willoughby Bush Fire Management Committee, 2017)
  - *Warringah Pittwater Bush Fire Risk Management Plan 2010–2015* (Warringah Pittwater Bush Fire Management Committee, 2010).

The assessment considered the potential for bushfire during construction and operation (including potential ignition risks), measures to mitigate the impact of bushfire on future infrastructure and its functionality, the effects of design on emergency service response and evacuation needs associated with bushfire and the likelihood of these risks impacting on biodiversity values. The assessment considered the potential bushfire hazard across the construction footprint in the context of existing bushfire prone lands and land which has the potential to carry bushfire. The assessment is consistent with *Practice Note 4/12: 'In Principle' Masterplan Agreements in Bush Fire Prone Areas* (NSW RFS, 2012). The assessment is considered robust and has allowed Transport for NSW to demonstrate due consideration for the bushfire risk that exists within the assessment and incorporate appropriate bushfire mitigation and design elements. Bushfire risk is further addressed in Section C22.2.4 below.

### Smoke or gas release

The key fire and life safety aspects of the project are described in Chapter 5 (Project description) of the environmental impact statement and would include fire and incident detection equipment, communication systems, fire suppression systems, emergency lighting, smoke management and power systems, cross passages or longitudinal egress passages, and tunnel closure systems. The fire and life safety systems and measures adopted for the project will be equivalent to or exceed the

fire safety measures recommended by *NFPA 502 - Standard for Road Tunnels, Bridges, and Other Limited Access Highways* (National Fire Protection Association (NFPA), 2020) (American), Permanent International Association of Road Congresses (PIARC) (European), Australian Standard *AS 4825-2011 Tunnel Fire Safety* (Standards Australia, 2011) and Australian Standard *AS 3959-2018 Construction of a Building in Bushfire-prone Areas* (Standards Australia, 2018a), and Transport for NSW standards in accordance with environmental management measure HR9 (refer to Table D2-1 of this submissions report).

The in-tunnel air quality under worst case breakdown or major accident is discussed in Section 12.6.1 of the environmental impact statement. The tunnel ventilation system would be designed to cater for various traffic scenarios, including where there is a breakdown or major incident at a point along the tunnel. The predicted in-tunnel trip average NO<sub>2</sub> concentration for the worst case vehicle breakdown or major incident scenario in the tunnel confirms that the tunnel ventilation system would achieve the NO<sub>2</sub> emissions criteria during all breakdown scenarios. The in-tunnel operational air quality limits for NO<sub>2</sub>, CO and visibility would also be achieved during all breakdown or major incident scenarios.

The likelihood of a fire or gas release during operation of the project cannot be entirely removed however environmental management measures, identified in Table D2-1 of this submissions report, have been developed to reduce the consequence of such events, including environmental management measure HR10 which prohibits the transport of dangerous goods and hazardous substances through the mainline and ramp tunnels. Uncontrollable human factors inherently lead to a risk of fires and incidents. Notwithstanding, the project would adopt best management practice fire and life safety systems and measures and the response to incidents within the motorway will be managed in accordance with the memorandum of understanding between Transport for NSW and the NSW Police Service, NSW Rural Fire Service, Fire and Rescue NSW and other emergency services as required by environmental management measure HR11 (refer to Table D2-1 of this submissions report). Given this and the outcomes of the air quality assessment described above, the need for further assessment is not warranted.

## **C22.2 Construction hazards and risks**

### **C22.2.1 Storage of dangerous goods and hazardous substances**

#### ***Issue raised***

Submitters raised concerns about the storage of dangerous goods and hazardous substances during construction. Specific concerns and requests include:

- Concerns about the fire risk if dangerous goods and hazardous substances are stored in laydown areas within temporary construction support sites and requests for chemicals to be stored in fireproof sprinkler protected buildings
- Concerns about the associated risks of storing dangerous goods and hazardous substances in close proximity to the community, particularly in relation to Cammeray Golf Course, Cammeray Public School, residential areas in Cammeray and at Wakehurst Parkway south construction support site (BL12) (as it is located in a bushfire prone zone)
- Requests that dangerous goods and hazardous substances are stored at Wakehurst Parkway east construction support site (BL13), instead of Wakehurst Parkway south construction support site (BL12) as it would be further distanced from residential areas.

### **Response**

The anticipated types and quantities of dangerous goods and hazardous substances that would be stored and used at the temporary construction support sites are detailed in Table 23-2 of the environmental impact statement.

A screening comparison of the indicative quantities of dangerous goods and hazardous substances to be stored at the temporary construction support sites against the threshold quantities listed in *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, 2011) has been carried out as detailed in Section 23.2.1 of the environmental impact statement. The assessment concludes that the inventory thresholds would not be exceeded for any material at any temporary construction support site. Providing they are appropriately stored and used in accordance with the environmental management measures outlined in Table D2-1 of this submissions report, the storage and use of dangerous goods and hazardous substances at the project temporary construction support sites, including the Cammeray Golf Course (BL1) and Wakehurst Parkway south (BL12) construction support sites, would not pose an unacceptable risk of harm beyond the temporary construction support site boundaries. Storage of some dangerous goods and hazardous substances would be required at all temporary construction support sites, including both the Wakehurst Parkway south (BL12) and Wakehurst Parkway east (BL13) construction support sites. This storage will be in accordance with the supplier's instructions, and will comply with applicable legislation, guidelines and Australian Standards, as detailed in environmental management measure HR1 (refer to Table D2-1 of this submissions report).

In addition, a number of environmental management measures have been provided to manage potential bushfire risks to and from the temporary construction support sites, including environmental management measures HR3 to HR6 (refer to Table D2-1 of this submissions report). Bushfire risk is further addressed in Section C22.2.4 below.

### **C22.2.2 Transportation of dangerous goods and hazardous substances**

#### **Issue raised**

Submitters raised concerns about the transportation of dangerous goods and hazardous substances during construction. Specific concerns include:

- Concerns about construction trucks carrying hazardous substances or contaminated materials and potential impacts to residential areas
- Concerns that construction vehicles using Wakehurst Parkway could result in accidental spills and impact on Garigal National Park and Manly Warringah War Memorial State Park.

#### **Response**

Potential impacts as a result of the transportation of dangerous goods and hazardous substances during construction of the project have been assessed in Section 23.2.2 of the environmental impact statement. Some dangerous goods and hazardous substances would be required to be transported to the temporary construction support sites, using roads which travel through residential areas. The transportation of dangerous goods and hazardous substances during construction would be managed to avoid impacts from spills or leaks. Dangerous goods and hazardous substances will be transported in accordance with relevant legislation and codes, including the *Dangerous Goods (Road and Rail Transport) Act 2008*, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2020), as required by environmental management measure HR2 (refer to Table D2-1 of this submissions report).

The proposed haulage routes for the project are outlined in Chapter 6 (Construction work) of the environmental impact statement. Where possible, the haulage routes have been selected to avoid local roads to minimise the risks associated with the transport of dangerous goods, hazardous substances and contaminated materials.

### **C22.2.3 Settlement risk**

#### ***Issue raised***

Submitters raised concerns about the risk of settlement, including:

- Concerns about the geological uncertainty related to the project
- Concerns about the risk of ground instability due to tunnelling work in sensitive residential areas in Artarmon and foreshore environments
- Concerns about ground movement occurring after the tunnel is completed.

#### ***Response***

##### Geological uncertainty

The project design and tunnel construction methods have been informed by initial geotechnical investigations to reduce the construction risks associated with encountering unexpected ground conditions, as discussed in Section 23.2.3 of the environmental impact statement. Additional geotechnical investigations would be carried out during further design development to provide further information on ground conditions as discussed in Section 6.3.1 of the environmental impact statement, which would further reduce geological uncertainty.

##### Tunnelling works in sensitive areas

The project tunnels would generally be excavated in good quality Hawkesbury Sandstone. Primary support in the tunnels would be installed as the excavation progresses, as recommended by an appropriately qualified geotechnical or tunnel engineer, to ensure tunnel stability during construction and operation, including work around residential areas and foreshore environments.

A number of major design and construction method reviews have been carried out to better understand the Lane Cove Tunnel failure which occurred at Longueville Road in 2005, as described in Section 23.2.3 of the environmental impact statement. The causes of the failure are generally cited as a complex combination of factors, including the changing ground conditions and geological defects and the inadequacy of the tunnel support system. The risk of a similar incident occurring during a Sydney tunnelling project are considered 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 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 unexpected, including probe drilling and ground treatment through suspected poor ground zones

- Continuous assessment and monitoring of likely excavation and groundwater conditions
- Detailed survey monitoring of surface roads, buildings and structures in the tunnel vicinity.

#### Ground instability

An assessment of potential ground movement associated with the project is provided in Section 16.4.2 of the environmental impact statement. Typical impacts which would be expected in relation to potential ground movement values and typical associated impacts for settlement are shown in Table 16-8 of the environmental impact statement. No buildings were predicted to be in the 'slight' to 'very severe' damage categories under relevant guidelines. Sixty-one buildings are categorised as potentially within the 'very slight' damage category. 'Very slight' damage (fine cracks) would be easily treated during normal decoration. Damage would generally be restricted to internal wall finishes, with small cracks visible on external brickwork or masonry. These buildings are mainly in the vicinity of locations where the tunnel would have shallow cover near portals and larger span caverns, including:

- The Warringah Freeway portal
- Northbridge, east of the Flat Rock Creek area
- Seaforth, at the junction of the mainline and ramp tunnels
- The Wakehurst Parkway cavern and portal.

To manage risks associated to buildings and/or structures from potential ground movement, condition surveys will be carried out prior to commencement of construction in accordance with revised environmental management measure SG7 (refer to Table D2-1 of this submissions report). Within three months of the completion of construction activities that have the potential to cause settlement or vibration-related damage to 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, a post-construction building condition survey will be carried out by a suitably qualified person.

The results of the survey 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 month of the survey being completed. Any building and/or property damage from settlement caused by the project will be repaired at no cost to the owner.

Further, 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 monitoring requirements, in accordance with environmental management measure SG5 (refer to Table D2-1 of this submissions report).

#### **C22.2.4 Bushfire risk**

##### ***Issue raised***

Submitters raised concerns about bushfire risk, including the loss of the fire break to properties at Kirkwood Street due to removal of trees at the Wakehurst Parkway south construction support site (BL12).

##### ***Response***

The risk of bushfire during construction is addressed in Section 23.2.6 of the environmental impact statement. In accordance with *Planning for Bushfire Protection: A guide for councils, planners, fire*



*authorities and developers* (NSW RFS, 2019) the predominant vegetation class (bushfire prone land) has been assessed to a distance of 140 metres from the project in all directions. The assessed bushfire risk levels for temporary construction support sites located on, or close to, bushfire prone land are provided in Table 23-4 of the environmental impact statement.

The Wakehurst Parkway south construction support site (BL12) was assessed as having a 'medium' bushfire risk level. The vegetation in this area is not currently managed in a way that would provide a viable fire break. The proposed removal of this vegetation during construction would increase the separation distance between the Kirkwood Street properties and the vegetation hazard west of Wakehurst Parkway. Therefore the proposed removal of these trees would reduce the bushfire risk to properties at Kirkwood Street.

Strategies to reduce risk from bushfire, such as site layout, setbacks from bushfire prone vegetation, access and emergency procedures along the Wakehurst Parkway will be developed and implemented during construction, as required by environmental management measures HR3 to HR6 (refer to Table D2-1 of this submissions report). This will include implementation of the following strategies at the temporary construction support sites to reduce bushfire risk:

- Adequate access and egress for fire fighting vehicles and staff will be provided. Access roads will have a minimum width of four metres to allow passage of fire fighting vehicles
- Adequate setbacks from bushfire prone vegetation to allow for fire fighting vehicle access will be provided
- An emergency response plan will be prepared for the construction of the project, including a bushfire risk matrix
- First response capabilities, including fire extinguishers, water carts and hoses will be assessed and provided where needed.

### **C22.2.5 Hazards and risks environmental management measures**

#### ***Issue raised***

Submitters raised concerns that environmental management measures HR5 and HR6 are inadequate with regard to bushfire risk to residential property, in addition to requests for a detailed bushfire plan to be developed and water storage tanks and pumps to be provided at the Wakehurst Parkway south construction support site (BL12).

#### ***Response***

A bushfire matrix will be prepared as part of the emergency response plan for the construction of the project at the temporary construction support sites, including Wakehurst Parkway south construction support site (BL12), as required by environmental management measure HR5 (refer to Table D2-1 of this submissions report). Strategies to reduce risk from bushfire along the Wakehurst Parkway will be developed and implemented during construction as described in Section C22.2.4 above. In addition, first response capabilities, including fire extinguishers, water carts and hoses will be assessed and provided at the temporary construction support sites where needed, as required by environmental management measure HR6 (refer to Table D2-1 of this submissions report).

Additionally, emergency management arrangements would be considered in regard to managing ignitions and preventing the spread of fire from sites during construction. High risk activities (such as welding and metal work) would be carefully considered on days with a Fire Danger Rating of High or above. On Total Fire Ban Days, high ignition risk activities would be avoided in or next to bushland areas.

Transport for NSW believes that these environmental management measures will adequately manage bushfire risks.

## **C22.3 Operational hazards and risks**

### **C22.3.1 Risk of terrorism**

#### ***Issue raised***

Submitters raised concerns about the tunnels being a potential terrorism risk.

#### ***Response***

While the Australian Federal Police and NSW Police Service have specific responsibility to investigate and prevent terrorism, the built elements of the project would contribute to creating a safe experience for all users, including the surrounding community and the environment. The urban design requirements of the project are outlined in Section 22.2.2 of the environmental impact statement, including consideration of the crime prevention through environmental design principles. Further discussion on the application of the crime prevention through environmental design principles is provided in Section 3.4.11 of Appendix V (Technical working paper: Urban design, landscape character and visual impact).

In addition, the project would also include Closed Circuit Television (CCTV) as described in Chapter 5 (Project description) of the environmental impact statement. The use of CCTV would improve safety and security for the project and would allow active surveillance in accordance with the crime prevention through environmental design principles.

### **C22.3.2 Detour routes**

#### ***Issue raised***

Submitters raised concerns that the environmental impact statement does not provide a detour route to the Northern Beaches Hospital in the event that the Beaches Link tunnel is closed or blocked.

#### ***Response***

The Military Road/Spit Road and Warringah Road corridors are currently the primary access routes to the Northern Beaches Hospital (from the south). The project would create an alternative to those corridors. As such, the project would increase the resilience of the Northern Beaches and North Shore road network to traffic incidents, as described in Section 3.4 of the environmental impact statement. The project would not impact on the ability to use existing routes to the Northern Beaches Hospital as a detour if required. Therefore, in the event that the Beaches Link tunnel was closed or blocked due to an incident, it is not anticipated that there would be any impact to potential detour routes.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C23 – Resource use and waste management

## C23 Resource use and waste management

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## C23.1 General issues

### ***Issue raised***

Submitters raised concerns about resource use and waste management during construction. Specific concerns and comments included:

- Concerns about the sustainability of the project as it would require large quantities of materials and generate large volumes of waste, for example, for concrete production
- Comments that the construction of a Metro as an alternative to the project would use less resources
- Concerns over the generation of hazardous waste from the project.

### ***Response***

#### Resource use and waste management

Construction resource use is detailed in Section 24.3.1 of the environmental impact statement. Indicative quantities and the potential sources of key construction materials are provided in Table 24-2 of the environmental impact statement. Given the scale of the project, substantial quantities of materials would be required for construction however material requirements are typical for a motorway project of this scale.

The design of the project has included careful consideration of the construction methodology and selection of materials and resources to ensure they are fit for purpose. 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, to the extent reasonably practicable, in accordance with revised environmental management measure WM1 (refer to Table D2-1 of this submissions report).

Consistent with the resource management hierarchy of the *Waste Avoidance and Resource Recovery Act 2001*, resource consumption will be further minimised during construction through reuse, where possible, in accordance with environmental management measure WM2 (refer to Table D2-1 of this submissions report). For example, temporary work structures such as road plates and tunnel formwork would be reused, and asphalt from decommissioned pavements would be reused in temporary and new pavements, where technically feasible. Examples of measures to minimise the generation of waste (including waste from concrete production) and maximise resource recovery include:

- Prioritisation of pre-cast concrete structural elements to improve efficiency and minimise waste
- On-site sorting of materials like timber, steel and concrete to maximise resource reuse on site or near to the site where possible.

The Beaches Link and Gore Hill Freeway Connection project is committed to achieving excellence in sustainability across all project stages. The project sustainability policy is expressed in Figure 25-2 of the environmental impact statement, which includes commitments to using resources (energy, water and materials) efficiently and reducing waste.

A number of indicative sustainability objectives and targets focussed on minimising energy use (both embodied energy and greenhouse gas) during construction and optimising resource efficiency and waste management are identified in Table 25-4 of the environmental impact statement. This includes use of cementitious substitution materials (where feasible), using recycled content in road base (where appropriate) and resource recovery of concrete as examples. The project would also

consider the sustainability values and commitments of different organisations and suppliers when procuring materials and services for the project.

The project sustainability framework will comprise the agreed sustainability objectives and targets for the project, including any relevant conditions which may be applied to the project by the Minister for Planning and Public Spaces, in accordance with environmental management measure SU1 (refer to Table D2-1 of this submissions report). The sustainability management plan (refer to environmental management measure SU2) will detail the activities required to implement the sustainability framework, including the Infrastructure Sustainability rating scheme credit requirements. The project will seek to achieve an 'Excellent' 'Design' and 'As Built' Infrastructure Sustainability rating using version 1.2 of the rating tool of the Infrastructure Sustainability Council of Australia.

### Resource use of project alternatives

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

Alternative transport modes, including bus, rail, light rail and active transport, were considered as part of the project development and alternatives process, but were ultimately not determined to be the preferred strategic alternative.

The project is part of a suite of current and future transport initiatives outlined in *Future Transport Strategy 2056* (NSW Government, 2018) that together, would provide the cross-harbour transport capacity required to cater for a diverse array of journeys and future population growth. Further, a new tunnelled harbour crossing would allow new public transport routes to be developed in response to diverse travel demands and support new social and economic development such as the emerging Northern Beaches Hospital Precinct in Frenchs Forest, as discussed in Chapter 3 (Strategic context and project need) of the environmental impact statement.

When considering the strategic alternatives and complementary projects, it was concluded that the construction and operation of a new tunnelled motorway crossing of Middle Harbour (the project) was the preferred solution.

### Hazardous waste

Construction of the project is estimated to generate about 1000 tonnes (subject to further investigation) of hazardous waste (for example asbestos and heavy metals) as noted in Table 24-4 of the environmental impact statement. The indicative waste streams and quantities provided in Table 24-4 of the environmental impact statement are typical of construction and demolition activities and can be adequately managed with the implementation of well-established environmental management measures.

Any surplus material requiring offsite disposal to land will be tested and classified in accordance with the *Waste Classification Guidelines* (NSW Environment Protection Authority (EPA), 2014b) (refer to environmental management measure WM3 in Table D2-1 of this submissions report). Wastes will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment in accordance with revised environmental management measure WM4.

Potentially contaminated areas directly affected by the project will be further investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contamination Land Management Act 1997*. An independent NSW EPA 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 in accordance with revised environmental management measure SG8 in Table D2-1 of this submissions report.

The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contamination discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime Services, 2013) in accordance with environmental management measure SG13 (refer to Table D2-1 of this submissions report).

Special and hazardous wastes would be disposed of at appropriately licensed waste management facilities to be selected during the later stages of the project and documented in the construction waste management plan as outlined in Section 24.5 of the environmental impact statement.

## **C23.2 Adequacy of the resource use and waste management assessment**

### **C23.2.1 Resource use and waste management**

#### ***Issue raised***

Submitters raised concerns about the adequacy of the resource use and waste management assessment. Specific concerns and suggestions included:

- Concerns that details regarding the handling, processing and transport and disposal of potentially contaminated dredged sediment from Middle Harbour are not yet confirmed, including identification of the location for a land-based facility for processing
- Concerns that the consequences of a traffic incident on Sydney Harbour Bridge involving a truck carrying spoil from the project have not been adequately assessed
- Suggestions for additional resource use and waste management assessment to identify potential waste impacts on terrestrial and marine ecosystems
- Suggestions that the environmental impact statement should include an assessment of the volume of virgin excavated natural material to be generated by the project.

#### ***Response***

Avoiding or minimising environmental impacts has been a key consideration throughout the design and development process for the Beaches Link and Gore Hill Freeway Connection project.

The assessment methodology used for the assessment of resource use and waste management is outlined in Section 24.2 of the environmental impact statement and comprised:

- A review of the likely resources required for the construction and operation of the project, including construction materials, water and power
- A review of the likely waste streams, volumes and classifications
- Identification of opportunities for the avoidance, minimisation and reuse of waste, including targets for the beneficial reuse of solid waste, wastewater and other waste consistent with the project's sustainability framework (refer to Chapter 25 (Sustainability) of the environmental impact statement)
- Identification of the environmental impacts associated with resource use and the generation (and subsequent disposal) of residual waste materials
- Management strategies for waste during construction and operation, including:
  - Managing construction waste through the resource management hierarchy established under the *Waste Avoidance and Resource Recovery Act 2001*

- Developing procedures for the assessment, handling, stockpiling and disposal of potentially contaminated materials and wastewater, in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014b).

The level of assessment provided in the environmental impact statement is considered to be suitable for a project of this scale.

#### Handling, processing, transport and disposal of potential contaminated dredged sediments

Spoil generation and management for dredged and excavated material from Middle Harbour construction activities is discussed in Section 24.3.3 of the environmental impact statement. An indicative total of about 163,000 cubic metres of soft soil, sediments and rock would need to be removed from Middle Harbour during the dredging activities required for the installation of the immersed tube tunnel and associated transition structures.

The majority of the dredged and excavated material removed from within Middle Harbour would comprise dredged sediments and rock that is considered suitable for offshore disposal. Transport for NSW will submit an application to the Department of Agriculture, Water and the Environment for an offshore disposal permit relating to sediments dredged and excavated from Middle Harbour, as discussed in Chapter 2 (Assessment process) of the environmental impact statement. The application proposes offshore disposal at a designated disposal site, which is located about 10 to 15 kilometres offshore of Sydney Heads. A detailed assessment has been completed and will be submitted to the Department of Agriculture, Water and the Environment, which documents sediments suitable for offshore disposal and details impacts associated with the disposal activity, as required by the permit application process.

A small quantity of about 12,000 cubic metres of sediment from the top one metre of the bed of the harbour would not be suitable for offshore disposal due to elevated levels of contamination. These materials would be loaded onto hopper barges and transported to a land-based load-out facility, outside of Middle Harbour, for transport by truck to land disposal at a licensed facility. Testing of the material has shown this material is suitable for disposal at a licensed facility as general solid waste (refer to Appendix M (Technical working paper: Contamination)).

Dredged and excavated materials for land-based disposal will be subject to waste classification under the *Waste Classification Guidelines* (NSW EPA, 2014b) and would be treated to make the material spadable (a consistency which allows the material to be spaded or shovelled). During this process, additives such as lime or absorbent polymers would be mixed into the material to assist in mitigating potential odour and to neutralise acid sulfate soils. This process is widely used on marine construction projects and has been applied on recent projects in Sydney Harbour, including Garden Island dredging works completed in 2010 and 2019. Once treated, materials would be loaded into sealed and covered trucks for transport to a suitably licensed disposal facility.

The environmental impact statement states that the location of a loadout facility for any dredged material not suitable for offshore disposal would be confirmed during further construction planning (refer to Table 28-2 of the environmental impact statement). Since public exhibition of the environmental impact statement, Transport for NSW has prepared a preferred infrastructure report and this includes further information on the associated load-out facility which would be located at the Port of Newcastle. Please refer to Section 5 of the preferred infrastructure report for further information.

#### Incidents involving spoil transport vehicles

Implementation of the various environmental management measures, including for construction traffic, waste management and hazards and risks (refer to Table D2-1 of this submissions report) will avoid, to the greatest extent possible, risks to traffic and public safety and achieve desired



performance outcomes in relation to identified issues. Further, environmental management measure CTT6 (refer to Table D2-1 of this submissions report) commits to ongoing consultation, as relevant to the location, with Greater Sydney Operations, the Port Authority of NSW, local councils, emergency services and bus operators to minimise traffic and transport impacts.

Wastes will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment as required by applicable legislation and revised environmental management measure WM4 (refer to Table D2-1 of this submissions report). Haulage routes would be designed to avoid local roads as far as possible, to minimise the risks associated with the transport of spoil and waste materials as described in Section C23.3.2 below.

