NSW GOVERNMENT

Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Submissions report

Part C
Response to community submissions

C Part C Response to community submissions

C1 Assessment process

This chapter addresses issues raised in community submissions associated with the assessment process for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 2 (Assessment process) of the EIS for further details on the assessment process for the project.

Contents

C1.1 Adequacy and independence of the EIS

25 submitters have raised issues regarding the adequacy and independence of the EIS.

C1.1.1 Adequacy of the EIS

Submitters raised concerns regarding the adequacy of the EIS in providing a detailed, consistent, justified, comprehensive and clear assessment of the environmental, social and economic impacts of the project. Specific concerns include:

- The EIS:
  - Does not meet the Planning Secretary's Environmental Assessment Requirements (SEARs)
  - Was not easy to understand due to its general tone, language, length and complexity
  - Contains inconsistencies, including:
    - Inconsistent references to Patmore Swamp, Scarborough Park North, Central Scarborough and North Scarborough Ponds, causing confusion
    - Inconsistencies regarding whether the Marsh Street widening project has been completed or not
  - Is based on a concept design, which suggests that there has not been enough analysis of the real impacts of the project during both construction and operation
  - Does not provide an accurate assessment of the project impacts, which will likely result in impacts greater than those forecast
  - Provides selective, confusing and misleading information
  - Is insufficient in scope, reflects inadequate investment in a rigorous assessment, and reflects a literal and legal approach to assessing project impacts.
- Artist impressions of the project are considered to be inaccurate, for example, President Avenue appears level even though it would be raised by 3 metres
- The non-disclosure of traffic modelling has prevented true and public review of the EIS.

Response

The EIS was prepared in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), the SEARs and Part 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (NSW) (the Regulation). A checklist against this regulation and a copy of the SEARs, including an indication of where they are addressed in the EIS, is provided in Appendix A (Statutory requirements) of the EIS.

The SEARs list the assessment requirements for the EIS and were prepared based on the recommendations of government regulatory agencies as well as industry standards and guidelines. The SEARs focused on the assessment of impacts (adverse and beneficial) from the construction and operation of the F6 Extension Stage 1 project. These requirements and impacts were analysed in depth within the relevant sections of the EIS. Technical studies were prepared to address all key issues identified in the SEARs.

The assessment of impacts resulting from the construction and operation of the project was based on the best available technical information, industry standards and guidelines, good environmental practice and risk minimisation. Further, to account for any future design changes, the EIS adopts a conservative approach to the technical studies (ie assesses the worst case scenarios and impacts). The NSW Department of Planning and Environment (DP&E), including its independent technical peer reviewers, and relevant NSW government agencies, confirmed that the SEARs were addressed and the EIS was suitable for public exhibition.

Tone, language, length and complexity

Detailed investigations and studies by technical specialists were required to adequately assess potential environmental impacts of the project. The technical reports that are appended to the EIS are by necessity technical documents. In order to make this information more available to the general public, the main EIS chapters have been simplified and written in plain English as much as possible, while still conveying the outcomes of the technical assessments.

The EIS contains an executive summary and a project synthesis, which provides an overview of the project components, the potential impacts and the approach to managing these. Roads and Maritime has aimed to use less technical terms and jargon and more common language, where possible. The document has been reviewed by technical editors and communications personnel with the intent of making the document readable for the general public. The consultation process for this project has been aimed at creating an open dialogue through many channels to ensure that the EIS is communicated on a level that everyone is able to participate on.

The Roads and Maritime project website also contains an interactive EIS portal which provides a brief summary of the project via an interactive map and the individual chapters of the EIS are available for download.

Inconsistencies in the EIS

Naming inconsistencies for waterbodies and open space areas

The surface water and flooding assessment for the project refers to the Scarborough Ponds catchment, which includes a watercourse about 2.5 kilometres long, comprising of a series of ponds, beginning at Brighton-Le-Sands and discharging into Botany Bay to the south of Ramsgate Beach.

The area to the south of President Avenue is known as Scarborough Park North and includes waterways referred to as the Scarborough Ponds.

Scarborough Park North is commonly known as Patmore Swamp. The name 'Patmore Swamp' is used in the heritage assessment because this is the name of the heritage listing for this area under the *Rockdale Local Environmental Plan 2011*. During community consultation prior to exhibition of the EIS, it was noted that community members commonly referred to this area as 'Patmore Swamp'. Patmore Swamp is one of the series of ponds/wetland areas that form Scarborough Ponds as a whole.

The reference to Central Scarborough in Chapter 19 (Non-Aboriginal heritage) of the EIS is from the NSW Office of Environment and Heritage statement of significance for Patmore Swamp. It states that Patmore Swamp is significant for its contribution to the Central Scarborough wetland area which is an integral part of the wetlands corridor. The Central Scarborough wetland area is part of the Rockdale Wetlands corridor and includes the wetlands south of President Avenue.

An updated figure has been produced to clarify these different water features and nomenclature. This is provided in **Chapter A2** (Clarifications).

Inconsistencies regarding the completion of the Marsh Street widening project

The project abuts the Marsh Street widening project and therefore the widening project has been considered in assessment of cumulative traffic and biodiversity impacts in the EIS. The Marsh Street project commenced in April 2016 and all major work has recently been completed (early 2018). The two projects, along with the New M5 Motorway project, would impact receivers in the vicinity continuously for several years, should the F6 Extension Stage 1 project be approved.

EIS based on a concept design

Similar to the planning approval processes for other major infrastructure projects, undertaking the environmental assessment based on a concept design allows stakeholders and communities to provide input into the scope of the project through various consultation mechanisms, including the EIS public exhibition period, before the detailed design of the project is undertaken and the exact design and construction method of the project is confirmed. As mentioned above, to account for any changes in the concept design, the EIS adopts a conservative approach to the technical studies (ie assesses the worst case scenarios and impacts).

Any changes to the design following project determination would need to be consistent with the conditions of approval. Design changes, subject to their scope and nature, may require additional impact assessment and application by Roads and Maritime to DP&E to modify the project approval.

Accuracy and completeness of diagrams and artist's impressions

The figures and diagrams provided in the EIS are based on the concept design of the project and are indicative only.

Artist impressions were used to provide a representation of the design of the project. The artist's impressions aim to visually represent the key features of the project within the existing landscape and do not incorporate architectural design treatments. It is acknowledged that one or both artist impressions of President Avenue may appear to not reflect a change in height of three metres. However, artist impressions are indicative only. A detailed review and finalisation of architectural treatment of the project's operation infrastructure will be undertaken during detailed design. The architectural treatment of these facilities will be guided by the outcomes of ongoing stakeholder and community consultation and urban design principles.

Access to traffic modelling

Detailed information on the approach to the traffic modelling for the project, including data inputs and assumptions, is included in Appendix D (Traffic and transport technical report) of the EIS. This was available to the public to review and comment on during the EIS exhibition period. Further responses regarding the traffic and transport modelling and assessment are provided in **Chapter C7** (Traffic and transport).

C1.1.2 Suitability/independence of EIS consultants

Submitters raised concerns regarding the suitability and involvement of various consultants/contractors in the preparation of the EIS. Specific concerns raised included:

- Errors have been found in previous project assessments by consultants who contributed to the F6 Extension Stage 1 EIS, which reduces public confidence that the EIS is accurate
- AECOM has been criticised for having multiple commercial interests in the WestConnex projects
- Impartial, independent assessment cannot be achieved due to conflicts of interest, such as the EIS consultant also being involved in the preliminary design; and the prospect of further commercial contracts relating to the F6 Extension Stage 1 project, if approved.

Response

The engagement of consultants to undertake the environmental assessment of the F6 Extension Stage 1 project was undertaken via a competitive tender process which included assessment against the tender evaluation criteria in accordance with NSW Government procurement processes. AECOM therefore participated in a fair and transparent process to provide professional engineering, technical and environmental services on the project.

The engagement of a specialist consultant to prepare the EIS is consistent with other major transport infrastructure projects of this size and scale. The EIS was prepared by a team of qualified professionals and presents a balanced, merit-based environmental impact assessment in accordance with the EP&A Act, the SEARs and applicable NSW assessment policies (refer to **section C1.1.1** for further information regarding the adequacy of the EIS).

C1.2 Approval process

196 submitters have raised issues regarding the approvals process for the project. Chapter 2 (Assessment process) of the EIS outlines the assessment process for the project.

C1.2.1 Adequacy of timing and duration of EIS exhibition

Concerns were raised that the public exhibition period of 37 days was inadequate to prepare meaningful submissions, given the length and complexity of the EIS. Further, submitters raised concerns that the EIS exhibition period occurred very close to the Christmas period, which affected the ability of the public to make considered submissions. This timing of the exhibition period warranted a longer exhibition period. Specific concerns raised included:

- The views and concerns of the local community will not be properly represented or considered, as reasonable time was not provided to fully consider the information in the EIS and provide an adequate response

- The exhibition period should have been extended to 90 days.

Response

Duration and timing of EIS exhibition

DP&E, as the determining authority for the project, is responsible for determining the timing and duration of public exhibition periods for the EIS, in accordance with section 5.8 of the EP&A Act. DP&E extended the public exhibition period from the minimum statutory period of 28 (calendar) days to a total of 37 days (11 November to 14 December 2018). This exhibition period considered the length and complexity of the EIS documentation as well as the time of year. The duration of the exhibition period was the same for both community members and government stakeholders, such as councils.

C1.2.2 Project governance

Submitters raised concern that the project fails to adhere to the Major Projects Assurance Framework, and fails to employ best practice governance. In particular, the submitters raised concerns that vital gateway reviews have not been carried out during preparation of the project.

Submitter raised concern that the project has bypassed Infrastructure Australia's merit based assessment.

Response

Reporting is undertaken by Infrastructure NSW monthly on the progress of project implementation and delivery. This is done as part of its role under the Infrastructure Investor Assurance Framework. These reports are prepared by Infrastructure NSW and provide independent advice on the F6 Extension to the NSW Cabinet Committee on Infrastructure. This ensures the NSW Government receives independent advice on the status of the project.

The F6 Extension Stage 1 Business Case has been through an externally managed Business Case Gateway Review, in accordance with the recommendation by the NSW Auditor-General that major projects be subject to the Infrastructure Investor Assurance Framework designed by Infrastructure NSW. The Infrastructure NSW Business Case Summary[1] found that the project would have a net overall benefit to NSW, and that the project is 'highly likely to deliver significant service improvements. This, together with the governance arrangements in place to deliver the project, represent a sound basis for Government's investment decision'.

C1.3 Issues occurring after project approval

142 submitters have raised issues regarding approval pathways following determination of the EIS.

C1.3.1 Implementation of the EIS conditions of approval

Submitters raised concerns with how approval conditions will be applied and regulated. Specific concerns include the following:

- Concern about appropriate implementation of conditions of approvals by operators and contractors, including the repair of community assets such as playing fields and open spaces
- Concern about the ability of government authorities to enforce compliance and to ensure this is exercised in a fair, consistent and equitable manner
- Concern with how conditions of approval have been managed and enforced by Roads and Maritime and DP&E.

[1] Infrastructure NSW (2018) Final Business Case Summary – F6 Extension Stage 1

Response

Implementation and enforcement of conditions of approval

Should the Minister for Planning determine that the project be approved, conditions of approval will be applied to the project. These conditions are expected to be informed by the EIS, including the proposed environmental management measures and other commitments, good practice on infrastructure projects, and the precedent set on other Stage Significant Infrastructure transport projects. DP&E have also developed a set of standard conditions of approval for Critical State Significant Infrastructure projects.

Roads and Maritime's appointed contractors and subcontractors will have to comply with all requirements of the conditions of approval for the project. This will require implementing all the environmental management measures described in the EIS and other necessary measures to prevent and/or minimise any harm to the environment and/or people that may result from the construction and/or operation of the project.

As the proponent, Roads and Maritime will be responsible for ensuring compliance with the conditions of approval for the project. Roads and Maritime will implement a compliance tracking program to track and monitor compliance with the conditions of approval for the duration of construction and for a minimum of one year following commencement of operation. A pre-construction compliance report will be prepared to detail how the conditions of approval will be complied with, and what actions will be taken to rectify non-compliance. Construction would not commence until this report is approved by the Planning Secretary of DP&E.

The DP&E and NSW EPA compliance teams undertake inspections to ensure projects meet their approval conditions and licence requirements. Enforcement can range from negotiating practical solutions to issuing penalty notices and, in serious cases, criminal prosecutions.

As described in Chapter 3 (Consultation) of the EIS, a Complaints Management System will be implemented for the duration of construction. This system will be used to capture any complaints including compensation requests for damage caused to private property and complaints about ongoing disturbance leading to construction fatigue.

C1.3.2 Changes to the concept design after approval

Submitters raised concerns about potential changes to the concept design and construction methods following approval of the EIS and appointment of a contractor. Concerns also relate to the potential for unforeseen impacts not anticipated in the EIS to not be regulated. Specific concerns raised include:

- Concern that the specific details of the project will only be revealed later
- Concern that the post approval pathways do not allow for reassessment of impacts and identification of mitigation measures for impacts not anticipated during the development of the EIS
- Concern that the EIS defers responsibilities to contractors.

Response

As described in **section C1.1.1**, the EIS is based on a concept design of the project. Any changes to the design following project determination will need to be consistent with the conditions of approval. Where the detailed design is inconsistent with the approved project, further assessment will be undertaken (including identification of further environmental management measures, where relevant), as required under the EP&A Act. If further assessment is required because of design changes, the relevant statutory process will be followed. This may include a request for modification of approval in accordance with section 5.25 of the EP&A Act. Following such an application, the Minister for Planning will assess the changes and may modify the approval (with or without conditions) or disapprove of the modification.

While the design and construction contractor(s) appointed following determination of the project may identify improvements to deliver the project, the design refinements will need to satisfy all technical road design requirements and road functionality as described in the EIS, and be consistent with the approved scope of the project, including environmental management measures and conditions of approval for the project. Roads and Maritime, as the proponent, remains responsible to ensure the conditions of approval are met.

C1.3.3 Awarding of contracts for the project

Submitters raised concerns regarding the tender process for project contracts including how contracts were awarded. Other specific concerns include:

- Concern that contracts to construct and operate the project have been awarded but not disclosed
- Concern that contracts are already in place for the construction of the F6 Extension and that this is the reason alternatives to the project have not been progressed
- Concern that the evaluation of tenders to construct and operate the project will be influenced by existing contract agreements with the WestConnex New M5 Motorway project ie Roads and Maritime are contractually obligated to connect a road to the New M5 tunnel stubs in the manner described as the WestConnex 'Southern Connector'.

Response

The construction contract for the project has not yet been awarded. It will be awarded in accordance with NSW Government procurement processes. The procurement process will take place via an open tender. The tender evaluation process will not be influenced by existing contracts. There will be a separate tender evaluation process to determine the preferred construction contractor. Roads and Maritime will make details of the project contract available online within three months of project award.

C Part C Response to community submissions

C2 Consultation

This chapter addresses issues raised in community submissions associated with the consultation undertaken and planned for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 3 (Consultation) and Appendix B (Draft community consultation framework) of the EIS for further details on the consultation undertaken.

Contents

C2.1 Consultation prior to public exhibition of the EIS

17 submitters raised issues regarding consultation prior to public exhibition of the EIS. Refer to section 3.2 of the EIS for details of the consultation carried out prior to public exhibition of the EIS.

Submitters expressed concerns regarding the level and method of consultation undertaken prior to the public exhibition of the EIS. Specific concerns include:

- Consultation with community members was rushed and limited, including consultation with residents in the Georges Rivers area, along West Botany Street, and stakeholders (including children) around Rockdale Bicentennial Park
- The consultation approach was considered to be disingenuous, ineffective and inadequate, particularly methods such as doorknocking
- Level of consultation with local councils including Georges River Council and Sutherland Shire Council was not evident
- Previous concerns raised about the project, such as relocation of ventilation outlets, were not addressed in the EIS
- Supporting consultation materials, including maps and artistic impressions, conveyed unrealistic impressions of the project and require clearer content for accuracy.

Response

Consultation approach and timing

Prior to the public exhibition of the EIS, extensive consultation was carried out from June 2016 during the preliminary planning phase and throughout the EIS planning phase until August 2018. The community consultation activities carried out used a variety of communication and engagement tools that are summarised in Table 3-1 of the EIS. These activities included:

- Tailored consultation with potentially impacted landowners, residents and businesses
- Doorknocks and letterbox drops to advise residents and local businesses of early investigation work being carried out near their premises
- Project briefings offered to key stakeholders within the vicinity of the project including local councils, schools, businesses, community groups, interested property owners, environmental groups and industries
- Distribution of factsheets and project update newsletters
- Interactive online portal
- ‘Pop-up’ information events and community information sessions
- Responses to inquiries received through the established engagement channels such as project 1800 contact number, project postal address and email address.

Doorknocking efforts extended to over 1,500 residences and businesses at Arncliffe, Kogarah, Monterey and Rockdale between June and July 2018. The doorknock area included residences within Moorefield Estate and residences and businesses along West Botany Street and President Avenue. Where community members were unavailable during the time of the doorknock, contact cards were provided along with project update information. This information provided community members with an opportunity to contact project team members and request a revisit to their property at a more suitable time. Where residents were present, project team members listened to their views and recorded comments for consideration in the project planning and design.

Targeted consultation was directed at landowners and businesses directly adjacent to the project footprint that are potentially affected by construction and operation impacts. These stakeholders were all located within the Bayside Council Local Government Area (LGA). Community members within the Georges River and Sutherland Shire LGAs were provided with project update newsletters and opportunities to visit pop-up information events or community information sessions, which were widely advertised. Community members outside of the project impact area also had options to visit the project web page on the Roads and Maritime website for further details and to register their interest to receive community email updates.

Direct consultation was not carried out with children however potential impacts or opportunities related to use of local recreation areas and operation of schools were discussed through briefings with stakeholders and representative groups. These groups included local primary and secondary schools as well as sporting clubs. Additionally, the project team has worked with Bayside Council to identify stakeholders to participate in the Stakeholder Liaison Group (SLG). The SLG provides a forum for discussion between Roads and Maritime, Bayside Council and representatives from community groups and organisations that have a direct interest in matters relating to Rockdale Bicentennial Park, East Bicentennial Playing Fields and Brighton Memorial Playing Fields. Section 3.2 of the EIS lists the stakeholders that were invited to participate in this forum, which includes local football associations, Department of Education and Training, St George Youth Services, St George Children with Disabilities and Madif Al Ameer Youth.

Consultation with local councils

The project footprint is mainly situated within the Bayside Council LGA and partly within the Canterbury-Bankstown Council and Inner West Council LGAs. Regular meetings with Bayside Council have occurred throughout the development of the EIS and are ongoing. A briefing was also held with Canterbury-Bankstown Council. Briefings were offered to Inner West, Georges River and Sutherland Shire councils during the development of the EIS, however, these councils did not take up the offer of a meeting with Roads and Maritime.

A number of councils, including Georges River Council, have provided written submissions on the EIS. Responses to submissions from the councils are provided in **Part B** (Response to key stakeholder submissions).

Consideration of community feedback

Feedback was provided by community members, special interest groups (including pedestrian and cyclist user groups, sporting associations and environmental groups), businesses and adjoining, affected landowners and stakeholders during the preparation of the EIS.

Table 3-7 of the EIS consolidates this feedback from the community and provides a response or indicates where in the EIS this topic has been addressed, including the issues raised in relation to the ventilation facilities. The options considered for the location of the Rockdale ventilation facility at the Rockdale motorway operations complex (MOC3) are discussed in section 5.5.1 of the EIS.

Refinements to the project design, approach and management were made as a result of community feedback, concerns and issued raised. Project refinements include:

- Consideration of traffic movements for local residents, especially within Moorefield Estate (refer to Section 2 of the preferred infrastructure report (President Avenue traffic and access changes)).
- Providing new and upgraded recreational space and sporting fields due to impacts on Bicentennial Park during construction (refer to environmental management measure SE2 in **Chapter D1** (Environmental management measures))
- Consideration of traffic calming measures along O'Connell Street and Civic Avenue to prevent rat-running
- Consideration of alternative routes for the shared cycle and pedestrian pathways (details on a southern extension of the shared cycle and pedestrian pathways is described in the preferred infrastructure report).

Quality of consultation materials

Artist impressions and photomontages have been produced for the EIS 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 EIS, are indicative at this stage and subject to further detailed design.

C2.1.1 Appreciation of consultation

Two submitters appreciated the level of consultation to promote awareness about the project.

Response

The submitters comment is noted.

C2.2 Consultation during public exhibition of the EIS

45 submitters have raised issues regarding consultation during the exhibition of the EIS. Refer to section 3.4 of the EIS for further information about consultation activities undertaken during the EIS exhibition.

C2.2.1 Consultation processes

Submitters raised concerns about the lack of consultation during the public exhibition of the EIS and commented on the communication processes. Specific concerns include:

- The consultation approach has been inadequate and misleading
- The consultation approach disregards community views
- Community consultation was undertaken only for the purpose of meeting compliance conditions
- The submission platform on the project website was not a secure website
- Inability for community members outside of the project area to assess impacts to their area via the online interactive map
- Limited knowledge by the project team representatives at the information sessions.

Response

Roads and Maritime has sought to provide genuine engagement during the exhibition of the EIS. This has involved using a range of methods including community information sessions, targeted meetings and stakeholder briefings, doorknocks, letter box drops and emails. An interactive website was also developed specifically for the project to provide additional information. Throughout these engagement activities, Roads and Maritime has sought to provide transparency around project design and development.