Emergency response measures would be implemented in the event of a potential traffic incident during construction involving the transportation of spoil. Sydney Harbour Bridge emergency response measures would be implemented in the event of a potential traffic incident during construction involving the transportation of spoil on the bridge.

#### Potential waste management impacts on terrestrial and marine ecosystems

The environmental impact statement has assessed the potential for land-based and marine-based construction impacts based on the estimated resource use and waste qualities identified in Chapter 24 (Resource use and waste management) of the environmental impact statement. As discussed above, the level of assessment provided in the environmental impact statement is considered to be suitable for a project of this scale. The potential impacts to marine water quality from the transport, treatment and/or temporary storage of dredged and excavated materials is assessed in Chapter 17 (Hydrodynamics and water quality) of the environmental impact statement.

The environmental impact statement concludes that for both spoil and non-spoil wastes, the identified types and quantities of waste are typical of construction and demolition activities and can be adequately managed with the implementation of the proposed environmental management measures. Although the contractor/s would ultimately determine the location for off-site disposal or reuse of spoil, a number of potential sites were identified in the environmental impact statement.

Investigations during further design development and construction planning phases would inform the details of the project approach to resource use and waste materials generation. This would include the agreed objectives and targets included in the sustainability management plan (refer to further details in Section C23.1 above). In addition, waste management facilities licensed to receive different types of wastes would be identified and routes from the various temporary construction support sites would be included in the waste and resource management plan, as part of the construction environmental management plan.

Section C18.6 of this submissions report also responds to issues raised regarding potential impacts on aquatic biodiversity due to contamination, wastewater discharge and erosion and sedimentation risks as a result of the project.

#### Virgin excavated natural material

The majority of the spoil generated by the project would be virgin excavated natural material – typically consisting of crushed sandstone and shale. Virgin excavated natural material is generally considered a desirable material for clean and stable fill in development sites and major earthworks projects (refer to Section 6.9.4 of the environmental impact statement).

The indicative volume of spoil to be generated during construction of the project is presented in Table 24-6 of the environmental impact statement. The project's land-based construction activities

would generate about three million cubic metres of spoil. It is anticipated that the majority of this material would be used at development, construction or remediation sites across Greater Sydney.

Spoil will be classified prior to leaving the site in accordance with NSW and Australian standards and guidelines. Any surplus material requiring off-site disposal to land will be classified in accordance with *Waste Classification Guidelines* (NSW EPA, 2014b), as required by environmental management measure WM3 (refer to Table D2-1 of this submissions report). It would not be reasonable or practical to conduct this classification prior to excavation of the spoil.

### **C23.2.2 Water use**

#### ***Issue raised***

Submitters raised concerns that the project would use a large volume of water during construction and that this reduces the sustainability of the project.

#### ***Response***

Estimated water use for the construction of the project is addressed in Section 24.3.1 of the environmental impact statement. The average total water demand during construction is estimated to be about 2645 kilolitres per day. About 50 per cent (about 1442 kilolitres per day) would be sourced from mains supply (potable water) with the remainder coming from treated groundwater or harvested rainwater (non-potable water). Measures to avoid and minimise water consumption, particularly of potable water, would be 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
- Collection, treatment and use of wastewater and rainwater at temporary construction support sites to minimise the use of potable water sources during construction
- A water sourcing hierarchy would be implemented, where feasible and reasonable and where water quality and volume requirements are met as follows:
  - Stormwater harvesting (non-potable water)
  - On-site construction water treatment and reuse, including groundwater sourced from infiltration into tunnelling works (non-potable water)
  - Mains supply (potable water).

Opportunities for 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 for construction purposes, such as dust suppression and compaction of earthworks and pavement materials.

The efficient management of water is a key sustainability objective for the project, as identified in Table 25-4 of the environmental impact statement. The sustainability framework will continue to be developed and refined during further design development and through the development and implementation of a sustainability management plan (refer to environmental management measure SU2 in Table D2-1 of this submissions report).

### C23.2.3 Spoil generation and disposal

#### ***Issue raised***

Submitters raised concerns about spoil generation and management during construction, including:

- The removal of over three million tonnes of land-based spoil
- The volumes of spoil to be removed from the Balgowlah Golf Course construction support site (BL10) and Wakehurst Parkway east construction support site (BL13) construction support sites are disproportionate. More spoil should be moved via the Wakehurst Parkway east construction support site (BL13) since the site is on the edge of a residential area and not adjacent to a school
- Spoil disposal at Flat Rock Drive construction support site (BL2)
- Removal and disposal of potentially contaminated sediment from Middle Harbour.

#### ***Response***

Transport for NSW is committed to maximising beneficial reuse of spoil generated during construction as much as possible. The management of spoil, dredged and excavated materials during construction of the project would depend on a number of factors such as the type of spoil and whether it is considered to be suitable or unsuitable for reuse.

#### Removal and disposal of land-based spoil

As discussed in Section C23.2.1 above, about three million cubic metres of spoil would be generated from land-based construction activities during construction (also refer to Section 24.3.3 of the environmental impact statement). The majority of land-based spoil generated by the project would be crushed sandstone from tunnelling. It is anticipated that most of this material would be used at development, construction or remediation sites across Greater Sydney. This material is generally considered a desirable engineering fill and is typically reused in development sites and major earthworks projects across Greater Sydney.

Four potential off-site locations for reuse/disposal of spoil are provided in Section 24.3.3 of the environmental impact statement, namely:

- Western Sydney Airport
- Moorebank Intermodal Terminal Precinct
- Kurnell Landfill
- Penrith Lakes Scheme.

Other construction projects may also be potential options, and these would be investigated by the contractor/s during construction planning.

The management of spoil and excavated materials during construction of the project would depend on its composition eg rock, soil etc, its waste classification and whether it is feasible to be reused on-site, with reuse being a preferred approach where possible. The approach to management of land-based spoil and excavated materials is shown in Figure 24-1 of the environmental impact statement.

It should be noted that the proposed construction methodology for the project is to use roadheaders rather than tunnel boring machines for all tunnelling north and south of the Middle Harbour crossing. This is further detailed in Section 4.5.1 of the environmental impact statement. Different tunnelling methods were considered for the project and for a combination of reasons, roadheaders were selected as the preferred tunnelling methodology. A key factor in this decision was that tunnel

boring machines would generate about 50 per cent more spoil. Tunnel boring machines are much larger than roadheaders, and use a circular rotating cutting head. Tunnel boring machines therefore produce a large circular tunnel cross-section, whereas a roadheader has much greater versatility in being able to excavate any cross-sectional shape, including the caverns required at points where tunnel entry and exit ramps merge or diverge. The higher volumes of spoil generated by a tunnel boring machine would also increase haulage and disposal/reuse requirements. The decision to use roadheaders instead of tunnel boring machines as the preferred tunnelling methodology for the project for all tunnelling north and south of the Middle Harbour crossing would therefore minimise spoil production, which is a better resource use and waste management outcome.

#### Balgowlah Golf Course construction support site (BL10) and Wakehurst Parkway east construction support site (BL13)

As shown in Table 24-6 of the environmental impact statement, for the construction support sites located north of the Middle Harbour crossing the largest volumes of tunnel spoil would be extracted from the Balgowlah Golf Course (BL10) and Wakehurst Parkway east (BL13) construction support sites, with indicative volumes being 673,940 cubic metres and 564,850 cubic metres respectively. Both of these temporary construction support sites would be tunnel support sites and are essential to the efficiency of tunnelling along the two sections of tunnel from Middle Harbour to Balgowlah and from Middle Harbour to Killarney Heights. It would not be practical or efficient to alter the proportions of tunnel spoil removed from these two locations, as this would involve complex and costly operations underground to move material over long distances, which is considered to be unnecessary and would extend the duration of the project. As discussed in Section 23.3.1, tunnel excavation at Balgowlah Golf Course (BL10) and Wakehurst Parkway east (BL13) construction support sites would be within an acoustic shed and/or underground. The environmental management measures included in Table D2-1 of this submissions report will ensure that potential impacts on surrounding receivers are minimised.

As discussed above, the majority of land-based spoil generated by the project would be crushed sandstone from tunnelling. Although some of the spoil material can be utilised on site at locations like the Balgowlah surface works, it is anticipated that most of this material would utilise beneficial re-use opportunities at development, construction or remediation sites across Greater Sydney. This material is generally considered a desirable engineering fill and is typically reused in development sites and major earthworks projects across Greater Sydney, such as the new Western Sydney Airport works.

#### Spoil disposal at Flat Rock Drive construction support site (BL2)

The indicative volume of surplus land-based spoil to be extracted and managed through each of the temporary construction support sites is summarised in Table 24-6 of the environmental impact statement. Spoil from all temporary construction support sites will be classified in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014b) as required by environmental management measure WM3 (refer to Table D2-1 of this submissions report).

The management of potential contamination from any of the temporary construction support sites, including Flat Rock Drive construction support site (BL2), is discussed in Section 24.3.3 of the environmental impact statement. This could include encapsulation on-site and/or removal off-site to a suitably licensed disposal facility. Further investigations will be carried out at the Flat Rock Drive construction support site (BL2) to determine the feasibility of encapsulation of contaminated materials on site, as discussed in environmental management measure WM9 (refer to Table D2-1 of this submissions report). Where contaminated soils and other materials are to be encapsulated on-site, encapsulation will be designed in accordance with the requirements detailed in the *Guidelines*

*for the Assessment of On-site Containment of Contaminated Soil* (Australian and New Zealand Environment and Conservation Council (ANZECC), 1999).

### Removal and disposal of contaminated sediment from Middle Harbour

Handling, processing, transport and disposal of potential contaminated dredged sediments from Middle Harbour is discussed in Section C23.2.1 above.

Environmental management measures specifically designed to limit the impact on water quality and the disruption and dispersion of contaminated sediments are outlined in Table D2-1 of this submissions report.

As required by environmental management measure WQ16 (refer to Table D2-1 of this submissions report), management measures that will be implemented during dredging activities to minimise impacts on marine water quality, vegetation and habitats will include:

- a) Use of a backhoe dredge with a closed environmental clamshell bucket operated within a localised floating silt curtain enclosure to a depth of two to three metres to dredge the top layer of marine sediments
- b) Implementation of 10 to 12 metre deep-draft silt curtains around the dredge works
- c) Implementation of silt curtains in accordance with revised environmental management measure B31 and environmental management measures B32 and B33.

## **C23.3 Handling, transport and storage**

### **C23.3.1 Storage and stockpiling of spoil and waste**

#### ***Issue raised***

Submitters raised concerns about the storage of spoil and waste during construction. Specific objections, requests and concerns included:

- Objections to waste being stored outside acoustic sheds, including contaminated wastes
- Requests that stockpiles be stored in enclosures
- Requests that no stockpiling be allowed at Flat Rock Drive and Cammeray
- Concerns about the storage of spoil and contaminated material at Cammeray, Flat Rock Drive and Balgowlah
- Concerns over the impacts of flooding on potentially contaminated spoil stored at the Flat Rock Drive construction support site (BL2).

#### ***Response***

The assessment of potential construction impacts relating to the storage of spoil and waste is outlined in Section 24.3.3 of the environmental impact statement.

### Stockpiling of tunnel spoil in acoustic sheds

Tunnel excavation at the Cammeray Golf Course (BL1), Flat Rock Drive (BL2), Punch Street (BL3), Balgowlah Golf Course (BL10) and Wakehurst Parkway east (BL13) construction support sites would be within an acoustic shed and/or underground, as indicated in Section 6.4.1 of the environmental impact statement. An acoustic shed is an enclosed noise mitigation structure that facilitates noisy works (such as tunnel excavation, including tunnel spoil handling activities) to take place outside of standard construction hours, without impacts on nearby receivers.

Stockpiling of tunnel spoil would only occur within the acoustic sheds or underground and acoustic sheds would be designed to accommodate stockpiled tunnel spoil accordingly. Underground stockpiling would supplement the capacity of the acoustic sheds, enabling ample excess tunnel spoil to be stored in case of transport delays due to conditions such as wet weather at spoil disposal sites, as well as over long weekends and public holidays. As an example, the mainline tunnel in the vicinity of the Flat Rock Drive construction support site (BL2) has two tunnel merge caverns where the Gore Hill Ramp tunnels join the mainline tunnels. These caverns are four to five lanes wide and about 200 metres long and have adequate capacity for underground tunnel spoil storage if required.

Spoil from tunnelling works represents the vast majority of spoil generated by the project and would be transported from the tunnel face to the surface using dump trucks. Spoil will be classified prior to leaving the site in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014b) (refer to environmental management measure WM3 in Table D2-1 of this submissions report). It is anticipated that most of this material would be used at development, construction or remediation sites across Greater Sydney, as discussed in Section C23.2.3 above.

#### Stockpile storage of tunnel spoil versus earthworks stockpiles and contaminated material

Tunnel spoil stockpiles would be contained within acoustic sheds or below ground within the tunnels being excavated, as described above.

Other earthworks, such as those required for establishing temporary construction support sites, carrying out surface road works and utility works, cut and cover and trough structures may require the stockpiling of earthworks materials on site if these materials cannot be loaded directly into trucks.

Earthworks would include bulk excavation, excavation for new pavement or pavement widening and placement and compaction of general fill and selected fill (refer to Section 6.5.1 of the environmental impact statement). Where earthworks are required, excavated material would be loaded directly into trucks and removed from site or unloaded and compacted directly into new fill areas or stockpiled for future reuse on the project. Tunnelling spoil would be used as fill material if it is available at the time required for surface earthworks. This is likely to involve stockpiling to ensure locally sourced materials could be utilised on site at the appropriate times rather than needing to be transported off site as spoil or to site from other sources, as stated in Section 6.5.1 of the environmental impact statement. Where fill material cannot be placed directly from trucks, stockpile areas would be established within temporary construction support sites and/or the construction footprint as required. Watercarts would be used to add moisture to aid compaction and control the generation of dust. In addition, concrete batch plant stockpiles and pavement material stockpiles would also be required at various locations. These non-tunnel related material stockpiles would be located outside of acoustic sheds however represent only a fraction of the total spoil quantities generated for the project.

The indicative location and volume of earthworks/non-tunnel related material stockpiles located outside of acoustic sheds is provided in Table 24-7 of the environmental impact statement and includes the temporary construction support sites at Cammeray Golf Course (BL1), Flat Rock Drive (BL2), Dickson Avenue (BL4), Balgowlah Golf Course (BL10), Wakehurst Parkway upgrade and Wakehurst Parkway south (BL12).

Several of the temporary construction support sites that would require stockpiling of material outside of acoustic sheds are large sites that are located away from residential receivers or within industrial areas which would further minimise potential amenity impacts. Appropriate environmental management measures such as bunding and dust suppression will be in place to minimise environmental and amenity impacts from the proposed stockpiles as described in Table D2-1 of this submissions report.

Potential impacts from leachate (ie contaminated liquid that drains from a landfill or stockpile) are considered unlikely during construction as the project does not involve the excavation or disturbance of known historical landfill areas with the exception of the Flat Rock Drive construction support site (BL2). In this instance, further investigation of this site is proposed (refer to revised environmental management measure SG8) and additional environmental management measures to reduce impacts on site workers and the local community from disturbance and potential mobilisation of contaminated materials are proposed (refer to revised environmental management measure SG9 and environmental management measure SG13 in Table D2-1 of this submissions report). Further information regarding the potential presence and management of contamination is provided in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement.

#### Impact of flooding on spoil stockpiles

Spoil stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside of the 10 per cent annual exceedance probability flood extent, in accordance with environmental management measure F8 (refer to Table D2-1 of this submissions report). The exact level of flood risk accepted at stockpile sites will depend on the duration of stockpiling operations, the type of material stored, the nature of the receiving drainage lines and also the extent to which it would impact flooding conditions in adjacent development.

### **C23.3.2 Transport of waste**

#### ***Issue raised***

Submitters raised concerns about the transport of waste during construction. Specific concerns, requests and suggestions included:

- Concerns about the transportation of contaminated sediment via Spit Bridge, Clontarf Beach and Balmoral Beach
- Concerns about the lack of clarity regarding the proposed haulage routes from temporary construction support sites and the location for disposal
- Requests that the project considers opportunities for alternate spoil haulage routes to avoid impacts on residential areas including Willoughby, Cammeray and Northbridge
- Suggestions for spoil haulage to be permitted 24 hours a day, seven days a week to reduce the intensity of traffic related impacts
- Requests that the option of progressing the tunnel link to Artarmon is investigated to transport spoil and reduce the duration of haulage over local roads such as Flat Rock Drive
- Suggestions for trucks delivering quarry products to concrete batch plants to be backfilled with tunnel spoil to take back to the quarry sites for use in rehabilitation works.

#### ***Response***

#### Transport of contaminated sediment and proposed haulage routes

The management of dredged material is discussed in Section 24.3.3 of the environmental impact statement and Section C23.2.1 above.

Wastes will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment as required by legislation and revised environmental management measure WM4 (refer to Table D2-1 of this submissions report).

It is proposed that dredged material suitable for offshore disposal would be loaded into a hopper barge and transported to the designated offshore disposal area. Material not suitable for offshore

disposal would be loaded into a hopper barge and transported to a land-based load-out facility, outside of Middle Harbour, for transport by truck to land disposal at a licensed facility (refer to Section C23.2.1 above for further detail).

Various management measures will be implemented during dredging activities to minimise impacts on marine water quality, vegetation and habitats, as required by environmental management measure WQ16 (refer to Table D2-1 of this submissions report). The type of dredge tool proposed is a closed environmental clamshell, which is used to minimise the spread of excavated material into the water column. The hopper barges are specially designed to hold dredged sediments and not allow overflow as described in Table 6-4 of the environmental impact statement. These measures are proposed to manage potential pollution impacts associated with the transportation of dredged material, including in the areas surrounding Spit Bridge, Clontarf Beach and Balmoral Beach.

#### Proposed haulage routes from temporary construction support sites

About three million cubic metres of spoil would be generated from land-based construction activities (terrestrial spoil) during construction, as discussed in Section C23.2.1. The majority of land-based spoil generated by the project would be crushed sandstone from tunnelling. It is anticipated that most of this material would be used at development, construction or remediation sites across Greater Sydney.

Four potential off-site locations for reuse/disposal of spoil are provided in Section 24.3.3 of the environmental impact statement and Section C23.2.3 above. Other construction projects may also be potential options, and these would be investigated by the contractor/s during construction planning. As the location of the disposal sites are not yet confirmed, the specific haulage routes are also not able to be confirmed. Considerations applied to selection of potential temporary construction support sites for the project included maximising opportunities for direct access to motorways and arterial roads or water transport opportunities for construction traffic and avoiding the need to use local residential streets if possible.

A key focus of future construction planning would be to minimise the need for heavy vehicles to travel through residential areas and limit the distance travelled to access the arterial road network.

Spoil haulage routes at temporary construction support sites would be confirmed through detailed design and construction planning with the following aims:

- Minimise the use of local or residential streets and maximise the use of arterial roads
- Minimise safety implications for pedestrians, cyclists and other road users
- Avoid the need to pass through or under the Sydney central business district
- Minimise the cumulative use of roads accessing different construction sites
- The movement of haulage vehicles accessing ancillary construction sites would be coordinated to minimise potential queuing and traffic access and disruptions in the local area.

Where feasible and reasonable, unless compliance with the relevant traffic noise criteria can be achieved, or alternative arrangements have been agreed with affected receivers, construction vehicle movements will not occur on local roads beyond those required for direct access to construction sites, as required by environmental management measure CNV6 (refer to Table D2-1 of this submissions report).

The proposed construction vehicle haulage routes to be used would be confirmed in the construction traffic management plan which would be a sub-plan of the construction environmental management plan. Route alternatives would be considered prior to the preferred routes included in the traffic management plan as detailed in Section D1 of this submissions report.



### Spoil haulage hours

Spoil would only be removed during the day, and outside of peak daytime periods where reasonable and feasible to minimise traffic and noise impacts to the community.

General site activities and spoil haulage would be carried out during standard construction hours (7am to 6pm Monday to Friday, 8am to 1pm Saturday). A coustic sheds would be designed to accommodate stockpiled tunnel spoil within the shed thereby removing the requirement for tunnel spoil haulage outside of standard hours, as discussed in Section C23.3.1 above. Some deliveries to and from the temporary construction support sites would be required outside of standard construction hours. However, feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements at night. Typical construction hours for each location are provided in Section 6.8 of the environmental impact statement and environmental management measure CTT8 (refer to Table D2-1 of this submissions report) commits to managing construction road traffic to minimise impacts of movements during peak periods where feasible and reasonable. The project conditions of approval would also specify the hours during which construction can occur, including spoil haulage activities. Works outside the specified construction hours may be allowed subject to following the process outlined in environmental management measure CNV2 and revised environmental management measure CNV3 (refer to Table D2-1 in this submissions report).

Given the volume of spoil to be removed, the project would require construction to progress on multiple work fronts simultaneously and therefore transport of spoil be carried out from multiple locations. Therefore, selecting only one location for removal of spoil (such as the tunnel link to Artarmon) would not be feasible. All temporary construction support sites have been selected to allow efficient access to and from arterial or regional roads and therefore limit construction traffic on local roads. Temporary construction support sites, including access arrangements, are described in Section 6.8 of the environmental impact statement.

A key reason for the selection of Flat Rock Reserve construction support site (BL2) was that it would provide direct arterial road access, avoiding haulage through local streets and town centres and direct impacts to private properties, as discussed in Section 4.5.7 of the environmental impact statement. The size of the site allows for the construction of an access decline and the ability to tunnel in three different directions, reducing the number of required intermediate tunnelling sites.

Further details of construction traffic and transport are discussed in Chapter 8 (Construction traffic and transport) of the environmental impact statement.

### Spoil transport optimisation

The suggestion to unload a quarry product and re-load with tunnel spoil to optimise construction vehicle movements is subject to a number of considerations, including that the quarry source requires the volume and type of product being removed from the project which is often not the case. Other considerations include the construction method and program sequencing and therefore opportunities to optimise construction processes, including materials haulage, would need to be decided by the construction contractor as part of detailed construction planning. Construction traffic management measures will be implemented to minimise traffic impacts as a result of the project as discussed in Chapter 8 (Construction traffic and transport) of the environmental impact statement and provided in Table D2-1 of this submissions report.

### **C23.3.3 Resource and waste management environmental management measures**

#### ***Issue raised***

Submitters raised concerns about environmental management measures relating to resource and waste management. Specific concerns, requests and suggestions included:

- Concerns about the contractor/s exceeding guidelines for waste disposal
- Requests for waste to be stored in sheds, hosed down and covered when transported
- Requests that containment measures are implemented to ensure that the risk of asbestos is not transferred from Flat Rock Reserve to the southern slopes of Northbridge and surrounding community
- Suggestions to revise environmental management measure WM4 to prevent leaks of contaminated materials which could impact on waterways.

#### ***Response***

##### Regulations for waste management and disposal

Waste management and disposal is regulated in NSW through the *Protection of the Environment Operations Act 1997* and the Protection of the Environment Operations (Waste) Regulation 2014 as described in Section 24.1 of the environmental impact statement. The regulation contains penalties for non-compliance.

Waste and any surplus material requiring off-site disposal to land, including marine sediments unsuitable for offshore disposal, will be classified in accordance with *Waste Classification Guidelines* (NSW EPA, 2014b) as required by environmental management measure WM3. All wastes would be disposed of at appropriately licenced waste facilities. Specific disposal facilities and collection contractors for the disposal of waste would be selected during construction planning and documented in the waste and resource management plan for the project as discussed in Section 24.5 of the environmental impact statement.

##### Management of waste stockpiles

Tunnel spoil stockpiles would be contained within acoustic sheds or below ground within the tunnels being excavated as described in Section C23.3.1 above.

Wastes will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment as required by revised environmental management measure WM4 (refer to Table D2-1 of this submissions report).

Standard construction air quality (dust) mitigation and management measures will be detailed in the air quality management plan, including minimising dust emissions during the transfer, handling and on site storage of spoil and construction material eg the covering of vehicle loads in accordance with revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report).

##### Risk of asbestos pollution

The risk of asbestos, including measures to be implemented to reduce potential contamination impacts, is described in Chapter 16 (Geology, soils and groundwater) of the environmental impact statement. Potential contamination at Flat Rock Reserve at Northbridge is discussed in Section 16.4.3 of the environmental impact statement.

Asbestos handling, management and disposal will be carried out in accordance with relevant legislation, codes of practice and Australian standards. A number of environmental management measures that will minimise potential pollution from asbestos-contaminated material, are described

in Table D2-1 of this submissions report. This includes handling, management and disposal in accordance with relevant legislation, codes of practice and Australian standards (as required by environmental management measure SG10), the conduct of hazardous materials assessments prior to and during the demolition of structures (revised environmental management measure SG11) and protocols for the discovery of any previously unidentified contaminated materials (environmental management measure SG13).

#### Revised environmental management measure WM4

Potential leachate impacts (ie contaminated liquid that drains from a landfill or stockpile of contaminate material) are considered unlikely during construction as the project does not involve the excavation or disturbance of known historical landfill areas with the exception of the Flat Rock Drive construction support site (BL2). Waste will be handled and stored in a manner that prevents pollution of the surrounding environment in accordance with revised environmental management measure WM4, as discussed in Section C23.2 above. In addition to WM4, a number of other environmental management measures designed to address erosion and sedimentation and pollution of the environment will also assist with the management of this issue including: SG8, SG9, SG12 and SG13 (refer to Table D2-1 of this submissions report). Updates to revised environmental management measure WM4 to address potential leachate impacts are therefore not considered necessary.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C24 – Sustainability

## C24 Sustainability

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## C24.1 Adequacy of assessment

### ***Issue raised***

Submitters raised concerns in relation to the adequacy and accuracy of the sustainability assessment process, including:

- The overall response to the Secretary's environmental assessment requirements are inadequate, including:
  - The sustainability framework for the project lacks clarity, particularly the sustainability commitments
  - The project should seek to achieve the highest Infrastructure Sustainability rating of 'Leading' rather than 'Excellent' under the Infrastructure Sustainability Council rating scheme
  - Inadequate information provided on the sustainability management plan and lack of consultation with the community on this plan
- Lack of information on how offset credits for the sustainability rating scheme would be achieved and implemented, where the offsets would take place and the party responsible for the offsets
- Lack of information on sustainability workshops held during project development and any decisions made from the workshops
- The project has a poor climate profile at a time when projects should be reducing emissions and does not meet changing public attitudes towards climate change.

### ***Response***

#### Secretary's environmental assessment requirements

A sustainability framework has been developed for the project to ensure that sustainability is embedded in project planning, design, construction and operation. The framework provides the overarching vision, objectives, targets and implementation approaches for the project, as described in Section 25.2 of the environmental impact statement.

The sustainability framework is underpinned by sustainability principles outlined in applicable legislation, policies and guidelines and these have directed the consideration and integration of sustainability in the project design and assessment completed (refer to Section 25.2.1 of the environmental impact statement). The sustainability framework also establishes the sustainability vision and policy for the project. Sustainability commitments, and how the project would deliver these commitments, are outlined in Figure 25-2 of the environmental impact statement. The sustainability framework would continue to be developed and refined in future phases of the project's delivery. The key implementation tools and processes that have been, and would continue to be, applied to the delivery of the sustainability framework are shown in Figure 25-1 of the environmental impact statement.

Activities to implement the sustainability framework, including requirements from the Infrastructure Sustainability rating scheme, will be implemented through a sustainability management plan. The management plan will detail measures to meet the sustainability objectives and targets outlined in Chapter 25 (Sustainability) of the environmental impact statement and achieve 'Design' and 'As Built' ratings of 'Excellent' under the Infrastructure Sustainability Council rating scheme, as required by revised environmental management measure SU2 (refer to Table D2-1 of this submissions report) and the Secretary's environmental assessment requirements. The Infrastructure Sustainability Council rating scheme has three levels of certification: 'Commended', 'Excellent' and the highest level – 'Leading'. A rating of 'Excellent' is considered an appropriate target for the

project, noting that this drives performance beyond business-as-usual, while allowing flexibility in approach and not precluding the achievement of even higher performance in different categories and subsequent project stages. The sustainability management plan would be developed during further design development, and as such has not been made available for public consultation and comments.

### Sustainability offsets

Registered Infrastructure Sustainability Council professionals would carry out an assessment of the project, independent from the planning process for the project, to rate the total credits required and identify the measures or actions required to achieve these credits under the Infrastructure Sustainability rating. Experienced personnel engaged by the contractor/s during further design development would implement the design and construction requirements needed to achieve the credits required, and the contractor/s would submit evidence to support the project's claimed rating to the Infrastructure Sustainability Council for accreditation to ensure a transparent assessment process.

### Sustainability workshops

During the design and development of the project and preparation of the environmental impact statement, a number of sustainability workshops were carried out with the Transport for NSW planning and design teams and subject matter experts to develop draft sustainability targets and objectives for the project, as outlined in Table 25-5 of the environmental impact statement. While the process and the workshop results are typically not published, the workshops produced conclusions and outcomes that would be reflected in the project's alignment with the Infrastructure Sustainability rating, which is published on the Infrastructure Sustainability Council website. The workshops and meetings with Transport for NSW helped to provide an early indication of the credits likely to be achieved by the project, and verify that the intended rating of 'Excellent' can be achieved. During further design development and construction, the project would account for the rating scheme requirements and independent assessors from the Infrastructure Sustainability Council would assess and confirm the project's overall sustainability rating.

### Project climate profile

Potential construction and operational impacts on greenhouse gas emissions are assessed in sections 26.2.3 and 26.2.4 of the environmental impact statement respectively. The estimated construction stage emissions represent about 0.6 per cent of NSW emissions and about 0.13 per cent of Australia's national emissions in 2018. The estimated operational emissions would represent about 0.03 and 0.04 per cent of projected NSW emissions in 2027 and 2037 respectively, and 0.01 per cent of Australia's projected national emissions in both 2027 and 2037. While these percentage contributions are small within the NSW and national contexts, environmental management measures are proposed to further minimise greenhouse gas emissions during the construction and operation of the project (refer to Table D2-1 of this submissions report). Greenhouse gas emissions will be managed and minimised as part of the sustainability management plan and will be implemented to assist in achieving 'Design' and 'As Built' ratings of 'Excellent' under the Infrastructure Sustainability Council rating scheme (Version 1.2), as required by revised environmental management measures SU2 and GHG2 (refer to Table D2-1 of this submissions report).

## C24.2 General sustainability

### ***Issue raised***

Submitters raised concerns about sustainability impacts of the project. Specific concerns include:

- The project would not meet sustainability principles, and it would not make Sydney a more sustainable city or support the city's economic growth
- The project does not effectively consider ecologically sustainable development
- Concerns that road projects in general do not lead to a more liveable, accessible or sustainable city
- The project would not be sustainable due to the volumes of waste generated, concrete produced and water used.

### ***Response***

#### Project sustainability

The project would establish robust sustainability objectives and targets to achieve the sustainability vision for the project and to contribute to the outcomes of the relevant NSW Government and Transport for NSW policies and guidelines outlined in Section 25.2.1 of the environmental impact statement, including:

- *Environmental Planning and Assessment Act 1979*
- *Future Transport Strategy 2056* (NSW Government, 2018)
- *Sustainability Design Guidelines Version 4.0* (Transport for NSW, 2017b)
- *NSW Government Resource Efficiency Policy* (NSW Government, 2019a)
- *Transport Sustainable Procurement Policy* (Transport for NSW, 2016a)
- *Transport Environment and Sustainability Policy* (Transport for NSW, 2020h)
- *Environmental Sustainability Strategy 2019 – 2023* (Roads and Maritime Services, 2019)
- *Beyond the Pavement 2020* (Transport for NSW, 2020a)
- *Infrastructure Sustainability Rating Scheme Version 1.2* (Infrastructure Sustainability Council of Australia, 2016).

Indicative objectives and targets (subject to later refinement to allow for incorporation of any relevant approval conditions) are outlined in Table 25-4 of the environmental impact statement and would contribute to achieving the policies and guidelines above through maximising sustainable procurement, minimising energy use and greenhouse gas emissions, optimising resource efficiency and resilience to climate change. The project would support Sydney's long term economic growth through improved motorway access and connections across strategic population centres and future growth areas, and has considered and incorporated ecologically sustainable development principles such as intergenerational equity in Table 25-5 of the environmental impact statement. Further discussion on the principles of ecologically sustainable development is provided in Section C24.3 below.

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 concerns. As a result of an expanding future population, employment and urban growth, Sydney can expect worsening road network and traffic conditions if integrated transport initiatives are not implemented. The project would 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 to contribute to a sustainable city.

The sustainability framework is underpinned by sustainability principles outlined in applicable legislation, policies and guidelines. Chapter 25 (Sustainability) of the environmental impact statement describes how sustainability principles have been applied to the design, construction and operation of the project, including the sustainability framework, legislation and policies relevant to the project and application of the principles of ecologically sustainable development to the project.

### Resource use

The assessment of resource use and waste management for the project included the identification of opportunities associated with the avoidance, minimisation and reuse of waste, including targets for the beneficial reuse of solid waste, wastewater and other waste consistent with the project's sustainability framework (refer to Chapter 24 (Resource use and waste management) of the environmental impact statement).

A number of environmental management measures have been proposed with regards to resource use and waste management during construction and operation (refer to Table D2-1 of this submissions report). These measures include 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 identified and implemented to reduce material use and maximise the use of materials with low embodied environmental impact, where feasible. During construction, the resource management hierarchy principles established under the *Waste Avoidance and Resource Recovery Act 2001* of avoid/reduce/reuse/recycle/dispose will be applied, as required by environmental management measure WM2 (refer to Table D2-1 of this submissions report). In addition, environmental management measures WM3 and WM4 (refer to Table D2-1 of this submissions report) will be implemented during construction to minimise contamination and waste.

With regards to water usage, measures to avoid and minimise water use, particularly of potable water, have been included in the project design (refer to Section 24.4.1 of the environmental impact statement). Opportunities to reuse treated groundwater during project operation will be considered where feasible and reasonable, as required by environmental management measure WM12 (refer to Table D2-1 of this submissions report).

## **C24.3 Principles of ecologically sustainable development**

### **C24.3.1 Precautionary principle**

#### ***Issue raised***

Submitters raised concerns about the precautionary principle, including that the project:

- May result in irreversible impacts to Sydney Harbour, Burnt Bridge Creek, Flat Rock Reserve, Manly Dam, Wakehurst Parkway, Balgowlah, Seaforth, Manly Vale, Manly Lagoon, Bantry Bay and ecosystems and waterways in the project footprint
- Has too many uncertainties and issues left to resolve in future design development, and that some environmental impacts would therefore be unavoidable as the environmental impact statement was based on an early stage of the design.

## ***Response***

### Impacts to the environment across the project footprint

The overall sustainability approach of the project, including how ecologically sustainable development principles were applied as an integral part of the design and assessment of the project, are outlined in Chapter 25 (Sustainability) of the environmental impact statement. The precautionary principle was applied during the project development and design through:

- Considering potential environmental impacts associated with the project in the alternatives and options analysis
- Identifying opportunities to avoid and minimise surface disturbance
- Using a conservative approach in environmental assessment, including assessing worst case impacts and scenarios, using best practice environmental standards and goals
- Identifying environmental risks associated with the project and developing safeguards and environmental management measures to reduce risks
- Holding sustainability workshops and meetings to develop draft sustainability targets and objectives for the project.

Specific examples of the application of the precautionary principle during preparation of environmental assessments for the project include:

- Biodiversity: the biodiversity assessment aligns with principles of the *Biodiversity Assessment Method* (Office of Environment and Heritage (OEH), 2017) to avoid and minimise impacts on native vegetation and habitat where possible, through the project development process; a number of measures were included to avoid and minimise impacts on biodiversity during project construction and operation (refer to Section 19.4 of the environmental impact statement and Appendix S (Technical working paper: Biodiversity development assessment report))
- Air quality: modelling for a number of worst case operational scenarios to demonstrate conservative assessment of air quality under the worst operating conditions are included in Appendix H (Technical working paper: Air quality)
- Groundwater: modelling of 'drained' tunnels including a number of conservative modelling assumptions associated with the hydraulic connectivity between surface and groundwater are included in Annexure F of Appendix N (Technical working paper: Groundwater)
- Construction noise: an assessment of construction noise due to typical and reasonable worst case construction activities at temporary construction support sites and surface road upgrades is included in Appendix G (Technical working paper: Noise and vibration)
- Human health: the human health impacts for air quality from the worst case operating conditions and for construction noise from the worst case construction scenarios are assessed in Appendix I (Technical working paper: Health impact assessment)
- Traffic and transport: an assessment of worst case construction traffic movements, including worst case cumulative construction impacts is included in Appendix F (Technical working paper: Traffic and transport).

From the environmental assessments listed above, the project is not anticipated to result in any threats of serious or irreversible environmental damage, including Sydney Harbour, Burnt Bridge Creek, Flat Rock Reserve, Manly Dam, Wakehurst Parkway, Balgowlah, Seaforth, Manly Vale, Manly Lagoon, Bantry Bay and ecosystems and waterways in the project footprint. However, to manage and further reduce environmental impacts, including the ecosystems and waterways across the project footprint, environmental management measures were developed for the project as provided in Table D2-1 of this submissions report.

### Project uncertainties

The project design would continue to be refined during further design development. The design would be guided by sustainability principles established during the planning and assessment phase of the project, including those outlined in sections 25.2 and 25.3 of the environmental impact statement. Since the design would be subject to further development, the environmental assessment that has been carried out used a conservative approach and modelled scenarios to account for both the worst case and realistic scenarios that could arise during the project construction and operation.

Should the project receive approval, any changes to the project thereafter would be reviewed for consistency to identify if the design refinements would result in any potential environmental or social impacts of a greater scale or impact than previously assessed and documented in the environmental impact statement (refer to Section 28.3 of the environmental impact statement). Further, current project uncertainties would be addressed and resolved during further design development, as outlined in Table 28-2 of the environmental impact statement. The proposed resolutions to project uncertainties are also reflected in the proposed environmental management measures (refer to Table D2-1 of this submissions report).

#### **C24.3.2 Intergenerational equity**

##### ***Issue raised***

Submitters raised concerns about the principle of intergenerational equity, including:

- Future generations would be impacted by an increase in car usage and impacts on green space, air quality and the noise environment as a result of the project
- The project does not achieve intergenerational equity due to a lack of consideration of public transport alternatives and does not future-proof the environment in the Northern Beaches
- The project does not meet the health and wellbeing needs of the present and future generations as it would impact on local landmarks, threatened species and biodiversity, and the productivity of the local environment including at Middle Harbour.

##### ***Response***

The project has committed to improving the operation of transport networks across Sydney while minimising the extent of impacts on green spaces in the project construction footprint, with the project development underpinned by the ecologically sustainable principles identified in Section 25.3 of the environmental impact statement, including the principle of intergenerational equity.

The project has avoided or sought to minimise permanent impacts to the environment through an extensive design development process and the identification of environmental management measures (refer to Table D2-1 of this submissions report).

While the project has been designed to provide improved capacity, access and connectivity for road users, it is also designed to reduce impacts to air quality and minimise noise during construction and operation, where possible to further minimise impacts on current and future generations (refer to Chapter 12 (Air quality), Chapter 10 (Construction noise and vibration) and Chapter 11 (Operational noise and vibration) of the environmental impact statement).

During the development of the project alternatives transport modes, including the provision of public transport, were considered in terms of their effectiveness in meeting the project needs (refer to Section 4.3.5 of the environmental impact statement). This assessment found that the physical and urban geography of the Northern Beaches region presents barriers to the consideration of rail-based alternatives in addressing the transport challenges faced by the region. Improved bus services on

existing surface corridors were also considered, however it was found that alone they would not be sufficient to provide the additional level of transport capacity required for the Northern Beaches region. For the benefits to the B-Line and other public transport to be sustained over the long term, investment in additional road capacity, through alternative routes or modes for corridors at capacity, is critical to improve the transport performance of the network in this area, as noted in Section 3.2.4 of the environmental impact statement. The Beaches Link and Gore Hill Freeway Connection project would provide a step-change in travel times and reliability for bus services, and resilience for the critical road network servicing the Northern Beaches region.

The application of the principle of intergenerational equity in the project development process is outlined in Section 25.3 of the environmental impact statement. The project will minimise impacts on the environment of the Northern Beaches through various environmental management measures that will be applied to aspects such as biodiversity, social and visual amenity, and human health (refer to Table D2-1 of this submissions report). The project has been designed to provide opportunities for public and active transport improvements, connect currently disconnected communities and facilitate greater access to community infrastructure, which is anticipated to benefit multiple future generations through population and economic growth.

The project has been designed to meet the needs of both current and future generations, with a design life of 100 years to contribute to the capacity and safety of road network users in the Northern Beaches. In addition to increasing the resilience of the road network, the project's resilience to future climate change is also enforced by adaptation measures incorporated into the design (refer to Chapter 26 (Climate change risk and greenhouse gas) of the environmental impact statement) and would continue to be considered in further design development. The project is also providing new and improved open space and recreation facilities at Balgowlah to continue providing community benefits after the project is completed. The environmental management measures for potential environmental impacts provided in Table D2-1 of this submissions report have been prepared to minimise impacts during construction and operation, and will be implemented to protect the future health, diversity and productivity of the environment.

### **C24.3.3 Biological diversity and ecological integrity**

#### ***Issue raised***

Submitters raised concerns about the principle of conservation of biological diversity and ecological integrity, including:

- The project does not align with the principles of conservation of biological diversity and ecological integrity as defined by the *Protection of the Environment Administration Act 1991*, due to proposed biodiversity impacts of the project being too large, and the proposed environmental management measures such as offsets are too limited and insufficient to conserve biodiversity, including endangered ecological communities near Manly Dam
- The need to preserve forests and wildlife areas to align with the *NSW Climate Change Policy Framework* (OEH, 2016a) (achieving net zero emissions by 2050).

#### ***Response***

The project has been designed and assessed with the aim of identifying, avoiding, minimising and mitigating impacts to biodiversity. Five different alignment alternatives were considered as part of the project development process to avoid and minimise potential impacts, including impacts to biodiversity (refer to Chapter 4 (Project development and alternatives) and Section 19.4 of the environmental impact statement). Through this process, consideration was given to avoiding and minimising biodiversity impacts by locating project elements as far as practicable away from areas

of biodiversity value. Where this was not possible, project elements were situated in areas with lower biodiversity values as noted in Table 25-5 of the environmental impact statement.

The potential impacts on terrestrial flora and fauna, aquatic biodiversity and marine biodiversity including threatened species, are assessed in 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.

Throughout the refinement of the design a number of elements were incorporated to avoid and minimise impacts on biodiversity including in bushland and wildlife areas across the project footprint, as outlined in Section 19.4 of the environmental impact statement. For example, direct impact on the Burnt Bridge Creek riparian corridor has been reduced by establishing an exclusion zone around riparian native vegetation adjoining the creek. Impacts to terrestrial fauna connectivity have been minimised by providing a number of fauna crossings spanning the Wakehurst Parkway that would provide fauna connectivity between Garigal National Park to the west and Manly Warringah War Memorial State Park to the east. Impacts to the Duffys Forest endangered ecological community have also been avoided as far as possible by optimising the location of the tunnel portals and permanent tunnel support facilities. These strategies, among others would act to preserve vegetation and biodiversity across the project footprint and enable the project to align with the sustainability principles outlined in Chapter 25 (Sustainability) of the environmental impact statement.

The project has sought to reduce construction and operational emissions where relevant, including avoiding or minimising the removal of vegetation during project design where possible, in line with *NSW Climate Change Policy Framework* (OEH, 2016a). The projected greenhouse gas emissions resulting from the removal of vegetation as a loss of a carbon sink are presented in Table 3-22 of Appendix X (Technical working paper: Climate change and greenhouse gas calculations). Total projected greenhouse gas emissions associated with the removal of vegetation would be about 2.9 kilotonnes of carbon dioxide equivalent, representing a small portion of the construction emissions and an even smaller portion of NSW emissions and Australia's national emissions (based on 2018 emissions) (refer to Table 26-5 of the environmental impact statement). While these percentage contributions are small within the NSW and national contexts, environmental management measures are proposed to further minimise vegetation removal and greenhouse gas emissions during the construction and operation of the project (refer to Table D2-1 of this submissions report).

#### **C24.3.4 Improved valuation and pricing**

##### ***Issue raised***

Submitters raised concerns about the ecologically sustainable development principles of improved valuation, pricing and incentive mechanisms. Concerns include the suggestion that project impacts were not valued correctly, as the environment may be impacted from unfiltered ventilation outlets, and increased traffic during project operation may impact the health and amenity of local communities.

### **Response**

The design of the project incorporates the principle of improved valuation and pricing of environmental resources as outlined in Table 25-5 of the environmental impact statement. Opportunities were identified in the design development to improve local amenity, public transport access, and active transport connections, and create new open space and public recreation facilities, demonstrating that the project has considered the value of environmental resources.

The opportunities and costs associated with planning, design and implementation of the project environmental management measures have been included within the overall project costs. The environmental factors and impacts associated with the project have been included in the valuation and cost estimates of the project.

The tunnel ventilation system would be designed and operated so that the operational in-tunnel air quality limits would not be exceeded. The potential health impacts associated with changes in air quality within the local community have been assessed for the project and are considered to be acceptable (refer to Section 13.5 of the environmental impact statement) and therefore ventilation outlet filtration is not considered necessary.

Specific issues related to air quality, traffic and transport, health and visual amenity (and other issues) will be addressed through the implementation of the environmental management measures provided in Table D2-1 of this submissions report. Responses to other community submissions received regarding air quality and health are provided in sections C11 and C12 of this submissions report respectively.

## **C24.4 Sustainability in transport**

### **Issue raised**

Submitters suggested that the project should provide Northern Beaches with a sustainable transport option such as a stronger public transport system or more walking and cycling networks. Concerns were raised that the project as a toll road is not a sustainable mass transit option and does not provide a sustainable response to congestion.

### **Response**

The project is forecast to reduce traffic demands and improve travel times and reliability across the road network in the Northern Beaches, and as such is expected to contribute to increased resilience of the network and reduced operational greenhouse gas emissions on Sydney's road network when compared to the project not being built (refer to Table 25-5 of the environmental impact statement). Buses, as a public transport mode, are also anticipated to utilise the project and benefit from reduced congestion, and therefore have improved travel times and improved reliability. The project is expected to increase the effectiveness of public transport specifically on the Military Road/Spit Road and Warringah Road/Eastern Valley Way corridors (refer to Section 4.3.1 of the environmental impact statement) as a result of reduced congestion.

While other public transport modes could be considered as strategic alternatives to the project, they are in fact complementary to the project and form part of a broader integrated transport network, and therefore do not negate the need to provide additional road capacity and improve connectivity across the Northern Beaches and lower North Shore.

*Sydney's Cycling Future* (Transport for NSW, 2013a) and *Sydney's Walking Future* (Transport for NSW, 2013b) outline that journeys made by cycling and walking are generally for short trips only, therefore improvement in active transport alone would not meet the project need of improving existing capacity constraints between the strategic centres across Greater Sydney and the Northern

Beaches. The project would however provide multiple active transport links, including a new shared user path along the Wakehurst Parkway to improve pedestrian and cyclist connectivity between Seaforth and Frenchs Forest, and to recreational areas in Garigal National Park and Manly Warringah Ware Memorial State Park. Other active transport additions and improvements that would improve existing networks and accessibility as well as user safety are provided in Table 5-9 of the environmental impact statement.

## **C24.5 Sustainability environmental management measures**

### ***Issue raised***

Submitters raised requests and concerns for sustainability considerations during project construction and operation, including:

- Requests for the project to require the use of sustainable materials, methods and lowest emissions technology available during construction and to use building materials with the highest environmental standards
- Requests for a minimum level of recycled material to be used in the project and for the project to have clear targets and innovative methods for materials use and disposal, waste minimisation and resource management
- Requests for renewable energy to be used during the construction and operation of the project
- Request to incentivise the use of electric vehicles and provide for electric vehicle charging at temporary construction support sites
- Concerns that the project does not have a carbon neutral footprint and requests for the project to be certified carbon neutral during construction and operation and to have an offset through carbon sequestration projects.

### ***Response***

Transport for NSW projects are underpinned by broader sustainability frameworks and are required to align with policies such as the *Transport Environment and Sustainability Policy* (Transport for NSW, 2020h), *Sustainability Design Guidelines Version 4.0* (Transport for NSW, 2017b) as well as the *Infrastructure Sustainability Rating Scheme Version 1.2* (Infrastructure Sustainability Council of Australia, 2016), all of which are embedded into the project sustainability framework and the overall project sustainability policy and vision. These frameworks guide the direction for implementing sustainability initiatives during delivery of infrastructure projects, including the Beaches Link and Gore Hill Freeway Connection project, and would continue to deliver sustainability thinking and targets throughout project design, planning, construction and operation.