Consultation during the development and public exhibition of the EIS was undertaken in accordance with the State significant infrastructure provisions of the *Environmental Planning and Assessment Act 1979* (NSW) and the Planning Secretary's Environmental Assessment Requirements (SEARs) for the project. While consultation is required to comply with these requirements, the efforts by Roads and Maritime in communicating key project messages have aimed to surpass the minimum statutory requirements. This is evident in the development of the interactive portal on the project webpage, which was innovated to enhance community member's understanding of the project's key features. Section 3.3 of the EIS details the feedback provided by government agencies, councils, other key stakeholders and the wider community that was recorded and considered during the preparation of the EIS. Section 3.3 of the EIS also describes how and where these issues have been considered in the EIS. Rockdale City and Kogarah City councils[1] strategic community plans were also reviewed as part of the social and economic assessment for the project (refer to section 15.2.5 of the EIS). Community, values and aspirations were identified from these plans which helped to inform the assessment of significance of social and economic impacts (refer to section 15.3 and 15.4 of the EIS).

This Submissions Report has also been prepared to identify the issues raised during exhibition of the EIS and provides responses to those issues. The environmental management measures for the project, including any updates and additional measures, are included in **Part D** (Environmental management measures).

[1] Rockdale City and Kogarah City councils have been amalgamated to form the current Bayside Council.

Refer to **Chapter C01** (Assessment process) for responses to other issues raised about the EIS process including the consultation requirements.

Security of website for submissions

Submissions on the EIS are made through the Department of Planning and Environment (DP&E) website[2]. Roads and Maritime, as the proponent, is not allowed to receive direct submissions on the EIS and has no control over the receipt of submissions by DP&E.

As stated in DP&Es privacy policy, personal information will only be collected for a lawful purpose which directly relates to their primary function as a NSW Government agency and for obtaining feedback about their services. DP&E will not collect any more information than is necessary for it to fulfil this function or disclose personal information to anyone without consent, unless legally required to do so. Anyone engaged to collect, store or use personal information for DP&E will be required to comply with the *Privacy and Personal Information Protection Act 1998* and DP&Es Privacy Management Plan.

Interactive map

The online interactive map was not intended to convey detailed information for community members whose addresses were situated outside of the project footprint. The purpose of the interactive map was to present the findings of the EIS through a user friendly navigation tool in order to support an understanding of the project impacts along the tunnel alignment.

Knowledge by project team representatives

Community information sessions were attended by a range of project team members from diverse technical backgrounds. Given the complexity of the project, not all technical areas are able to be represented at each session. Where questions were not able to be readily responded to, community members were:

- Directed to relevant chapters of the EIS documentation or the project website to gain further information
- Encouraged to submit their inquiries through the ‘ask a question’ link on the online web portal for response by the project team.

C2.3 Consultation following public exhibition of the EIS

117 submitters have raised concerns regarding the consultation period following the exhibition of the EIS. Refer to section 3.5 and Appendix B (Draft community consultation framework) of the EIS for the draft community consultation framework.

Submitters are concerned about the level of future community consultation and that public concerns will not be addressed following the EIS phase. Specific issues relate to:

- Concern about the management of community complaints during construction including property impacts and noise impacts
- Concern about complaint fatigue and believes the complaints process is inadequate as residents only receive 'cut and paste email' responses
- Queries regarding when additional consultation will begin, for example, when more details will be made available
- Suggests the commencement of the Stakeholder Liaison Group be expedited.

Response

Construction complaints handling

A Community Communication Strategy will be prepared prior to construction to detail the processes to facilitate communication between the project team and the community.

[2] https://www.planning.nsw.gov.au/privacy

One of the objectives of consultation activities supporting construction of the project is to provide a complaints management system. This system will be used to capture any complaints including ongoing disturbance from noise or vibration impacts and would include a complaints register to record the issue and how it has been addressed. Complainants will be contacted within 24 hours to follow up and respond to their complaint.

Complaints fatigue

The extent and impacts of complaint fatigue would be considered by:

- Identifying regular complainants from previous and current projects (including the New M5 Motorway) within close proximity to the project footprint
- Analysing the cause and solution for each complaint
- Determining whether the project would result in similar or overlapping impacts with other projects, which are likely to result in a complaint.

The project team will implement a number of different complaint mechanisms to cater to different needs and preferences. Responses to complaints will be tailored based on the assessment that is relevant to the individual receptor. Complaint management tools for the project are outlined in Appendix B (Draft community consultation framework) of the EIS. Where a community member is not satisfied with the complaints handling or response process, a Community Complaints Commissioner, who is an independent specialist, would oversee the system and follow-up on the particular concern.

Future consultation

Consultation after the public exhibition of the EIS will occur from early 2019 onwards. Initial communications would be related to the planning approval, updates on the tender process and contract award (if the project is approved).

Communities and stakeholders would have the opportunity to comment on future phases of development including architectural design treatments, which would be presented in an Urban Design and Landscape Plan during the detailed design phase.

Proposed consultation activities during project delivery will be communicated in the lead up to construction in 2020, as outlined in a Community Communication Strategy. There will be ongoing community engagement during the construction phase up until the project is open to traffic in 2024.

Stakeholder Liaison Group

A SLG for the project has already been established consisting of Bayside Council, local sporting clubs, Brighton-Le-Sands Public School and a diverse range of community groups (including Rockdale Wetlands Preservation Society and St George Bike User Group) to discuss construction impacts and mitigation options. Section 3.2 of the EIS lists all the stakeholders and community groups that were invited to participate in the SLG. The first meeting of the SLG was held in late October 2018. Discussions focussed on how to maximise existing land usage including upgrades to current sporting fields and making school playing fields available to local clubs. Roads and Maritime will continue to work with the SLG to address and mitigate project impacts.

C Part C Response to community submissions

C3 Strategic context and project need

This chapter addresses issues raised in community submissions associated with the strategic context and project needs assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 4 (Strategic context and project need) of the EIS for further details on the project objectives, justification, planning, cost and funding.

Contents

C3.1 Strategic planning and policy framework

Nine submitters have raised issues regarding the consistency of project elements with local and State Government transport planning frameworks. Refer to Chapter 4 (Strategic context and project need) of the EIS for details of the strategic context of the project.

C3.1.1 Strategic justification

Submitters have expressed concern with the justification for the project. This includes that it is weak and inconsistent with the NSW Government's strategic planning and policy framework including:

- Future Transport Strategy 2056
- NSW Transport Master Plan 2012
- Strategic priorities set by Infrastructure NSW
- Greater Sydney Commission's Goal to move efficiently within and around Sydney in 30 minutes.

Response

Consistency with Future Transport 2056 and the Long Term Transport Master Plan

Future Transport Strategy 2056 is the NSW Government's 40 year vision for transport outcomes in NSW and is an update to NSW's *Long Term Transport Master Plan 2012*. The project is identified in *Future Transport 2056* as a committed initiative for the next 0 – 10 years and the project has been funded by the NSW Government. Future stages of the F6 Extension are also identified as an initiative for investigation and immediate detailed planning. Roads and Maritime is carrying out initial geotechnical investigations between Kogarah and Loftus as part of the future F6 Extension.

The *Greater Sydney Services and Infrastructure Plan* component of the overarching *Future Transport 2056* identifies that the project, in combination with future stages of the F6 Extension, would complete the missing link in the Sydney motorway network between the Princes Highway and the Sydney motorway network.

Consistency with strategic priorities set by Infrastructure NSW

The State Infrastructure Strategy 2018-2038[1] is a 20-year strategy, prepared by Infrastructure NSW that identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth. The Strategy acknowledges that the F6 Extension has been identified as a priority and that it (as well as other projects) is envisaged to extend the strategic road and motorway network, providing crucial functions such as improving its resilience, extending the network to major growth areas and connecting key freight precincts.

Greater Sydney Commission's 30 minute city

The project would contribute towards the 30 minute city concept[2] outlined in the *Greater Sydney Region Plan* by providing more reliable and shorter travel times between southern Sydney and the Sydney central business district (CBD).

[1] Infrastructure NSW (2018) *First things first - The State Infrastructure Strategy 2012 – 2032*
[2] Greater Sydney Commission (2018) *Greater Sydney Region Plan – A metropolis of three cities*

C3.2 Project need and justification

298 submitters have raised issues regarding the planning and lack of justification for the project. Refer to Chapter 4 (Strategic context and project need) of the EIS for details on the need for the project.

C3.2.1 Project justification

Submitters have expressed concern about the planning and lack of justification for the project. Specific concerns include:

- The project is not a priority considering it was not pursued years ago when it was first proposed
- The project is intended to increase reliance on other WestConnex projects
- The project prioritises motorists and those not living in the area over local residents
- The benefits of the project would not be realised without future stages of the F6 Extension and other projects such as Sydney Gateway
- Inconsistency with community preferences as the community would prefer public transport and do not need or want roads
- The project would use space which should be used for other purposes, such as to retain the open space being acquired for the project or to use the space for residential development
- The preferred network connection between eastern and western Sydney (ie M5 Motorway to the Sydney CBD) and the M1 Motorway is not a primary road that requires the F6 Extension connection
- The project provides poor connectivity to other major transport links.

Response

The project is identified in *Future Transport 2056* as a committed initiative for the next 0 – 10 years and the project has been funded by the NSW Government. Future stages of the F6 Extension are also identified as an initiative for investigation and immediate detailed planning. Roads and Maritime is carrying out initial geotechnical investigations between Kogarah and Loftus as part of the future F6 Extension.

The project is considered to be a priority based on forecast traffic growth across Sydney and current and future forecast congestion impacts in Southern Sydney along corridors such as The Grand Parade and the Princes Highway (refer to section 4.2.1 of the EIS for further information).

The project is considered to be one component of an integrated transport solution being delivered to by the NSW Government to address transport challenges in Southern Sydney and the wider Sydney region.

Traffic modelling for the project identified that around 50% of motorists forecast to use the project originate from the local Kogarah area.

Reliance on other projects

A Business Case for the F6 Extension Stage 1 project was developed between November 2017 and March 2018 by Roads and Maritime Services. The Business Case was reviewed by Infrastructure NSW, the NSW Government's independent infrastructure advisory agency and confirmed the standalone benefits of the project including a positive benefit cost ratio (BCR) of between 1.31 and 1.56, depending on the quantifiable benefits included. Refer to **section C3.3.1** for further information regarding the Business Case for the project.

The project is viable as a standalone project with forecast benefits and improvements to the traffic network in southern Sydney that are not reliant on future stages of the F6 Extension or the proposed Sydney Gateway project (as described further below). Notwithstanding, the F6 Extension Stage 1 project would be one component of an integrated transport solution which includes a number of projects (including Sydney Gateway) being delivered to by the NSW Government to address transport challenges in southern Sydney and the wider Sydney region.

The northern end of the tunnel would connect directly to the New M5 Motorway. This would provide an onward connection to both Sydney's strategic motorway network and to the surface road network via the St Peters interchange.

Chapter 8 (Traffic and transport) of the EIS provides an assessment of potential traffic impacts for a range of scenarios including the F6 Extension Stage 1 only (operation 'do something' scenarios) as well as the F6 Extension Stage 1 along with possible future stages of the F6 Extension (operation 'cumulative' scenario). The Sydney Gateway project is included in the operation 'do something' scenarios as it is a committed project that will provide a high-capacity connection between the St Peters interchange and the Sydney Airport and Port Botany precinct. However, traffic modelling for the project identified that only around 10-15 per cent of traffic movements originating from Sydney Airport and Port Botany travel within the F6 corridor area. This suggests that only a small proportion of traffic that would utilise the F6 Extension Stage 1 would travel to Sydney Airport or Port Botany via Sydney Gateway and therefore the forecast benefits of the F6 Extension Stage 1 are not reliant on the Sydney Gateway.

A number of key benefits and improvements are forecast as a result of the 'do something' scenario (which does not include future stages of the F6 Extension):

- Improved network productivity on the Sydney metropolitan network, with more trips forecast to be made or longer distances travelled on the network in a shorter time. The forecast increase in vehicle kilometres travelled (VKT) and reduction in vehicle hours travelled (VHT) is mainly due to traffic using the new motorway, with small reductions in daily VKT and VHT forecast on non-motorway roads. As the project is a comparatively short section of motorway in the context of the metropolitan road network, the impact is small
- The project, along with investment in other road, public transport and active transport projects, would help to accommodate the forecast growth in population and travel demand in the Sydney metropolitan area
- Reduced travel times are forecast between Kogarah and Mascot, Sydney CBD, North Sydney, Macquarie Park and Parramatta, in the peak directions of travel in the peak periods
- Reduced daily traffic is forecast on sections of major arterial roads including sections of the Princes Highway, West Botany Street and General Holmes Drive
- Heavy vehicle volumes are forecast to fall by around 40 per cent on sections of Princes Highway and West Botany Street and by more than 30 per cent on General Holmes Drive, each weekday.

Inconsistency with community preferences

Extensive community engagement and consultation prior to and during public exhibition of the EIS was carried out. Some members of the community identified a preference for the development of public transport infrastructure as an alternative to the project, however other members of the community identified their support for the project.

The NSW Government is proposing to deliver a range of transport infrastructure projects, including road and public transport projects, to address the transport challenges associated with a growing Sydney and to provide a range of transport alternatives to support the variety of trips being made across the city.

Indirect costs associated with health, social and economic impacts

Impacts from the project, such as social, economic and health impacts, have been considered in detail in the EIS (refer to Chapter 10 (Health, safety and hazards) and Chapter 15 (Social and economic) of the EIS). The economic cost-benefit analysis of the project was undertaken in accordance with NSW Treasury Guidelines for Capital Business Cases, as well as Infrastructure NSW and Infrastructure Australia requirements. In accordance with these guidelines, the cost benefit analysis for the project includes estimates of the economic, social and environmental costs and benefits, including for items for which there is no market value.

Use of space which should be used for other purposes

The majority of the project is located underground, with permanent surface infrastructure located within the existing F6 reserved corridor - a corridor zoned for road infrastructure for more than 50 years. A motorway tunnel option for the project minimises significant impacts to social infrastructure and open space. Recreational areas impacted by surface works will be reinstated as far as practical following construction, with additional community facilities provided elsewhere by Roads and Maritime Services to offset these impacts.

Connectivity to other major transport links

There is currently no motorway between the existing M1 Princes Motorway at Waterfall and the Sydney motorway network. All local and through traffic, including heavy vehicle traffic, is currently required to use the arterial road network to travel between Waterfall and Sydney, principally the A1 Princes Highway, the A3 King Georges Road and/or the A6 Heathcote Road/New Illawarra Road. This results in traffic congestion, leading to delayed travel times. Improved east-west motorway connections are being facilitated by separate Roads and Maritime projects, including the WestConnex program of works.

The project, through a connection with the New M5 Motorway, would assist in providing more efficient and economic transport connections for freight vehicles, workers and other commercial operators travelling from the A1 Princes Highway to industrial and commercial areas in Sydney. The project would function as a key movement corridor within the Sydney orbital network. Orbital motorway networks provide efficient, high speed motorway travel, which is central to the needs of a growing global city such as Greater Sydney.

C3.2.2 Need for the project

Submitters raised concern that there is no need for the project. Specific issues raised include:

- The public prefer to use public transport
- There will continue to be a modal shift towards public transport and other forms of transport in the future
- The project would discourage the use of, and investment in, public transport projects
- The EIS claims that the public prefer to drive however this is inaccurate
- The project is not a solution to transport freight.

Response

Future trends in transport use

As described in section 4.2.2 of the EIS, future trends in transport have been taken into consideration in the development of the project in line with the NSW Government's *Future Transport Strategy 2056*. The EIS notes that in the last decade, a greater percentage of the Sydney population is travelling on public transport and that fewer young people are driving and owning cars. Concurrent with this trend is the development of autonomous vehicles for both buses and cars. It is expected that fully autonomous vehicles would be active on our roads within the next 15 to 20 years.

In addition to these trends, there is still a need to make provision for the growth in commercial and freight travel demand (eg trade vehicles, grocery and goods delivery) and to reduce congestion across the Sydney road network. The need for continued investment in road transport infrastructure, including motorways, therefore remains important for the future. The project would result in productivity benefits from it being easier for people to get to jobs, for businesses to transport goods and to access their markets, and for heavy vehicles to move more efficiently through southern Sydney.

Investment in public transport

The NSW Government is investing in a range of transport infrastructure projects including road, public transport and active transport projects to address the transport challenges associated with a growing Sydney. In June 2018, the NSW State Government committed to improvements on the T4 Illawarra Line and T8 Airport Line following an $880 million investment in technology improvements to modernise the Sydney Trains network. The NSW State Government considers the relative merits of, and investment in, projects through the NSW Government Business Case process. One of the dimensions of analysis as per the NSW Treasury Government Business Case Guidelines is the cost benefit analysis, which involves the assessment of a range of competing options that address a community, environmental or economic need and contribute to achieving objectives identified in the case for change.

The *Future Transport Strategy 2056* and the *State Infrastructure Strategy 2018-2038*[3] outline a policy direction that supports the provision of integrated transport solutions which consider the need for expanding the road network, providing more public transport services and improving active transport connectivity.

The NSW Government has committed to upgrading the road and motorway network to cater for private vehicles, freight and on-road public transport. The project is therefore considered to be one component of an integrated transport solution being delivered to by the NSW Government to address transport challenges in Southern Sydney and the wider Sydney region.

The project would not preclude rail infrastructure or bus service improvements from occurring in the area. Improvements to public transport, including improved bus services, would be complementary to the project.

Inaccurate claims that the public prefer to drive

In assessing the need for new road infrastructure, the *State Infrastructure Strategy* found that public transport was the best option for journeys to dense employment centres (such as the Sydney CBD), where public transport is already the preferred choice for many employees. However, the dispersed nature of the majority of Sydney's journeys means that the flexibility provided by the private car makes it the dominant choice. This demand pattern is the consequence of established land use patterns in Sydney and there is no indication in the available data that the patterns of demand would change in the future.

In Sydney's South District (which includes the Canterbury-Bankstown, Georges River and Sutherland Local Government Areas (LGAs)), over 50 per cent of journeys are currently undertaken by car, based on Australian Bureau of Statistics Travel to work data[4]. Development across southern Sydney is relatively dispersed and typical of low density urbanisation, meaning the private vehicle is the predominant form of local and intra-regional travel.

The project is not a solution to transport freight

The project would contribute to delivering a freight network that efficiently supports the projected growth of the NSW economy and is consistent with the action programs identified in the *NSW Freight and Ports Strategy*[5]*:*

- Network efficiency – the project would improve network efficiency by delivering travel time savings and improved connectivity on the Sydney motorway network
- Network capacity – the project, through its connection with the New M5 Motorway, would provide increased road capacity on the north–south network for the movement of freight between Sydney Airport/Port Botany (via the St Peters interchange) and southern Sydney
- Network sustainability – traffic modelling indicates that the project would remove a large number of heavy freight vehicles travelling along The Grand Parade and the Princes Highway, which would result in improved network capacity and reduce freight traffic on surface roads.

[3] Infrastructure NSW (2018) *First things first - The State Infrastructure Strategy 2012 – 2032*
[4] Australian Bureau of Statistics (2016) Travel to work data
[5] Transport for NSW (2013) *NSW Freight and Ports Strategy*

C3.2.3 Limited benefits of the project

Submitters objected to the project based on the limited benefits of the project. Specific concerns included:

- The project would have no benefits to the community or environment
- The benefits of the project are outweighed by the adverse impacts
- The motorway would not benefit motorists or improve traffic flow travelling from southern Sydney to Port Botany, Sydney Airport, the Eastern Suburbs or Western Sydney
- The amount of cars that would be taken off local roads is insignificant, and more heavy vehicles will use surface roads
- Bus services and reliability would not be improved due to expected increases in traffic volumes that would impact bus routes
- Traffic congestion would only be alleviated in the short term and benefits would be minor due to induced demand
- The project would only benefit private stakeholders (such as Transurban or the owners of WestConnex) and is therefore a waste of public funds.

Response

The project benefits are centred on the importance of the road network to businesses and communities within the project footprint and the effects that improvements to network function may provide. Project benefits also include enabling future stages of the missing motorway link between the M1 Princes Motorway and the Sydney motorway network.

The main benefits of the project on local communities include easing congestion and improving travel times. A number of other benefits as a result of the project include improvements in local air quality (as a result of vehicles being directed into the tunnels) and provision of improved active transport connections. Overall, the operation of the project would benefit the public and private businesses (refer to section 4.4 and section 15.4 of the EIS).

A Business Case for the F6 Extension Stage 1 project was developed between November 2017 and March 2018 by Roads and Maritime. The Business Case was reviewed by Infrastructure NSW, the NSW Government's independent infrastructure advisory agency and confirmed the standalone benefits of the project including a positive BCR of between 1.31 and 1.56, depending on the quantifiable benefits included. Refer to **section C3.3.1** for further information regarding the Business Case for the project.

Benefits outweighed by impacts

The nature and scale of the project means that some impacts are unavoidable. Impacts will be managed through the implementation of the environmental management measures identified in **Chapter D1** (Environmental management measures). There would be some potential residual impacts that would be further reviewed during detailed design development and construction planning and where necessary additional measures would be implemented to ensure these impacts are suitably mitigated.

However, overall the project would deliver a large number of benefits as described above and in **section C3.2.3**.

The impacts and benefits of the project would be considered by the NSW Department of Planning and Environment (DP&E) as part of the assessment of the project, in accordance with section 4.15 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Benefits for motorists travelling to Port Botany, Sydney Airport, eastern suburbs and western Sydney

The project, through a connection with the New M5 Motorway, would assist in providing more efficient and economic transport connections for freight vehicles, workers and other commercial operators travelling from the A1 Princes Highway to Sydney Airport/Port Botany (via the St Peters interchange) and beyond to the eastern suburbs of Sydney. The project would also reduce surface road traffic on The Grand Parade/General Holmes Drive by just under 15 per cent in 2026 and 2036 (refer to section 9.3.1 of the EIS) which would also improve connections to Sydney Airport/Port Botany.