### **Sustainable materials**

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, to the extent reasonably practicable, as required by revised environmental management measure WM1 (refer to Table D2-1 of this submissions report).

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.

In addition, the project sustainability vision and policy both commit to achieving excellence in sustainability, including to encourage innovation, setting high environmental and sustainability standards and to develop and maintain an environmental management framework to embed best practice pollution management and sustainable outcomes during construction (refer to Figure 25-2 of the environmental impact statement).

### Recycling and waste

The contractor/s for the project would determine how the sustainability objectives would be embedded into supply chain requirements. Nonetheless, construction materials will be sourced in accordance with the project's sustainability framework to optimise resource efficiency and waste management and with a preference for Australian materials and prefabricated products with low embodied energy, to the extent reasonably practicable, as required by environmental management measures WM10 and revised environmental management measure WM1 (refer to Table D2-1 of this submissions report) and the *Waste Avoidance and Recovery Act 2001*. Opportunities for wastewater reuse and recycling, including use of stormwater from sediment basins and recirculating water during tunnel excavation to use for dust suppression or off-site reuse, will be investigated and implemented where feasible and reasonable, as required by environmental management measure WM6 (refer to Table D2-1 of this submissions report).

Measures to minimise the generation of waste have been included in the design and construction planning for the project and are listed in Section 24.3.2 of the environmental impact statement. They include:

- Prioritisation of pre-cast concrete structural elements to improve efficiency and minimise waste
- On-site sorting of materials like timber, steel and concrete to maximise resource reuse on site or near to the site where possible
- Chipping and mulching of cleared vegetation for reuse on site as a preference to disposal where appropriate or reusing salvaged logs for fauna connectivity structures and habitat enhancement measures.

### Energy and electricity

Measures to avoid and minimise electricity consumption have been included in the design and construction planning for the project. Indicative sustainability objectives and target themes to minimise energy use are provided in Table 25-4 of the environmental impact statement. Examples of target themes to optimise resource efficiency and waste management are outlined in Section 24.3.1 of the environmental impact statement and include:

- Use of guidance systems for tunnel excavation and rock bolting to ensure efficient use of tunnelling equipment to minimise excessive electricity consumption
- Use of energy efficient site buildings and equipment at temporary construction support sites, including use of solar powered lights and signage, where feasible and reasonable
- Efficient design of electricity transmission systems to supply power as efficiently as possible.

Energy efficiency will also be considered during further design development with energy efficient systems installed where reasonable and practicable, as required by environmental management measure GHG1 (refer to Table D2-1 of this submissions report).



### Electric vehicles

While the project has taken into consideration improvements in fuel efficiency and increases in electric vehicles that would help reduce overall emission on Sydney's roads in the future, a significant uptake of electric vehicles was not included in the modelling scenarios and traffic projects. While the project can accommodate electric vehicles during operation, electric vehicle infrastructure such as charging stations are generally built on private land and are not the responsibility of Transport for NSW, and therefore are outside the scope of this project. Measures to incentivise electric vehicles and associated infrastructure are also a policy matter for the NSW Government and beyond the scope of the project design submitted for approval in the environmental impact statement.

### Carbon neutrality

There are no regulatory or legislative requirements for the Beaches Link and Gore Hill Freeway Connection project to be carbon neutral, or to obtain complete certifications or offsets regarding carbon neutrality. However, the project will continue to draw upon ecologically sustainable development principles to ensure greenhouse gas emissions will be managed and minimised as part of the sustainability management plan and to assist in achieving 'Design' and 'As Built' ratings of 'Excellent' under the Infrastructure Sustainability Council rating scheme (Version 1.2), as required by environmental management measure GHG2 (refer to Table D2-1 of this submissions report) and discussed in Section C24.1 above.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C25 – Climate change and greenhouse gas

## **C25 Climate change and greenhouse gas**

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## C25.1 Adequacy and accuracy

### ***Issue raised***

Submitters raised concerns regarding the adequacy and accuracy of the climate change risk and greenhouse gas assessments in the environmental impact statement. Submitters raised specific concerns and requests including:

- The project has not considered climate change projections
- The climate change risk assessment does not consider construction impacts, the energy demand of the ventilation outlets or induced traffic demand
- The greenhouse gas assessment does not consider traffic travelling to the tunnels
- Requests for the environmental impact statement to disclose energy efficiency measures.

### ***Response***

#### Climate change projections

The design of the project and assessment of climate change risk have been prepared in accordance with Australian Standard *AS 5334-2013 Climate Change Adaptation for Settlements and Infrastructure – A Risk-based Approach* (Standards Australia, 2013) and guided by the draft *Technical Guide: Climate Adaptation for the Road Network* (Roads and Maritime Services, unpublished).

The assessment of climate change risk was informed by climate change projections over three periods, the years 2030, 2050 and 2090, which broadly reflect the operating timeframes of different elements of the project, as detailed in Section 26.1.3 of the environmental impact statement. Further discussion on the climate change risk assessment methodology is included in Section 26.1.2 of the environmental impact statement.

#### Climate change risk assessment

The results of the climate change risk assessment are presented in Table 26-3 of the environmental impact statement. The table is simplified to only include those initial risks (ie before mitigation or treatment measures are applied) which were rated as high or medium. Many other risks which may be encountered were considered but were not included in the summary table as the risk ratings associated with these items were lower than a medium rating, with a low or negligible rating.

The climate change risk assessment focused on the climate or climate influenced variables with the potential to affect the operation and maintenance of the project, based on the projections which look at shifts in climate patterns over decades. Risks such as construction impacts, the energy demand of the ventilation outlets, induced demand, etc are not valid climate variables and would not affect the operation or maintenance of the project and therefore are not included in the risk assessment.

Construction impacts, the energy demand of the ventilation outlets, induced demand and other impacts of the project on greenhouse gas emissions are considered in the greenhouse gas assessment in Table 26-5 and Table 26-6 of the environmental impact statement. Table 26-5 of the environmental impact assessment summarises the impacts of the construction of the project on greenhouse gas emissions. Table 26-6 of the environmental impact statement summarises the impacts of the operation and maintenance of the project on greenhouse gas emissions and includes the energy demand of the ventilation outlets and fuel consumed by vehicles using the road network.

### Traffic travelling to the tunnels

The methodology for the greenhouse gas assessment is based on relevant greenhouse gas reporting legislation and international reporting guidelines, as described in Section 26.2.2 of the environmental impact statement.

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 greenhouse gas emissions associated with each greenhouse gas source using equations and emission factors specified in the *Greenhouse Gas Assessment Workbook for Road Projects* (Transport Authorities Greenhouse Group (TAGG), 2013).

The modelling of traffic emissions was based on estimates of traffic volumes on about 6000 road links across a domain that covers about 20 kilometres by 20 kilometres, well beyond the extent of the tunnels themselves, as described in Appendix X (Technical working paper: Climate change and greenhouse gas calculations). The assessment of greenhouse gas emissions therefore takes into consideration the movement of all vehicles within the modelled area, including those vehicles within the tunnels.

### Energy efficiency

During the further design development phase and following engagement of the contractor/s, energy efficiency will be further considered, and specific energy efficiency measures to be implemented will be confirmed, including the installation of energy efficient systems where reasonable and practicable in accordance with the environmental management measure GHG1 (refer to Table D2-1 of this submissions report).

In the construction phase, greenhouse gas emissions will be managed and minimised as part of the sustainability management plan (refer to environmental management measure GHG2 in Table D2-1 of this submissions report).

## **C25.2 Emissions from the project overall**

### ***Issue raised***

Submitters raised general concerns about emissions from the project and their contribution to climate change.

### ***Response***

Greenhouse gas emissions attributable to the project during construction are discussed in Section 26.2.3 of the environmental impact statement and those associated with operation are discussed in Section 26.2.4 of the environmental impact statement.

The project is part of a suite of current and future transport initiatives outlined in the *Future Transport Strategy 2056* (NSW Government, 2018) that would work together to provide additional cross-harbour transport capacity, as stated in Section 4.3.6 of the environmental impact statement. Moving to an environmentally, economically and socially sustainable transport system is essential to tackle climate change, create liveable places and a productive economy, reduce congestion, and support the better health and wellbeing of communities. The project would contribute to the

development of this sustainable transport system, with reduced traffic demands and improved travel times and reliability across the road network in the Northern Beaches, contributing to increased resilience of the network. Although greenhouse gas emissions are also projected to increase as traffic numbers across the road network grow, the expected reduction in congestion as a result of the project and expected improvements in fuel efficiency and increases in electric vehicles, are projected to result in improvements to the overall efficiency of emissions. The project would increase the number of road links across the network, but 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.

The estimated construction stage emissions of the project represent about 0.6 per cent of NSW emissions and about 0.13 per cent of Australia's national emissions compared to a 2018 baseline as detailed in Section 26.2.3 of the environmental impact statement. Due to the indirect nature of Scope 3 emissions, a proportion of these emissions may be generated interstate or internationally.

The estimated operation phase emissions of the project represent about 0.03 and 0.04 per cent of projected NSW emissions in 2027 and 2037 respectively, and 0.01 per cent of Australia's projected national emissions in both 2027 and 2037 as detailed in Section 26.2.4 of the environmental impact statement.

While these percentage contributions are small within the NSW and national contexts, environmental management measures have been developed to ensure greenhouse gas emissions are addressed effectively during further design development and construction (refer to Table D2-1 of this submissions report).

### **C25.3 Emissions during construction**

#### ***Issue raised***

Submitters raised concerns that the proposed construction methodology is emissions intensive. Specific concerns and comments on the sources and impacts of greenhouse gas emissions include:

- The amount of transport, resources and materials required for the project and their associated carbon dioxide emissions, including the use and number of diesel plant and heavy vehicles, waste generated, water and concrete required
- The loss of green space and tree removal having an effect on carbon absorption and contributing to the heat island effect.

#### ***Response***

##### Emissions arising from construction materials use and consumption

The greenhouse gas assessment for the project considered emissions associated with materials used and consumed during the construction of the project. The emissions likely to arise from the construction phase of the project are provided in the response to Section C25.2 above and are small in comparison to the NSW and national projected emissions totals.

Given the scale of the project, substantial quantities of materials would be used for construction. Indicative quantities and the potential sources of construction materials are provided in Table 24-2 of the environmental impact assessment.

The design of the project has included careful consideration of the construction methodology and the selection of materials and resources to ensure they are fit for purpose and minimise resource consumption. Measures to avoid, minimise or manage resource consumption and waste generation as a result of the project are detailed in Table D2-1 of this submissions report. These measures

include sourcing construction materials in accordance with the project's sustainability framework and with a preference for Australian materials and prefabricated products with low embodied energy, to the extent reasonably practicable (refer to revised environmental management measure WM1).

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. An example of one such opportunity is Transport for NSW's commitment to use a minimum of 10 per cent recycled content (when locally available and fit for purpose) by volume in road base and subbase as per target RW5 in the *Environmental Sustainability Strategy 2019-2023* (Roads and Maritime Services, 2019). In addition, all resources consumed for the project will be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001* waste management hierarchy of avoid, recover, dispose, in accordance with environmental management measures WM2 and WM11 (refer to Table D2-1 of this submissions report).

Other measures to manage and minimise resource use and consumption would be outlined in the sustainability management plan which would include the requirement for consideration of fuel efficient plant for construction activities (environmental management measure GHG2) and consideration of installation of energy efficient systems where reasonable and practicable (environmental management measure GHG1). Refer to Table D2-1 of this submissions report for these and other environmental management measures.

#### Loss of green space, tree removal and urban heat island effect

The project design development process has considered a number of opportunities to avoid or minimise vegetation removal through the selection of the preferred corridor, refinement of the preferred corridor design and development of the construction methodology as described in Section 19.4 of the environmental impact statement. However, some vegetation removal is unavoidable during construction, with total projected greenhouse gas emissions associated with vegetation removal being about 2.9 kilotonnes of carbon dioxide equivalent (CO<sub>2</sub>-e) or 0.4 per cent of construction emissions.

Following completion of construction, land areas no longer required for construction, including areas of new and improved public open space and recreation areas, would be rehabilitated which would restore a portion of the lost carbon sink (refer to environmental management measure LP5 in Table D2-1 of this submissions report). 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* (Roads and Traffic Authority (RTA), 2011a), as required by environmental management measure B13 (refer to Table D2-1 of this submissions report). Mature amenity trees removed by construction will be replaced at a ratio of 2:1, in accordance with revised environmental management measure V13 (refer to Table D2-1 of this submissions report).

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 localised areas of high urban development. The urban heat island effect is not considered to contribute directly to global warming, however the localised warming is likely to be exacerbated by increased temperatures due to climate change.

As the vast majority of the project is located underground or involves replacing existing hard surfaces or previously cleared surfaces with new hard surfaces, the project is considered to have only a minor impact on the urban heat island effect.

An urban design and landscape plan will be developed during further design development and implemented in line with the strategic urban design framework for the project, as required by environmental management measure V1 (refer to Table D2-1 of this submissions report). The plan will detail landscape treatments including the planting of trees, shrubs and groundcover that would provide shade and reduce the potential urban heat island effect. Further information is provided in Chapter 22 (Urban design and visual amenity) of the environmental impact statement.

## **C25.4 Emissions during operation**

### ***Issue raised***

Submitters questioned whether there would be a reduction in operational greenhouse gas emissions following the implementation of the project.

### ***Response***

The primary sources of operational greenhouse gas emissions from the project are associated with electricity, maintenance and traffic (fuel consumed by vehicles) as outlined in Section 26.2.4 of the environmental impact statement and detailed in Section 3.2.2 of Appendix X (Technical working paper: Climate change and greenhouse gas calculations).

The greenhouse gas assessment shows that greenhouse gas emissions for electricity, maintenance, and traffic are projected to increase under both the 'Do minimum' (no project), and the 'Do something' and 'Do something cumulative' (includes project) scenarios due to an increase in traffic volumes across the road network and the associated increase in fuel consumed by vehicles using the road network. However, despite these projected increases, the greenhouse gas emissions from road traffic with the project are projected to increase only slightly relative to the 'Do minimum' scenario by 1.4 to 6.6 per cent, both in 2027 (year of project opening) and 2037 (10 years after project opening). Refer to Table 3-26 of Appendix X (Technical working paper: Climate change and greenhouse gas).

Although traffic volumes across the road network are projected to increase following operation of the project, the efficiency of vehicles using the road network is also forecast to improve, due to fewer vehicle stop and start movements, less congestion and an increase in average vehicle speed which would have a positive effect on the project greenhouse gas emissions.

This outcome 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.

## **C25.5 Environmental management measures**

### ***Issue raised***

Submitters raised concerns that the proposed greenhouse gas environmental management measures are inadequate to address energy efficiency and emission of greenhouse gases during construction. Alternative environmental management measures were proposed including that electricity be sourced from 100 per cent renewable sources, and steel emissions reduced by at least 50 per cent, including through sourcing from mills using green hydrogen.

### ***Response***

Transport for NSW's *Environmental Sustainability Strategy 2019-2023* (Road and Maritime Services, 2019) seeks to deliver a more sustainable transport system in NSW, identifying specific focus areas for integrating sustainability into Transport for NSW's road projects and services. The



strategy includes the focus area of energy and carbon management and the objective to minimise energy use and reduce carbon emissions without compromising the delivery of services to customers, reiterating Transport for NSW's support for the long-term objectives of the *NSW Climate Change Policy Framework* (Office of Environment and Heritage, 2016a). To achieve this objective Transport for NSW aims to reduce its carbon footprint through a range of policies including the sourcing of construction materials. The project is committed to aligning with, supporting and, where feasible, exceeding the ambitions of the *Environmental Sustainability Strategy 2019-2023*.

The greenhouse gas assessment identified environmental management measures (refer to Table D2-1 of this submissions report) to be incorporated into the construction and operational framework for the project to address risks and maximise opportunities to embed sustainability principles at the heart of the project.

During construction, a sustainability management plan would be developed during further design development to drive improvements in achieving sustainability targets including minimising and managing greenhouse gas emissions. It is crucial for the plan to be developed post-engagement of the contractor/s to ensure it and the opportunities identified are specific to their design and construction methodology. Measures to minimise greenhouse gas emissions would be implemented to assisting in achieving an "Excellent" rating under the *Infrastructure Sustainability Rating Scheme Version 1.2* (Infrastructure Sustainability Council of Australia (ISCA), 2016) to verify the project sustainability performance.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C26 – Cumulative impacts

## C26 Cumulative impacts

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## C26.1 Adequacy of the cumulative impact assessment

### Issue raised

Submitters were concerned about the adequacy of the cumulative impact assessment. Specific concerns included:

- Cumulative impacts due to the upgrade of the Willoughby Leisure Centre have not been considered
- Cumulative impacts of the Northside Storage Tunnel infrastructure have not been considered or assessed
- Combined greenhouse gas emissions for the Western Harbour Tunnel and Beaches Link program of works would be more than what was indicated in the environmental impact statement.

### Response

#### Willoughby Leisure Centre pool area upgrades project

The potential cumulative impacts of the project during construction and operation are assessed in Chapter 27 (Cumulative impacts) of the environmental impact statement. The assessment was based on publicly available information available at the time of its preparation. The project environmental impact statement was placed on public exhibition on 9 December 2020 with an exhibition closing date of 1 March 2021.

Willoughby Leisure Centre pool area upgrades project has been proposed by Willoughby City Council and would involve alterations and additions to existing pool facilities. Given the timing of the release of concept plans for Willoughby Leisure Centre pool area upgrades in late 2020 and lodgement of the development application documentation in early 2021, there was limited opportunity to consider this upgrade in the cumulative impact assessment detailed in Chapter 27 (Cumulative impacts) of the environmental impact statement.

In response to the issue raised, the assessment of potential cumulative impacts associated with the Willoughby Leisure Centre pool area upgrades is detailed below.

When applying the screening criteria for cumulative impact assessment in Table 27-2 of the environmental impact statement, the Willoughby Leisure Centre pool area upgrades would meet the criteria of location, timeframe and status as it is located opposite Flat Rock Drive construction support site (BL2), is anticipated to begin construction in 2022 and is currently under statutory environmental impact assessment. However, given the scale of work anticipated with the Willoughby Leisure Centre pool area upgrades, the potential for cumulative impacts with the Beaches Link and Gore Hill Freeway Connection project is considered minor and would be limited to impacts during construction as discussed in Table C26-1 below. Potential cumulative impacts during operation would be considered negligible.

**Table C26-1 Potential cumulative construction impacts – Willoughby Leisure Centre pool area upgrades**

| Environmental impact  | Willoughby Leisure Centre pool area upgrades   |
|-----------------------|--|
| Traffic and transport | There is potential for increased construction vehicle traffic on the local road network at Naremburn and Willoughby during the assumed construction overlap. However, based on construction routes detailed in Section 7.2.5 of the amended <i>Willoughby Leisure Centre Pool Redevelopment Statement of</i> |

| Environmental impact                  | Willoughby Leisure Centre pool area upgrades   |
|---------------------------------------|--|
|                                       | <p><i>Environmental Effects</i> (Urbis, 2021), the Willoughby Leisure Centre pool area upgrades would use different routes compared to the project.</p> <p>There is also potential impact to public parking availability at the Flat Rock Reserve car park which is located within the Flat Rock Drive construction support site (BL2). The project would provide a replacement public car park slightly to the north of the existing car park, as shown in Figure 6-31 of the environmental impact statement. Access to the adjusted public car parking area would be via Small Street. The Willoughby Leisure Centre pool area upgrades proposes construction worker parking to be located at the Flat Rock Reserve car park. However, the amended <i>Willoughby Leisure Centre Pool Redevelopment Statement of Environmental Effects</i> (Urbis, 2021) also proposes that the use of public transport or car-pooling would be encouraged during the entire construction period for the pool upgrades.</p> <p>Given the above, and implementation of revised environmental management measure CTT11 (refer to Table D2-1 of this submissions report) by the project, it is anticipated that cumulative impacts to the existing parking availability at the Flat Rock Reserve can be managed. As such, the overall construction cumulative impact on parking is considered to be minor.</p> |
| Noise and vibration                   | <p>There is potential for additional and prolonged temporary increase in construction noise for residential receivers from construction works for the Willoughby Leisure Centre pool area upgrades and the establishment of the Flat Rock Drive construction support site (BL2). However, with the implementation of the environmental management measures to manage construction noise detailed in Table D2-1 of this submissions report and the proposed environmental management measures in Appendix X of the amended <i>Willoughby Leisure Centre Pool Redevelopment Statement of Environmental Effects</i> (Urbis, 2021), the potential for cumulative noise impacts would be considered minor.</p>  |
| Socio-economic, land use and property | <p>There is potential for additional and prolonged temporary amenity impacts in the Willoughby residential area in the vicinity of the Willoughby Leisure Centre pool area upgrades and Flat Rock Drive construction support site (BL2).</p> <p>Potential additional and prolonged temporary impacts to public open space and recreation facilities as Flat Rock Drive construction support site (BL2) would require the temporary use of a small area of Flat Rock Reserve and the Willoughby Leisure Centre pool area upgrades would require temporary use of a netball court as part of construction and associated impacts.</p>  |
| Biodiversity                          | <p>The majority of the trees to be removed during the Willoughby Leisure Centre pool area upgrades are of low environmental significance due to their exotic species or limited useful life expectancy. Landscaping works proposed for the Willoughby Leisure Centre pool area upgrades include appropriate tree replacement with native species, including six spotted gums trees that would be planted at the Small Street frontage and five spotted gums are proposed to be planted within the Willoughby Leisure Centre site (Urbis, 2021).</p> <p>While the project includes clearing associated with the establishment of Flat Rock Drive construction support site (BL2), with the limited biodiversity value impacted by the Willoughby Leisure Centre pool area upgrades and environmental management measures included in Table D2-1 of this submissions report to manage project impacts, the cumulative biodiversity impacts would be minor.</p>   |

While the potential for cumulative impacts between the project and the Willoughby Leisure Centre pool area upgrades is considered minor, there is potential for the Willoughby Leisure Centre pool area upgrades to add to the potential for construction and complaint fatigue for nearby residential receivers at Naremburn and Willoughby as discussed in Section 27.3.7 of the environmental impact statement.

To address this issue, the Willoughby Leisure Centre pool area upgrades project has been added to revised environmental management measure CI2 to allow for its inclusion in multi-party engagement to manage construction fatigue impacts as follows (refer to Table D2-1 of this submissions report):

Multi-party engagement and cooperation will be established prior to construction to coordinate with the following projects to manage construction fatigue impacts where possible:

- a) Western Harbour Tunnel and Warringah Freeway Upgrade
- b) Sydney Metro City & Southwest
- c) Channel 9 site staged residential redevelopment
- d) Willoughby Leisure Centre pool area upgrades.**

#### Northside Storage Tunnel

The Northside Storage Tunnel was completed in September 2000 and is therefore not required to be considered as part of the cumulative impact assessment detailed in Chapter 27 (Cumulative impacts) of the environmental impact statement.

The Northside Storage Tunnel follows a different alignment to the project although the two pieces of infrastructure would cross at three separate locations. The location where the two tunnels are at their closest is at Sailors Bay Road, near Strathallen Avenue at Northbridge, where the project crosses the Scotts Creek branch of the Northside Storage Tunnel. At this location, the Northside Storage Tunnel is about 30 metres below the Beaches Link tunnels and therefore no interactions or impacts are expected. At the other two crossing locations, the distance between the two tunnels is even larger, so similarly no impacts are expected.

Notwithstanding, utility and infrastructure owners will continue to be consulted during the further design development and construction planning phase of the project. Utility and infrastructure owners will be consulted prior to the commencement of excavation or tunnelling works which may potentially affect the asset to identify settlement criteria and appropriate mitigation measures to ensure, where possible, that the asset will not experience exceedances of the relevant criteria, as required by new environmental management measure SG21 (refer to Table D2-1 of this submissions report).

#### Greenhouse gas emissions calculations in the environmental impact statement

For both the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection environmental impact statements, scenario modelling was carried out to determine greenhouse gas emissions projected for a 'Do something cumulative' scenario. This scenario accounted for multiple projects operating in conjunction, including the Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, Sydney Gateway, M6 Motorway Stage 1 and Sydney Metro City & Southwest (refer to Table 3-14 in Appendix X (Technical working paper: Climate change and greenhouse gas calculations)). Due to further design development that occurred after the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement was published, the Beaches Link and Gore Hill Freeway Connection environmental impact statement subsequently made adjustments to the greenhouse gas emissions calculations.