Through the connection with the New M5 Motorway, the project would provide a direct link to Sydney's motorway network, facilitating movements to western Sydney via the M4-M5 Link and M4 East and to the north via existing and proposed motorway links.

Travel benefits would be insignificant

The wider road network is forecast to perform better with the project than without the project in 2026 and 2036, with improved average travel speeds as traffic (including heavy vehicle traffic) switches from using the surface road network to using the new motorway. Traffic modelling for the project anticipates either a decrease, or a negligible increase, in traffic (light vehicles and heavy vehicles) on local roads around the President Avenue interchange.

Reduced daily traffic is forecast on sections of major arterial roads including sections of the Princes Highway, West Botany Street and General Holmes Drive:

- The two-way average weekday traffic (AWT) on General Holmes Drive is forecast to reduce by more than 10,000 vehicles in 2026 and 2036, equating to a decrease in two-way AWT of just under 15 per cent
- Two-way daily traffic on the Princes Highway is forecast to decrease by about five per cent in 2026 and 2036 with the project – a decrease of about 2,000 vehicles per day
- The two-way AWT on West Botany Street is forecast to fall by more than 10 per cent in 2026 and 2036 – a decrease of about 3,000 vehicles per day in 2026 and 3,500 vehicles per day in 2036
- Heavy vehicle volumes are forecast to fall by more than 40 per cent on sections of the Princes Highway and West Botany Street and by more than 30 per cent on General Holmes Drive, each weekday
- Smaller reductions in traffic volumes are also forecast on strategic roads such as King Georges Road and the Eastern Distributor in 2026 and 2036 when compared to scenarios without the project.

With the project, average travel times in the peak directions in 2036 peak periods are forecast to reduce:

- Between Kogarah and Mascot, average travel times in the peak direction in the peak period are forecast to reduce by about 15 minutes – a 15 to 35 per cent reduction
- Between Kogarah and Macquarie Park, Parramatta, the Sydney CBD or North Sydney, average travel times in the peak direction in the peak period are forecast to reduce by about 10 minutes – a 10 to 15 per cent reduction.

Bus service reliability

The project is forecast to result in minimal change in bus travel times across the modelled road network. Forecast peak period travel times for the entire length of the bus routes that travel through the President Avenue intersection and surrounds indicate savings of between one and six minutes. Other bus routes within the project corridor would also see benefits of similar magnitude (refer to section 8.7.2 of the EIS).

Induced traffic demand

A new or substantially upgraded road can induce changes in trip patterns, which then appear as induced traffic demand. This induced demand is included in the strategic traffic forecasts for the project. The analysis of induced demand for the project has been considered in the traffic and related assessments for the EIS. Induced demand in the future 2036 scenario equates to about 0.3 per cent additional daily trips in the Sydney metropolitan area in 2036, which would result in a negligible impact to the traffic network. The travel benefits outlined above are therefore inclusive of forecast induced traffic demand.

The project would only benefit private stakeholders or the owners of other motorways

The project would result in a number of benefits for the public as described above and throughout **section C3.2**. The NSW Government would own and operate the project and collect revenue from tolling. The Business Case for the project identified a positive BCR of between 1.31 and 1.56 which demonstrates that investment in the project represents good value for money.

The justification for the project as described in **section C3.2.1** and section 24.8 of the EIS is based on the F6 Extension Stage 1 project as a standalone project. The commercial implications of the project for the WestConnex program of works are not a justification for the project.

C3.2.4 Objectives

Submitters commented that the project objectives are not adequate and/or measurable. Submitters were concerned that the project is not needed as it would not meet its objectives due to the following:

- The project would not maintain regional air quality
- The project would not meet sustainability objectives.

Response

Regional air quality

As described in section 9.6.8 of the EIS, the project's regional air quality impacts are expected to be negligible. Regional air quality would therefore be maintained with the inclusion of the project.

Sustainability objectives

The sustainability policy framework relevant to the project is outlined in section 23.1.1 of the EIS and the specific objectives of relevant strategic documents are described throughout section 23.1 of the EIS. The overarching sustainability objectives for the project would be met through the implementation of a Sustainability Management Plan and project specific sustainability initiatives.

Sustainability of the project will be assessed in accordance with the Infrastructure Sustainability Council of Australia (ISCA) Rating Tool to determine and set an appropriate target rating for the project, in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs). The project is seeking a 'Design' and 'As-Built' rating of 'Excellent' (refer to section 23.2 of the EIS for further information).

C3.3 Business case

11 submitters have raised issues regarding the business case completed for the project.

C3.3.1 Cost benefit analysis

Submitters raised concerns with the adequacy, validity and transparency of the business case for the project, stating that some benefits and costs were left out or omitted (eg health, social and economic impacts) and that the project was committed to before it was properly evaluated. One submitter suggested an independent review is required as recent Cabinet processes have changed.

Response

A Business Case for the F6 Extension Stage 1 project was developed between November 2017 and March 2018 by Roads and Maritime Services. Infrastructure NSW, the NSW Government's independent infrastructure advisory agency, carried out an independent review of the Business Case and prepared a Business Case Summary. The Business Case Summary was made available on the Infrastructure NSW website[6] in June 2018.

A full economic cost-benefit analysis of the project was undertaken in accordance with NSW Treasury Guidelines for Capital Business Cases, as well as Infrastructure NSW and Infrastructure Australia requirements. The cost benefit analysis involves the estimation of economic, social and environmental costs and benefits, including for items for which there is no market value.

The Business Case completed for the project provided the recommended analysis and demonstrated strategic merit, a well-defined project scope and a positive BCR of between 1.31 and 1.56, depending on the quantifiable benefits included. While the NSW Government has been committed to the investigation of the F6 Extension for a number of years, the project was not funded until the completion of the Business Case for the project.

[6] http://www.infrastructure.nsw.gov.au/media/1664/f6-extenstion-stage-1_fbc-summary_final.pdf

An independent review of the Business Case was carried out by Infrastructure NSW and independent peer reviews were carried out on the cost estimate and traffic model prior to funding being committed.

C3.3.2 Benchmark against alternatives

Submission concern that the project business case did not benchmark the project against alternatives such as rail.

Response

NSW Treasury Guidelines for Capital Business Cases require the consideration of realistic service delivery alternatives to meeting strategic objectives.

As described in section 5.1.2 of the EIS, public transport alternatives would not meet the strategic objectives of the project and therefore were not considered in the business case for the F6 Extension Stage 1.

The NSW Government is investing in a range of transport infrastructure projects including road, public transport and active transport projects to address the transport challenges associated with a growing Sydney.

Refer to **section C4.2** for further responses regarding the strategic alternatives to the project.

C3.4 Project cost

73 submitters have raised issues regarding the financial risk of the project.

C3.4.1 Financial risk

Submitters raised concerns about the high cost of the construction and operation of the project, suggesting:

- The project could become bankrupt during construction (and not be completed) or during operation
- Costs associated with compensation to residents for subsidence or increased risk of flooding have not been included in the project budget
- There is a financial risk to public funds and tax payers.

Response

Construction costs were estimated in the Business Case for the project consistent with relevant guidelines, and assumed a construction period of 2020 to 2024. Operating costs were calculated for a period of 35 years from the completion of construction, and include operating costs, annual maintenance costs and capital maintenance.

The Business Case identifies that the project would be delivered by Roads and Maritime Services using its tested project management framework for developing and delivering major road projects. A strong governance structure is in place to support both the planning and delivery of the project.

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

The costs associated with mitigating project impacts and compensation for damages caused during construction of the project will be borne by the design and construction contractor and would be factored into the construction cost during the tender process. This would include repairing property damage due to settlement impacts at no cost to the property owner. Potential damages due to flooding are assessed in Appendix M (Flooding and drainage technical report) of the EIS and appropriate mitigation measures are provided in **Chapter D1** (Environmental management measures) to manage potential flooding impacts.

The project was fully funded as part of the NSW Government 2018-19 Budget. The Budget Statement 2018-19 can be viewed online[7] and notes funding for the F6 Extension Stage 1 project. Funding for the project includes appropriate allowances for risk items, contingency and escalation to allow for the rising cost of construction over the construction period.

The Business Case for the project identified a positive BCR of between 1.31 and 1.56 which demonstrates that investment in the project represents good value for money.

C3.4.2 Financial impacts of the traffic assessment

A submitter raised concern that the project would result in financial failure due to inadequate traffic modelling assessment and projections.

Response

Traffic modelling has used the Sydney Strategic Motorway Planning Model (SMPM) version 1. A key component of the SMPM is the toll choice assignment model, which test impacts of toll and infrastructure strategies and provides infrastructure project traffic forecasts. This toll choice assignment model is designed to forecast the traffic choosing to use tolled and non-tolled routes for the representative peak and inter-peak periods of the day.

Toll pricing for the F6 Extension Stage 1 tunnel has been developed as a distance based, point toll system, in accordance with other toll roads in NSW. Under this system, tolls are calculated based on the distance travelled on the motorway. The distance travelled is calculated using toll points located at the entry and exit points of the tunnel which record where vehicles enter and exit the motorway.

The traffic modelling is as accurate as possible at the time of modelling, having been based on the most up-to-date input information available. The traffic modelling approach and assessment has been undertaken in accordance with the SEARs, which outlines the modelling approach to be undertaken for the assessment as well as the guidelines that the assessment needed to follow. Modelling for the EIS has been undertaken in several stages, which ensures that results are as accurate and representative as possible. These stages are detailed in in section 4.2 of Appendix D (Traffic and transport technical report) of the EIS.

Based on recommendations from Infrastructure NSW, the traffic modelling guiding the Business Case was refined and peer reviewed prior to the finalisation of the cost-benefit analysis for the project.

The project was fully funded as part of the NSW Government 2018-19 Budget and is being delivered by Roads and Maritime. The project is therefore not reliant on private funding or tolling revenue for the delivery or operation of the project.

C3.5 Project funding and tolling

108 submitters have raised issues regarding the tolling aspect of the project and transparency around funding.

C3.5.1 Tolling regime

Submitters objected to and questioned the need for tolls. Specific concerns were related to the following:

- Unfair distance based calculation
- Questions around the toll amount and evaluation formula
- Duration of tolls (including the assumption it will be 43 years as per the M4).

[7] https://www.budget.nsw.gov.au/nsw-budget-2018-19-budget-papers

Response

The NSW Government would own and operate the project and collect revenue from tolling. 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 tax payers across NSW, not just those in Sydney that would benefit.

Free, alternative traffic routes would remain available to those who choose not to use the tolled motorway.

Tolling fees have been determined based on the government's principles for tolling, developed on a distance basis, and are comparable with other tolling regimes in Sydney. The toll system enables this important piece of infrastructure to be delivered while minimising both the price of tolls and the contribution from taxpayers.

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* (2015), which sets 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.

In recognition of the growing number of toll roads within Sydney, the NSW Government implemented the Toll Relief plan[8] in 2017, designed to ease the financial burden on privately registered vehicle owners who regularly need to use toll roads. The Toll Relief plan provides free vehicle registration for NSW registered vehicle owners who spend on average more than $25 a week (ie at least $1,300 over a year) on NSW toll roads. Free registration has been available to all owners of privately registered vehicles since 1 July 2018. It is anticipated that tolls paid for use of the F6 Extension Stage 1 tunnel would be counted towards the total spend for privately registered vehicles under the Toll Relief plan. This would assist in alleviating the cumulative economic impact of tolled roads on private vehicle users.

C3.5.2 Funding transparency

Submission suggested that the public should be provided with clear and understandable information about how the project is funded.

Response

The project was fully funded as part of the NSW Government 2018-19 Budget. The Budget Statement 2018-19 can be viewed online[9] and notes funding for the F6 Extension Stage 1 project.

C3.6 Support for the project

Five submitters expressed general support for the project.

Submitters expressed general support for the project, including the project's contribution to achieving a more accessible city.

One submitter also expressed support for the active transport opportunities that would be provided by the project as they are consistent with formalised objectives of NSW and local government bodies and would benefit the community by improving safety and connectivity.

Response

The support for the project is noted. Changes to the active transport corridor in the southern part of the project footprint, including an extended shared cycle and pedestrian pathway to Chuter Avenue/O'Connell Street, are proposed as described in the preferred infrastructure report.

[8] NSW Government (2017) Toll Relief plan *https://www.nsw.gov.au/your-government/the-premier/media-releases-from-the-premier/toll-relief-free-rego-for-drivers/*
[9] https://www.budget.nsw.gov.au/nsw-budget-2018-19-budget-papers

C3.7 Future stages of the F6 Extension

85 submitters have raised issues regarding the future stages of the F6 Extension.

C3.7.1 Cumulative impacts with future stages of the F6 Extension

Submitters raised concern over the cumulative impacts of the future stages of the F6 Extension, stating that the future stages are not identified or included in the cumulative impact statement.

Submitters commented that even if construction of all sections of the F6 Extension is staged, all of the potential impacts of the full F6 Extension project should be considered altogether.

Response

The size and scale of the F6 Extension requires the program of work to be delivered in stages. The F6 Extension Stage 1 has been identified as the highest priority to ease congestion on Sydney's roads, forming a key component of the existing and committed motorway network of Greater Sydney, linking southern Sydney with the Sydney motorway network. The project would provide a direct link with the WestConnex motorways, through to the proposed Sydney Gateway and Western Harbour Tunnel projects. Assessing the F6 Extension in stages also allows for a more comprehensive analysis of potential localised impacts.

Future stages of the F6 Extension are currently under investigation and would be subject to separate environmental assessment and planning approval, which would be required to consider potential cumulative impacts with the F6 Extension Stage 1. Each stage would be assessed separately, but the impacts of each project would also be considered in the context of the broader F6 Extension. However, there is currently no formal commitment from the NSW Government regarding the development of a design or timeline for future stages of the F6 Extension.

As required by the SEARs for the project, the EIS has considered cumulative impacts of likely future projects based on currently available public information. This includes the future stages of the F6 Extension and other potential motorway projects including the Western Harbour Tunnel and Beaches Link projects.

The results of the cumulative impact assessment were included in the relevant technical reports and chapters in the EIS for each environmental aspect.

However, as the NSW Government has not provided committed funding to delivery of the entire F6 Extension, Stage 1 must be considered and assessed as a standalone project to ensure that it meets all regulatory requirements.

C3.7.2 Concerns regarding future stages of the F6 Extension

Submitters raised queries and concerns regarding future stages of the F6 Extension, including:

- Requests for clarification on the footprint, design, alignment and timeframes for future stages, suggesting that the route of the full F6 Extension is currently different in the F6 Stage 1 EIS (Figure 5-4 of the EIS) and the F6 Stage 1 SSI Scoping Report (Figure 10 of the SSI Scoping Report)
- Concern over potential impacts of future stages, including:
  - Impacts on the Royal National Park
  - Impacts on heritage items including Patmore Swamp and the Grawley Bay Landscape Conservation Area
  - Property acquisition
- Concern over the financial cost of constructing the full F6 Extension
- Suggestions for the design of future stages, for example stating that the tunnel stubs for the project should be extended to Rocky Point Road
- Concern that existing plans for future stages have not been released due to political reasons
- Concern that future stages would not be built
- The approval of the F6 Extension Stage 1 would bias approvals for future stages of the project.

Response

The project would provide stub tunnels to facilitate a connection with future stages of the F6 Extension, as described in section 6.1 of the EIS. There are no design details of future stages of the F6 Extension and the alignments detailed in the EIS are indicative only. Future stages of the F6 Extension are currently under investigation and would be subject to separate environmental assessment and planning approval. Specific impacts associated with the construction and operation of future stages of the F6 Extension are beyond the scope of the F6 Extension Stage 1 project and EIS. Impacts on the Royal National Park at Loftus would form part of the future assessment.

The NSW Government has no current plans to investigate a motorway connection for the A1 Princes Highway that runs adjacent to the Royal National Park between Loftus and Waterfall.

The NSW Government is committed to improving travel times and easing congestion for motorists travelling between the Illawarra and Sydney CBD. The development of the F6 Extension is an important part of the long term transport solution for Sydney. Long term access to the Sydney CBD and North Sydney are considered in future motorway plans. More information can be found in the *Future Transport Strategy 2056*, which is the NSW Government's 40 year vision for transport outcomes in NSW.

C3.7.3 Support for future stages of the F6 Extension

Submitters offered support for future stages of the F6 Extension, stating that it would ease congestion in the Sutherland area.

Response

The support for the future stages of the F6 Extension is noted.

C Part C Response to community submissions

C4 Project development and alternatives

This chapter addresses issues raised in community submissions associated with the development of the project the assessment of alternatives. Refer to Chapter 5 (Project alternatives and options) of the EIS for further details on the assessment of project alternatives and options.

Contents

C4.1 Adequacy of strategic alternatives assessment

76 submitters have raised issues regarding the adequacy of the strategic alternatives assessment. Refer to section 5.1 of the EIS for details of the strategic alternatives assessment completed for the project.

Submitters raised concern over the adequacy of the strategic alternatives assessment. Specifically concerns included:

- The Planning Secretary's Environmental Assessment Requirements (SEARs) have not been met because strategic alternatives have not been adequately considered
- The assessment of alternative solutions to the project does not consider future mobility demands
- An independent evaluation should be undertaken to support a more balanced view of public transport alternatives
- The project has inadequately addressed strategic alternatives to road infrastructure and the project, such as public transport, improvements to existing infrastructure or other investment options, including a consideration of their benefit cost ratios
- Alternative policies that would address current congestion issues have not been considered.

Response

The SEARs for the project require that the EIS include an analysis of feasible strategic alternatives to carrying out the project, including an analysis of the alternatives and options considered, having regard to the project objectives. The EIS is considered to have provided a balanced assessment of strategic alternatives to the project with regard to the project objectives.

Strategic alternatives and project options were outlined in Chapter 5 (Project alternatives and options) of the EIS. Strategic alternatives included:

- Alternative 1 – The base case or 'do nothing/do minimum'
- Alternative 2 – Rail infrastructure improvement options
- Alternative 3 – Bus service improvements
- Alternative 4 – Motorway option (development of the F6 Extension).

The assessment considers the viability of strategic alternatives based on current and projected future transport demands. Further information regarding the assessment of public transport alternatives is provided in **section C4.2.1**.

As identified in Chapter 5 (Project alternatives and options) of the EIS, the strategic alternatives to the project outlined above would not on their own meet the objectives of the project. A key objective of the project is to improve travel times and reliability for road users travelling between Southern Sydney and strategic centres in Greater Sydney while supporting faster and more reliable times for local bus customers and road users in Southern Sydney. The strategic alternatives would generally not meet this objective which involves catering to a growing demand for mobility by road travel and supporting the efficient movement of road freight and commercial vehicles.

Rail infrastructure and bus service improvements and investment in other transport initiatives, are being implemented by the NSW Government to address transport challenges in Southern Sydney and the wider Sydney region. The project is one component the integrated transport solution being delivered by the NSW Government to address Sydney's transport challenges. An integrated transport solution is needed as improvements in a single mode of transport (ie the motorway network or public transport improvements) would not address the broad range of transport challenges in Southern Sydney and the wider Sydney region.

The SEARs for the project do not require an analysis or comparison of the cost benefits of strategic alternatives to the project. This is undertaken at a policy level in government and is developed in detail for individual projects as an input into the investment decision by government.

The NSW State Government considers the relative merits of, and investment in, projects through the NSW Government Business Case process. One of the dimensions of analysis as per the NSW Treasury Government Business Case Guidelines is the cost benefit analysis, which involves the assessment of a range of competing options that address a community, environmental or economic need and contribute to achieving objectives identified in the case for change. The analysis includes estimates of the economic, social and environmental costs and benefits, including for items for which there is no market value.

A Business Case for the F6 Extension Stage 1 project was developed between November 2017 and March 2018 by Roads and Maritime Services. The Business Case was reviewed by Infrastructure NSW, the NSW Government's independent infrastructure advisory agency. The findings of the F6 Extension Stage 1 Business Case were that the project delivers a benefit cost ratio (BCR) of 1.56, indicating that for every dollar invested in the project, there would be a return of $1.56. Eighty-four percent of the benefits result from transport improvements.

Future Transport Strategy 2056[1] is the NSW Government's 40 year vision for transport outcomes in NSW and is an update to NSW's Long Term Transport Master Plan. The project is identified in *Future Transport Strategy 2056* as a committed initiative for the next 0 – 10 years, with future stages of the F6 Extension also identified as a motorway for investigation. *Future Transport Strategy 2056* identifies a range of measures to address congestion issues in Sydney, including investment in motorways, public transport and active transport.

The project is consistent with other relevant transport policies including *NSW Freight and Ports Strategy*[2] and *State Infrastructure Strategy 2018-2038*[3].

C4.2 Strategic alternatives to the project

319 submitters have raised issues regarding the strategic alternatives to the project. Refer to section 5.1 of the EIS for details of the strategic alternatives to the project.

C4.2.1 Public transport

Submitters commented that improved public transport and/or active transport should be considered and prioritised as an alternative method of transport. Specific comments included:

- NSW Infrastructure should be more focused on public transport options to address car dependency issues
- Other variables that influence the public transport system need to be considered
- The NSW Government's rail improvements including to the T8 Airport Line and T4 Illawarra Line, completion of the Maldon to Dombarton line, and a new underground railway from Waterfall to Thirroul, are suggested alternatives to the project
- Suggest consideration of rail alternatives such as a fast rail between Wollongong, Sydney and Newcastle, and a new rail line between Parramatta and Hurstville/Kogarah
- Focus on providing public transport facilities and networks in order to improve public transport connections
- Suggestions to help improve public transport and efficiency on the roads by adding a dedicated bus lane (ie on President Avenue/roads affected by the project)
- That public transport is a better option because it:
  - Helps meet targets for climate change by reducing pollution from private vehicles
  - Builds economic revenues
  - Increases property values
  - Provides critical response in emergencies

[1] NSW Government (2018) *Future Transport Strategy 2056*
[2] Transport for NSW (2013b) *NSW Freight and Ports Strategy*
[3] Infrastructure NSW (2018) *First things first - The State Infrastructure Strategy 2012 – 2032*

– Benefits individuals as it reduces stress from driving on congested roads
– Fosters a more active lifestyle.

Response

Government commitment to public transport improvements

The NSW Government is proposing to deliver a range of transport infrastructure projects including road, public transport and active transport projects to address the transport challenges associated with a growing Sydney and to provide a range of transport alternatives to support the variety of trips being made across the city.

In June 2018, the NSW State Government committed to improvements on the T4 Illawarra Line and T8 Airport Line following an $880 million investment in technology improvements to modernise the Sydney Trains network. The improvements would allow for:

- Five more trains an hour during the peak on the T4 Illawarra Line from Cronulla, which is an increase of up to 30 per cent in capacity
- Eight more services an hour on the T8 Airport Line at the International, Domestic, Mascot and Green Square stations, meaning trains at least on average every four minutes instead every six, along with extra services from Revesby.

Over the next 10 years, upgrades to the T4 and T8 lines would deliver:

- More services that will reduce wait times, meet demand and provide more seats for long distance customers
- Faster travel times for customers through digital train control technology and upgraded rail infrastructure, creating more opportunities for express trains
- Improved reliability and reduce customer impacts from incidents.

The strategic alternative to improve rail infrastructure also considered the provision of a new mass transit line servicing southern Sydney and the Illawarra. A new southern mass transit line would involve the identification of a new alignment for an additional rail line servicing southern Sydney, which could include above ground and/or underground sections.

The *Greater Sydney Services and Infrastructure Plan* component of the overarching *Future Transport Strategy 2056*[4] identifies that for all types of transport, both public and private, roads will continue to perform an important function in transporting people and goods within Greater Sydney. Efficient, reliable and easy to understand journeys will be enabled through a clear road hierarchy that better separates different types of trips.

Public transport is best suited to providing concentrated, high volume flows of people to and from established centres. It is less suited to providing dispersed cross-city or local trips. While public transport is part of the integrated transport solution for Sydney, it is recognised that not all trips in Sydney can be served by public transport, especially trips to dispersed destinations, or commercial trips requiring the movement of large or heavy goods/materials. A congested road network also affects road-based public transport, resulting in increased bus travel times and variable journey times.

Consideration of bus service improvements

There is a low use of buses in the area for commuting to work, at around two per cent. It is around four per cent for trips originating or terminating in Kogarah and Rockdale. Buses nevertheless perform an important role in the region, as they feed trunk rail services and are the main form of public transport in southern Sydney, aside from trains.

In 2018, Roads and Maritime completed a project[5] to improve bus services in Arncliffe, Rockdale and Wolli Creek as part of the objectives of *Sydney's Bus Future*[6]. The project included implementing a range of measures including bus lanes, bus priority at traffic lights and more efficient bus stop placement.

[4] NSW Government (2018) *Future Transport Strategy 2056*
[5] http://www.rms.nsw.gov.au/projects/sydney-south/arncliffe-rockdale-wolli-creek-bus-priority/index.html
[6] NSW Government (2013) *Sydney's Bus Future*

The implementation of the F6 Extension Stage 1 project would create opportunities on arterial and other roads for bus service improvements by reducing through traffic on arterial roads. These improvements would be complementary to the project.

While opportunities for new express bus routes would be facilitated by the project, the delivery of bus service improvements (such as new bus lanes) would be delivered by others and would be subject to separate environmental assessment.

Consideration of rail infrastructure improvements

Options to improve rail infrastructure (eg an underground railway between Waterfall and Thirroul, fast rail between Sydney, Newcastle and Wollongong or a railway between Parramatta and Kogarah) would not considerably enhance the productivity of commercial and freight-generating land uses in isolation and would not address the objectives of the project.

The public transport projects such as the upgrades to the T4 Illawarra Line and T8 Airport Line as described above are likely to be complementary to the project as they would further reduce the number of vehicles on surface roads and would provide opportunity for place making at key strategic centres.

Although opportunities exist to shift more freight from the road network onto the freight heavy rail network, the need to transport freight by road will continue. The *NSW Freight and Ports Strategy* notes that dedicated freight rail corridors are being planned to ensure passenger and freight rail demand can be accommodated. However, rail freight transport is more effective for long distance transport of goods to regional centres while Sydney's freight, service and business task relies upon a dispersed point-to-point transport connection to customers within the metropolitan area.

The proposed Maldon to Dombarton Railway is currently being investigated by Transport for NSW. Infrastructure Australia's review of the project noted the project's cost currently outweighs the economic benefits and it is currently not commercially sustainable. While the railway could provide additional rail freight capacity in and out of Port Kembla and the Illawarra, this would not be sufficient to service the freight needs of Sydney, which relies on a dispersed point-to-point transport connection to customers within the metropolitan area. Furthermore, the existing rail infrastructure is sufficient to manage the short to medium-term rail capacity requirements for the Illawarra.

Options to improve rail infrastructure (eg an underground railway between Waterfall and Thirroul, fast rail between Sydney, Newcastle and Wollongong or a railway between Parramatta and Kogarah) would not considerably enhance the productivity of commercial and freight-generating land uses in isolation and would not address the objectives of the project.

C4.2.2 Improvements to the existing road network

Submitters raised the following issues about improvements to the existing road network:

- Improvements to the existing arterial road network would be a better solution to help reduce congestion on roads
- Suggest that better demand management measures be considered to discourage non-essential vehicle travel, such as:
  - A 'user pays' or 'polluter pays' model should be investigated for motorways by the NSW Government
  - Road pricing reforms (tolling).

Response

Improvements to the arterial road network

Ongoing improvements to the broader transport network are either planned or already underway. Operational traffic modelling conducted for the project has taken into consideration the effect of the implementation of these road improvements.

However, improvements to the arterial road network would only provide incremental change in the efficiency of the road network, and would not support the additional capacity required for regional traffic growth associated with the forecast increase in Sydney's population and subsequent increases in vehicle travel. Further, continued urban development along the arterial roads in southern Sydney, including the Princes Highway, means there is limited capacity to widen and/or upgrade these roads.

Improvements to the arterial road network alone, other than those already planned through the Easing Sydney's Congestion Program, are not a feasible or long-term alternative to the project and would not meet the project objectives. Arterial road upgrades are complementary to the major motorway projects and are part of a coordinated infrastructure program to add to overall improvements in travel time and reliability.

Travel demand management

Travel demand management relates to minimising or avoiding the need to invest in new motorway infrastructure such as the project, by reducing individual trip lengths and making alternative transport mode options more viable.

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. Therefore, while travel demand management could help reduce demand on the road network during peak times, its effectiveness would be limited by other constraints.

Travel demand management changes alone are therefore not a viable alternative to meeting the project objectives. They are, however, viewed as complementary initiatives, together with the project, to reduce the impacts of road traffic on Sydney's road network.

Travel through the F6 Extension Stage 1 tunnel would incur a toll. Toll pricing for the F6 Extension Stage 1 tunnel has been developed on a distance basis in accordance with other NSW toll roads (refer to section 15.4.7 of the EIS for further information regarding tolling).

C4.2.3 Active transport

Submitters stated that active transport should be pursued as an alternative to the project:

- NSW infrastructure should be more focused on active transport options
- Active transport and improved access to active transport should be progressed as an alternative to the project (pedestrian and cyclist connections), as these improve health and wellbeing by encouraging people to walk, cycle and use public transportation.

Response

Active transport improvements are regarded as complementary to other transport modes including roads and public transport. They are an essential component of an integrated transport solution, meeting the needs of local communities and shorter distance commuters.

The project would provide shared cycle and pedestrian pathways aimed at improving north-south active transport movements between Bestic Street and Civic Avenue. Changes to the active transport corridor in the southern part of the project footprint, including an extended pathway to Chuter Avenue/O'Connell Street, are proposed and are described and assessed in the preferred infrastructure report.

The new shared cycle and pedestrian pathways and reduction of surface road traffic associated with the project would also result in opportunities for further co-ordinated development of an active transport network to link to key centres. A range of opportunities are outlined in Appendix C1 (Place making and urban design strategy) of the EIS including:

- Opportunity 1: Establish a shared and pedestrian pathways system throughout the existing F6 reserved corridor
- Opportunity 3: Extension of off-road shared cycle and pedestrian pathways between CA Redmond Field to Bicentennial Park
- Opportunity 9: Alternative shared cycle and pedestrian pathways route to that currently proposed including at Whiteoak Reserve and Rockdale Women's Sports Fields
- Opportunity 10: Improvement of on-road cycleway route at Bruce Street, Francis Avenue, Bay Street and England Street
- Opportunity 11: Amenity improvements for cycle and pedestrian links on east-west streets.

The NSW Government is investing in other active transport improvements to provide regional active transport connections. One example is the Sutherland to Cronulla Active Transport Link which is a pedestrian and bicycle path between Sutherland and Cronulla to help make walking and bike riding a more convenient, safer and enjoyable transport option.

When linked to the existing Alfords Point to Sutherland shared path, it would provide a regional continuous off-road path in excess of 22 kilometres and allow connections to Bankstown and on to Parramatta.

DP&E are also investigating active transport opportunities and planning in the Arncliffe, Banksia and Cooks Cove areas as outlined in the Bayside West Precincts 2036 Plan[7]. Potential improvements and infrastructure upgrades include new pedestrian and cycling paths and a bridge along the Cooks River, and between Princes Highway to Arncliffe West, following a section of the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS).

C4.2.4 Better land use planning

Submitters suggested the following:

- Suggestion to consider the impact of high density residential developments on congestion and to stop the approval of high density development in areas that cannot cope with congestion
- Suggestion that better land use planning would allow people to work closer to home and avoid congestion.

Response

The *Greater Sydney Region Plan*[8] places a strong focus on the integration of land use and transport planning with the aim of delivering benefits such as improved access to transport and services, connectivity to jobs and homes and positive health and environmental outcomes. Strategic traffic modelling for the project included an analysis of changes to traffic that may occur at a metropolitan or 'strategic' level, including factors such as changes in land use patterns and major developments.

The *Eastern City District Plan*[9] is a guide for implementing the *Greater Sydney Region Plan* at a district level and is a bridge between regional and local planning. The *Eastern City District Plan* acknowledges that the project would improve motorway access and freight movements from the Eastern Harbour City across Greater Sydney and to Port Kembla/Illawarra, supporting the functions of critical economic gateways and freeing up road capacity.

The project would also facilitate better connectivity between key employment hubs and commercial, health and education centres identified in the *Eastern City District Plan* including the Kogarah health and education precinct and the Arncliffe and Rockdale local centres.

The *Eastern City District Plan* states that local councils are in the best position to investigate and confirm locations in their LGA required for additional medium-density land use opportunities.

[7] NSW Department of Planning and Environment (2018) Bayside West Precincts 2036 Plan – Arncliffe, Banksia and Cooks Cove
[8] Greater Sydney Commission (2018) *Greater Sydney Region Plan*
[9] Greater Sydney Commission (2018) *Eastern City District Plan*

C4.3 Corridor and F6 Extension staging options development

Six submitters have raised issues regarding the strategic corridor and F6 staging options development. Refer to section 5.2 and 5.3 of the EIS for details on the strategic corridor options analysis and F6 Extension staging options analysis.

Submitters raised concerns about why the F6 Extension was being staged and suggested that it should be assessed as one project.

Submitters questioned why other strategic corridors were not used for the development of a motorway. Specific concerns include:

- Submitter suggests 'fixing up' either the A6 or A3 corridors as a north-south bypass rather than a corridor so close to the existing 'Harbour City'
- Connecting the A6 with the M5 Motorway at Padstow.

Response

F6 Extension staging

A multi-criteria analysis of staging and incremental works was undertaken to confirm the most appropriate area to commence construction of the F6 Extension based on the defined geographic sections (A – C). The analysis considered the option of constructing the F6 Extension in one stage. The analysis identified that the option to construct the F6 Extension in one stage only met some of the desired performance criteria regarding environmental and social, productivity and cost benefit considerations.

It was determined that constructing Section A (ie the project) would be the preferred first stage as it would provide the greatest benefits to the community across the criteria. Section A has high levels of traffic congestion, with peak hour speeds on the existing arterial network amongst the lowest in Sydney. As a first stage, it would alleviate some of this congestion and provide a direct connection to the motorway network in Sydney.

Motorway corridor selection

Road corridor improvements considered to link the A1 Princes Highway at Loftus with the existing and proposed motorway network in Sydney included an F6, A1, A3 and A6 corridor option (refer to section 5.2 of the EIS).

Each corridor was assessed against desired criteria relating to traffic and transportation benefits, environmental and social impacts and benefits, engineering requirements, geotechnical conditions, property impacts, cost and place making opportunities.

The F6 corridor was selected as the preferred corridor as it would:

- Cater for the eastern distribution of future traffic demand travelling north
- Provide a motorway solution without removing arterial roads
- Have a greater impact on reducing congestion for north-south traffic
- Create, in conjunction with the New M5 Motorway and other projects, a new north-south motorway through Sydney, completing a missing connection in the national highway.

C4.4 Existing F6 reserved corridor

Two submitters have raised issues regarding the existing F6 reserved corridor. Refer to section 5.4.1 of the EIS for details on the consideration of the existing F6 reserved corridor.

Submitters raised concern about the use of the existing F6 reserved corridor, stating that more of the existing corridor should be used for the project.

Response

The use of the existing F6 reserved corridor between Arncliffe and President Avenue was considered in the early stages of project development. However, it was discounted for the following reasons:

- The high value of the ecological and recreational resources within the existing F6 reserved corridor
- The social and environmental impacts of a surface motorway (either at-grade or on viaduct)
- The engineering challenge of tunnelling under the existing F6 reserved corridor given the identified poor geotechnical conditions
- The significant constraints on any northern end connection due to previous commercial and residential developments, with a lack of viability without a connection to the New M5 Motorway.

As a result of the preferred location and alignment of the project, the existing F6 reserved corridor would not be required for the project, aside from a small portion of land within Rockdale Bicentennial Park. Therefore, the existing F6 reserved corridor between Arncliffe and President Avenue would no longer be required for motorway purposes.

C4.5 Project options

265 submitters have raised issues regarding the options considered for the design of the project. Refer to section 5.4 of the EIS for details on the options considered for the design of the project.

C4.5.1 Northern and southern connection

Submitters raised concern that the F6 Extension Stage 1 does not provide access to the Eastern Distributor.

Submitters also raised concern about the justification for the location of the southern connection as it has a number of impacts. Submitters suggested that a better location for the southern connection would be at West Botany Street as it avoids the Rockdale Wetlands.

Response

Northern connection

Options considered for the northern connection for the project are described in section 5.4.2 of the EIS. Key destinations for the Eastern Distributor are the Sydney central business district and northern suburbs of Sydney. The project would facilitate connections to these destinations through the New M5 Motorway, M4-M5 Link (via the Rozelle interchange) and the proposed future Western Harbour Tunnel.

For motorist who wish to use the Eastern Distributor rather than the project and the other motorways described above, the project would improve surface road connections on The Grand Parade and West Botany Street.

Provision of a direct connection to West Botany Street

Compared to the tunnel connection at President Avenue, the provision of a tunnel connection at West Botany Street is not preferred for the following reasons:

- The area is constrained by residential and commercial properties located directly to the west of West Botany Street. A direct connection would require additional residential and commercial property acquisition as well as changes to access arrangements to the west of West Botany Street to facilitate road widening
- The connection would result in greater temporary and permanent impacts on Ilinden Sports Centre and Rockdale Bicentennial Park. If Rockdale Bicentennial Park was relocated to the east there would be permanent impacts on the Brighton Memorial Fields and a greater net loss to recreational open space in the area
- Unlike President Avenue, West Botany Street is not directly connected to the Princes Highway or The Grand Parade and additional intersection upgrades would likely be required
- The existing F6 reserved corridor would not be utilised
- A greater portion of the Rockdale Bicentennial Park wetland would be permanently impacted.

C4.5.2 Local road changes

Submitter questioned why there are no intersection upgrades at the intersection of Rocky Point Road/Princes Highway and The Grand Parade/President Avenue.

Response

Traffic modelling did not indicate that further upgrades to the intersections of Rocky Point Road/Princes Highway and The Grand Parade/President Avenue were required for the project. Traffic at the intersection of The Grand Parade and President Avenue is forecast to reduce as a result of the project and would result in improved levels of service (refer to Table 8-44 of the EIS). Traffic at the intersection of the Princes Highway and Rocky Point Road is forecast to remain consistent or slightly increase (for the 2036 PM peak only), however, the intersection would function at an acceptable level of service (Level of Service D for the 2036 PM peak and Level of Service C for all other scenarios).

Pinch Point Program work has been completed at The Grand Parade and President Avenue, Monterey (completed 2017) and at the Princes Highway, Gray Street and Rocky Point Road, Kogarah (completed 2018).

In accordance with environmental management measure TT8 (refer to **Chapter D1** (Environmental management measures)), an Operational Road Network Performance Review will be undertaken within 12 months and five years from commencement of operation to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. The review will identify relevant mitigation measures, if required, to address impacts on road network performance. The results of the review will be considered in future operational network performance planning carried out by Roads and Maritime. The Review will be undertaken in consultation with Transport for NSW and relevant councils.

C4.5.3 Shared cycle and pedestrian pathways

Submitters raised concerns about the locations of the shared cycle paths and pedestrian bridge. These include:

- Concern that the EIS does not justify why a bridge has to be built over President Avenue. There is no coherent plan or route options identified
- The pedestrian bridge should only extend to either side of President Avenue to allow for quick movements across the road
- The eastern option for the shared cycle and pedestrian bridge rather than a western alternative, as there is less impact on residents and means less travel
- The EIS states that the project will improve active transport movements between Bestic Avenue and Civic Avenue. However, Civic Avenue is not a key community destination
- Submitters also suggested an extension to, or changes to, the shared cycle and pedestrian pathways, including:
  - A cycle path should be implemented to connect to the Bayside cycleway
  - Link President Avenue with Sydney Airport
  - Include a connection at Marsh Street via the Giovanni Brunetti Bridge
  - Joining the bicycle path to other cycle ways within Rockdale to increase connectivity with Kogarah Town Centre or Brighton-Le-Sands
  - A shared path along the corridor running all the way to Bona Park in Sans Souci.

Response

The shared bridge over President Avenue is intended to provide a corridor scale connection for pedestrians and cyclists, rather than a pedestrian crossing for short trips back and forth across President Avenue. For these movements, pedestrians would be able to cross President Avenue via the signalised intersections at West Botany Street and O'Connell Street. However, if so desired, pedestrians would also be able to access the shared bridge, on the northern side via footpaths or on the southern side via Civic Avenue.

As described in section 5.4.9 of the EIS, due to the proposed raising of President Avenue at the location of the intersection, each of the eastern options would have been higher than the roof line of nearby residential dwellings. This would have resulted in visual impacts and reduction in privacy for residents along President Avenue and Colson Crescent. In addition, the residential catchment east of Scarborough Park North is already served by a shared pedestrian and cycle network along The Grand Parade and Brighton-Le-Sands foreshore.

The project would provide shared cycle and pedestrian pathways aimed at improving north-south active transport movements between Bestic Street and Civic Avenue. Extensions to the active transport corridor in the southern part of the project footprint including an extended pathway to Chuter Avenue/O'Connell Street are proposed and are described and assessed in the preferred infrastructure report. The proposed extended pathway would connect to the existing on-road cycle route along Chuter Avenue to the south.

On-road cycleway section

An active transport corridor that provided a direct route (ie a predominately separated off-street pathway) between Rockdale Bicentennial Park and Bruce Street would require property acquisition as well as additional impacts on adjacent residents and potential pedestrian and cyclist safety issues through Kings Wetland, south of Bay Street.

East-west connections at President Avenue

The project would retain existing signalised pedestrian crossings of President Avenue at Princes Highway, West Botany Street and O'Connell Street. Footpaths would be upgraded where widening of President Avenue is proposed. Between West Botany Street and O'Neill Street, the main east-west pedestrian movement would be on the southern side of President Avenue, adjacent to Scarborough Park North, by way of a new shared path. Pedestrian connectivity would be provided within and around Rockdale Bicentennial Park to enable movement of pedestrians and cyclists within the parkland and to/from President Avenue.

Other suggestions

The proposed shared cycle and pedestrian pathways would provide opportunity for east to west pedestrian and cycleway linkages between Rockdale and Kogarah train stations, and the Botany Bay foreshore, however other future active transport links are outside the scope of the project. A range of opportunities identified during the development of the project design are outlined in Appendix C1 (Place making and urban design strategy) of the EIS and summarised in **section C4.2.3**.

C4.5.4 Permanent power supply route

A submitter suggested that the permanent power supply should connect from the Rockdale Motorway Operations Complex south (MOC3) to the Arncliffe Motorway Operations Complex (MOC1) via the project tunnels rather than connecting to the proposed Canterbury substation.

Response

The Rockdale Motorway Operations Complex south (MOC3) would provide the bulk power supply connection for the project, however an external power source is required. The permanent power supply route described in section 6.12.3 of the EIS is required to connect the Rockdale Motorway Operations Complex south (MOC3) to the existing Ausgrid Canterbury sub-transmission substation (ie a power source).

A connection from Rockdale Motorway Operations Complex south (MOC3) to a new substation at the Arncliffe Motorway Operations Complex (MOC1) would be provided through the tunnel as described in the EIS.

C4.5.5 Operational ancillary infrastructure

Submitters raised concerns about the decision to not use alternatives such as progressive in-tunnel ventilation to alleviate air quality impacts. The potential costs and benefit have been misrepresented.

Response

Filtration of ventilation systems

Potential operational air quality impacts associated with the project are discussed in Chapter 9 (Air quality) of the EIS. The predicted ventilation outlet concentrations are below the relevant air quality criteria.