The 2037 projected emissions for operational electricity in a cumulative scenario was 73.7 ktCO<sub>2</sub>-e in Table 3-27 of Appendix X (Technical working paper: Climate change and greenhouse gas calculations) of the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement, while the corresponding projected emissions was 69.8 ktCO<sub>2</sub>-e in Table 3-27 of Appendix X (Technical working paper: Climate change and greenhouse gas calculations) of the Beaches link and Gore Hill Freeway Connection environmental impact statement. These differences were due to the emissions factors for electricity consumption having changed in between the calculations for the two projects (refer to Table 3-11 in Appendix X (Technical working paper: Climate change and greenhouse gas calculations)). The Scope 2 and Scope 3 emission factors reduced between 2017 to 2019 due to the National Greenhouse Accounts Factors being updated and reviewed every year, and as a result the total emissions calculated for cumulative operational electricity was also lower in the Beaches Link and Gore Hill Freeway Connection project.

While the projected emissions for cumulative 2037 operational electricity are different, the projections for other emissions are very similar across both projects, including cumulative emissions for maintenance in 2027 and 2037 (rounded to 1.6 ktCO<sub>2</sub>-e), traffic vehicle emissions (rounded to 45 ktCO<sub>2</sub>-e in 2027 and 68 ktCO<sub>2</sub>-e in 2037) (refer to Table 3-27 in Appendix X (Technical working paper: Climate change and greenhouse gas calculations)). This indicates that overall, for the Western Harbour Tunnel and Beaches Link program of works, the operational emissions reflected the same calculation methodologies being used and similar findings in terms of emissions that would be generated.

Energy efficiency will be considered during further design development with energy efficient systems installed where reasonable and practicable, as required by environmental management measure GHG1. Greenhouse gas emissions will be managed and minimised as part of the sustainability management plan and will be implemented to assist in achieving 'Design' and 'As Built' ratings of 'Excellent' under the Infrastructure Sustainability Council of Australia rating scheme (Version 1.2), as required by environmental management measure GHG2 (refer to Table D2-1 of this submissions report).

## **C26.2 Cumulative impacts associated with Western Harbour Tunnel and Warringah Freeway Upgrade**

### **C26.2.1 Increased traffic and transport impacts**

#### ***Issue raised***

Submitters raised concerns about cumulative traffic and transport impacts associated with the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects. Specific concerns included:

- Increased construction traffic, particularly near temporary construction support sites
- Increased operational traffic and transport impacts in North Sydney, increased parking demand, and the introduction of a toll on the Sydney Harbour Bridge heading north.

#### ***Response***

##### **Construction traffic impacts**

Peak cumulative construction traffic is expected in 2024, if construction of the project and the Western Harbour Tunnel and Warringah Freeway Upgrade project are carried out concurrently. The main areas where cumulative impacts could be experienced are at North Sydney and Cammeray. Cumulative construction traffic impacts from the project and the Western Harbour Tunnel and Warringah Freeway Upgrade project are summarised in Chapter 27 (Cumulative impacts) of the

environmental impact statement with further detail provided in Section 8.4.6 of the environmental impact statement and Appendix F (Technical working paper: Traffic and transport). The discussion in Section 8.4.6 of the environmental impact statement is based on modelling a cumulative construction 2024 scenario.

Under the cumulative construction 2024 scenario, as detailed in Section 8.4.6 of the environmental impact statement, key impacts include:

- Cumulative construction activities are only expected to have minor and manageable impacts on overall network performance in the Warringah Freeway and surrounds area, with an increase in traffic demand by about one per cent
- Travel times would increase by less than one minute for most routes. Predicted travel time increases between one and three minutes are expected for the following routes:
  - Warringah Freeway: Gore Hill Freeway to Sydney Harbour Bridge (AM peak)
  - Warringah Freeway: Gore Hill Freeway to Sydney Harbour Tunnel (AM peak)
  - Warringah Freeway: Falcon Street to Sydney Harbour Bridge (PM peak)
  - Miller Street: Amherst Street to Berry Street (AM peak)
  - Miller Street: Berry Street to Amherst Street (PM peak).
- A number of intersections at Warringah Freeway surrounds would experience minor impacts to the level of service in the AM and PM peaks. During the AM peak, intersections which would experience a material increase in average vehicle delay (around 30 to 40 seconds) include Willoughby Road/Gore Hill Freeway interchange, intersection of Brook Street and Merrenburn Avenue and Brook Street/Warringah Freeway off ramp. During the PM peak, some intersections within the North Sydney area would experience a minor increase in average vehicle delay
- For Warringah Freeway bus routes, increased traffic demand, including potential additional traffic movements across the southbound bus lane south of Falcon Street, could increase congestion, which could impact bus travel times.

Potential cumulative construction traffic and transport impacts will be managed through the implementation of relevant construction traffic and transport environmental management measures for each project, which are documented in Table D2-1 of this submissions report and Table D2-1 of the Western Harbour Tunnel and Warringah Freeway Upgrade submissions report. Cumulative impacts will be managed through the establishment of considered and tailored multi-party engagement and cooperation prior to construction to ensure all contributors to impacts are working together to minimise adverse impacts or enhance benefits of multiple projects occurring concurrently or consecutively, in accordance with environmental management measure C11 (refer to Table D2-1 of this submissions report). Haulage routes and road occupancy will be coordinated with other major transport projects via Greater Sydney Operations. If both projects are under construction concurrently, works at the Cammeray Golf Course construction support site (BL1) would be planned and programmed to manage any overlap between the two projects and minimise impacts on the surrounding road network and road users.

### Operational traffic impacts in North Sydney

Potential cumulative traffic and transport impacts during the operation of the project have been assessed in Chapter 9 (Operational traffic and transport) of the environmental impact statement. Modelling of cumulative impacts included various projects including NorthConnex, WestConnex, Western Harbour Tunnel and Warringah Freeway Upgrade, Beaches Link and Gore Hill Freeway Connection, Sydney Gateway, M6 Motorway Stage 1, Sydney Metro City & Southwest and Northern



Beaches Hospital road upgrade (as summarised in Table 9-3 of the environmental impact statement). Under the 'Do something cumulative' scenario, the project is expected to improve accessibility between the Northern Beaches and destinations south of Sydney Harbour. When considered with the Western Harbour Tunnel and Warringah Freeway Upgrade project, the modelled road network performance in the Warringah Freeway and surrounding areas is expected to improve in terms of average travel speeds, and overall network capacity and connectivity across Sydney Harbour Bridge and Sydney Harbour Tunnel, including around North Sydney, could improve during peak periods (refer to Section 9.4.2 of the environmental impact statement).

Under the 'Do something cumulative' scenario, localised increases in travel times for some local trips within North Sydney such as on Miller Street would be expected. While average delays around some localised intersections in North Sydney could experience an increase, road users within and around North Sydney would generally benefit from the substantial overall travel time savings on the broader network, and traffic impacted at individual intersections in the North Sydney area is therefore still anticipated to receive a substantial net benefit due to the broader connectivity and efficiency improvements (refer to Section 9.4.2 of the environmental impact statement).

Further assessment was requested by the Department of Planning, Industry and Environment for particular locations where the environmental impact statement indicated potential localised intersection traffic performance impacts (refer to Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report), including through the North Sydney CBD. The refined operational traffic modelling for the 2037 'Do something' and 2037 'Do something cumulative' scenarios in the morning and evening peaks generally result in an improvement to overall road network performance compared to the 2037 'Do minimum' scenario, and the performance of intersections in focus would be maintained or improved with the project, with a few exceptions where minor residual impacts to isolated intersection delay are reported.

Transport for NSW would continue to investigate further opportunities to provide additional benefits or mitigate any residual impacts within the North Sydney CBD and surrounds through the Western Harbour Tunnel and Beaches Link program of works and/or other relevant processes such as the North Sydney Integrated Transport Program (discussed in Section B14.5.2 of this submissions report). The North Sydney Integrated Transport Program is a staged program of road based network and place improvements developed by Transport for NSW in close partnership with North Sydney Council, Greater Sydney Commission and Government Architect NSW. Given the context of this complex, constrained, urban area, additional mitigations would focus on multi-modal strategies to reduce private vehicle demand rather than seek to deliver further road capacity upgrades.

A review of operational network performance will be carried out after 12 months, and again after five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections, in accordance with environmental management measure OT1 (refer to 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 that used in Appendix F (Technical working paper: Traffic and transport). Where required, additional feasible and reasonable mitigation measures will be identified in consultation with Department of Planning, Industry and Environment and the relevant council to manage any additional traffic performance impacts identified during the review of operational network performance.

Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network during operation. Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable, as required by environmental management measure OT2 (refer to Table D2-1 of this submissions report).

Parking demand in North Sydney during operation is not expected to be materially changed by the cumulative impacts of the Beaches Link and Gore Hill Freeway Connection project and the Western Harbour Tunnel and Warringah Freeway Upgrade project. Existing parking supply in North Sydney is constrained and subject to high levels of demand. The Western Harbour Tunnel and Beaches Link program of works would not increase parking supply; without increased parking supply it is not practically possible for the project to increase parking demand.

### Sydney Harbour Bridge northbound tolling

The issue of tolling is addressed in Section C28.5 of this submissions report. The decision to apply tolls to roads is a NSW Government decision and is not made at the project level. While no decision on tolls for northbound traffic using the Sydney Harbour Bridge and Sydney Harbour Tunnel has yet been made, the 'Do something cumulative' scenario assumes that tolls would apply to all north and southbound trips on all harbour crossings in the future, including two-way tolling on the Western Harbour Tunnel, Beaches Link tunnel, Sydney Harbour Tunnel and Sydney Harbour Bridge.

## **C26.2.2 Construction noise and vibration impacts**

### ***Issue raised***

Submitters raised concerns about cumulative construction noise and vibration impacts for receivers in Cammeray associated with the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects.

### ***Response***

The cumulative impact assessment has considered potential cumulative construction noise and vibration impacts as a result of the Western Harbour Tunnel and Beaches Link program of works in Section 10.6 and Chapter 27 (Cumulative impacts) of the environmental impact statement, as well as Appendix G (Technical working paper: Noise and vibration). Particularly for the Cammeray Golf Course construction support site (BL1), there is potential for cumulative increases of construction noise from concurrent works associated with the Beaches Link and Gore Hill Freeway Connection project, and the final stages of the Western Harbour Tunnel and Warringah Freeway Upgrade project. Sensitive receivers in Cammeray in the vicinity of the temporary construction support site would experience potentially extended durations of increased noise levels and potential increased disturbance outside standard construction hours. Site specific environmental management measures would be developed for the Cammeray Golf Course construction support site (BL1) where noise management levels are exceeded, to ensure construction fatigue is minimised. Construction activities associated with the temporary construction support site would be coordinated between the Beaches Link and Gore Hill Freeway Connection project and the Western Harbour Tunnel and Warringah Freeway Upgrade project where feasible and reasonable to provide affected receivers with appropriate respite (refer to Section 10.6.4 of the environmental impact statement). A construction noise and vibration management plan will also be developed for the project as discussed in Section D1.1 of this submissions report and as required by revised environmental management measure CNV1 (refer to Table D2-1 of this submissions report). Potential cumulative construction noise impacts will be mitigated through targeted environmental management measures including CNV13 and CI1 and revised environmental management measures CNV3, CNV9 and CI2. Other measures for managing and minimising potential noise impacts to receivers in the project construction footprint are detailed in Table D2-1 of this submissions report.

While additional and prolonged temporary increases in construction noise from construction work at the Cammeray Golf Course construction support site (BL1) for the Western Harbour Tunnel and Beaches Link program of works would be expected if no environmental management measures are implemented, no cumulative vibration impacts are expected to occur for receivers near the southern

portal of the Beaches Link and Gore Hill Freeway Connection project. At this concept stage of construction planning, it is likely that some construction for the Beaches Link and Gore Hill Freeway Connection and the Western Harbour Tunnel and Warringah Freeway Upgrade projects would occur concurrently and consecutively, however due to the varying nature of vibration intensive activities, cumulative vibration impacts are unlikely to result in increased vibration levels at sensitive receivers (refer to sections 5.2 to 5.16 of Appendix G (Technical working paper: Noise and vibration)). Final scheduling for tunnelling works from the Cammeray site would be subject to further design development and detailed planning prior to construction commencing.

### **C26.2.3 Increased air quality and health impacts**

#### ***Issue raised***

Submitters raised concerns about cumulative air quality and health impacts associated with the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects. Specific concerns included:

- Increased dust impacts for receivers in Cammeray
- Increased operational air quality impact for receivers in Cammeray, North Sydney and Neutral Bay due to ventilation outlets being located together at the Warringah Freeway at Cammeray
- Increased particulate matter levels and increased dust across concurrent construction periods which can impact on health of sensitive receivers, particularly in Cammeray and Willoughby.

#### ***Response***

##### Cumulative air quality impacts during construction

The risks of dust impacts during construction, including for the North Sydney and Cammeray areas, was considered in Section 12.5.1 of the environmental impact statement (refer to Zone 2 of Figure 12-4 of the environmental impact statement). The majority of Zone 2 would have already undergone disturbance during the construction of the Western Harbour Tunnel and Warringah Freeway Upgrade project, therefore the construction activities for the Beaches Link and Gore Hill Freeway Connection project that include dust generating works would have mostly been completed. This means that the overlap of construction periods for both projects would reduce the total length of exposure to dust generating construction activities and keep the risks of cumulative dust impacts to a shorter timeframe, compared to if the projects were constructed separately and sequentially.

There may be a low risk of cumulative impacts due to the overlapping construction periods for the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project, as the same sensitive receivers in Cammeray and surrounds are expected to experience dust impacts during both projects. Construction dust impacts will be effectively managed through the implementation of revised environmental management measure AQ1 (refer to Table D2-1 of this submissions report).

In addition, coordination between the Beaches Link and Gore Hill Freeway Connection project and the Western Harbour Tunnel and Warringah Freeway Upgrade project will be managed through implementation of revised environmental management measure CI2 (refer to Table D2-1 of this submissions report). This would further minimise the risk of cumulative air quality impacts occurring during overlapping construction periods.

##### Cumulative air quality impacts during operation

Cumulative air quality impacts from the operation of both the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project have been incorporated into the air quality modelling in addition to other major projects

under the 'Do something cumulative' scenarios detailed in Table 12-2 of the environmental impact statement.

The air quality assessment provided emissions modelling for different scenarios, accounting for expected and theoretical worst-case conditions to predict emissions from existing and proposed tunnel ventilation outlets, existing tunnel portals and surface roads (refer to Section E.5.2 of Appendix H (Technical working paper: Air quality)). For the emissions modelling, the assessment assumed that all emissions in-tunnel would be released through ventilation outlets, meaning that predicted in-tunnel air quality levels would directly translate to ventilation outlet air quality levels. In total, 11 separate tunnel ventilation outlets were included in the assessment (refer to Figure 8-1 of Appendix H (Technical working paper: Air quality)), including all outlets associated with the Western Harbour Tunnel and Beaches Link program of works, and existing and future projects (WestConnex, Cross City Tunnel and Lane Cove Tunnel) in order to assess potential cumulative impacts.

Potential operational impacts from both the Beaches Link and Gore Hill Freeway Connection and the Western Harbour Tunnel and Warringah Freeway Upgrade projects, and other major projects in operation, would not exceed operational air quality limits nor the air pollutant criteria applied to the project as set in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016) (refer to Table 12-3 and Table 12-4 of the environmental impact statement for the applicable criteria). The design of the tunnel ventilation system would ensure that there are no emissions from the tunnel portals and that local air quality would be effectively maintained (refer to Section 12.6.2 of the environmental impact statement).

For receivers in and around North Sydney, the cumulative scenarios assessment found that there are expected reductions in concentration of air pollutants along Military Road, Spit Road, the portals of Sydney Harbour Tunnel, Sydney Harbour Bridge and Warringah Freeway (refer to Section 10.2.2 of Appendix H (Technical working paper: Air quality)). As the air quality modelling has assessed the effects of the Beaches Link and Gore Hill Freeway Connection in conjunction with the Western Harbour Tunnel and Warringah Freeway Upgrade, WestConnex, Sydney Gateway, and M6 Motorway Stage 1 and full project, the impact from the combined major projects have been considered to produce a comprehensive cumulative impact assessment.

#### Cumulative construction air quality related health issues

The potential for cumulative dust related impacts for the Cammeray and Willoughby areas as a result of the Beaches Link and Gore Hill Freeway Connection and the Western Harbour Tunnel and Warringah Freeway Upgrade projects is discussed above. Given the low likelihood of impacts and proposed environmental management measures, the potential for cumulative construction impacts in terms of health issues associated with dust are considered negligible.

In addition, the assessment of health impacts from changes in air quality found that for almost all construction activities, substantial impacts on receivers would be avoided through project design and the implementation of environmental management measures during construction activities (refer to Section 13.4.1 of the environmental impact statement and Appendix I (Technical working paper: Health impact assessment)). Overall, potential air quality impacts during construction of the Beaches Link and Gore Hill Freeway Connection are unlikely to result in any health related impacts. Potential cumulative impacts to air quality and health during the construction of the Beaches Link and Gore Hill Freeway Connection and the Western Harbour Tunnel and Warringah Freeway Upgrade projects are addressed through environmental management measures CI1, CI2, AQ1 and AQ3 (refer to Table D2-1 of this submissions report).

### **C26.2.4 Cumulative impacts to schools**

#### ***Issue raised***

Submitters raised concerns about impacts to a number of schools surrounding the project in Cammeray, Neutral Bay, and North Sydney due to the cumulative impact of the construction of the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects. Submitters were concerned about the effect on students' education, and health and wellbeing from aspects such as noise, construction traffic and air quality.

#### ***Response***

Potential cumulative impacts on the education and schooling, and health of students as a result of concurrent construction activities in North Sydney and Cammeray across the program of works are assessed in the cumulative impact assessment in Section 27.3.1 of the environmental impact statement, including traffic and transport, health and noise impacts. The potential for construction fatigue, as a result of the project and the Western Harbour Tunnel and Warringah Freeway Upgrade project, has also been identified for the North Sydney and Cammeray areas as discussed in Section 27.3.7 of the environmental impact statement. Areas considered most likely to experience sustained impacts to receivers that may result in construction fatigue include receivers near the Cammeray Golf Course and the Warringah Freeway.

Consideration of cumulative traffic and transport, health and noise impacts associated with the project and the Western Harbour Tunnel and Warringah Freeway Upgrade project are discussed above in sections C26.2.1, C26.2.3 and C26.2.2 respectively. The implementation of the environmental management measures described in these sections will minimise the potential cumulative traffic and transport, health and noise impacts during construction for sensitive receivers, including schools near the construction footprint of the program of works in North Sydney and Cammeray. These aspects of potential cumulative impacts would not be expected to directly affect schools in Neutral Bay due to the distance from the project, as shown in Table 27-5 of the environmental impact statement.

Ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction works/temporary construction support sites and sensitive social infrastructure above the tunnel alignment including schools, about the timing and duration of construction works and management of potential impacts, in accordance with environmental management measure SE2 (refer to Table D2-1 of this submissions report). Consultation for the project will be carried out in accordance with the community consultation framework provided in Appendix E (Community consultation framework) of the environmental impact statement, in accordance with environmental management measure SE3 (refer to Table D2-1 of this submissions report). Multi-party engagement and cooperation will be established prior to construction to coordinate with projects including the Western Harbour Tunnel and Warringah Freeway Upgrade project to manage construction fatigue impacts where possible, as required by revised environmental management measure CI2 (refer to Table D2-1 of this submissions report).

### **C26.2.5 Increased heritage impacts**

#### ***Issue raised***

Submitters raised concerns about the increased potential for impacts on heritage properties at Naremburn due to cumulative construction vibration impacts associated with the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects.

### ***Response***

Potential cumulative construction impacts at Naremburn and Willoughby are expected to be negligible for both Aboriginal and non-Aboriginal heritage as outlined in Section 27.3.3 of the environmental impact statement. While no cumulative heritage impacts are expected in Naremburn and Willoughby during construction, vibration generating activities will be managed through the implementation of minimum working distances to achieve vibration screening levels, as required by environmental management measure CNV7 (refer to Table D2-1 of this submissions report). A range of other environmental management measures will be implemented to manage potential vibration impacts, including revised environmental management measures CNV1 and SG7 (refer to Table D2-1 of this submissions report).

### **C26.2.6 Increased impact on public open space at Cammeray Golf Course**

#### ***Issue raised***

Submitters raised concerns about the prolonged and increased impact on public open space at Cammeray Golf Course as a result of the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects.

#### ***Response***

Impacts to land within Cammeray Golf Course would initially result from the establishment of temporary construction support sites (the Cammeray Golf Course construction support sites (WHT10 and WFU8)) for the Western Harbour Tunnel and Warringah Freeway Upgrade project and was assessed as part of the environmental impact statement for Western Harbour Tunnel and Warringah Freeway Upgrade (Transport for NSW, 2020k). Part of the site would be later adjusted to support the establishment of the Cammeray Golf Course construction support site (BL1). Part of Cammeray Golf Course would be acquired for permanent operational facilities for both the project and the Western Harbour Tunnel and Warringah Freeway Upgrade project (outlined in Table 20-5 of the environmental impact statement). This would reduce the amount of land available for public recreational use.

Both the Beaches Link and Gore Hill Freeway Connection project and the Western Harbour Tunnel and Warringah Freeway Upgrade project have been designed and developed to minimise, to the extent reasonably practicable, impacts to Cammeray Golf Course as discussed in Table 20-4 of the environmental impact statement. The project would not impact on the feasibility of Cammeray Golf Course to operate as a nine-hole golf course or for public recreation and open space purposes, either during construction or operation. However, construction and the longer-term operation of project support infrastructure at Cammeray would require reconfiguration of the golf course including changes to some holes on the golf course. Transport for NSW is continuing to consult with Cammeray Golf Club, Department of Planning, Industry and Environment (Crown Lands) and North Sydney Council (the trustee) on this matter.

Transport for NSW will address the potential impacts to the Cammeray Golf Course as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project in accordance with revised environmental management measure LP7 from the Western Harbour Tunnel and Warringah Freeway Upgrade submissions report and relevant conditions of approval provided by the NSW Minister for Planning and Public Spaces on 21 January 2021, including condition E101 which requires that the design and establishment of an altered Cammeray Golf Course must provide an equivalent standard golf course or the provision of works to offset the loss in standards.

The majority of open space used for construction of the project would not be required to operate the project. Where feasible and reasonable, the extent of permanent impact on public open space areas will be minimised in further design development, in accordance with environmental management

measure SE1 (refer to Table D2-1 of this submissions report). After construction of the Beaches Link and Gore Hill Freeway Connection project has been completed, areas of the golf course not required for permanent project infrastructure will be rehabilitated and returned in consultation with relevant stakeholders, including replacement trees and landscaping (refer to environmental management measure LP5 in Table D2-1 of this submissions report). The adjoining Cammeray Park sportsground, tennis club, croquet club and skate park would remain operational during construction and would not be directly impacted during construction of the Beaches Link and Gore Hill Freeway Connection project or the Western Harbour Tunnel and Warringah Freeway Upgrade project.

### **C26.2.7 Increased loss of trees**

#### ***Issue raised***

Submitters were concerned about the cumulative loss of trees from the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects.

#### ***Response***

The design development process for the Beaches Link and Gore Hill Freeway Connection project has considered a number of opportunities to avoid or minimise biodiversity impacts including impacts to trees through selection of the preferred corridor, and refinement of the preferred corridor design and development of construction methodology as described in Section 19.4 of the environmental impact statement. Vegetation removal will be further minimised during further design development and construction planning to the extent reasonably practicable, as required by revised environmental management measure B6 (refer to Table D2-1 of this submissions report).

A similar process was also carried out for the Western Harbour Tunnel and Warringah Freeway Upgrade project, as described in Section 4 of the *Western Harbour Tunnel and Warringah Freeway Upgrade Technical Working Paper: Biodiversity Development Assessment Report* (Transport for NSW, 2020j).

Where possible, trees will be protected or pruned rather than removed, as required by revised environmental management measure V10 (refer to Table D2-1 of this submissions report). Both projects include other environmental management measures to further reduce impacts to native vegetation and amenity trees during further design development, including environmental management measures B1 and V9 (refer to Table D2-1 of this submissions report). Further detail on the environmental management measures proposed as part of the Western Harbour Tunnel and Warringah Freeway Upgrade project can be found in the submissions report for that project (refer to environmental management measures B1, V8 and V9).

Where vegetation impacts cannot be avoided during further design development, both projects have committed to offsetting impacts. For the Beaches Link and Gore Hill Freeway Connection project, this includes offsetting in accordance with the requirements of the NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016* which is discussed in Section 19.6.1 of the environmental impact statement. Where mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme, established under Part 6 of the *Biodiversity Conservation Act 2016*) are removed as a result of construction, they will be replaced at a ratio of 2:1 in accordance with revised environmental management measure V13 (refer to Table D2-1 of this submissions report).