Most tunnels achieve acceptable air quality criteria without filtration. Less than 0.1 per cent of tunnels in the world use filtration to reduce particulate matter or nitrogen dioxide levels to maintain acceptable in-tunnel or external air quality.

If in-tunnel air quality levels could not be achieved with the proposed ventilation system, the most effective solution would be the introduction of additional ventilation outlets and additional air supply locations. This is a proven solution and more sustainable and reliable than tunnel filtration systems.

Incorporating filtration to the ventilation outlets would have negligible benefit and require a significant increase in the size of the tunnel facilities to accommodate the equipment. It would result in increased project size, community footprint, and capital cost. The energy usage would be substantial and does not represent a sustainable approach. Further, the air leaving the outlet is not highly concentrated with pollutants (as demonstrated by the air quality assessment) since it must be of a quality to be acceptable for tunnel users. Predicted impacts on local air quality is very small even without a filtration system.

In summary, the provision of a tunnel filtration system does not represent a feasible and reasonable mitigation measure and is not being proposed.

Ventilation outlet regulation reforms

In February 2018 the NSW Government announced reforms to the regulation of ventilation outlets for motorway tunnels in NSW. The reforms apply to the project and include:

- Ventilation outlets will be regulated by the NSW Environment Protection Authority (NSW EPA). The NSW EPA will require tunnel operators to meet air quality limits and undertake air quality monitoring, where practicable
- The Advisory Committee on Tunnel Air Quality (ACTAQ) will coordinate a scientific review of a project's air emissions from ventilation outlets
- The NSW Chief Health Officer will release a statement on the potential health impacts of emissions from tunnel ventilation outlets
- The Minister for Planning will not approve a motorway tunnel project until the ACTAQ scientific review is considered.

ACTAQ's comments on the EIS is provided in **Chapter B1** of this report. The review stated '*Our overall conclusion of the F6 Extension – Stage 1 EIS is that it constitutes a thorough review of high quality. It covers all of the major issues and areas that an EIS 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 review of the project by the Chief Health Officer[10] noted stated: '*The draft EIS predicts that the contribution of emissions from road tunnel ventilation outlets to community exposures is small relative to the contribution of emissions from traffic on surface roads from other pollution sources. The primary source of community exposure to air pollution is from pre-existing regional air pollution, followed by pollution from surface road traffic. NSW Health considers that any potential air pollution-related health effects from the project are likely to be primarily a result of changes in volumes of traffic on the surface road network, not a result of the tunnel ventilation outlets'*. A subsequent review of the final EIS by the Chief Health Officer indicated that the statement above remains applicable to the project.

[10] Statement posted on the DP&E major projects website

C4.5.6 Construction

A submitter suggested that removal of spoil and haulage should be a 24 hour operation to increase efficiency of construction.

Response

The suggestion is noted. Roads and Maritime is seeking approval to carry out tunnelling and tunnelling support work (including spoil removal) 24 hours a day, seven days a week and the assessment in the EIS reflects this. This is required to limit the overall duration of the project.

C4.6 Suggested alternatives and options

37 submitters have suggested alternatives and options for elements of the project. Refer to section 5.4 of the EIS for details on the options considered for the design of the project.

C4.6.1 Location of F6 Extension

Suggestion to change the location of the project, as the current alignment is not optimal. For example:

- Move the location of the portal further to the west along President Avenue
- Connect the project with the westbound lanes of the New M5 Motorway.

Response

Relocation of the President Avenue intersection to the west

The President Avenue intersection has been designed to minimise property acquisition as well as potential impacts on nearby vegetation and social infrastructure while ensuring the overall constructability of the intersection. Relocation of the intersection further to the west on President Avenue would involve permanent direct impacts on the Rockdale Wetlands and the Ilinden Sports Centre and present constructability issues associated with the construction of cut-and-cover structures directly within the wetlands.

Connection to New M5 Motorway westbound

A connection with the New M5 motorway westbound tunnels was considered for the project, however strategic traffic analysis found that there was insufficient demand for a connection to the New M5 Motorway westbound. The alternatives considered for the northern connection with the New M5 Motorway are discussed in section 5.4.2 of the EIS.

C4.6.2 Car parking suggestions

Suggestion that if the Brighton Memorial Fields are reinstated that there should be a car park established as the existing car park is not sufficient.

Response

The project would not directly impact on Brighton Memorial Fields. However, Roads and Maritime is working with Bayside Council and has identified Brighton Memorial Fields together with McCarthy Park as providing an opportunity to offset the temporary loss of the recreational facilities at Rockdale Bicentennial Park. Roads and Maritime and Bayside Council will develop the concept designs at each of these locations, with the need to modify car parking being investigated. The construction and installation of these offset facilities would be subject to separate planning approvals and are outside the scope of the EIS.

C4.6.3 Construction management

Spoil should be transferred to shipping containers within the tunnel to avoid spoil handling on the surface and at disposal sites.

Response

Spoil would generally be loaded directly on to spoil haulage vehicles within the tunnel which would minimise requirements for spoil handling at the surface of construction ancillary facilities. Soil stockpiling and handling would be required when spoil cannot be immediately transported offsite (for example, when spoil is contaminated or when available spoil disposal sites are limited during the night time period). Handing and loading of shipping containers within an excavated tunnel is not a feasible option. Spoil handling would be required in some form at disposal sites even if spoil was to be transported in a shipping container.

C4.6.4 Suggested improvements to local roads

Suggested improvements to nearby roads (intersection improvements, speed limits, right hand turn lanes etc.):

- Questions why a right hand turn bay and lane has not been considered for Oakdale Avenue at Moorefield Estate
- Suggestion to include intersection improvements at Princes Highway/West Botany, Grand Parade, Bay Street, O'Connell Street/Crawford Road to ease congestion when exiting the tunnels
- Suggestion to acquire more land from St George TAFE to increase the number of lanes to turn left in order to improve congestion southbound (from President Avenue into Princes Highway)
- Suggestion to install clearways on the following roads:
  - President Avenue, on the westbound side, in the vicinity of the entrance to the TAFE
  - The Grand Parade, to increase traffic flow and reduce congestion
- Option of downgrading General Holmes Drive away from a freight passage route (movement corridor) to a destination should be acknowledged
- Suggestion that access to the soccer fields from O'Neill Street should be blocked off as people access the fields via O'Neill Street and this creates issues for residents.

Response

Changes to access arrangements at Moorefield Estate are described and assessed in the preferred infrastructure report.

The option of a right turn bay at Oakdale Avenue is not considered necessary as right turn movements into Moorefield Estate from President Avenue would be available at a new signalised intersection at Lachal Avenue. Right turn movements out of Moorefield Estate would also be facilitated through a new signalised intersection at Civic Avenue. The signalised intersections would improve safety by reducing potential traffic conflicts in and out of Moorefield Estate.

Traffic modelling of future conditions with the project reviewed potential upgrades at the nominated intersections. The modelling indicated that upgrades at the Princes Highway/President Avenue intersection would be required to accommodate the additional traffic anticipated as a result of the project. The design presented in the EIS would be sufficient to accommodate additional traffic volumes due to the extra capacity provided by the right turn lane from Princes Highway northbound into President Avenue and the left turn lane from Princes Highway southbound into President Avenue.

Upgrades to the President Avenue/West Botany Street and President Avenue/O'Connell Street intersections are also proposed, as described in the preferred infrastructure report. Traffic modelling did not indicate that upgrades to the other nominated intersections were required as a result of the project.

The project does include changes to on-street parking along President Avenue during peak periods to support the operational performance of the President Avenue corridor. With the project, President Avenue would operate with clearway conditions during AM and PM peak periods, west of O'Connell Street. In off-peak periods and at night, on-street parking along President Avenue would be reinstated as per existing conditions, with some exceptions as outlined in section 8.7.3 of the EIS.

The Roads and Maritime Clearways Project is a separate project that aims to maximise the capacity of existing routes through the introduction or extension of clearways. The Grand Parade has been considered as part of this Clearways Project.

Roads surrounding President Avenue would still be required for surface traffic movements to destinations not primarily serviced by the F6 Extension or the New M5 Motorway. General Holmes Drive will remain an important connection to Sydney Airport.

Existing issues between residents and users of the Brighton Memorial Fields when the fields are accessed by O'Neill Street are outside of the scope of the project. O'Neill Street would become a cul-de-sac at President Avenue as a result of the project, however, access to Brighton Memorial Fields would be retained by accessing O'Neill Street via Crawford Road.

In order to address operational road network performance impacts of the project, including potential increased traffic on some parts of the network, an Operational Road Network Performance Review will be undertaken within 12 months and five years from commencement of operation to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. The review will identify relevant mitigation measures, if required, to address impacts on road network performance. The results of the review will be considered in future operational network performance planning carried out by Roads and Maritime.

The Review will be undertaken in consultation with Transport for NSW and relevant councils.

C Part C Response to community submissions

C5 Project description

This chapter addresses questions raised in community submissions relating to the description of the project in the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 6 (Project description) of the EIS for further details on the concept design for the project.

Contents

C5.1 Reinstatement of Rockdale Bicentennial Park

Two submitters questioned the reinstatement of Rockdale Bicentennial Park. Refer to section 6.7 of the EIS for details on the proposed reinstatement of the park following construction.

The submitters asked whether a playground or a skatepark would be reinstated; or if both a playground and skatepark would be reinstated. The submitters also queried whether the reinstatement would be conducted in consultation with Bayside Council.

Response

Recreational facilities within Rockdale Bicentennial Park would be directly impacted by the project for the duration of construction, including the need to remove a playground with equipment, a skate park, open space and three soccer playing fields within the existing F6 reserved corridor in land adjacent to the park.

Following completion of the motorway tunnel and portal within the park and existing F6 reserved corridor, recreational facilities at Rockdale Bicentennial Park would be reinstated as part of the project. A concept design for the reinstatement of Rockdale Bicentennial Park has been prepared (refer to **Figure C5-1**) having regard to the urban design objectives and principles for the project.

Roads and Maritime will consult with Bayside Council as the recreational park facility owner, and the sport groups that use the soccer fields. Reinstated facilities would be comparable with existing facilities and it is currently expected that both a playground and a skate park would be reinstated. What facilities are provided will also be informed by a recreational needs study that Roads and Maritime is working on with Bayside Council.

The concept design will be refined during the development of an Urban Design and Landscape Plan, which will be prepared based on the detailed design for the project (see environmental management measure LVIA1 in **Chapter D1** (Environmental management measures)). The Urban Design and Landscape Plan will be prepared in consultation with Bayside Council and other key stakeholders and made available to the public.

C5.2 Tunnels

One submitter raised a query regarding the location of the mainline tunnels for the project. Refer to section 6.3 of the EIS for details of the design of the mainline tunnels.

The submitter asked about the proposed tunnel portal location and queried how close it would be to residential properties on Eden Street at Arncliffe.

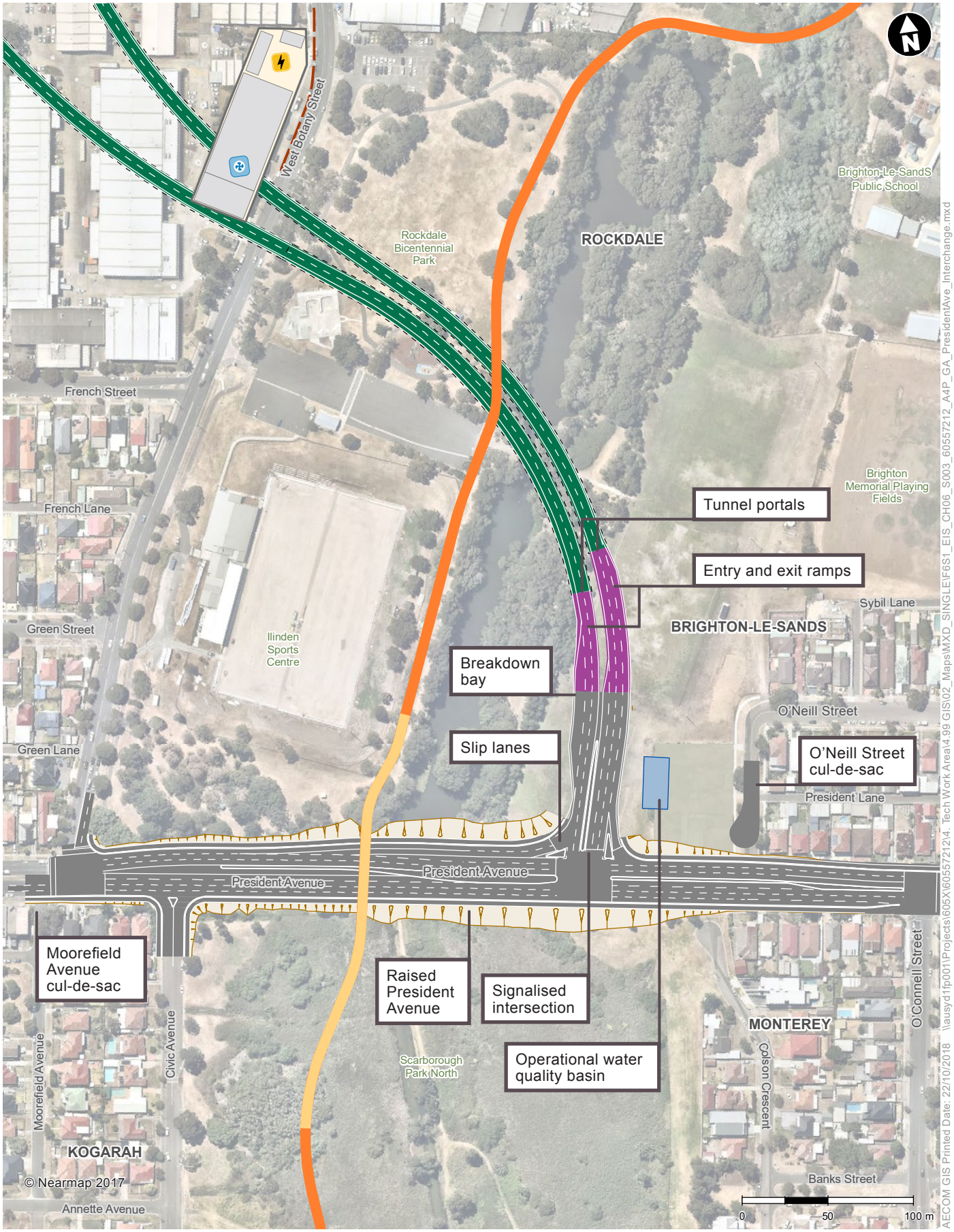
Response

The connection between the New M5 Motorway and the project in Arncliffe is an underground connection, therefore there is no tunnel entrance portal at Arncliffe. The surface entrance and exit to the F6 Extension Stage 1 tunnels are at President Avenue in Kogarah, as shown in **Figure C5-2**.

Furthermore, Eden Street is about 300 metres away from the current location of the proposed project tunnels and the tunnels are around 70 metres underground at this location. The tunnel design, including the vertical and horizontal positioning of the tunnels underground, may however change subject to further refinements made during detailed design.

The indicative design alignment of the underground tunnels were shown in Figure 6-1 and Figure 6-2 of the EIS.

Figure C5-1 Indicative concept plan for reinstated Rockdale Bicentennial Park and adjacent F6 corridor (as per EIS Figure 6-12 of the EIS) C5-2



LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Building
- Embankment
- Water quality basin
- Motorway operations complex
- Substation
- Permanent power supply line
- Rockdale ventilation facility

Figure C5-2 President Avenue intersection layout

C5.3 President Avenue surface works

Four submitters have requested clarification of the President Avenue surface works. Refer to section 6.5 of the EIS for details on the design of the President Avenue surface works.

Submitters have requested clarification or raised queries in regard to the President Avenue surface works. Specific queries and concerns include:

- Whether there would be a signalised pedestrian crossing at the entrance to the tunnel on President Avenue
- East/west connections along President Avenue must be maintained for commuters travelling towards the Kogarah Health and Education Precinct and the Brighton-Le-Sands and Monterey area for recreational cyclists
- Concern that no safe crossing would be provided at major roads for pedestrians (eg along President Avenue)
- Request to clarify the area of the Patmore Swamp heritage curtilage that would be used by the project
- Request for further detail on the area currently used as nature strip and footpath widths on President Avenue following completion of the project.

Response

Pedestrian crossings

The project design does not include a signalised pedestrian crossing for pedestrian movements between either side of the portal entrance at the intersection with President Avenue. Pedestrians (and cyclists) can use the new footpaths on the southern side of President Avenue to travel east or west along President Avenue at the intersection.

If pedestrians approach the intersection on the northern footpath along President Avenue, they would use the existing signalised crossings at West Botany Street or O'Connell Street (depending on direction of approach) to cross to the southern side of President Avenue where there will be a new shared path. The new shared cycle and pedestrian bridge from within Rockdale Bicentennial Park to Scarborough Park North would provide another connection between the north and south side of President Avenue. Pedestrians could also travel north into the reinstated Rockdale Bicentennial Park and use the pedestrian bridge over the wetlands for east-west connectivity along President Avenue.

The project would retain existing signalised pedestrian crossings of President Avenue at Princes Highway, West Botany Street and O'Connell Street. Footpaths would be upgraded and installed where widening of President Avenue is proposed. There is currently no formal footpath on the south side of President Avenue at the location of the F6 Extension Stage 1 tunnel intersection.

Pedestrian connectivity would also be provided within and around Rockdale Bicentennial Park to enable movement of pedestrians and cyclists within the parkland and to/from President Avenue. The provision of wayfinding signage would be considered for pedestrian routes that have been changed as part of the project as part of the urban design for the project.

A signalised crossing point on the northern side of President Avenue is not required given that east-west pedestrian movement would be available on the southern side of President Avenue and north-south movements across President Avenue would be available via the existing signalised pedestrian crossings of President Avenue described above. The majority of east-west pedestrian and cyclists movements along President Avenue would originate beyond West Botany Street (for travellers bound eastward) and O'Connell Street (for travellers bound westward) and therefore the use of the existing signalised pedestrian crossings at these locations is not considered to be a significant diversion. The shared cycle and pedestrian bridge that forms part of the project would provide a new safe connection over President Avenue from Rockdale Bicentennial Park to the east and south (connecting to Civic Avenue and Chuter Avenue). The shared cycle and pedestrian bridge and pathways in the vicinity of President Avenue are shown in **Figure C5-3**.

Curtilage area of Patmore Swamp

The President Avenue surface works and the heritage curtilage of Patmore Swamp (Listing: I202, Rockdale Local Environmental Plan 2011) are shown in **Figure C5-3**. The total area of the Patmore Swamp heritage curtilage listing is around 262,020 metres squared and is located in Lot 1 of DP1113262. The project, including the southern extension of the shared cycle and pedestrian pathway, would result in around four per cent of the curtilage area being directly impacted.

The impact of the project on the heritage values of Patmore Swamp is discussed in **Chapter C19** (Non-Aboriginal heritage).

Road verge dimensions at President Avenue

There is currently no formal footpath between Civic Avenue and Colson Crescent along the south side of President Avenue. Elsewhere along President Avenue there are footpaths provided within the road verge on both the north and south side of the road. The size of the road verge varies but is generally around four to five metres, with the footpaths typically around one metre width.

The current road design allows for a typical three metres of footpath and a one metre verge either side of President Avenue where the project is being upgraded or reconstructed; this is however subject to further detailed design. A new shared path would be provided on the south side of President Avenue between Civic Avenue and Colson Crescent.

Vegetation along President Avenue would be retained where possible. Where the removal of trees is unavoidable during construction, trees would be replaced in accordance with the tree management strategy for the project, which would be prepared in consultation with relevant stakeholders (including local councils). The replacement of trees would be in accordance with a number of general principles, including a net increase in the number of replacement trees.

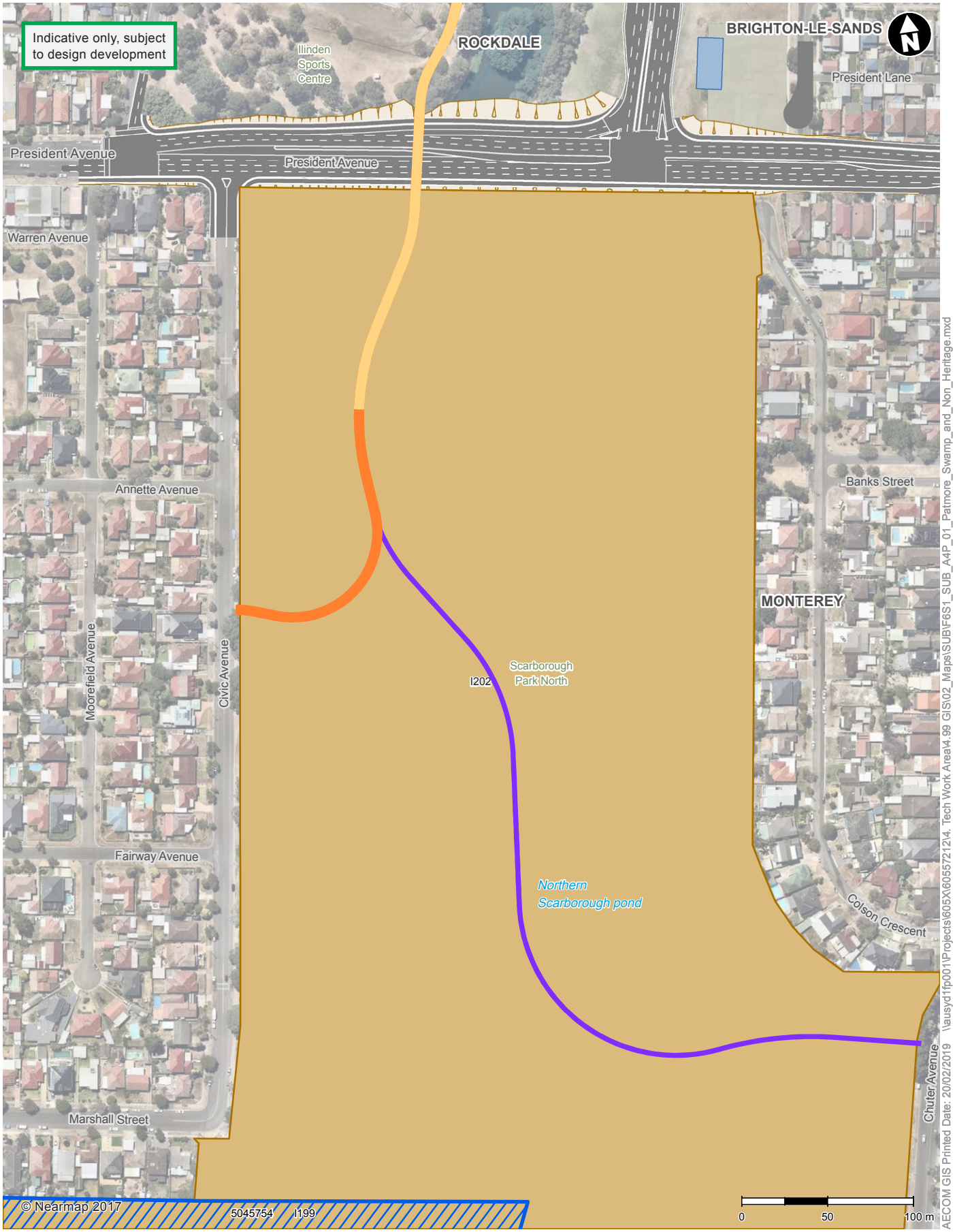


Figure C5-3 Project features within Patmore Swamp

C5.4 Shared cycle and pedestrian pathways

16 submitters have asked about, or expressed support for the shared cycle and pedestrian pathways. Refer to section 6.8 of the EIS for details on the design of the shared cycle and pedestrian pathways.