For the Western Harbour Tunnel and Warringah Freeway Upgrade project, trees will be replaced in accordance with conditions of approval E184 and E185.

## **C26.2.8 Western Harbour Tunnel and Beaches Link program of works construction sequencing**

### ***Issue raised***

Submitters requested that consideration be given to constructing the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects consecutively so that the construction periods do not overlap, to minimise cumulative impacts from both projects.

### ***Response***

As the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project form a single program of works, the overlap of construction is expected in the Cammeray area only, where the two projects connect. The overlap between the two projects within a single program of works is intended to reduce the overall length of the construction periods and thereby reduce potential construction traffic and transport, construction noise and vibration, construction air quality, socio-economic, land use and property impacts that may arise from the overlapping construction periods, which have been assessed in Chapter 27 (Cumulative impacts) of the environmental impact statement. The planned overlap of the Western Harbour Tunnel and Beaches Link program of works construction periods would seek to limit cumulative impacts to localised areas such as Cammeray and ensure that specific environmental management measures are implemented to address potential cumulative impacts. In particular, environmental management measures CI1, CI3 and CI4 and revised environmental management measure CI2 will mitigate potential cumulative impacts, and all other environmental management measures as provided in Table D2-1 of this submissions report will be implemented to minimise potential cumulative impacts. In addition, the Western Harbour Tunnel and Warringah Freeway Upgrade works would include all the surface works for the Beaches Link and Gore Hill Freeway Connection project where these two projects interface at Cammeray, so that potential cumulative traffic impacts would be minimised.

## **C26.3 Cumulative impacts associated with other major projects**

### **C26.3.1 Traffic and transport impacts**

#### ***Issue raised***

Submitters were concerned about cumulative construction traffic and transport impacts, including:

- Construction traffic impacts in the same areas that were impacted by the Northern Beaches Hospital road upgrade project
- Concerns about cumulative construction traffic impacts due to the Beaches Link and Gore Hill Freeway Connection project and the Channel 9 site staged residential development in Willoughby
- Concerns about cumulative construction traffic impacts due to the Beaches Link and Gore Hill Freeway Connection project and the Bunnings Warehouse development on the corner of Warringah Road and Allambie Road at Frenchs Forest
- Request for cumulative impacts of traffic congestion during construction and operation across the district and regional road network to be further examined in an additional report to be submitted prior to the conclusion of the assessment of the environmental impact statement.



## ***Response***

### **Northern Beaches Hospital road upgrade project**

The potential for cumulative impacts in Frenchs Forest from other projects, including the Northern Beaches Hospital road upgrade project has been assessed in Chapter 27 (Cumulative impacts) of the environmental impact statement. The Northern Beaches Hospital road upgrade project was recently completed in August 2020 after a five-year construction period. Major work on Beaches Link and Gore Hill Freeway Connection is planned to begin by 2023, which would provide the surrounding community in Frenchs Forest respite between both projects. As such, the cumulative impact assessment found that, based on the status, timeframe, location and scale of impact of assessed projects and strategic plans relevant to the area, the construction of the project in Frenchs Forest would be unlikely to produce cumulative impacts in this area, as discussed in Chapter 27 (Cumulative impact) of the environmental impact statement.

Traffic and transport impacts associated with the construction and operation of the Beaches Link and Gore Hill Freeway Connection project are assessed in Chapter 8 (Construction traffic and transport) and Chapter 9 (Operational traffic and transport) of the environmental impact statement and Appendix F (Technical working paper: Traffic and transport). The assessment of construction impacts on the road network around Frenchs Forest indicates that the road network would perform marginally worse during construction. However, in most locations it would operate at a satisfactory level of service during peak periods.

The Beaches Link and Gore Hill Freeway Connection construction footprint in the Frenchs Forest area is provided in Figure 6-29 of the environmental impact statement. This construction footprint slightly overlaps with the footprint of the Northern Beaches Hospital road upgrade project along the Wakehurst Parkway between Warringah Road and Yarraman Avenue. Due to there being some overlap of the project footprints in the Frenchs Forest and surrounds area, there could be community concern that construction and operational impacts of the Northern Beaches Hospital road upgrade project could be repeated as a result of the Beaches Link and Gore Hill Freeway Connection project. However, the scale and duration of works required for the Beaches Link and Gore Hill Freeway Connection project are significantly less than the scale and duration of works carried out for the Northern Beaches Hospital road upgrade project.

Table D2-1 of this submissions report includes a comprehensive suite of construction traffic and transport environmental management measures that will be implemented to manage and minimise potential impacts from the project. These environmental management measures will be key to managing any perceived construction fatigue concerns in the Frenchs Forest area. In addition, the community consultation framework presented in Appendix E (Community consultation framework) has also been developed with consideration of construction fatigue and includes procedures to proactively manage this issue where possible as part of the community communication strategy.

### **Channel 9 site staged residential redevelopment at Willoughby**

Potential cumulative traffic impacts on the local road network in Naremburn and Willoughby could occur as a result of the Beaches Link and Gore Hill Freeway Connection project having overlapping construction periods with the Channel 9 site staged residential redevelopment as described in Table 27-7 of the environmental impact statement. While potential construction vehicle routes are not known for the Channel 9 site staged residential redevelopment, given it is located on Artarmon Road, construction vehicles are less likely to use proposed routes for Flat Rock Drive construction support site (BL2) or Barton Road construction support site (BL5).

Notwithstanding, considered and tailored multi-party engagement and cooperation will be established prior to construction, including with the construction contractor for the Channel 9 site

staged residential redevelopment if required, to ensure all contributors to impacts are working together to minimise adverse impacts or enhance benefits of multiple projects occurring concurrently or consecutively as required by environmental management measure CI1 (refer to Table D2-1 of this submissions report).

#### Bunnings Warehouse development, 357-373 Warringah Road at Frenchs Forest

The Bunnings Warehouse development on the corner of Warringah Road and Allambie Road at Frenchs Forest was approved in February 2021 while the Beaches Link and Gore Hill Freeway Connection environmental impact statement was on exhibition. As such, the Bunnings Warehouse development was not considered within Chapter 27 (Cumulative impact) of the environmental impact statement.

The timing for construction of the Bunnings Warehouse development is unknown at this stage. However, given its status as an approved project, it may have an overlapping construction period with the Beaches Link and Gore Hill Freeway Connection project.

As such, there is potential that during construction of the Beaches Link and Gore Hill Freeway Connection project there may be some interaction with the Bunnings Warehouse development in terms of construction traffic impacts along Warringah Road, as the development site is located near the Wakehurst Parkway north construction support site (BL14). However, with the implementation of the construction traffic and transport environmental management measures for the project (refer to Table D2-1 of this submissions report), and the development consent conditions for the Bunnings Warehouse development requiring a detailed construction traffic management plan in accordance with *Traffic Control at Work Sites Technical Manual* (Transport for NSW, 2020g) and restricting heavy movements in peak periods, it is likely that cumulative traffic impacts would be minor and manageable.

As discussed above, considered and tailored multi-party engagement and cooperation will be established prior to construction, including with the construction contractor for the Bunnings Warehouse development if required, to ensure all contributors to impacts are working together to minimise adverse impacts or enhance benefits of multiple projects occurring concurrently or consecutively as required by environmental management measure CI1 (refer to Table D2-1 of this submissions report).

#### Request for consideration of cumulative traffic impacts

Potential cumulative traffic and transport issues have been addressed in Chapter 8 (Construction traffic and transport), Chapter 9 (Operational traffic and transport) and Chapter 27 (Cumulative impacts) of the environmental impact statement. The assessment of potential cumulative impacts for traffic congestion within the construction footprint and in the broader road network is further detailed in Appendix F (Technical working paper: Traffic and transport). Environmental management measures developed to minimise potential cumulative traffic impacts during construction and operational phases of the project include CI1, CTT6, CTT8, CTT14 and OT2 and revised environmental management measure CI2 (refer to Table D2-1 of this submissions report). As such, an additional report to examine cumulative impacts of traffic congestion across the district and regional road network is not considered to be required.

In addition to the results presented in Chapter 9 (Operational traffic and transport) of the environmental impact statement, additional operational traffic modelling improvements and further analysis of expected future traffic demand levels and road network capacity have been provided in Section 6 (Assessment of road intersection operational performance) of the preferred infrastructure report. The assessment confirms that the project is not expected to adversely impact the performance of the Gore Hill Freeway and Artarmon area and Balgowlah and surrounds area local

road network. Refined modelling of the Warringah Freeway and surrounds area and Frenchs Forest and surrounds area indicates that the impacts presented in the environmental impact statement can be further mitigated by network management and the optimisation of traffic signal operations. However, this analysis also illustrates that road network upgrades and management alone is not expected to be able to fully mitigate impacts, which would require complementary public transport and other demand management initiatives through other established forums and processes beyond the scope of the project.

A review of operational network performance will be carried out after 12 months, and again after five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections, in accordance with environmental management measure OT1 (refer to 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 that used in Appendix F (Technical working paper: Traffic and transport). Where required, additional feasible and reasonable mitigation measures will be identified in consultation with Department of Planning, Industry and Environment and the relevant council to manage any additional traffic performance impacts identified during the review of operational network performance.

Where required, Transport for NSW will investigate local area traffic management measures to minimise the impact of the project on the surrounding local road network during operation. Such measures will be determined in consultation with relevant councils and implemented where feasible and reasonable, as required by environmental management measure OT2 (refer to Table D2-1 of this submissions report).

### **C26.3.2 Construction noise and vibration impacts**

#### ***Issue raised***

Submitters were concerned that Flat Rock Reserve and surrounds would be subject to cumulative construction noise and vibration impacts from the project, Willoughby Leisure Centre pool area upgrades and the redevelopment of the former Channel 9 site in Willoughby.

#### ***Response***

Construction activities at the Flat Rock Drive construction support site (BL2) are expected to occur in close proximity to and interact with major projects such as the Channel 9 site staged residential redevelopment and Willoughby Leisure Centre pool area upgrades.

The potential for cumulative construction noise and vibration impacts were considered in Section 10.6 and Chapter 27 (Cumulative impacts) of the environmental impact statement. Potential cumulative construction noise and vibration impacts with the project and the Channel 9 site staged residential redevelopment were considered to be negligible due to the distance between each project. Site specific environmental management measures will be developed for Flat Rock Drive construction support site (BL2) with the aim of ensuring that relevant noise management levels are met in accordance with environmental management measures CNV1 to CNV14 (refer to Table D2-1 of this submissions report).

The potential for cumulative construction noise and vibration impacts with the project and the Willoughby Leisure Centre pool area upgrades is also discussed in Section C26.1 above.

### **C26.3.3 Human health impacts**

#### ***Issue raised***

Submitters were concerned about potential cumulative impacts from multiple projects on urban bushland in Sydney and the effects on the mental health of receivers.

### **Response**

Potential impacts to urban bushland and open space during construction and operation of the project and the associated health impacts are outlined in Section 9.4 of Appendix I (Technical working paper: Health impact assessment).

Although the project proposes to use some open space, including bushland areas and parks, as temporary construction support sites, it would align with Objective 32 of the Greater Sydney Commission's *A Metropolis of Three Cities* vision, which seeks to create the Greater Sydney Green Grid with a network of green spaces across the cities of Sydney. By establishing new and improved open space and recreation facilities at Balgowlah Golf Course as well as new public open space at Manly Warringah War Memorial State Park, the project would contribute to the Green Grid objective being met within Greater Sydney. Nevertheless, the potential impacts to open space within the construction footprint are assessed in Table 9-1 of Appendix I (Technical working paper: Health impact assessment).

The potential for mental health impacts to arise as a result of multiple projects using and removing open space have been acknowledged in Section 13.4.3 of the environmental impact statement and where they have been identified, Transport for NSW has proposed environmental management measures to minimise such impacts. The implementation of these environmental management measures will reduce the potential for mental health issues in the affected communities during construction. Where feasible and reasonable, the extent of permanent impact on public open space areas (eg Artarmon Park) will be minimised in further design development, as required by environmental management measure SE1 (refer to Table D2-1 of this submissions report).

Once construction is complete, impacted land in open space areas in Artarmon Park, Flat Rock Reserve, Spit West Reserve and Balgowlah Golf Course area would be rehabilitated and reinstated (refer to Table 9-1 of Appendix I (Technical working paper: Health impact assessment)). Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate condition, and rehabilitation will be carried out in consultation with the relevant landowner, the local council and community (where appropriate), as required by environmental management measures LP4, LP5 and LP8 (refer to Table D2-1 of this submissions report).

#### **C26.3.4 Potential reductions in water flows**

##### **Issue raised**

Submitters raised concerns regarding water flow reduction impacts leading to cumulative impacts when combined with Willoughby City Council plans to draw water from Flat Rock Creek to water playing fields after construction of the Beaches Link and Gore Hill Freeway Connection project is complete.

##### **Response**

Transport for NSW has been approached recently by Willoughby City Council with a request to utilise a regular amount of treated tunnel groundwater inflow from the Gore Hill Freeway operational wastewater treatment plant as part of their planned water harvesting improvement scheme in the Artarmon/Willoughby Flat Rock Creek catchment area, as outlined in Section B12.15.2 of this submissions report. Transport for NSW intends to develop an Interface Agreement with Willoughby City Council which would provide more detail on the scope, rights and obligations for both the construction and operational phases of the project. Transport for NSW would continue to work with Willoughby City Council regarding the viability of accessing water from the Beaches Link wastewater treatment plant at Artarmon during further design development. The Interface Agreement would include any applicable arrangements associated with Willoughby City Council's

stormwater harvesting schemes in Flat Rock Creek.. Agreements on a water sharing arrangement would take in full consideration of any requirements to offset Flat Rock Creek flows.

Notwithstanding the above, as a result of the submissions received, and through discussions with the Department of Planning, Industry and Environment, Transport for NSW has conducted additional investigations and groundwater modelling. A clarification is provided in Section A5.1.15 of this submissions report which outlines the additional studies carried out and the overall findings.

The updated groundwater modelling (refer to Appendix E of this submissions report) confirms that the predicted baseflow reductions for Flat Rock Creek are consistent with those reported in the environmental impact statement. The studies also estimated that the corresponding reduction in streamflow at the downstream weir of Flat Rock Creek is about 22 per cent based on streamflow data measured in May 2018. However, during construction and operation, groundwater infiltration to the tunnels would be collected, treated and discharged to Flat Rock Creek which is expected to offset the predicted reduction in streamflow. As noted above, any agreements on a water sharing arrangement would take in full consideration of any requirements to offset Flat Rock Creek flows.

### **C26.3.5 Socio-economic and land use impacts**

#### ***Issue raised***

Submitters were concerned about cumulative socio-economic and land use impacts during construction and operation. Specific concerns include:

- Cumulative impacts from multiple projects in the Northern Beaches that lead to extended construction periods would impact the quality of life of residents
- Concerns that there has not been any consideration to the potential for proposed redevelopment around Frenchs Forest.

#### ***Response***

##### Cumulative impacts on quality of life

Cumulative socio-economic impacts have been considered as part of the environmental impact statement in relation to a range of projects planned in proximity to the Beaches Link and Gore Hill Freeway Connection project. Suburbs within the Northern Beaches local government area are expected to experience negligible cumulative socio-economic impacts during the construction period of the project, considering projects which are at a stage that they can be assessed, as outlined in Chapter 27 (Cumulative impacts) of the environmental impact statement. It is noted that additional cumulative construction impacts at Balgowlah and at Frenchs Forest may be generated by future projects associated with the *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b) and *Northern Beaches Hospital Precinct Structure Plan* (Northern Beaches Council, 2017a) respectively; however construction programs and specific scopes for individual projects from these strategies have not yet been released.

To address potential and emerging cumulative impacts, ongoing engagement will be carried out with representatives of user groups and managers of social infrastructure located near surface construction works/construction support sites and sensitive social infrastructure above the tunnel alignment about the timing and duration of construction works and management of potential impacts, as required by environmental management measure SE2 (refer to Table D2-1 of this submissions report).

During operation, the project, in conjunction with the Western Harbour Tunnel and Warringah Freeway Upgrade project, would help to reduce traffic and congestion on major roads within and connecting to the Northern Beaches local government area, including Military Road, Spit Road,

Eastern Valley Way, Warringah Road and Mona Vale Road, thereby improving road safety and amenity along these key surface road transport corridors into and out of the Northern Beaches. By providing new underground bypass routes, the Western Harbour Tunnel and Beaches Link program of works would enable the movement of heavy vehicle trips from surface arterial roads to the motorway tunnels and provide the opportunity for express bus services in the tunnels between the Northern Beaches and strategic centres such as North Sydney, the Sydney CBD, Macquarie Park and St Leonards. This would result in improved amenity near surface arterial roads and improved access and connectivity for customers and employees. The additional, faster and more direct road connections would also improve connectivity for businesses and industry to the broader network and enhance the efficiency of supply chain movements, allowing deliveries to reach their destinations more quickly. Due to the movement of heavy vehicle trips from surface arterial roads to the motorway tunnels, the overall amenity of the existing arterial road network to and from the Northern Beaches peninsula would be improved. Further, this would result in reduced interactions between general traffic, heavy vehicles, public transport vehicles, pedestrians and cyclists. This reduced interaction would improve road safety and reduce the severity of crashes on the arterial road network.

Through the re-purposing of land at Balgowlah as new and improved open space and recreation facilities for the community, the project would support the implementation of the *Northern Beaches Sportsground Strategy* (Northern Beaches Council, 2017b). The project would return an area, equivalent to around 90 per cent of the current open space, as new and improved open space and recreation facilities at Balgowlah, in consultation with Northern Beaches Council and the community. Increased availability of public open space and passive and active recreation facilities would impact positively on local amenity in this area.

#### Northern Beaches Hospital Precinct Structure Plan

The *Northern Beaches Hospital Precinct Structure Plan* (Northern Beaches Council, 2017a) defines the desired future land uses in Frenchs Forest and consequent multi-modal transport operation and infrastructure requirements to, from and through Frenchs Forest. The plan provides the strategic land use planning framework for Frenchs Forest for the next 20 years and includes proposed land use rezoning around the Northern Beaches Hospital to the north and west of the Wakehurst Parkway/Warringah Road intersection as part of a strategy to support long term growth in the area (including a proposed 5360 new dwellings in the next 20 years).

The *Draft Frenchs Forest 2041 Place Strategy* (NSW DPIE, 2021a) was placed on public exhibition on 23 July 2021 (until 3 September 2021) and outlines how the NSW government will deliver the first phase of the new Frenchs Forest town centre as part of the *Northern Beaches Hospital Precinct Structure Plan*, including 2000 new homes, 250 affordable dwellings, about 2000 new jobs, public open spaces, and easier walking and cycling connections. The draft strategy package also includes a Special Infrastructure Contributions scheme which provides up to \$37.3 million to pay for the required infrastructure including roads, public transport infrastructure, pedestrian and cycling paths, health facilities, emergency services, schools and open space improvements (NSW DPIE, 2021a).

The Northern Beaches Hospital Precinct Structure Plan was considered as part of the cumulative impact assessment in Chapter 27 (Cumulative impacts) of the environmental impact statement. Additional cumulative construction impacts at Frenchs Forest may be generated by future projects associated with the plan, however construction programs and specific scopes for individual projects have not yet been released.

### C26.3.6 Biodiversity impacts

#### ***Issue raised***

Submitters were concerned about cumulative biodiversity impacts during construction and operation. Specific concerns included:

- Combined loss of threatened ecological communities and vegetation from the Beaches Link and Gore Hill Freeway Connection project and other projects such as Northern Beaches Hospital road upgrade project, the Belrose Super Centre development, Manly Vale Public School upgrade, and Mona Vale Road West Upgrade project
- The potential for increased fragmentation of fauna habitats from the Beaches Link and Gore Hill Freeway Connection project, Northern Beaches Hospital road upgrade project and Mona Vale Road West Upgrade project.

#### ***Response***

##### Combined loss of threatened ecological communities and vegetation

The cumulative impact assessment did not identify the potential for cumulative biodiversity impacts as a result of the project and the projects identified from the screening assessment described in Section 27.1.2 of the environmental impact statement. The screening criteria used to determine the inclusion of projects in the cumulative impact assessment applied a locality distance of two kilometres from the construction footprint (refer to Table 27-2 of the environmental impact statement). The majority of the projects mentioned above by submitters are not within the two kilometres locality (ie Mona Vale Road West Upgrade project or the Belrose Super Centre development) or the timeframe between completion and the project is not consecutive (ie Manly Vale Public School upgrade).

The Northern Beaches Hospital road upgrade project was recently completed in August 2020 and there is an overlap with the northern extent of the Beaches Link and Gore Hill Freeway Connection construction footprint. The area of overlap has been heavily modified/cleared due to the construction of the Northern Beaches Hospital road upgrade, and as such calculations of biodiversity impacts have excluded the area of overlap as shown in Figure 19-5 of the environmental impact statement. The Northern Beaches Hospital road upgrade project was assessed in the cumulative impact assessment, as outlined in Table 27-3 of the environmental impact statement. Cumulative biodiversity impacts are not anticipated due to the following:

- The Northern Beaches Hospital road upgrade project implemented a suite of biodiversity management measures to minimise impacts in accordance with the Concept Plan and Stage 1, and Stage 2 environmental impact statements and conditions of approval, including implementation of the monitoring program described in the *Wildlife Connectivity and Road Risk Minimisation Strategy* (Biosis, 2020), to determine the effectiveness of the main management measures
- The Northern Beaches Hospital road upgrade project has offset its impacts in accordance with relevant project conditions of approval as detailed in *Northern Beaches Hospital Connectivity and Network Enhancements Biodiversity Offset Package – Stage 3 Report* (SMEC, 2020), which included offsetting for Duffys Forest endangered ecological community and Red-crowned Toadlet (*Pseudophryne australis*)
- The Beaches Link and Gore Hill Freeway Connection project has included site-specific environmental management measures to ensure impacts are avoided on biodiversity measures and features implemented as part of the Northern Beaches Hospital road upgrade project, including (refer to Table D2-1 of this submissions report):

- Removal of the existing fauna fencing installed as part of the Northern Beaches Hospital road upgrade project will be avoided where possible in overlapping construction areas. Where this is not possible, temporary fauna fencing will be installed during construction to ensure fauna are guided to existing underpasses and away from construction areas and/or live traffic (refer to new environmental management measure B39)
- During site establishment of the Wakehurst Parkway north construction support site (BL14), the project will ensure that the revegetated area within the eastern section of the site (planted as part of the Northern Beaches Hospital road upgrade project with species consistent with Duffys Forest endangered ecological community) is fenced adequately so that it is avoided and protected from disturbance during construction. During operation, this revegetation area will continue to be protected and managed (refer to new environmental management measure B41).
- The Beaches Link and Gore Hill Freeway Connection project and the Northern Beaches Hospital road upgrade project have considered ways to minimise potential impacts on key species and ecological communities, such as Duffys Forest endangered ecological community and Red-crowned Toadlet. This includes:
  - Minimising the area of Duffys Forest endangered ecological community impacted as described in Section 19.4 of the environmental impact statement and committing to environmental management measures to further reduce impacts to the extent reasonably practicable, including environmental management measures B6, B41, V9 and V10 (refer to Table D2-1 of this submissions report)
  - Consideration of potential impacts to Red-crowned Toadlet habitat in the design of the operational water quality devices for Wakehurst Parkway and frog fencing which will be added to the fauna exclusion fencing within identified Red-crowned Toadlet habitat (refer to revised environmental management measure B3 in Table D2-1 of this submissions report).

In addition, since the exhibition of the environmental impact statement, Transport for NSW has refined the design of the ramps for the new shared user bridge at the northern end of the upgraded and realigned Wakehurst Parkway as outlined in Section A4.3 of this submissions report. The design refinement is proposed to improve connectivity and has reduced the area of Duffys Forest endangered ecological community impacted by the project by 1684 square metres.

Also in regard to Duffys Forest endangered ecological community, updated mapping of the existing extent has been carried out for the project in response to comments provided by the Department of Planning, Industry and Environment (Environment, Energy and Science Group) on the environmental impact statement (refer to Section B4.2.2 of this submissions report). The updated mapping has involved review of recent aerial imagery and consideration of clearing extents from Northern Beaches Hospital road upgrade project and Mona Vale Road West Upgrade project to more accurately show the current distribution of Duffys Forest endangered ecological community within the Pittwater Interim Biogeographically Regionalisation of Australia (IBRA) subregion. While it is not considered a cumulative assessment, it has allowed for an updated and contemporary serious and irreversible impact assessment of Duffys Forest endangered ecological community (refer to Appendix F1 of this submissions report). A summary of the updated mapping and outcomes of the revised serious and irreversible impact assessment are provided in Section B4.2.2 of this submissions report.

#### Potential for increased fragmentation of fauna habitats

The Mona Vale Road West Upgrade project is not in the locality of the Beaches Link and Gore Hill Freeway Connection project and is situated about six kilometres north-west of the northern extent of the project. While it is acknowledged that the Mona Vale Road West Upgrade project would result in



increased habitat fragmentation due to the area of remnant native vegetation removed for the Mona Vale Road West Upgrade project (about 17 hectares) and the Mona Vale Road East Upgrade project (about 6.6 hectares), the impacts would likely be experienced by different fauna populations to those potentially impacted by the Beaches Link and Gore Hill Freeway Connection project. Information on environmental management measures to address increased habitat fragmentation due to the Mona Vale Road West Upgrade project can be found at: [roads-waterways.transport.nsw.gov.au/projects/mona-vale-road/index.html](https://roads-waterways.transport.nsw.gov.au/projects/mona-vale-road/index.html)

The upgrade and realignment of Wakehurst Parkway as part of the project has been designed to minimise and/or mitigate habitat fragmentation to the extent possible as detailed in Section 19.4 of the environmental impact statement. This has also involved consideration of fauna connectivity measures constructed as part of the Northern Beaches Hospital road upgrade project as described in *Wildlife Connectivity and Road Risk Minimisation Strategy* (Biosis, 2020). This has resulted in an enhanced approach to managing the impacts of habitat fragmentation and fauna connectivity for about a three-kilometre section of the Wakehurst Parkway between Kirkwood Street and Warringah Road. Key features include:

- Five fauna underpasses (this includes retention of two existing structures as part of the Northern Beaches Hospital road upgrade project and three new fauna underpasses as part of the project)
- Six rope crossing structures (this includes three new rope crossing structures and replacement of three existing rope crossing structures, two of which were constructed as part of the Northern Beaches Hospital road upgrade project)
- Fauna exclusion fencing along the length of the Wakehurst Parkway, tying into the existing fauna exclusion fencing for the Northern Beaches Hospital road upgrade project to the north and ending before Seaforth Oval and Kirkwood Street to the south-west and south-east, respectively.

Further discussion on the effectiveness of the design measures to minimise impacts to fauna connectivity along the Wakehurst Parkway is provided in sections B4.6 to B4.13 of this submissions report.

In addition to the above, the project will continue to minimise the extent of habitat fragmentation during further design development and construction through the implementation of a number of environmental management measures including B2, B3, B6, B13, V9 and V10 (refer to Table D2-1 of this submissions report).



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C27 – Support

## C27 Support

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## C27.1 General support

### *Issue raised*

Submitters expressed general support for the project and support for the project need, including:

- The importance of the project in providing improved infrastructure that would benefit the community
- That the project is long overdue and should be progressed quickly to minimise disruption
- The benefits of the project in reducing congestion and providing connections to the existing road network
- That the project would improve the overall quality of life for residents and would benefit the local community and wider Sydney areas
- That the project would form a vital connection and provide improved access to and from the Northern Beaches
- Support for a new Middle Harbour crossing, with three lanes of traffic in each direction in the tunnel
- Job creation due to the project construction
- Government investment in projects on the Northern Beaches.

### *Response*

The support for the project is noted. Major work on the Beaches Link and Gore Hill Freeway Connection project is planned to begin by 2023.

## C27.2 Specific support

### *Issue raised*

Submitters expressed specific support for various elements of the project, including:

- Support for the fauna fencing, underpasses for wildlife and rope crossings to allow fauna connectivity between the Manly Warringah War Memorial State Park and Garigal National Park
- Support for environmental management measures (such as noise barriers and silt curtains) used to avoid or minimise environmental impacts
- Support for the additional and replacement shared user underpasses and bridges proposed at Wakehurst Parkway to improve the safe crossing by pedestrians and cyclists
- Support for the new and improved public open space and recreation facilities at Balgowlah
- Support for the project and tunnel allowing for the future provision of express bus connections
- Support for the revised connections to and from the Burnt Bridge Creek Deviation and associated surface road works at Balgowlah due to less impacts on the community.

### *Response*

The support for the specific elements of the project is noted.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C28 – Out of scope

## C28 Out of scope

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## C28.1 Road upgrades and network improvements

### ***Issue raised***

Submitters requested a number of road upgrades and network improvements outside the scope of the project, including:

- Removal of traffic lights at Dee Why, Collaroy, Brookvale and Manly Vale to improve travel times and reduce congestion
- Reduction in the volume of traffic on the Narrabeen to Manly Vale corridor
- Upgrade of Condamine Street between the Burnt Bridge Creek Deviation and Campbell Parade and upgrade of its intersection with Pittwater Road
- Upgrades of Quirk Road and Kenneth Road at Manly Vale
- Upgrade the intersection of Balgowlah Road and Roseberry Street at Balgowlah
- Upgrades of Frenchs Forest Road, Forest Way and Grace Avenue at Frenchs Forest
- Upgrade of Wakehurst Parkway between Frenchs Forest and North Narrabeen
- Closure of Heaton Avenue at the Manly Road intersection at Clontarf
- Restriction of right turn movements from Military Road southbound
- Installation of traffic lights at the intersection of Grafton Avenue and Brook Street at Naremburn and implementation of a 50 km/h speed limit on Grafton Avenue
- Amendments to traffic light phases along the Pacific Highway at the intersections of Pacific Highway with Boundary Street, Fullers Road, Mowbray Road (for Pacific Highway northbound traffic) and the addition of right turn lanes at the intersections with Mowbray Road (for Pacific Highway southbound traffic) and the Gore Hill Freeway
- Concerns that the lane widths on the Sydney Harbour Bridge do not comply with current road standards and a barrier should be installed to prevent accidents
- Responsibility for upgrades to local roads and intersections impacted by the project due to increased congestion should be funded by Transport for NSW not local ratepayers
- Widening of Spit Bridge and amendment to the opening schedule to improve traffic flow.

### ***Response***

The project has been designed to create faster, safer and more reliable journeys for freight services, public transport and other road users between the Northern Beaches region and other strategic centres across Greater Sydney, including North Sydney, the Harbour CBD, Macquarie Park and St Leonards. Most long-term impacts of the project have been addressed through the design, including maintenance of access to existing roads, management of capacity constraints and provision for public transport capacity and active transport.

To minimise unexpected traffic and transport impacts associated with the project, 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 on surrounding arterial roads and major intersections, in accordance with environmental management measure OT1 (refer to Table D2-1 of this submissions report). Where required, additional feasible and reasonable mitigation measures will be identified in consultation with the Department of Planning, Industry and Environment and the relevant council to manage any additional traffic performance impacts identified during the review of operational network performance. In addition, where required Transport for NSW also will investigate local area traffic management measures in this area in

accordance with environmental management measure OT2 (refer to Table D2-1 of this submissions report). Such measures will be determined in consultation with the relevant council and implemented where feasible and reasonable.

The project surface connections at Balgowlah are anticipated to attract traffic demand from both east and west of Burnt Bridge Creek Deviation, as outlined in Section 9.4.5 of the environmental impact statement. The additional traffic from North Balgowlah could travel via Kitchener Street to access the new access road from Sydney Road east. This could increase traffic volumes on local roads between Kitchener Street and Sydney Road unless local area traffic management is also put in place to minimise increased traffic on local roads. Local area traffic management on Wanganella Street, Rickard Street and West Street would result in traffic demand using Woodland Street and Condamine Street instead, which is more appropriate to the function of these roads. The requirement for traffic calming measures in this area would be determined during further design development. The final design and location of traffic calming measures would be developed in consultation with Northern Beaches Council.

The project would also enable other divisions of Transport for NSW and other agencies (including councils) to explore opportunities for urban renewal, public transport, active transport and changes to transport management on key corridors. This includes working with local council and other government stakeholders to develop a place based transport plan for the lower North Shore, which would identify potential transport opportunities to respond to the changing needs of the community, including movement types, and initiatives for mode shift and network operation across all transport modes. The development of the plan would consider the transport needs for the area based on transport and land use changes within the area, including their purpose, connections between centres and modal priority, eg light vehicle, freight, buses and cyclists, and changes to the transport network as a result of major infrastructure projects currently proposed and being delivered in the area. Transport for NSW is commencing engagement with Willoughby City Council, Mosman Council, North Sydney Council and Lane Cove Council in the last quarter of 2021. The place based transport plan does not form part of the Beaches Link and Gore Hill Freeway Connection project and has not been considered as part of project development activities or the project design assessed in the environmental impact statement (refer to Chapter 5 (Project description) of the environmental impact statement).

The requested road upgrades and network improvements identified in these submissions are considered outside the scope of the project as the majority are well outside locations that could be affected by the project's integration with the existing road network.

Regarding the request to widen Spit Bridge and amend the opening schedule to improve traffic flow, it is noted that for the 'Do something' scenario for 2037, the peak period traffic demand on Spit Road would decrease by up to 33 per cent as a result of the project (refer to Section 9.4.1 of the environmental impact statement). This is further reduced for the 'Do something cumulative' scenario when the project is combined with the Western Harbour Tunnel and Warringah Freeway Upgrade project. Additionally, under the 'Do something' scenario, peak period heavy vehicle demand on the Spit Road/Military Road corridor would also decrease substantially by up to 74 per cent as a result of the project.



## C28.2 Parking

### ***Issue raised***

Submitters raised concerns and requests regarding parking in areas outside the scope of the project, including:

- Concerns there would be limitations on parking at various beaches within the Northern Beaches local government area due to increased traffic from the project, with a variable message sign recommended at the tunnel exit at Balgowlah to provide real-time parking availability at local beaches
- Requests that following completion of the project, Northern Beaches Council provide permits to residents for parking at local beaches given likely increase in traffic
- Requests that parking on Military Road be replaced with commuter parking
- Requests for more car parks at bus stops to encourage bus patronage
- Requests that North Sydney Council be provided with funding to enforce parking restrictions.

### ***Response***

Parking at various beaches within the Northern Beaches local government area, including restrictions and availability, is the responsibility of Northern Beaches Council and is outside the scope of the project. It is noted that residents and ratepayers in the Northern Beaches local government area are provided free parking in designated beach permit parking areas in accordance with the Northern Beaches Council's *Beach Parking Permit Policy*.

Replacing parking on Military Road with commuter parking is outside the scope of the project. However, the project creates an opportunity to reimagine Military Road and how this movement corridor services the lower North Shore and Northern Beaches. It would enable other divisions of Transport for NSW and other agencies (including council) to explore opportunities for urban renewal, public transport, active transport and changes to transport management on key corridors, including the Military Road/Spit Road corridor. This includes working with local councils and other government stakeholders to develop a place based transport plan for the lower North Shore, which would identify potential transport opportunities to respond to the changing needs of the community, including movement types, and initiatives for mode shift and network operation across all transport modes. Transport for NSW would also investigate alternative uses for road space, with initiatives aiming to contribute to the development of 'Successful Places', one of the six outcomes for NSW in the *Future Transport Strategy 2056* (NSW Government, 2018). Further discussion on the Military Road/Spit Road corridor is provided in sections B13.2 and B14.1.4 of this submissions report.

Although the provision of more car parking at bus stops is outside the scope of the project, it is noted that as part of the delivery of the B-Line Program by Transport for NSW, six new commuter car parks were provided at Mona Vale, Warriewood, Narrabeen, Dee Why, Brookvale and Manly Vale.

Transport for NSW understands the importance of minimising impacts on local communities, including the impacts of worker parking in streets. Where possible, temporary construction support sites have been located to accommodate the provision for parking and sized to balance the different constraints in each location, with a particular emphasis on minimising property acquisitions. The number of car parking spaces and tailored complementary demand management strategies at each temporary construction support site would be determined during detailed construction planning, following engagement of the contractor/s. Environmental management measure CTT11 (refer to Table D2-1 of this submissions report) has been updated to better reflect the intention to minimise

parking in local streets through a range of complementary initiatives. This is further discussed in Section A5.1.1 of this submissions report. These measures are considered to mitigate the impacts of worker parking in local streets and therefore Transport for NSW does not propose to provide funding to North Sydney Council to enforce parking restrictions.

## **C28.3 Public transport**

### ***Issue raised***

Submitters raised concerns, requests and suggestions relating to changes to public transport and infrastructure that are outside the scope of the project, including:

- Concerns that new bus services are not proposed as part of the project
- Requests for increased bus services and facilities within the Willoughby and Northern Beaches local government areas including an expansion of the successful B-Line program
- Concerns regarding the reduction or cancellation of bus services in the Willoughby and Northern Beaches local government areas. Specific concern was raised regarding the changes to the 169 and E69 bus routes
- Requests that the Freshwater class ferries to Manly be maintained
- Requests that the cost of public transport be reduced
- Concerns that incentives and infrastructure for electric buses is underdeveloped in Greater Sydney
- Suggestions for the Beaches Link tunnel to link directly to an underground bus interchange at North Sydney, to reduce congestion caused by buses from the Northern Beaches terminating at North Sydney
- Requests for a Northern Beaches public transport study to be prepared.

### ***Response***

The project has been designed to be a key piece of the public transport network of the Northern Beaches, allowing for the future provision of express bus connections with North Sydney, the Sydney CBD, Macquarie Park, St Leonards and potentially other key centres across Greater Sydney via the motorway network. There would also be the opportunity for express bus services using the project to interchange with Sydney Trains and the new Sydney Metro at North Sydney, Crows Nest and St Leonards. However, while the Beaches Link tunnels have been designed to allow use by buses, including taller double decker bus services and express buses, the provision and operation of new bus services is not part of the project for which approval is being sought.

The project would provide benefits to public transport customers as discussed in Section 3.6.3 of the environmental impact statement. The project would enable substantial improvements for public transport customers currently using some of Sydney's busiest road corridors – allowing for quicker and more reliable travel times for express bus services between the Northern Beaches and strategic centres. The project would also support the continued operation of the B-Line program along with other existing and proposed bus services by improving travel times and reliability on routes connecting the Northern Beaches to key centres including Spit Road/Military Road and Warringah Road/Eastern Valley Way. These benefits would make buses a more attractive transport option, supporting and encouraging a mode shift to public transport as outlined in Section 9.1.3 of the environmental impact statement. Additionally, the reduced vehicle congestion on Warringah Road between Frenchs Forest and Roseville would support the possible implementation of a rapid bus service, similar in nature to the existing B-Line operating on Military Road/Spit Road, between Dee Why and Chatswood.

Public transport infrastructure proposed as part of the Beaches Link component of the project is outlined in Table 5-9 of the environmental impact statement. A northbound and a southbound bus lane would be maintained along the Burnt Bridge Creek Deviation as part of the realignment and widening of the road. This would be consistent with existing bus provisions in this area, but would benefit from the new Beaches Link tunnels, which would enable express services to bypass the Military Road/Spit Road corridor to access North Sydney, the Sydney CBD, Macquarie Park, St Leonards and other strategic centres.

Transport for NSW announced a number of Northern Beaches and lower North Shore bus service improvements in December 2020. This included more than 2000 additional weekly bus services with new services including overnight B-Line services operating between Mona Vale and the Sydney CBD, and buses operating every 10 minutes on key routes as part of an all-day frequent network operating seven days a week. To help reduce duplication on the network, some routes eg Route 169, were replaced by new routes or extra services on other routes. Further detail is provided at: <https://transportnsw.info/news/2020/northern-beaches-lower-north-shore-bus-service-improvements>.

The reduction, cancellation or provision of bus routes and services within the Willoughby and Northern Beaches local government areas is outside the scope of the project as is the provision of additional bus stops along Burnt Bridge Creek Deviation.

Other concerns and requests relating to changes to public transport and infrastructure, such as the continued operation of the Freshwater class ferries between Manly and Circular Quay, the cost of public transport, incentives and infrastructure for electric buses, provision of an underground bus interchange at North Sydney and a Northern Beaches public transport study are considered outside the scope of the project.

## **C28.4 Active transport**

### ***Issue raised***

Submitters raised concerns and requests regarding active transport infrastructure that is outside the scope of the project, including:

- Requests for dedicated active transport facilities between the Northern Beaches and the CBD, including upgrading the Military Road/Spit Road corridor to include bicycle lanes, grade separated pedestrian crossings and amenity plantings
- Requests for the development of additional pedestrian pathways to access the Sydney Harbour Bridge
- Concerns that the Spit Bridge shared user path is inadequate in dimension and is unsafe for all users
- Requests that traffic lights be installed for Manly West Public School at Balgowlah to improve pedestrian safety
- Requests that a pedestrian bridge be constructed over Flat Rock Drive at Willoughby
- Requests that a green bridge be provided over the Warringah Freeway, between Miller Street and Ernest Street
- Requests that an upgraded active transport network be provided between Willoughby, North Sydney and the CBD, via Naremburn and Cammeray.

## **Response**

The NSW Government is committed to encouraging people to walk or cycle as part of their everyday travel. Walking and cycling for commuting and short trips relieve pressure on roads and public transport networks, and are part of a healthy lifestyle for communities. The Walking and Cycling Program in line with the NSW Government's *Future Transport Strategy 2056* (NSW Government, 2018), 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. Through this program councils can apply for funding for cycleways. Further information is available at [www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program](http://www.transport.nsw.gov.au/projects/programs/walking-and-cycling-program).

North Sydney Council, Mosman Council and Northern Beaches Council had successful applications for funding via the Walking and Cycling Program in 2019/20 and 2020/21 for the following:

- Construction of a walking and cycle link, combining sections of shared path, footpath, separated path and on-road cycle route, along the north side of Ridge Street from Miller Street to the existing shared user bridge over the Warringah Freeway
- Construction of a mixed treatment cycle route, over two kilometres long, between the Sydney Harbour Bridge and Cremorne
- Design and construction of stage one of the Mosman Regional Cycle Route, an on-road cycle route along Wyong Road from McPherson Street to Killarney Street at Mosman
- Construction of shared zone in Melaleuca Lane near Spit Junction, to encourage walking and cycling between a B-Line bus interchange and local schools and shops
- Construction of a 480 metre long shared path adjacent to Allambie Road and Rodborough Road at Frenchs Forest.

Applications for the NSW Government's 2022/2023 Walking and Cycling Program will commence shortly and councils are encouraged to continue to apply for funding for specific initiatives via the program.

In addition, Transport for NSW is also progressing plans to upgrade access to the Sydney Harbour Bridge cycleway, with the provision of a new ramp at the northern end of the bridge to improve the safety and capacity of the cycleway, enhance connections to the wider bike network and make bicycle riding convenient and attractive for more people. Consultation was carried out in June 2021, seeking the community's feedback on two options for the design of the cycle ramp. Based on the feedback received, Transport for NSW has commenced a competitive design process to progress the preferred option.

The Western Harbour Tunnel and Warringah Freeway Upgrade project includes a new shared user bridge, with landscaped edges including shade tree plantings, to the north of Ernest Street at Cammeray to connect the Cammeray Golf Course site with ANZAC Park as described in Section 5.3.6 of the Western Harbour Tunnel and Warringah Freeway Upgrade project environmental impact statement. This shared user bridge would provide opportunities for both passive and active recreation. The project will also complete an Active Transport Network Review of active transport infrastructure in the vicinity of the Warringah Freeway corridor, analysing existing capacity, patronage, suitability of shared facilities, the identification of constraints and missing links and recommendations to address the findings of the review.

The project creates an opportunity to reimagine Military Road and how this movement corridor services the lower North Shore and Northern Beaches. As the project design is further developed it would seek to maintain opportunities for the Military Road/Spit Road corridor identified under the *Mosman Local Strategic Planning Statement* (Mosman Council, 2020) and the *Military Road*

*Corridor Planning Study – Stage 1* (North Sydney Council, 2021). The project would enable other divisions of Transport for NSW and other agencies (including council) to explore opportunities for urban renewal, public transport, active transport and changes to transport management on key corridors, including the Military Road/Spit Road corridor. This includes working with local councils and other government stakeholders to develop a place based transport plan for the lower North Shore, which would identify potential transport opportunities to respond to the changing needs of the community, including movement types, and initiatives for mode shift and network operation across all transport modes. Transport for NSW will commence engagement with Mosman Council, Willoughby City Council, North Sydney Council and Lane Cove Council on this plan in the last quarter of 2021. Transport for NSW would also investigate alternative uses for road space, with initiatives aiming to contribute to the development of ‘Successful Places’, one of the six outcomes for NSW in the *Future Transport Strategy 2056* (NSW Government, 2018). Further discussion on the Military Road/Spit Road corridor is provided in section B13.2 and B14.1.4 of this submissions report.

It is anticipated that the project would result in reduced traffic volumes, reduced peak period demand and lower volumes of heavy vehicles on Spit Road and the Spit Bridge, improving local access and connectivity for pedestrians and cyclists. Lower traffic demand is also anticipated on Flat Rock Drive and Brook Street, which would assist in improving the efficiency of local movements and also impact positively on local access and connectivity for pedestrians and cyclists.

The proposed scope of the project complements other active transport planning being carried out by Transport for NSW, including those items discussed above.

The requested active transport upgrades identified in these submissions are considered outside the scope of the project.

## **C28.5 Tolling**

### ***Issue raised***

Submitters raised objections, concerns and requests about tolling or toll operators, including:

- Objections that the project would become a toll road
- Concerns about the cost of tolls and effectiveness of tolls in reducing congestion
- Concerns that toll roads disincentivise the provision of public transport
- Requests that a condition of approval be applied that prevents the toll road operator having a “conflict” which would prevent the development of public transport options
- Concerns that Transurban has a monopoly over tolled roads in Sydney.

### ***Response***

A tolled motorway applies a ‘user-pays’ principle to the provision of the faster alternative route compared to existing routes. This principle aims to fund the improved infrastructure through contributions from those who would benefit the most, rather than paying for the project out of general government revenue which is raised from taxpayers across NSW. This model is considered fair by Transport for NSW as the NSW Government alone cannot fund all infrastructure investment required in NSW. This model also accords with the Australian Government’s *National Public Private Partnership Guidelines* (Department of Infrastructure and Regional Development, 2015), which set out the basic case for user charging, noting that this allows infrastructure investment to be brought forward. This in turn provides for improved economic growth and efficiencies, providing benefits across the State in both the short and long term. This road tolling model has been used to fund

delivery of a number of motorway projects in NSW and across Australia. In October 2014, the NSW Government agreed to a broad set of principles for tolling of Sydney's motorways. As per the NSW Government's tolling principles, tolls can continue while they provide broader network benefits or fund ongoing costs. In addition, new tolls are applied only where the users receive a direct benefit.

Although private and commercial users of tolled motorways pay to use the route, patrons on public transport services that utilise the tolled motorway do not pay to use this faster alternative route. Tolled motorways are also expected to reduce demand on existing non-tolled routes eg surface roads, benefiting motorists and public transport patrons of these routes.

Tolling infrastructure for the Beaches Link tunnels has been included as part of the environmental impact statement, as discussed in Section 5.2.7 of the environmental impact statement. Travel demand management including consideration of congestion charging is discussed in Section 4.3.2 of the environmental impact statement.

As with other tolled motorway projects, alternative cost-free routes and public transport options would be maintained and the provision of new public transport routes would not be precluded through contractual arrangements.

The project would reduce congestion and improve travel times and reliability across Middle Harbour, including for B-Line services travelling to and from the Sydney CBD, with peak period traffic demand on Military Road and Spit Road expected to decrease as a result of the project by up to 11 per cent and 33 per cent respectively, resulting in improved travel speeds by 2037. This would deliver improved travel times for freight services, public transport and other road users that continue to use this route. This project would provide opportunities to operate new express bus services to and from the Northern Beaches via the Beaches Link tunnel, which would fundamentally improve existing bus travel times between the Northern Beaches and strategic centres including Sydney CBD and North Sydney.

The project would also provide the opportunity for efficient access and interchange with the new Victoria Cross Metro Station at North Sydney as part of the Sydney Metro City & Southwest project, which is a committed project under construction by Transport for NSW. The Sydney Metro City & Southwest project would 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 the Sydney Metro City & Southwest project would 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.

Conditions of approval are a matter for the Department of Planning, Industry and Environment to consider during its assessment of the project.

Comments about Transurban are outside the scope of the project.

## **C28.6 Privatisation**

### ***Issue raised***

Submitters raised objections to the privatisation of public assets, including concerns about the planned privatisation of bus services.