Submitters expressed support and others requested further information on the proposed shared cycle and pedestrian pathways. Specific queries included:

- Would the shared cycle and pedestrian pathways provide access to the Kogarah Town Centre
- Would the design of the shared cycle and pedestrian pathways along Frances Street and Bruce Street extend across the roads, thereby preventing vehicle movements
- Would the shared cycle and pedestrian pathways be built as a separated path, to allow three metres for riders and two metres for pedestrians, without pinch points or unsafe corners
- Requests a side elevation of the shared cycle and pedestrian track (as viewed from Civic Avenue, President Avenue, and the water channel within Patmore Swamp)
- Would the shared cycle and pedestrian pathways provide a direct route with no on-road sections
- The dedicated bridge should connect with safe paths and other active transport connections
- The design should include safe and effective lighting and limited curves for cyclists and pedestrians
- The design should include protected crossings, clear signage and support the diverse use of commuters.

Response

Shared cycle and pedestrian pathway routes

The project would deliver new shared cycle and pedestrian pathways including from Bestic Street, Brighton-Le-Sands south to Chuter Avenue/O'Connell Street, Kogarah through the reinstated Rockdale Bicentennial Park, including some parts along existing roads (Bruce Street and Francis Street).

The route of the shared cycle and pedestrian pathway does not provide direct access to Kogarah Town Centre. Figure 6-14 of the EIS indicates that commuters would be able to continue onto Kogarah Town Centre and the Sydney Central Business District (CBD) using the existing pathways and/or cycleways in those areas. To connect with Kogarah Town Centre from the pathways at Civic Avenue Reserve, a pathway user could use the southern extension to the pathway (as described in the preferred infrastructure report) and the existing pathways within Scarborough Park to connect with Marshall Street or Scott Street. These streets could then be used to connect with Kogarah Town Centre.

Where the pathway crosses over roads, pedestrian refuge islands would be provided to provide safe crossing points. Vehicle lanes and movements would remain unchanged. Details of road crossings would be developed during future design stages in consultation with Bayside Council.

Where possible, the shared cycle and pedestrian pathways would be a separate cycle and pedestrian pathway unless surrounding constraints require a shared section. The average width would be five metres, comprising a three metre, two-way cycle lane, 1.5 metre pedestrian path and 0.5 metre edge buffer. A cross section of the shared cycle and pedestrian pathways was shown in Figure 6-13 of the EIS. Detailed descriptions of the shared cycle and pedestrian pathways are also provided in Appendix C1 (Place making and urban design) of the EIS.

The shared cycle and pedestrian pathways would be subject to detailed design in accordance with the Urban Design and Landscape Plan for the project. The plan will outline detail regarding lighting, crossings, safety (including path geometry) and wayfinding. The plan will be developed in consultation with Bayside Council and other stakeholders.

Side elevation of the shared cycle and pedestrian bridge over President Avenue

Artist impressions of the shared cycle and pedestrian bridge over President Avenue are provided in **Figure C5-4** and **Figure C5-5**. The height of the bridge would be a minimum of 5.5 metres above the raised President Avenue.

The design elements of the bridge would comply with the relevant Roads and Maritime 'Bridge Aesthetics' design guidelines and be designed to achieve relevant access requirements.

Figure C5-4 Artist's impression of President Avenue shared cycle and pedestrian bridge, looking east

Figure C5-5 Shared cycle and pedestrian bridge example

C5.5 Water and drainage infrastructure

One submitter asked about the water and drainage infrastructure for the project. Refer to section 6.9 of the EIS for details on water and drainage infrastructure for the project.

Submitters raised the following queries regarding the proposed water and drainage infrastructure to be installed as part of the project:

- Request for information regarding the proximity of the water quality basin to the proposed cul-de-sac at O'Neill Street
- Questioned whether the current weir located immediately north of President Avenue, between Kings Wetland and Patmore Swamp would be replaced as it regulates the freshwater requirements for Patmore Swamp.

Response

Water quality basin

The upgrades to the existing pavement drainage system at President Avenue includes the diversion of water runoff from the tunnel portal to temporary storage tanks and pump wells located beneath the carriageways before pumping to a water quality basin and discharges into Scarborough Ponds.

The water quality basin would be located to the west from the proposed cul-de-sac at O'Neill Street as shown in **Figure C5-1**. Annexure B of Appendix L (Surface water technical report) of the EIS shows the concept design for the water quality basin as President Avenue.

Replacement of the existing weir structure

The current weir located immediately north of President Avenue which separates the Rockdale Bicentennial Park Pond and the Northern Scarborough Pond. The weir controls water levels within the Rockdale Bicentennial Park Pond, before flowing into a culvert. The culvert discharges into an open channel immediately downstream of President Avenue, which includes a floating boom and litter trap to collect floating litter and plants prior to discharges to the Northern Scarborough Pond.

To maintain the existing permanent water level in the Rockdale Bicentennial Park Pond upstream of President Avenue, the weir that is located upstream of the existing of the existing box culvert would be replaced with a similar arrangement at the inlet of the new box culvert. The proposed drainage system at President Avenue is shown in Figure 6-17 of the EIS.

C Part C Response to community submissions

C6 Construction

This chapter addresses issues raised in community submissions associated with the construction strategy for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 7 (Construction) of the EIS for further details on the construction strategy for the project.

Contents

C6.1 Construction program

Five submitters have raised issues regarding the construction program or the duration of construction. Refer to section 7.1 of the EIS for details of the construction program.

Submitters have expressed concern about construction program. Specific concerns included:

- How long the project would take to construct
- The project would take longer than the proposed four years to construct, as construction timeframes are rarely met.

Response

The indicative construction program of around four years will be refined by the successful design and construction contractor(s), who will develop the detailed design and construction methodology for the project.

The indicative construction program has been developed to achieve a balance between efficiency and safety, while minimising impacts to the community.

The program of around four years is based on undertaking construction concurrently from six construction ancillary facilities. However, the construction method and program will be dictated by a number of factors, including geotechnical conditions, inclement weather, timing restrictions imposed by government agencies or conditions of approval; and scheduling to mitigate environmental or community impacts.

C6.2 Construction hours

One submitter raised concern regarding the construction work hours for the project. Refer to section 7.7.2 of the EIS for further details on the indicative construction hours for the project.

A submitter raised concern in regards to the construction hours for the project. The concern was in regards to the construction hours (24 hours a day, 7 days a week) proposed at the Rockdale construction ancillary facility (C2). The submitters concern included if a respite period would be provided for residents adjacent to the construction compound.

Response

Tunnelling and spoil management would occur within the Rockdale construction ancillary facility (C2) 24 hours a day located at the existing Roads and Maritime depot off West Botany Street, seven days a week, for around two years.

The majority of spoil removal and haulage would occur during standard construction hours (ie 7am – 6pm on weekdays and between 8am – 1pm on Saturday). However, some spoil haulage and movement of vehicles to support the spoil management and oversize deliveries that could not occur during normal hours, may be required outside of these hours.

Some construction works are required 24 hours a day, 7 days a week to maximise construction efficiency and minimise the overall duration of the construction period. While tunnelling activities would occur 24 hours a day, 7 days a week, limited activity would occur within the Rockdale construction ancillary facility (C2). Activities conducted at C2 outside of standard construction hours would largely occur within an acoustic shed to minimise noise impacts to nearby receptors.

The noise and vibration and air quality environmental management measures detailed in **Chapter D1** (Environmental management measures) would assist in minimising impacts on residential receptors adjacent to the Rockdale construction ancillary facility (C2).

Noisy work (to be defined in the Environmental Protection Licence for the project) and vibration intensive activities (those activities that exceed the relevant vibration criteria[1]) will be scheduled to be undertaken during standard construction hours (defined above) as far as possible. Works or activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods.

Respite measures will be implemented for noisy work and vibration intensive activities in a manner consistent with the Environmental Protection Licence for the project and Roads and Maritime guideline requirements[2].

All residents affected by noise from the construction of the project which are expected to experience an exceedance of the construction Noise Management Levels will be consulted about the project prior to the commencement of the particular activity, with the highest consideration given to those that are predicted to be most affected as a result of the works. The community will be able to provide feedback via a 24 hour, toll-free project information and complaints line, a dedicated email address and postal address for the project.

In addition, a Construction Fatigue Protocol will be prepared and implemented as part of the Construction Noise and Vibration Management Plan (CNVMP) to address potential construction fatigue impacts. The protocol will include consideration of noise attenuation and periods of respite for affected stakeholders, where reasonable and feasible, and restricting out of hours work, where practicable.

C6.3 Construction ancillary facilities

Four submitters have raised issues regarding the construction ancillary facilities. Refer to section 7.3 of the EIS for details on the construction ancillary facilities for the project.

Submitters raised queries regarding the construction ancillary facilities for the project including:

- Would the service station (7-Eleven) at the north-eastern corner of the Princes Highway and President Avenue intersection be fully or partially demolished within the Princes Highway construction ancillary facility (C6)
- Are dust mitigation measures proposed for sand, aggregate and bulk cement (typical of concrete batching plants) at construction ancillary facilities.

Response

Demolition of the service station

The current service station site (7-Eleven) on the north-eastern corner of the Princes Highway and President Avenue intersection would be fully acquired (around 1,500 metres squared in total) for the construction of the project and for the Princes Highway construction ancillary facility (C6). During site establishment, it is expected that the majority of existing structures at the service station site would need to be demolished.

Much of the land within the service station would be residual to the project needs following completion of construction. The future use of this land is yet to be determined; however it would not be precluded from similar commercial uses.

[1] ANZECC Guidelines – Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration, and AS 2187.2-2006 Explosives - Storage and Use Part 2: Use of Explosives – Appendix J
[2] Roads and Maritime Services (2016) *Construction Noise and Vibration Guideline*

Dust management

As noted in **Chapter A2** (Clarifications), construction air quality mitigation measures relevant to sand, aggregate and bulk cement handling at construction ancillary facilities, as described in Appendix E (Air quality technical report) of the EIS, were not specifically listed in the compilation of management measures in section 24.6 of the EIS. This was an omission and these dust management measures, which would form part of the Construction Air Quality Management Plan (CAQMP) for the project, have been updated in environmental management measure AQ1 in **Chapter D1** (Environmental management measures). These relevant measures will be employed as good practice on construction sites and include:

- Sand and other aggregates will be stored in bunded areas and will not be allowed to dry out, unless this is required for a particular process, in which case appropriate additional control measures will be put in place
- Fine materials (such as bulk cement and other fine powder) will be transported, stored and handled to minimise dust generation.

C6.4 Construction activities

One submitter raised issues regarding construction activities. Refer to section 7.4 of the EIS for details on the construction activities for the project.

The submitters expressed concern about the specific construction activities for the project. Specific queries or concerns include the following:

- Would concrete batching plants be required for the construction of the project
- What is the approach to the construction of the shared cycle and pedestrian pathways
- Would protection for pedestrians and the general community be provided during construction, including during construction of the shared cycle and pedestrian pathway at President Avenue.

Response

Concrete use

Typical construction plant and equipment for each construction activity is identified in section 5.1 of Appendix G (Noise and vibration technical report) of the EIS. The list of typical plant and equipment includes concrete saws, concrete trucks and concrete pumps. A concrete batching plant is not proposed to be used during construction of the project, however, a bentonite plant/silo would be required to stabilise the construction of the cut-and-cover structures at the President Avenue construction ancillary facility (C3). Clarifications regarding the use of the bentonite plant are provided in **Chapter A2** (Clarifications).

Construction of the shared cycle and pedestrian pathways

Construction of the shared cycle and pedestrian pathways between Bestic Street and Bruce Street would be supported by two construction ancillary facilities, C4 (near West Botany Street) and C5 (near Bruce Street). C4 and C5 are located within a recreation area near Muddy Creek. Construction ancillary facilities C4 and C5 are shown on **Figure C6-1**.

The shared cycle and pedestrian pathways would be constructed during standard working hours at this location. The key construction activities to be undertaken within C4 and C5 are outlined in section 7.3.5 of the EIS.

Construction of the shared cycle and pedestrian pathways south of Bruce Street would be supported by the President Avenue construction ancillary facility (C3). This would include the construction of the shared cycle and pedestrian bridge and abutments over President Avenue. There would also be an additional construction site to support the construction of the dedicated shared bridge to the south of President Avenue, east of Civic Avenue. The shared cycle and pedestrian pathways are now proposed to be extended further south towards Barton Street in Kogarah. The approach to construction, potential environmental impacts and additional management measures for this southern extension of the active transport corridor is described further and assessed in the preferred infrastructure report.

The proposed extension would be outside the project footprint assessed in the EIS, however the construction works and materials required to facilitate these changes would be of a similar nature to those originally proposed in the EIS.

The proposed extended shared cycle and pedestrian pathway would be constructed as a boardwalk and therefore would not require concrete pathway pouring as for the proposed shared cycle and pedestrian pathways described in the EIS.

The potential impacts during construction of this southern extension are considered to be generally consistent with the impacts described in the EIS and would be managed by the implementation of the proposed environmental management measures outlined in **Chapter D1** (Environmental management measures).

Figure C6-1 Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) indicative layout

Protection for pedestrians and the community during construction

Site establishment works would include the installation of temporary site fencing and hoarding around construction sites, including for the construction of the shared cycle and pedestrian pathway on President Avenue. This would be to ensure construction worker and public safety as well as to manage potential visual and air quality impacts. Site establishment works are described in further detail in section 7.4.2 of the EIS.

To assist with protecting pedestrians and cyclists during construction, a Construction Traffic Management Plan (CTAMP) will be prepared to include a strategy for managing temporary changes to pedestrian and cyclist facilities including:

- Closing or detouring the pedestrian pathways along either side of President Avenue during works along President Avenue. This would occur one side at a time and diversions would be put in place
- Temporary blocking of the walking path that circumnavigates Rockdale Bicentennial Park during construction of the cut-and-cover structure. Pedestrian movements would be diverted along West Botany Street and President Avenue to the south of construction ancillary facility (C3) or along the northern boundary of C3 if possible

- Retention of the pedestrian access between West Botany Street and Kings Road with potential relocation to the northern extent of the park area
- Closure of the pedestrian bridge over Rockdale Wetlands for the duration of the construction works in the area. Pedestrians would be diverted along President Avenue
- Temporary closure (one side at a time) of pedestrian pathways along either side of the Princes Highway during the intersection upgrade works. Pedestrians would be diverted to the opposite side.

C6.5 Access impacts during construction

Seven submitters have raised issues regarding access impacts during construction. Refer to section 7.6 of the EIS for details on the traffic management and access changes required during construction.

Submitters have expressed concern about access changes during construction. Specific concerns include the following:

- Pedestrian and cycling access should be maintained during construction and replacement paths should not force cyclists into traffic
- Access to the Kirby Industrial Park along West Botany Street during construction including alternative arrangements to maintain access for long B-double trucks
- The use of O'Neill Street and Sybil Lane to access the President Avenue construction ancillary facility.

Response

Maintaining pedestrian and cyclist access

Potential impacts to pedestrians and cyclists during construction are discussed in section 8.4.5 of the EIS. Some pedestrian footpaths and cycling paths would need to be closed or diverted during construction. The shared paths at risk of being diverted have been discussed above in **section C6.4**.

A strategy for ensuring pedestrian and cyclist access is maintained throughout construction will be included in the CTAMP. The CTAMP will include details of diversions and alternative safe routes/pathways, traffic controls to be implemented, consultation with affected stakeholders such as road user groups; and staging of works.

Access along West Botany Street

During construction, the outer lanes of West Botany Street would need to be closed outside of peak hours during site establishment at the President Avenue construction ancillary facility (C3), prior to construction of the cut-and-cover structures.

Other changes to the road network along West Botany Street are anticipated to include:

- Temporary diversion of West Botany Street traffic lanes for the cut-and-cover structures across West Botany Street and utility relocations
- Reinstatement of original alignment of West Botany Street following construction of the cut-and-cover structures
- Temporary traffic signals on West Botany Street at the Rockdale construction ancillary facility (C2) to allow safe movements of construction traffic into and out of C2
- Temporary traffic signals on West Botany Street at C3 in order to allow construction traffic to pass from the construction area for he Rockdale Motorway Operations Complex (south) (MOC3) on the eastern side to the western side of West Botany Street.

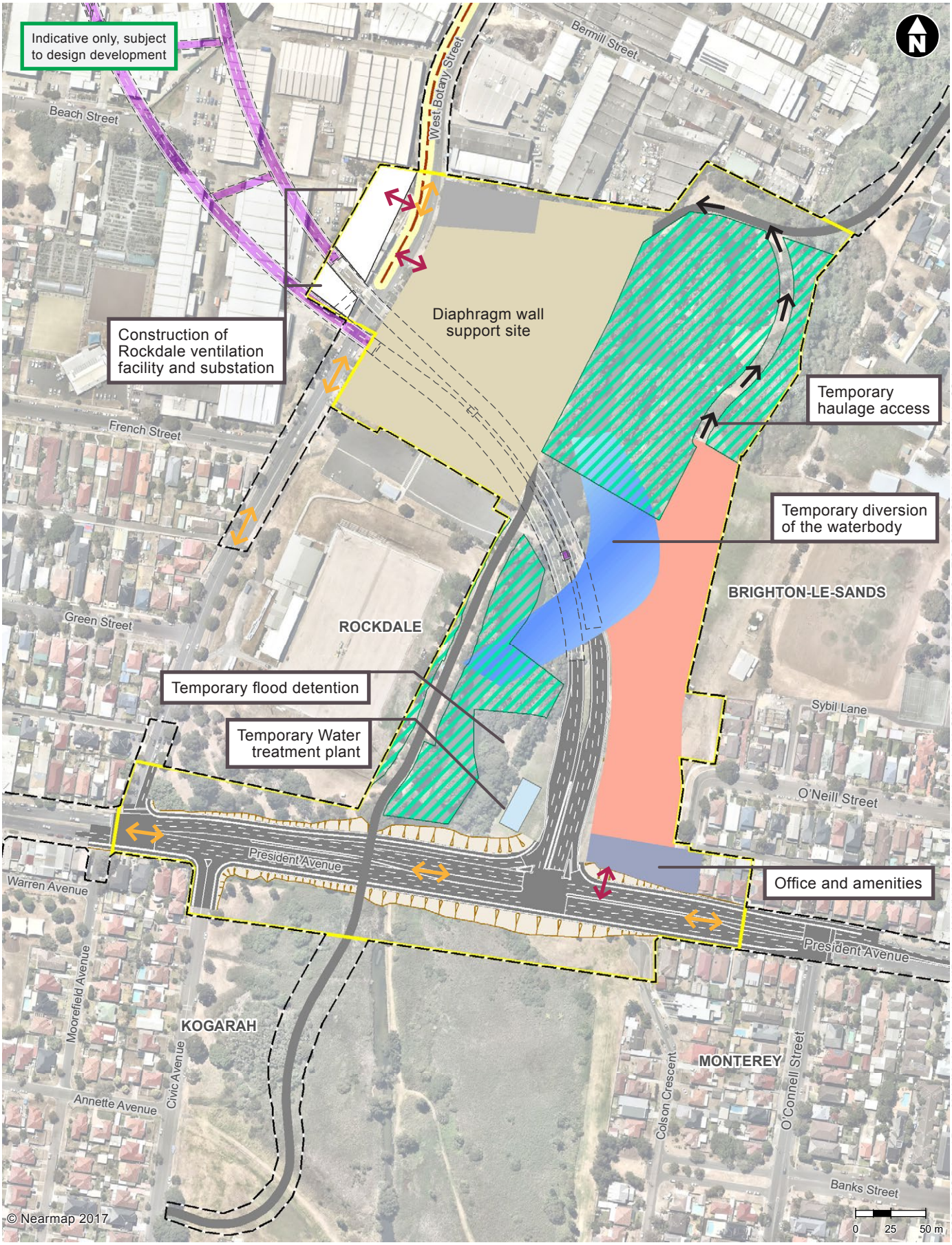
Access to properties not acquired, leased or otherwise occupied for project purposes would generally be maintained at all times during construction (including the industrial and commercial properties located along West Botany Street).

The northern entrance to the Kirby Industrial Park along West Botany Street would be maintained during construction, including for heavy vehicles such as B-double trucks. Access may not always be able to be maintained at the southern entrance to the Kirby Industrial Park along West Botany Street.

During detailed design, further investigation into potential lane/road closures and B-double access requirements will be investigated further, including in the area around the Kirby Industrial Park. Where temporary impacts on existing property access are unavoidable as a result of construction activities, consultation will be carried out with the landowner and/or tenants to provide equivalent standards of access.

Use of O'Neill Street and Sybil Lane

Section 7.3.4 of the EIS provides an overview of the President Avenue construction ancillary facility (C3). As shown in **Figure C6-2**, both O'Neill Street and Sybil Lane would not be used to access the C3 facility. Vehicle access to C3 would be gained from West Botany Street and President Avenue.



LEGEND

- Surface works
- Embankment
- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- Underground construction - Temporary access tunnel
- Building
- Carpark
- Sediment basin
- Soil treatment area
- Carpark and facilities
- Waterbody diversion
- Diaphragm wall support site
- Vehicle access
- Vegetation exclusion zone
- Permanent power supply line
- Permanent power supply construction boundary

Figure C6-2 Access to the construction ancillary facility (C3)

C Part C Response to community submissions

C7 Traffic and transport

This chapter addresses issues raised in community submissions associated with the traffic and transport assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 8 (Traffic and transport) and Appendix D (Traffic and transport technical report) of the EIS for further details on the traffic and transport assessment.

Contents

C7.1 Level and quality of traffic and transport assessment

168 submitters have raised issues regarding the level and quality of the traffic and transport assessment. Refer to section 8.1 and Appendix D (Traffic and transport technical report) of the EIS for more details on the methodology for the traffic and transport assessment.

Submitters expressed concern in regard to the level and adequacy of the traffic and transport assessment. Specific concerns include:

- The modelling not considering the following areas:
  - Around the New M5 Motorway and other roads in southern Sydney
  - South of Park Road and Ramsgate Road (specifically regarding spoil haulage)
- The modelling not considering rat-running, toll avoidance and traffic queuing
- The modelling is inaccurate in regards to the following:
  - Increased congestion on President Avenue and other local roads means impacts on the community will be higher than predicted (mostly on The Grand Parade)
  - Anticipated travel time savings do not account for existing congestion at interchanges
  - Overestimation of the travel time benefits for the community
  - Proposed road design changes, such as changing Lachal Avenue into a two way street, will create new pinch points
- Insufficient information about modelling inputs, assumptions and methodology of forecasts
- Request that the traffic modelling be independently verified
- Concern that the traffic modelling would be incorrect based on issues with previous projects
- The traffic modelling has optimistic assumptions that would cause the project to be a high financial risk
- The assessment states 23 traffic lights will be bypassed by the project when only four are bypassed using an alternative route on West Botany Street
- The assessment should use peak hours of 5am-10am and 2:45pm-7pm instead of 7am-8am and 5pm-6pm
- The assessment not considering:
  - The needs of existing bus services including the 947 service
  - Predicted traffic information on Marshall Street and President Avenue for residents at Moorefield Estate
  - Kogarah to Hurstville school bus service which collects students from St George School on Marshall Street
  - Potential issues associated with increased volumes of freight containers
- The assessment should provide further information on accessing the TAFE NSW St George Campus car park access
- The inclusion of cumulative scenarios is misleading as the assessment should be a stand-alone report for Stage 1
- Concern that the executive summary of Appendix D (Traffic and transport technical report) says there would be a 15 per cent reduction in traffic along The Grand Parade, but then Table 8-5 of Appendix D says the percentage ‘capacity reduction’ would be 33 per cent. The submitter also states that a reduction in traffic would not result in ‘place making’ opportunities.

Response

Traffic modelling approach and method

Traffic modelling has used the Sydney Strategic Motorway Planning Model version 1 (SMPMv1), which takes into account driver behaviour including the potential for rat-running and avoiding tolls. A key component of the SMPM is the toll choice assignment model, which test impacts of toll and infrastructure strategies and provides infrastructure project traffic forecasts. This toll choice assignment model is designed to forecast the traffic choosing to use tolled and non-tolled routes for the representative peak and inter-peak periods of the day. Further details regarding SMPM's modelling of toll choice can be found in section 4.2 of Appendix D (Traffic and transport technical report) of the EIS. Operational traffic modelling carried out for the project around the President Avenue intersection, and for the wider area around the St Peters interchange, has used software packages that account for the impacts of traffic queueing and blocking intersections.

The SMPMv1 was developed by Roads and Maritime via a rigorous staged process to ensure that assumptions and data are fit for purpose. Strategic traffic forecasts for the project have been implemented using the SMPMv1. This process has included:

- A review of the available transport planning models and data to determine the optimal models and data to provide an appropriate foundation for the SMPM
- Sourcing base and future population and employment data, generation rates and mode choice for metropolitan Sydney from Transport for NSW Transport Performance and Analytics
- An assessment of available toll choice modelling techniques in the current Sydney context where multiple competing toll roads cover a substantial portion of the developed Greater Sydney metropolitan area
- Value of Travel Time Savings surveys of drivers' willingness to pay tolls undertaken to inform the toll choice modelling, and a review of existing road infrastructure for the base year
- The development of a set of future road infrastructure projects anticipated for future years to form the basis for the future 'do minimum' networks modelled in SMPM.

An assessment of the calibration and validation of SMPM has been undertaken by independent peer reviewers. The outcome of this review found that the SMPM is suitable for the purposes of the EIS.

The operational modelling was undertaken for a 4-hour AM period (6:00am – 10:00am) and a 4-hour PM period (2:45pm to 7:00pm), however the impacts in the EIS were assessed during a one hour peak period where the traffic volumes are the highest, which is 7:00am – 8:00am in the morning and 5:00pm – 6:00pm in the evening. As such, these modelled AM and PM peak hours capture the worst case traffic performance for the modelled road network and extending these hours would not capture any performance that was worse than that reported in the EIS.

The traffic modelling is fit for purpose, having been based on the most up-to-date input information available at the time of modelling. The traffic modelling approach and assessment has been undertaken in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs), which outlines the modelling approach to be undertaken for the assessment as well as the guidelines that the assessment needed to follow. Modelling for the EIS has been undertaken in several stages, which ensure that results are as accurate and representative as possible. These stages are detailed in section 4.2 of Appendix D of the EIS.

In the calculation of travel time savings, the forecast travel times with the project are compared to the forecast travel times without the project for future scenarios. These future scenarios are developed from the existing travel conditions, and so the existing congestion is factored into the future scenarios.

Geographical scope of the traffic model

The scope of the study areas for the traffic assessment for the project was informed by the forecast traffic and transport changes from SMPMv1. The assessment methodology for the assessment is detail in section 4 of Appendix D (Traffic and transport technical report) of the EIS.

Operational traffic modelling included assessment of the New M5 Motorway from the New M5/F6 Extension interface point, to the St Peters interchange, however other sections of the New M5 Motorway were not included, as anticipated changes were not significant enough to warrant operational modelling. Further details of the justification of the modelled traffic network areas can be found in Annexure A of Appendix D of the EIS.

Assessing project impacts

Alternative parallel routes

Screenline analysis was undertaken to examine how traffic might shift between alternative parallel routes or corridors throughout the traffic and transport assessment study area. One of the impacts captured was a forecast 15 per cent reduction in traffic on General Holmes Drive, north of Bay Street, with the project. Forecast reductions along parallel routes may provide an opportunity for placemaking as the decrease in traffic volumes improves amenity for pedestrians.

The travel time results from traffic modelling, including the 33 per cent increase in travel time when comparing the 2014/2015 'base case' to the 2026 'do minimum' scenario, are a measure of the number of hours that vehicles are travelling on the road network rather than a measure of network capacity.

Spoil haulage

The construction impact assessment in section 7 of Appendix D (Traffic and transport technical report) of the EIS outlines anticipated major impacts of construction on the road network, including of spoil haulage. The road network at and to the south of Park Road/Ramsgate Road was not included in this assessment as spoil haulage is not expected to have an impact on this area of the road network.

Bus travel times

The impact of the project on bus travel times for the five bus routes across the President Avenue intersection and surrounds, including for route 947, have been assessed. Details of this assessment can be found in section 10.3.6 of Appendix D (Traffic and transport technical report) of the EIS.

Moorefield Estate

Proposed changes to access arrangements at Moorefield Estate in response to community feedback are described in the preferred infrastructure report. The proposed changes include a proposed signalised intersection at the President Avenue/Civic Avenue intersection, which allows left turns into Civic Avenue and right and left turns out of Civic Avenue. This improvement of accessibility and safety for vehicles that travel on Civic Avenue and Marshall Street will improve access for Moorefield Estate residents, and for the school bus service which collects students from St George School on Marshall Street.

The proposed changes to access arrangements also involve the conversion of Lachal Avenue from one-way northbound to one-way southbound ie inbound movements from President Avenue only (previously proposed to be two-way in the EIS). A right turn bay and traffic signals would be provided for the right turn into Lachal Avenue from President Avenue, to ensure safe vehicle movements. The signals would be activated as required by traffic demand.

TAFE access

As detailed in section 10.3.8 of Appendix D of the EIS, a refuge will be provided for the right turn out of the TAFE car park. Formalised holding space for vehicles turning right into the TAFE campus will also be provided as vehicles will be able to wait within and turn from the right turn bay being provided for the right turn into Lachal Avenue, detailed in the Moorefield Estate section above.

Cumulative impacts

The assessment of a cumulative scenario is one of the SEARs. It should be noted that both a project only scenario and cumulative scenario has been modelled for 2036 to allow assessment of the project in isolation. While the projects included in the cumulative scenario are not being assessed in this EIS, the project is Stage 1 of the F6 Extension, with the expectation that full benefits of the F6 Extension would be reached with the completion of later stages of the F6 Extension. In addition, the projects included in the cumulative scenario are currently expected to be built in the future. Ignoring these projects would not be presenting the most accurate view of the possible future road network performance.

Freight container volume

The traffic forecasts which were used in the traffic and transport assessment account for anticipated changes to traffic volumes due to increases in freight container volume. Therefore potential traffic issues associated with increased freight container volumes are captured in the anticipated project impacts reported in sections 9 and 10 of Appendix D (Traffic and transport technical report) of the EIS.

Bypassing traffic lights

The assessment of the bypassing of 23 sets of traffic lights is based on the assessed corridor extending along Princes Highway from President Avenue in Kogarah to Canal Road in St Peters.

C7.2 Construction traffic and transport impacts

16 submitters have raised issues regarding traffic and transport impacts during construction. Refer to section 8.4 of the EIS and section 7.4 of Appendix D (Traffic and transport technical report) for details on construction traffic and transport impacts.

C7.2.1 Construction traffic and haulage routes

Submitters raised concern over traffic and transport impacts during construction. Specific concerns include:

- Construction vehicle activities and impact on the surrounding network
- Traffic disruption, delays and reliability issues on surface roads and at intersections due to an increased number of heavy vehicles
- The potential for Civic Avenue being included as part of a construction traffic route
- Concern about trucks disregarding signage and using local roads
- West Botany Street cannot handle an additional set of temporary traffic lights at the entrance to the Rockdale construction ancillary facility
- A submitter requests more detailed information regarding the various construction vehicle movements and their impact on the surrounding area (concerned that the Construction Traffic and Access Management Plan (CTAMP) is not available yet)
- Changes to traffic around the industrial park located on West Botany Street, Rockdale including:
  - The length of time the industrial park will experience changes from construction works
  - How additional construction traffic will impact haulage times to and from the industrial park
  - How the proposed two signalised intersections will operate, particularly in peak hour periods, and subsequent changes to travel time and queuing
  - The three years of potential restricted access to the industrial estate
  - Temporary diversion of West Botany Street and subsequent changes to access of the industrial park
  - Requests a temporary traffic control measure (eg traffic lights) for heavy vehicles to enter the Kirby Industrial Park on West Botany Street.

Response

Spoil haulage routes are not anticipated to include Civic Avenue. Full details of indicative construction traffic access routes can be found in section 7.3.3 of Appendix D of the EIS.

The design and construction contractor(s) and sub-contractors working on the project will be required to meet the requirements of a CTAMP. This will include the identification of measures to manage the movements of construction-related traffic, including truck movements, to minimise traffic and access disruptions on the public road network. The CTAMP will also assess any impacts of construction vehicle movements and contain any required mitigation measures. The CTAMP is not provided at the EIS stage of assessment as it is subject to detailed design and construction planning and will reflect the project to be delivered by the construction contractor.

Existing haulage routes to the Kirby Industrial Estate include West Botany Street, therefore haulage times would be affected by changes to traffic conditions on West Botany Street during construction. The traffic assessment in the EIS anticipates minimal impact on traffic conditions on West Botany Street as a result of project construction. An indication of the peak hour heavy vehicle traffic due to construction along West Botany Street has been provided in Table 7-2 of Appendix D of the EIS. An additional 36 heavy vehicles are expected in the AM peak hour and 52 heavy vehicles in the PM peak hour. This represents less than five per cent of the traffic that would already be using West Botany Street. Such a proportion of vehicles would be within the daily variation in traffic volumes on the road, and therefore be considered to have a minimal impact on traffic operation, including for haulage times to/from the Kirby Industrial Estate.

The construction works would require the establishment of two new signalised intersections on West Botany Street for the duration of the construction program to facilitate construction vehicle access. These would be located at the Rockdale construction ancillary facility (C2), about 100 metres south of Bay Street, and at the President Avenue construction ancillary facility (C3), between the existing off-street car parks at Rockdale Bicentennial Park. As detailed in section 7.4.2 of Appendix D of the EIS, these intersections would operate on demand (from C2 and C3) and the impact on traffic movements is expected to be minor.

As minimal impacts on traffic performance on West Botany Street are expected as a result of construction, the signalisation of access to the Kirby Industrial Estate would be outside the scope of this assessment.

In response to the submitter's concern regarding potential restrictive access to Kirby Industrial Estate and the temporary diversion of West Botany Street, the temporary diversion of West Botany Street would be subject to further detailed assessment through the CTAMP development process. The CTAMP will include the guidelines, general requirements and principles of traffic management to be implemented during construction. It will seek to minimise delays and disruptions to the Kirby Industrial Estate and identify and respond to changes in road safety as a result of project construction works.

As mentioned above, the temporary traffic lights at the entrance to the Rockdale construction ancillary facility would operate on demand (from C2 and C3) and the impact on traffic movements is expected to be minor. The impact on traffic movements is therefore expected to be minor.

A construction impact assessment has been carried out to assess the impact of construction activities on proposed access routes, public transport, pedestrians and cyclists. In both the AM and PM peak hours, it was found that construction activities were expected to have a minor impact on traffic operation. Further details of the impact assessment can be found in section 7.4 of Appendix D of the EIS.

C7.2.2 Road safety during construction

Submitters were concerned about the safety impacts on pedestrians, cyclists and local traffic during construction due to the increased number of heavy vehicles, including on Bay Street, Rockdale Plaza Drive, Sybil Lane and near the Bunnings car park along West Botany Street.

Response

Should the project be approved, a CTAMP will be prepared to guide the maintenance of safety for pedestrians and cyclists and to ensure safe operation of local traffic during construction. The CTAMP will also manage pedestrian and cyclist movements around construction ancillary facilities and include measures to ensure pedestrian and cyclist safety is maintained during construction.

Pedestrian and cyclist access and connectivity will be maintained, where possible, throughout the construction phase. Where it would not be feasible to use existing routes, alternative routes will be provided and communicated to the community.

The general principles that would be used to develop alternative pedestrian and cyclist footpaths and routes during construction would include consideration of the following:

- Impact of construction works on existing pedestrian and cyclist connections
- Volume of pedestrians/cyclists
- Type of pedestrian and cyclist activity, whether office, retail, residential, school or recreational
- Pedestrian and cycle desire lines/travel paths

- Needs of vulnerable pedestrians, such as children, the elderly and disabled people
- Proximity of pedestrian and cycle-generating developments, such as schools, shopping centres, bus stops/layovers.

C7.2.3 Impacts on public transport during construction

Submitters were concerned about reduced access to public transport during construction (particularly for elderly people), including services travelling along The Grand Parade and President Avenue.

Response

Potential impacts of the project on public transport services are limited to the potential temporary relocation of bus stops on President Avenue and the potential for a reduction in the reliability of bus services. No impacts are expected for services on The Grand Parade.

There are five bus stops on President Avenue and two bus stops at James Cook Boys Technology High School which are located within the construction boundary. The project may require the temporary relocation of some of these bus stops during construction, which may result in some passengers having to walk a short distance further to access a temporary bus stop. The temporary relocation of some bus stops along President Avenue during construction would be undertaken in consultation with relevant stakeholders including Transport for NSW and bus operators and would seek to minimise the distance from existing bus stops. Should the project be approved, the CTAMP will guide safety measures for pedestrians including safe access to and from bus stops.

C7.2.4 Parking impacts during construction

Submitters raised concern over parking impacts during construction. Specific concerns include:

- The reduction in available parking during construction as a result of the closure of various car parks as well as parking restrictions on West Botany Street and President Avenue
- Insufficient parking has been provided for construction workers which will impact street parking availability on President Avenue and surrounding streets including Green Street to Chandler Street and at Moorefield Estate
- Offset parking is necessary due to the proposed upgrade of McCarthy Reserve.

Response

During construction, the existing car park in the north western corner of Bicentennial Park, and some on-street parking along sections of President Avenue and West Botany Street, would be removed and reinstated following completion of construction. The majority of the 200-space and 22-space parking areas located adjacent to the north and west of the Ilinden Sports Centre would not be impacted by the project. However, construction of the cut and cover structure would require some (about five) car spaces to be temporarily removed from the 200-space parking area. As described in the EIS, the car parking to be retained at the Ilinden Sports Centre is expected to provide sufficient parking for sporting and recreation activities that would occur during construction, as the parking demand would be expected to decrease with the temporary relocation of some sporting fields, the skate park and children's playground. Further details regarding potential impacts on sports field parking are included in section 7.4.5 of Appendix D (Traffic and transport technical report) of the EIS.

As outlined in Table 7-3 of Appendix D of the EIS, sufficient parking for construction workers would be provided at the construction ancillary facilities and it is therefore not expected that construction workers would need to use on-street parking.

In addition, should the project be approved, a CTAMP will be prepared which will include a Construction Parking and Access Strategy to identify and mitigate impacts resulting from on- and off-street parking changes during construction of the project. The strategy will be developed to limit impacts on the surrounding communities and will include the parking management measures that will be implemented on adjacent local streets.

Proposed offset works at McCarthy Reserve are not part of the project and would be assessed under separate planning approvals. As part of the approval process, Roads and Maritime would continue to work with stakeholders to address concerns.

C7.3 Traffic and transport network impacts during operation

105 submitters have raised issues regarding traffic and transport impacts on the road network during operation. Refer to section 8.7 and section 8 of Appendix D (Traffic and transport technical report) of the EIS for details on operational traffic and transport impacts from the project.

C7.3.1 Increased traffic during operation

Submitters raised concern over traffic and transport impacts during operation. Specific concerns include:

- Additional congestion created due to changes in traffic lights at intersections with President Avenue
- Trucks will be redirected onto other main roads including the Princes Highway and Rocky Point Road causing disruptions for locals and making roads more dangerous
- Increased traffic along President Avenue, the Princes Highway and The Grand Parade
- The intersection at Civic Avenue and President Avenue would not be able to sustain the predicted traffic volumes which would cause disruptions for those travelling on President Avenue
- Reduced access to public transport and increased travel times (mostly on the Grand Parade)
- The impacts of more clearways during operation
- The Princes Highway would not be able to sustain any more traffic due to school zones and not enough turning lanes
- Over-height trucks could enter the tunnel causing disruptions and delays in the event of an accident
- Concern over increased traffic on the network and the shift of traffic onto other roads, reducing access to local facilities such as schools, parks and hospitals. In particular, concerns included:
  - Around the President Avenue tunnel intersection including on President Avenue, the Princes Highway, The Grand Parade, Rocky Point Road, O'Connell Street and West Botany Street
  - From President Avenue through to Captain Cook Bridge and Tom Ugly's Bridge
  - From Kirby Industrial Park through to Sydney Airport.

Response

Network performance

The traffic and transport assessment carried out for the EIS has assessed anticipated impacts of the project on the road network, including impacts on the Princes Highway, Rocky Point Road, O'Connell Street and The Grand Parade.

Modelling indicates that vehicles would use key arterial roads to access the project and as a result there would be some increases in traffic on these roads around the President Avenue intersection.

The Princes Highway and President Avenue intersection would be upgraded as part of the project. This would include the provision of an additional right turn lane from the Princes Highway into President Avenue, and signal optimisation to move traffic through the area as efficiently as possible.

An assessment of the network performance of the President Avenue intersection and surrounds with these proposed changes showed that the network would be able to safely accommodate increases in traffic from the project. A summary of intersection modelling results in 2036 at roads which have been identified by submitters is provided in **Table C7-1**.

Table C7-1 Intersection modelling results in 2036

Intersection	2036 'do minimum'		2036 'do something'	
	Ave delay (sec)	LoS	Ave delay (sec)	LoS
AM peak hour				
The Grand Parade / President Ave	37	C	26	B
President Ave / O'Connell St	44	D	43	D
President Ave / West Botany St	18	B	28	B
Princes Hwy / President Ave	45	D	32	C
Princes Hwy / West Botany St	18	B	16	B
Princes Hwy / Rocky Point Rd	30	C	44	D
PM peak hour				
The Grand Parade / President Ave	37	C	30	C
President Ave / O'Connell St	15	B	20	B
President Ave / West Botany St	24	B	19	B
Princes Hwy / President Ave	37	C	54	D
Princes Hwy / West Botany St	11	A	11	B
Princes Hwy / Rocky Point Rd	21	B	21	B

Results show that intersections are generally forecast to experience similar Levels of Service (LoS) with the project compared to without the project. At any locations where decreases in LoS are forecast, performance is expected to remain at acceptable levels of service.