### ***Response***

Consideration of the privatisation of public assets (or asset recycling) is outside the scope of the project.

Notwithstanding, the NSW Government's asset recycling strategy is enabling the delivery of critical public transport projects such as the Sydney Metro City & Southwest project, the More Trains, More Services program and Parramatta Light Rail.

## **C28.7 Upgrades to public facilities and open space**

### ***Issue raised***

Submitters raised concerns and requests regarding public facilities that are outside the scope of the project, including:

- Requests to upgrade the Willoughby Leisure Centre and Bicentennial Reserve Oval
- Concerns that land would not be returned to Manly Warringah War Memorial State Park, as promised, to compensate for the loss of bushland caused by the Manly Vale Public School expansion
- Requests that a park be added adjacent to Taylor Lane and the Butterflies Early Learning Centre in Artarmon
- Concerns that the environmental levy paid by local ratepayers to the former Manly Council to support Burnt Bridge Creek was a waste.

### ***Response***

Upgrades to the Willoughby Leisure Centre and Bicentennial Reserve Oval are outside the scope of the project and are the responsibility of Willoughby City Council.

The proposed Wakehurst Parkway east construction support site (BL13) would occupy two portions of land east of Wakehurst Parkway and north of Kirkwood Street currently owned by Sydney Water. One portion of land, surrounding the main Bantry Bay Reservoir site north of the existing water tanks, would be leased by Transport for NSW from Sydney Water and returned once construction is complete. The other portion of the site would be located wholly on vacant non-operational Sydney Water owned land, immediately north of the existing water tanks. Transport for NSW would acquire this non-operational part of the Bantry Bay Reservoir site from Sydney Water. This land would be rehabilitated and revegetated as soon as practicable after construction and handed over to the Northern Beaches Council to manage for use by the community as part of the Manly Warringah War Memorial State Park. This would add about 4000 square metres of new public space to the Manly Warringah War Memorial State Park. The provision of other additional land to Manly Warringah War Memorial State Park as a result of the Manly Vale Public School expansion is outside the scope of the project and is a matter for the NSW Department of Education and Department of Planning, Industry and Environment (Crown Lands) and/or Northern Beaches Council.

The parcel of land at Taylor Lane is not within the construction footprint and it is therefore outside the scope of the project convert this land to public open space as suggested by the community.

The determination of environmental levies and rates is the responsibility of councils and is outside the scope of the project. However, it is noted that impacts to Burnt Bridge Creek have been minimised by the project. The realignment of the new access road has removed the requirement to realign Burnt Bridge Creek and minimised works to an extension of the existing box culvert crossing of Burnt Bridge Creek Deviation and associated scour protection, as discussed in Section 4.5.5 of the environmental impact statement.

## C28.8 Land use and zoning

### ***Issue raised***

Submitters requested changes to land zoning on the east side of Brook Street at Naremburn, to allow residential subdivision.

### ***Response***

Changes to land zoning on Brook Street are outside the scope of the project and are a matter for Willoughby City Council.

## C28.9 Vegetation clearing

### ***Issue raised***

Submitters raised objections to the *10/50 Vegetation Clearing Code of Practice for NSW* (NSW Rural Fire Service (RFS), 2015).

### ***Response***

The *10/50 Vegetation Clearing Code of Practice for NSW* (10/50 Code) (NSW RFS, 2015) was developed by the NSW Rural Fire Service to provide for vegetation clearing work to be carried out in certain areas near residential accommodation, high-risk facilities or farm sheds to reduce the risk of bush fire. The 10/50 Code is not being applied by the project.

Further information on the proposed clearing limits for the project and how this has been reduced through project development and construction planning is provided in Chapter 19 (Biodiversity) of the environmental impact statement. Environmental management measures to further minimise clearing are provided in Table D2-1 of this submissions report.

## C28.10 Motorcycle laws

### ***Issue raised***

Submitters raised requests regarding changes to motorcycle laws that are outside the scope of the project, including:

- Requests that motorcycle learner and provisional license holders are given special dispensation to lane filter in tunnels to reduce exposure to air pollution
- Requests that motorcycles with sidecars and other three-wheeled motorcycles are given dispensation to use the lane shoulders in the tunnels to reduce exposure to air pollution.

### ***Response***

The Beaches Link tunnel and associated ventilation system would be designed to ensure that all relevant health-based in-tunnel air quality criteria would be met at all times. This health-based in-tunnel air quality criteria applies to all motorists, including private vehicles and motorcyclists, and compliance with similar relevant in-tunnel air quality criteria is required by the planning approvals of other operational tunnels in Sydney. Therefore, impacts are not expected for any users of the tunnel.

Motorcyclists using tunnels have no opportunity to minimise exposures through the use of vehicle ventilation controls and would be exposed to NO<sub>2</sub> and particulate levels higher than passenger vehicles and trucks, as discussed in Section 6 of Appendix I (Technical working paper: Health impact assessment). These exposures, under normal conditions, are not expected to result in



adverse health effects. It is also considered common practice to discourage motorcyclists from using any motorway tunnel during periods of congestion. Motorcyclists also have the option to use the surface road network to minimise their exposure to elevated vehicle emission levels within the tunnels.

The suggested changes to motorcycle laws identified in the submissions are outside the scope of the project.

## C28.11 Electric vehicles

### ***Issue raised***

Submitters raised concerns and requests relating to electric vehicle use that are outside the scope of the project, including:

- Requests that the uptake of electric vehicles be incentivised to reduce air quality and noise impacts
- Requests that the use of the Beaches Link tunnel be restricted to electric vehicles
- Concerns that the project does not scope the cost of incorporating electric vehicle infrastructure
- Requests that investment in electric vehicle initiatives be considered
- Concerns that there is no timeline to deregister internal combustion engines, yet the environmental impact statement uses the uptake of electric vehicles as one of the drivers for less greenhouse gas emissions
- Requests that tolled motorway projects should not be approved until there has been a transition to electric vehicles powered from renewable energy.

### ***Response***

While the concerns and requests relating to electric vehicle use are outside the scope of the project, Transport for NSW's *Future Transport Strategy 2056* (NSW Government, 2018) includes NSW's *Electric and Hybrid Vehicle Plan* (NSW Government, 2019b). Actions within the plan are identified for the next five years, and are focussed on three key priority areas:

- Vehicle availability
- Charging points
- Customer information.

Further information on *NSW's Electric and Hybrid Vehicle Plan* is available at: <https://future.transport.nsw.gov.au/plans/nsw-electric-and-hybrid-vehicle-plan>.

The NSW Government announced on 20 June 2021 its Electric Vehicle Strategy, which includes an investment of almost half a billion dollars in tax cuts and incentives to drive uptake and reduce barriers for electric vehicle purchases over the next four years. The aim of this strategy is to drive sales of electric vehicles to more than 50 per cent of new car sales by 2030-31 and transition the entire NSW government passenger fleet to electric vehicles by 2030. Further information is available at: <https://www.nsw.gov.au/initiative/nsw-governments-electric-vehicle-strategy>.

Furthermore, the NSW Government is committed to transition to zero emission buses, delivering more sustainable outcomes for the community. Transport for NSW is carrying out a number of initiatives to understand the most effective way to transition the bus fleet, including partnering with leaders in the energy, transport, manufacturing and financing sectors to participate in trials of zero emission buses. The results of these initiatives will help to shape the direction of zero emission

buses in this State, including the most appropriate technology for the range of environments that the bus fleet operates in. The transition will be conducted in stages over the course of multiple years, to ensure that to continued delivery of safe and reliable services for customers.

It is acknowledged that Section 26.2.4 of the environmental impact statement states expected improvements in fuel efficiency and increases in electric vehicles would contribute to the project's overall efficiency of emissions. However, for the purposes of the emissions modelling as part of Appendix H (Technical working paper: Air quality), the fleet forecast did not account for alternate-fuel and low-emission vehicle technologies (eg electric vehicles, hybrids).

## **C28.12 Northern Beaches Council submission response**

### ***Issue raised***

Submitters raised concerns regarding road upgrades outside the scope of the project, including:

- Concerns that upgrades to local roads and intersections in the Northern Beaches area, as requested in the submission by Northern Beaches Council would not take place
- Concerns that upgrades to local roads and intersections in the Northern Beaches area, as requested in the submission by Northern Beaches Council would lead to additional traffic and congestion.

### ***Response***

The Northern Beaches Council submission to the environmental impact statement is considered in Section B11 of this submissions report.



Transport for NSW

# **Beaches Link and Gore Hill Freeway Connection**

C29 – Related projects

## **C29 Related projects**

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## C29.1 Integration of the Western Harbour Tunnel and Beaches Link program of works

### ***Issue raised***

Submitters raised concerns about the integration of the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects. Specific comments included:

- Beaches Link and Gore Hill Freeway Connection project should be considered separately to the Western Harbour Tunnel and Warringah Freeway Upgrade project
- What measures would be taken to ensure a clear demarcation and coordination between the Western Harbour Tunnel and Warringah Freeway Upgrade and Beaches Link and Gore Hill Freeway Connection projects and how would this be communicated to stakeholders.

### ***Response***

The Western Harbour Tunnel and Beaches Link program of works is a major transport infrastructure program that would make it easier, faster and safer to get around Sydney.

As discussed in Chapter 1 (Introduction) of the environmental impact statement, the Western Harbour Tunnel and Beaches Link program of works include:

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

While the Western Harbour Tunnel and Beaches Link program of works is an integrated program, the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project are subject to separate and coordinated environmental assessment and approval processes and are being delivered as separate projects, each with their own program start and completion times.

This submissions report relates to the Beaches Link and Gore Hill Freeway Connection project.

The Western Harbour Tunnel and Warringah Freeway Upgrade project received planning approval from the NSW Minister for Planning and Public Spaces on 21 January 2021 under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* and will commence construction before the Beaches Link and Gore Hill Freeway Connection project (which is still subject to planning approval).

It is planned for the Warringah Freeway Upgrade project to complete the surface works necessary to construct the two Beaches Link tunnel portals within the Warringah Freeway. This will assist in minimising disruption to traffic and the community in and around Cammeray. The Warringah Freeway Upgrade project will carry out this Beaches Link surface work in advance when they have access to these specific areas during the staging of their works to minimise the impacts and duration of the works.

Major work on the Beaches Link and Gore Hill Freeway Connection project is planned to begin by 2023, subject to planning approval and procurement.

Further opportunities for coordination between the Western Harbour Tunnel and Beaches Link program of works to maximise construction efficiency and minimise disruption impacts to the surrounding community are discussed in Chapter 5 (Project description) and Chapter 6 (Construction work) of the environmental impact statement. Delivery of any elements of the Beaches Link component as part of the Western Harbour Tunnel and Warringah Freeway Upgrade works would be subject to the conditions of approval for the Beaches Link and Gore Hill Freeway Connection project and the revised environmental management measures provided in Table D2-1 of this submissions report.

For the purposes of the environmental impact statement and assessing potential operational impacts of the project, the Warringah Freeway Upgrade (without Western Harbour Tunnel) is assumed to be delivered (refer to Section 5.1 of the environmental impact statement for further discussion).

Consultation for the Beaches Link and Gore Hill Freeway Connection project will be carried out in accordance with the community consultation framework provided in Appendix E (Community consultation framework), as required by environmental management measure SE3 in Table D2-1 of this submissions report. The community consultation framework has been prepared to guide the planning and delivery of communication and stakeholder engagement activities across the project in accordance with the Secretary's environmental assessment requirements. Should the project be approved, a community communication strategy based on Appendix E (Community consultation framework), would be prepared to provide further details about community involvement during design, construction and the project opening phase. The community communication strategy would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

Communication between the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project would be guided by the community communication strategy and will be in accordance with environmental management measures C11 and C13 and revised environmental management measure C12 (refer to Table D2-1 of this submissions report). This will ensure considered and tailored multi-party engagement and cooperation is established prior to construction and all contributors to impacts are working together to minimise adverse impacts or enhance benefits of multiple projects occurring concurrently or consecutively.

## **C29.2 Western Harbour Tunnel and Warringah Freeway Upgrade project impacts**

### ***Issue raised***

Submitters raised concerns about the impacts of the Western Harbour Tunnel and Warringah Freeway Upgrade project. Specific concerns and objections included:

- Concerns regarding operational access and network performance including:
  - A request for reconsideration of the closure of Ernest Street, Miller Street and Falcon Street to more than one harbour crossing
  - How access to the Western Harbour Tunnel would be achieved from Mosman/Neutral Bay from Falcon Street or Ernest Street, suggesting the entrance to Western Harbour Tunnel is provided several hundred metres south on the Warringah Freeway

- Concerns the Miller Street and Brook Street ramps would be inaccessible by traffic using the Western Harbour Tunnel
- Western Harbour Tunnel and Warringah Freeway Upgrade project would result in traffic congestion on Willoughby Road, in addition to being an inconvenience to travel to Northbridge, Castlecrag, East Roseville and Killarney Heights
- Concerns that crossing Falcon Street would become more difficult
- Concerns that there may be impacts to the coal loader facility and Aboriginal heritage items such as the rock carvings at Balls Head at Waverton
- Objections to the use of St Leonards Park during construction as it would remove a recreation facility in Crows Nest
- Concerns whether previous issues raised about the Warringah Freeway Upgrade at Cammeray would be adequately addressed by the contractor/s.

### ***Response***

The issues raised relate to the Western Harbour Tunnel and Warringah Freeway Upgrade project. The project and the Western Harbour Tunnel and Warringah Freeway Upgrade project are subject to separate environmental assessment and approval processes, as noted in Section C29.1 above and Section 1.1 of the environmental impact statement. Further information, including the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement, submissions report and conditions of approval, can be accessed at: [www.planningportal.nsw.gov.au/major-projects/project/10451](http://www.planningportal.nsw.gov.au/major-projects/project/10451).

### **Operational access and network performance**

Project elements and environmental assessments in relation to the Western Harbour Tunnel and Warringah Freeway Upgrade project are presented in that project's environmental impact statement. In particular, the project design is presented in Chapter 5 (Project description), and operational traffic and transport impacts are presented in Chapter 9 (Operational traffic and transport) and Appendix F (Technical working paper: Traffic and transport) of the Western Harbour Tunnel and Warringah Freeway Upgrade environmental impact statement. Requested design changes are out of the scope of the Beaches Link and Gore Hill Freeway Connection project.

The Warringah Freeway Upgrade component of the Western Harbour Tunnel and Warringah Freeway Upgrade project requires an improvement of the bypass and access/distributor functions of the road corridor to achieve optimised connectivity for the harbour crossings and support growth in traffic demand. This requires a number of modifications as discussed in Section 5.3 of the Western Harbour Tunnel and Warringah Freeway Upgrade project environmental impact statement.

The Warringah Freeway Upgrade 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 Warringah Freeway Upgrade includes upgrades to existing interchanges with High Street and Falcon Street, the provision of new, upgraded and relocated road bridges, upgrades to the surrounding road network, and provision of a new southbound bus lane on the Warringah Freeway. These modifications will also result in improvements to performance, safety and wayfinding. Residents and businesses in the suburbs around the Warringah Freeway will remain closely connected to at least one harbour crossing, and in most cases have good access to multiple harbour crossing options. Access arrangements upon completion of construction works at the Warringah Freeway is provided in Figure 9-5 of the environmental impact statement.

The intersection level of service at the Willoughby Road/Gore Hill Freeway interchange will substantially improve during peak hours with the construction of the Western Harbour Tunnel and Warringah Freeway Upgrade project (and also with the introduction of the Beaches Link and Gore Hill Freeway Connection project) compared to the without project scenario, as outlined in Table 9-8 of the Western Harbour Tunnel and Warringah Freeway Upgrade project environmental impact statement. The Western Harbour Tunnel and Warringah Freeway Upgrade project is not anticipated to result in a substantial increase in traffic volumes along Willoughby Road and surrounding streets.

The Western Harbour Tunnel and Warringah Freeway Upgrade project will result in a number of safety benefits for pedestrians due to a decrease in traffic on local and arterial roads, reducing potential for interactions between vehicles and pedestrians. Specific to the Warringah Freeway Upgrade and works associated with Falcon Street, improvements to the active transport infrastructure have been included as detailed in Table 5-13 of the Western Harbour Tunnel and Warringah Freeway Upgrade project environmental impact statement. This includes upgraded pedestrian crossings at the Falcon Street on ramp and off ramp, at North Sydney/Cammeray/Neutral Bay, replacement of the Falcon Street shared user bridge and provision of a new pedestrian footpath along the median through the centre of the Falcon Street interchange upgrade. With the inclusion of these improvements, there will be a number of opportunities to safely cross the Falcon Street road corridor.

#### Potential Aboriginal and non-Aboriginal heritage impacts at Balls Head at Waverton

Potential impacts to the former Balls Head Coal Loader site and Aboriginal heritage sites located at Balls Head and surrounds are discussed in Chapter 14 (Non-Aboriginal heritage) and Chapter 15 (Aboriginal cultural heritage) of the Western Harbour Tunnel and Warringah Freeway Upgrade project environmental impact statement, respectively.

The Western Harbour Tunnel and Warringah Freeway Upgrade project will have no direct impact on the former Balls Head Coal Loader site and Aboriginal heritage sites located at Balls Head and surrounds. However, there is potential for indirect impacts associated with vibration and ground movement. Notwithstanding, a number of environmental management measures included in Table D2-1 of the Western Harbour Tunnel and Warringah Freeway Upgrade project submissions report. These measures will be implemented in combination with relevant conditions of approval provided by the NSW Minister for Planning and Public Spaces on 21 January 2021 under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

#### Use of St Leonards Park

The Ridge Street north construction support site (WHT9) associated with the Western Harbour Tunnel and Warringah Freeway Upgrade project will 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 the Ridge Street north construction support site (WHT9) about the timing and duration of construction works and management of potential impacts, in accordance with relevant environmental management measures (refer to Table D2-1 of the Western Harbour Tunnel and Warringah Freeway Upgrade project submissions report) and conditions of approval. 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.



### Previous issues raised about the Warringah Freeway Upgrade

Previous community issues raised about the Warringah Freeway Upgrade were addressed in the *Western Harbour Tunnel and Warringah Freeway Upgrade submissions report* (Transport for NSW, 2020i) (refer to Part C of that report). Transport for NSW's response to the community issues raised and any revised environmental management measure were considered by the Department of Planning, Industry and Environment in preparing their Assessment Report and recommending conditions of approval. The Western Harbour Tunnel and Warringah Freeway Upgrade project was approved by the NSW Minister for Planning and Public Spaces on 21 January 2021.

The contractor/s for the Warringah Freeway Upgrade will be responsible for implementing the conditions of approval including revised environmental management measures, and Transport for NSW will monitor how the contractor/s comply with the conditions of approval during construction.

There would be numerous obligations on the contractor/s 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 the Western Harbour Tunnel and Warringah Freeway Upgrade project submissions report. Many of the environmental management measures require consultation with the community and stakeholders during construction. Additionally, the conditions of approval prescribe compliance measures for monitoring of impacts, environmental reporting and environmental performance.

## **C29.3 Northern Beaches Hospital road upgrade project impacts**

### ***Issue raised***

Submitters raised concerns about the impacts of the Northern Beaches Hospital road upgrade project and its relationship to the Beaches Link and Gore Hill Freeway Connection project. Specific concerns and requests included:

- Concerns there has not been full consideration of biodiversity impacts as a result of the Northern Beaches Hospital road upgrade project in the Beaches Link and Gore Hill Freeway Connection project environmental impact statement
- Requests for data on the impact of vibration on the Aboriginal heritage sites in the vicinity of the Northern Beaches Hospital road upgrade project construction site.

### ***Response***

#### General

It should be noted that the potential for cumulative impacts in Frenchs Forest from other projects, including the Northern Beaches Hospital road upgrade project has been assessed in Chapter 27 (Cumulative impacts) of the environmental impact statement. The Northern Beaches Hospital road upgrade project was recently completed in August 2020 after a four year construction period. Major work on the Beaches Link and Gore Hill Freeway Connection project is planned to begin by 2023, which would provide the surrounding community in Frenchs Forest respite between both projects. As such, the cumulative impact assessment found that, based on the status, timeframe, location and scale of impact of assessed projects and strategic plans relevant to the area, the construction of the project in Frenchs Forest would be unlikely to produce cumulative impacts in this area.

#### Consideration of biodiversity impacts as a result of the Northern Beaches Hospital road upgrade project

The recently completed Northern Beaches Hospital road upgrade project overlaps with the northern extent of the construction footprint as shown in Figure 19-5 of the environmental impact statement.

The area of overlap has been heavily modified/cleared due to the construction of the Northern Beaches Hospital road upgrade project and was therefore excluded from the biodiversity assessment carried out for the project including calculations of biodiversity impacts (refer to Chapter 19 (Biodiversity) of the environmental impact statement).

The area of overlap was assessed as part of the *Biodiversity Assessment Report: Northern Beaches Hospital Connectivity and Network Enhancements Stage 2 Environmental Impact Statement* (SMEC, 2015) and associated impacts have been offset in accordance with relevant project conditions of approval for the Northern Beaches Hospital road upgrade project as detailed in *Northern Beaches Hospital Connectivity and Network Enhancements Biodiversity Offset Package – Stage 3 Report* (SMEC, 2020). As such, the Beaches Link and Gore Hill Freeway Connection project was not required to reassess this area under the *Biodiversity Assessment Method* (Office of Environment and Heritage (OEH), 2017a).

#### Data on the impact of vibration on Aboriginal cultural heritage sites

Vibration monitoring of Aboriginal heritage sites in the vicinity of the Northern Beaches Hospital road upgrade project was not required in the project conditions of approval or as part of the approved noise and vibration construction environmental management sub-plan. This was due to the type of works carried out for the project and the distance of these works from Aboriginal heritage sites.

Further detail regarding monitoring requirements for the Northern Beaches Hospital upgrade and compliance reporting is available at: <https://roads-waterways.transport.nsw.gov.au/projects/northern-beaches-hospital/project-documents.html>.

## **C29.4 Concerns related to the WestConnex**

### ***Issue raised***

Submitters suggested that the WestConnex had experienced cost increases, resulted in poor community experiences, and demonstrated a lack of transparency regarding remediation. There were concerns the same would be repeated for the Beaches Link and Gore Hill Freeway Connection project.

### ***Response***





Specific issues related to projects being delivered as part of the WestConnex are beyond the scope of the project. Notwithstanding, an extensive library of documents required to be prepared and published under the relevant WestConnex conditions of approval and environment protection licences, including but not limited to, monitoring and compliance tracking reports, minutes from community reference groups and documents in relation to remediation are provided at: <https://www.westconnex.com.au/document-library/>.

Delivery of the Beaches Link and Gore Hill Freeway Connection project would be carried out in accordance with conditions of approval provided by the NSW Minister for Planning and Public Spaces, the environment protection licence(s) that would be issued for the project as well as the project environmental management framework and revised environmental management measures detailed in Table D2-1 of this submissions report. There would be numerous obligations on the contractor/s and Transport for NSW in terms of ongoing monitoring and communication of environmental impacts during construction. Many of the environmental management measures require consultation with the community and stakeholders during construction. Additionally, the likely conditions of approval that could be applied to the project would prescribe compliance measures for monitoring of impacts, environmental reporting and environmental performance.

The Western Harbour Tunnel and Beaches Link program of works has followed the Infrastructure NSW process. Through this process the program of works has demonstrated its economic merit and successfully passed, for this development stage of the project, 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 Beaches Link and Gore Hill Freeway Connection project has undergone extensive scrutiny throughout its development.

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



-  [nswroads.work/whtbl](https://nswroads.work/whtbl)
-  [whtbl@transport.nsw.gov.au](mailto:whtbl@transport.nsw.gov.au)
-  1800 931 189
-  Customer feedback  
Transport for NSW, Locked Bag 928  
North Sydney NSW 2059



### Translating and Interpreting Service

If you need an interpreter, please call the Translating and Interpreting Service (TIS National) on **131 450** and ask them to telephone Transport for NSW on **1800 931 189**.

#### Chinese (simplified)

若您需要口译员，请拨打 **131 450** 致电翻译与口译服务处 (TIS National)，并要求他们转拨 **1800 931 189** 致电 Transport for NSW。

#### Italian

Se avete bisogno di un interprete, chiamate il servizio traduttori e interpreti (TIS National) al numero **131 450** e chiedete di telefonare a Transport for NSW al numero **1800 931 189**.

#### Portuguese

Se necessitar de um(a) Intérprete, por favor, ligue para o Serviço de Tradução e Interpretação (TIS National), através de **131 450** e peça o telefone do Transport for NSW, através de **1800 931 189**.