As per environmental management measure TT9, Roads and Maritime will, in conjunction with the local council, implement Local Area Traffic Management (LATM) measures, such as heavy vehicle load limits, raised pedestrian crossings and speed humps, to reduce traffic demand on O'Connell Street/Chuter Avenue and Civic Avenue/Marshall Street. On West Botany Street, decreases in traffic are generally expected with the project, and on The Grand Parade, decreases in traffic are expected north of President Avenue, and small increases south of President Avenue. Further details regarding intersection modelling can be found in section 10.3.3 of Appendix D (Traffic and transport technical report) of the EIS.

Screenline analysis was also undertaken as part of the traffic assessment for the project to examine shifts in traffic between alternative parallel routes or corridors not captured in the operational modelling. Looking at the road network north of President Avenue, from Kirby Industrial Park through to Sydney Airport, it was found that the project predominantly shifted traffic off of these surface arterial routes, ie Princes Highway, West Botany Street and The Grand Parade. The impacts of increases in traffic volumes south of President Avenue on the Princes Highway, Rocky Point Road and O'Connell Street were assessed in the operational modelling detailed earlier. The screenline analysis looked at the impact of the project further south at the Georges River, and found that the project resulted in little change in traffic volumes Full details of the outcomes of the heavy vehicle screenline analysis can be found in Annexure B of Appendix D (Traffic and transport technical report) of the EIS.

Moorefield Estate

Proposed changes to access arrangements at Moorefield Estate in response to community and stakeholder feedback are described in the preferred infrastructure report. The proposed changes include a proposed signalised intersection at the President Avenue/Civic Avenue intersection, which allows left turns into Civic Avenue and right and left turns out of Civic Avenue. This improvement would ensure that access can be maintained safely to minimise disruption to traffic on President Avenue.

The proposed changes to access arrangements also involves the conversion of Lachal Avenue from one-way northbound to one-way southbound ie inbound movements from President Avenue only (previously proposed to be two-way in the EIS). A right turn bay and traffic signals would be provided for the right turn into Lachal Avenue from President Avenue, to ensure safe vehicle movements. The signals would be activated as required by traffic demand.

Bus stop relocations

Bus stops that would be temporarily relocated during construction of the project are planned to be reinstated at their original locations. No permanent relocations of bus stops are planned as part of the project; therefore there would be no long term reductions in access to public transport as a result of the project. The impact of the project on bus travel times for the five bus routes across the President Avenue intersection and surrounds, including for routes 478 and 303, which are the key bus routes that use The Grand Parade, were assessed. The results indicate minimal changes to bus travel times. Forecast peak period travel times for the entire length of the bus routes that travel through the President Avenue intersection and surrounds indicate savings of between one and six minutes with the project. Further details about bus travel times with the project can be found in section 10.3.6 of Appendix D (Traffic and transport technical report) of the EIS.

Clearways

Clearway conditions are proposed along President Avenue which would result in the loss of some on-street parking. In off-peak periods and at night, on-street parking along President Avenue will be reinstated as per existing conditions between O'Connell Street and The Grand Parade, and from 100-150 metres east of the Princes Highway to West Botany Street.

Road signage

The project would include the integration of 'Smart Motorway' (also known as a 'managed motorway') features. This means that it would use real-time information, communication and incorporated traffic control systems into and alongside the road, in order to improve traffic flow and the safety of the road environment. As part of this, measures including variable message signs, over-height vehicle detection, dynamic diversion signage and portal physical barriers (boom gates) would be used to notify drivers of tunnel height restrictions.

C7.3.2 Pedestrian and cycling connectivity

Submitters raised concerns about pedestrian and cycling connectivity during operation. This included that the project should integrate with the active transport plans of the City of Sydney and Bayside councils.

Response

The project would provide shared cycle and pedestrian pathways aimed at improving north-south active transport movements between Bestic Street and Civic Avenue. Changes to the active transport corridor in the southern part of the project footprint, including an extended pathway to O'Connell Street, are proposed and are described and assessed in the preferred infrastructure report.

Integration with City of Sydney and Bayside councils plans

The project is not located within or directly adjacent to the City of Sydney local government area. The shared cycle and pedestrian pathways for the project would provide connections with several existing and proposed routes that are being delivered by Bayside Council and/or Roads and Maritime, including:

- Bestic Street and cycleways north of Bestic Street, along Muddy Creek
- West Botany Street, opposite Ador Avenue Reserve
- Bruce Street, Francis Street, Bay Street and England Street, Brighton-Le-Sands
- West Botany Street, next to Rockdale Bicentennial Park
- Rockdale Bicentennial Park
- Civic Avenue, Kogarah.

The project would improve the journey experience for pedestrians and cyclists by providing an alternative for through traffic, in some places reducing the traffic along the local surface road network and by improving cycling infrastructure near the new motorway corridor. This would result in improved connectivity, amenity and safety for pedestrians and cyclists and would facilitate opportunities for other pedestrian and cyclist infrastructure to be delivered by Bayside Council, or others.

C7.3.3 Road safety during operation

Submitters raised concern about road safety issues on surface roads due to increased traffic volumes, including safe entry and exit into the St George TAFE, driveways on President Avenue, around schools, at the intersection of President Avenue and Princes Highway, and on Bay Street.

Response

Any road design changes which have been proposed to accommodate anticipated increases in traffic would be designed to Australian Standards and in line with Roads and Maritime requirements during the detailed design phase. These standards ensure appropriate design for driver safety. The traffic and transport assessment includes an assessment of road safety. This assessment investigated roads around the President Avenue intersection and surrounds that were identified as warranting additional attention based on crash density mapping. It compared the predicted number of traffic incidents on these roads and their cost in dollar terms both with and without the project. It was found that, for these roads identified for additional attention, the project generally decreased daily traffic in the 'do something' scenario (ie with the project) compared to the 'do minimum' scenario (ie without the project). This resulted in an overall decrease in the total number and cost of crashes on the roads under investigation. However as a result of some changes in travel patterns and vehicle movements as people take up use of the project, there were also small increases forecast on some roads. Further details regarding traffic crashes can be found in section 10.3.5 of Appendix D (Traffic and transport technical report) of the EIS.

C7.3.4 Pedestrian and cyclist safety during operation

Submitters raised concern about safety and accessibility for cyclists and pedestrians due to increased traffic flows and removed pedestrian crossings, including on President Avenue. Specific concerns include:

- Removal of the footpath on one side of President Avenue
- No access to Crawford Road through Bicentennial Park
- Safety for pedestrians at the pedestrian island at the intersection of the Princes Highway and President Avenue
- Suggestion to remove the school zone on the Princes Highway (and development of an overhead pedestrian bridge) to manage increased traffic flow.

Response

Pedestrian access and connectivity would be retained along President Avenue and through Rockdale Bicentennial Park during operation, despite minor changes to the network as a result of the project. Pedestrian footpaths along President Avenue, and Bicentennial Park access, will be reinstated after construction. All existing pedestrian crossings of President Avenue will also be maintained with the project.

All existing movements for pedestrians at the Princes Highway/President Avenue intersection would be retained under the proposed intersection layout with the project. If the project is approved and moves into detailed design, design of the Princes Highway/President Avenue intersection would take into account the forecast pedestrian demand at the intersection. Both changes to the Princes Highway/President Avenue intersection, as well as changes on President Avenue, would be designed to Australian Standards. These standards ensure appropriate design for driver and pedestrian safety.

The submitter's suggestion regarding removal or the school zone on the Princes Highway and the development of a pedestrian bridge is noted. The investigation of school zones are carried out by Roads and Maritime but would be outside the scope of this project. As noted above, the design of the detailed design of the Princes Highway/President Avenue intersection would be designed to meet pedestrian demand. The implementation of a pedestrian bridge would not be required as part of the project.

C7.3.5 Improvements to the network during operation

Submitters stated their support of the project, stating that the project will result in better traffic conditions for the surface road network during operation.

Response

The support for the project is noted.

C7.4 Local road impacts during operation

48 submitters have raised issues regarding traffic and transport impacts on local roads during operation. Refer to section 8.7 of the EIS for details on traffic and transport impacts with the project.

C7.4.1 Traffic impacts on local roads

Submitters raised concern over local road impacts during operation. Specific concerns include:

- Impacts of increased traffic on local roads, including congestion, access to St George TAFE or schools, and rat-running to avoid tolls
- Concern that there is no plan in the EIS to mitigate the impact of rat-running caused by toll avoidance
- Potential impacts on local roads due to increased traffic from the project, including on Bank Lane, O'Connell Street, England Street, Lachal Avenue, Traynor Avenue, Oakdale Avenue, Moorefield Avenue, Civic Avenue and Cross Street
- Traffic is already congested on local roads and the project would make it worse, for example, traffic currently already has to pass through four sets of traffic lights to turn out of Jubilee Avenue
- Adequate provision for public transport to transfer traffic off local roads is not provided
- The ease of access and safety issues when exiting Moorefield Estate
- Submitter requests the addition of traffic signals to improve access from local roads, at the following intersections:
  - Lachal Avenue and President Avenue
  - Traynor Avenue and President Avenue
  - Oakdale Avenue and President Avenue
  - Moorefield Avenue and President Avenue
  - Civic Avenue and President Avenue
  - Marshall Street and Rocky Point Road
- The impacts of implementing a cul-de-sac on O'Neill Street including restricted access and increased traffic congestion
- Changes to Lachal Avenue into a two-way street are not suitable and parking restrictions would need to be applied to Lachal Avenue to facilitate two-way movement – this would further impact parking issues
- Heavy vehicles would be directed on to local roads from the Princes Highway and Rocky Point Road
- A safe right turn lane form Moorefield Avenue onto President Avenue to head east has not being provided
- No plan to ensure that pedestrians can safely cross President Avenue in the vicinity of Moorefield Estate to access the shops
- A right turn lane from President Avenue into Cross Street would not be possible.

Response

The potential impacts of the project on the local road network have been informed by traffic modelling. Traffic modelling results show that increases in traffic are expected to use existing arterial roads. As detailed in **section C7.3.1**, traffic modelling indicates that with proposed changes, the road network is expected to be able to accommodate increases in traffic. Diversion of traffic, including heavy vehicle traffic, from roads including Princes Highway and Rocky Point Road, are not anticipated, with either a decrease, or a negligible increase, in traffic expected around the President Avenue intersection including on Bank Lane, England Street, Lachal Avenue, Traynor Avenue, Oakdale Avenue, Moorefield Avenue, and Cross Street. The exception to this is on O'Connell Street and Civic Avenue. On O'Connell Street, there is forecast to be an increase in traffic with the project. This is addressed by environmental management measure TT9, where Roads and Maritime will, in conjunction with local council, implement LATM measures, such as heavy vehicle load limits, raised pedestrian crossings and speed humps, to reduce traffic demand on O'Connell Street/Chuter Avenue and Civic Avenue/Marshall Street.

The submission regarding turning movements out of Jubilee Avenue as well as the request to signalise the intersection of Marshall Street and Rocky Point Road, is noted. Operational modelling for the project has not identified that impacts of the project would cause unacceptable levels of service at these intersections. The existing performance at these intersections is outside the scope of the project.

Potential impacts of toll avoidance

The project would not cause changes in traffic route choice due to toll avoidance. With the project, a new tolled motorway connection between President Avenue and the New M5 Motorway would be provided. In addition, all current routes would remain available to drivers. Drivers can either choose to use the project, or choose to use the existing route they would have used without the project.

Changes at Moorefield Estate

Submitters have expressed concern regarding local traffic impacts at Moorefield Estate including potential increases in traffic on Civic Avenue, as well as requesting traffic signals on President Avenue from the intersection with Lachal Avenue to the intersection of Civic Avenue.

Proposed changes to access arrangements at Moorefield Estate, and an assessment of impacts on Moorefield Estate, are described in the preferred infrastructure report. These changes include:

- The conversion of Lachal Avenue from one-way northbound to one-way southbound (inbound movements from President Avenue only). The majority of parking would be retained along Lachal Avenue
- The conversion of Taynor Avenue from one-way southbound to one-way northbound. Only left turn movements out of President Avenue would be permitted. This change would allow Lachal Avenue and Traynor Avenue to continue to operate as a one-way pair.

Access to Cross Street would still be available via West Botany Street and other local roads. Right turn movements onto President Avenue eastbound would be available via a signalised intersection at Civic Avenue. The left-in left-out arrangement at Moorefield Avenue would be retained. Based on the surveyed and forecast traffic volumes using this intersection, it was determined that converting Moorefield Avenue to a cul-de-sac, as described in the EIS, was not necessary.

The above described changes facilitate safe and efficient access to and from Moorefield Estate while reducing traffic flow on President Avenue. Providing traffic signals at every intersection from Lachal Avenue to Civic Avenue would not improve accessibility to Moorefield Estate. This is because wait times to access Moorefield Estate would be spread out across all intersections, rather than signalising only select intersections, to maximise signal green times. Non-standard ie short distances between intersections may also introduce see-through effects, where drivers react to the traffic signals at the next intersection rather than the intersection they are at, which can adversely impact road safety.

To ensure safe and efficient network operation, O'Neill Street would be converted to a cul-del-sac as part of the project. An increase in traffic congestion would be unlikely as traffic surveys indicate that less than 20 vehicles currently exit from O'Neill Avenue during each of the AM and PM peak hours. Access would still be available to and from President Avenue via Crawford Road. In addition, Roads and Maritime will work with relevant stakeholders to address any potential impacts of the cul-de-sac conversion.

Pedestrian access at Moorefield Estate

Pedestrians can currently cross President Avenue to access the shops to and from the Moorefield Estate via the signalised pedestrian crossing provided at the West Botany Street/President Avenue intersection. This signalised crossing will be retained and pedestrians will continue to be able to cross safely.

Public transport for local access

Increased or optimised provision of public transport to transfer traffic off local roads would require a review of public transport needs in the local area and implementation of changes in response to this investigation. This is outside the scope of the project.

C7.4.2 Improvements to traffic conditions on local roads during operation

Submitters stated that they support the project on the basis it would reduce traffic on local roads during operation.

Response

The support for the project is noted.

C7.5 Parking impacts during operation

8 submitters have raised issues regarding parking impacts on local roads during operation. Refer to section 8.7 of the EIS for details on traffic and transport impacts with the project.

Submitters raised concern over parking impacts during operation. Specific concerns include:

- The impact of clearways on parking, including along President Avenue and Rocky Point Road
- The impacts of increased traffic on parking along local roads, including England Street and Lachal Avenue
- The implementation of a cul-de-sac on O'Neill Street will decrease available street parking
- The lack of parking facilities at Brighton Memorial Fields once it is upgraded
- Query whether the parking on President Avenue between Cross Lane and West Botany Street would be timed between the clearway timings.

Response

While clearways on President Avenue in the AM and PM peak periods will mean the loss of some parking on President Avenue, much of these impacts will be limited to peak periods. In off-peak periods and at night, on-street parking along President Avenue would be reinstated as per existing conditions between O'Connell Street and The Grand Parade, and from 100-150 metres east of Princes Highway to West Botany Street. There are no plans as part of this project to implement clearways on Rocky Point Road.

England Street is not located close to President Avenue and it is unlikely that parking on England Street would be affected by the project. Demand for parking on Lachal Avenue may be affected by clearways on President Avenue; however clearways on President Avenue close to Lachal Avenue would only be in operation during peak periods.

The conversion of O'Neill Street to a cul-de-sac may result in the loss of some on-street parking spaces, however, this is expected to be offset by lower demand for parking as the changed traffic conditions are likely to result in fewer traffic movements on O'Neill Street. Roads and Maritime are working with Bayside Council to address potential impacts as a result of this change.

Roads and Maritime are proposing to undertake improvements at Brighton Memorial Playing Fields as part of offset works for the project. These works are subject to separate planning approvals and are outside the scope of the project.

Parking changes between Cross Lane and West Botany Street

Once the project is operational, clearway parking restrictions would be applied along President Avenue in both directions in the AM and PM peak periods, between Cross Lane and West Botany Street (refer to section 8.7.3 of the EIS). Details regarding parking changes along President Avenue are provided in **Table C7-2**.

In off-peak periods and at night, on-street parking along President Avenue will be reinstated as per existing conditions.

Table C7-2 President Avenue intersection and surrounds: indicative impact on on-street parking during peak periods

Road section	Indicative impact
Eastbound	
President Avenue, between Cross Lane and Cross Street	Currently parking (no time limit) in both peaks Loss of around 28 spaces
President Avenue, between Cross Street and Oakdale Avenue	Currently parking (no time limit) in both peaks Loss of around seven spaces
President Avenue, between Oakdale Avenue and West Botany Street	Currently parking (1P) in both peaks Loss of around four spaces
President Avenue, between West Botany Street and O'Neill Street	Currently parking (no time limit) in both peaks Loss of around 54 spaces
President Avenue, between O'Neill Street and O'Connell Street	Currently parking (no time limit) in both peaks Loss of around four spaces
Westbound	
President Avenue, between O'Connell Street and West Botany Street	Currently parking (no time limit) in both peaks Loss of around 70 spaces
President Avenue, between West Botany Street and Oakdale Avenue	Currently parking (1P) in both peaks Loss of around six spaces
President Avenue, between Oakdale Avenue and Lachal Avenue	Currently parking (no time limit) in both peaks Loss of around seven spaces
President Avenue, between Lachal Avenue and Cross Lane	Currently parking (no time limit) in AM peak period Loss of around 12 spaces No stopping in PM peak period

C7.6 General traffic and transport concerns

Four submitters have raised issues regarding traffic and transport impacts in general, but did not specify if they were concerned with construction or operation. Refer to Chapter 8 (Traffic and transport) and Appendix D (Traffic and transport) for details on the traffic and transport assessment completed for the project.

Submitters raised concern that the project would affect general traffic conditions and increase congestion in surrounding areas, but did not specify if they were concerned with construction or operation impacts.

Response

The traffic and transport assessment carried out in the EIS investigated the impacts of the project on traffic operation. The operational traffic assessment for the area around the President Avenue intersection assessed both network performance and intersection performance. The network

performance assessment found that the road network, including upgrades and changes proposed as part of the project, is able to accommodate forecast increases in traffic with the project. The intersection performance assessment found that intersections are generally forecast to experience similar levels of service with the project compared to without the project, except for the President Avenue/O'Connell Street intersection, which is forecast to deteriorate slightly in the 2026 AM peak hour from LoS B to LoS C, and the Princes Highway/President Avenue intersection, which is forecast to improve in the 2036 AM peak hour, but deteriorate in the 2036 PM peak hour, due to the higher forecast westbound demand on President Avenue. However, while performance is forecast to decrease, it is forecast to remain at acceptable levels of service at the two intersections.

The traffic and transport assessment also investigated the impacts of construction activities on the road network. The construction modelling forecasts that all intersections impacted by construction activities would operate at an acceptable LoS D or better, except the Princes Highway intersection with Wickham Street and Forest Road, and the intersection of West Botany Street and Bay Street. However, both of these intersections are already operating at LoS F during both peak hours.

C7.7 Cumulative traffic and transport impacts

19 submitters have raised issues regarding cumulative traffic and transport impacts. Refer to section 8.8 of the EIS for details on cumulative traffic and transport impacts.

Submitters raised concern over cumulative traffic and transport impacts during operation. Specific concerns include:

- The general cumulative traffic impacts of the F6 Extension Stage 1 and other projects, such as the New M5 Motorway, would result in large delays at the St Peters Interchange
- The congestion resulting from 120,000 extra vehicles channelled into the central city area would threaten business activity, Sydney's competitiveness and jobs and employment.

Response

The operational cumulative traffic assessment considered NorthConnex, the WestConnex program of works, Sydney Gateway, and some upgrades to the broader road and public transport network. The assessment found that, with road network upgrades proposed as part of the EIS, the road network is able to operate acceptably with the cumulative impacts of the F6 Extension Stage 1 and other approved road network projects.

The assessment included consideration of the St Peters interchange. It was found that in 2036, while the surface road network is not significantly impacted by the project, queuing is forecast on the exit ramp from the F6/New M5 Motorway and the M4-M5 Link to the Campbell Road/Euston Road intersection in the AM peak hour, which may queue back to the New M5 mainline motorway.

While the project is expected to induce some vehicle trips, the majority vehicles forecast to utilise the F6 Extension Stage 1 would be composed of non-induced vehicle trips which would occur regardless of the project, and would have simply used the existing surface road network if the project were not to be built. This is confirmed by strategic traffic modelling for the project which forecasts a negligible change in traffic volumes on the road network within the Sydney central business district with the project. In both the 2026 and 2036 scenarios, there are slight changes in traffic volumes with the project in the AM and PM peak hours of about 50 vehicles or less. Across the day, this equates to a change of about 500 vehicles or less.

An Operational Road Network Performance Review will be undertaken within 12 months and five years from commencement of operation to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. The review will identify relevant mitigation measures, if required, to address impacts on road network performance. The results of the review will be considered in future operational network performance planning carried out by Roads and Maritime. The Review will be undertaken in consultation with Transport for NSW and relevant councils.

C7.8 Traffic and transport environmental management measures

11 submitters have raised issues regarding the environmental management measures for traffic and transport. Refer to **Chapter D1** (Environmental management measures) for details on the traffic and transport management measures for the project.

Submitters raised concern or suggestions on traffic and transport environmental management measures proposed to manage impacts during construction and operation. Specific concerns include:

- Detour management for cyclists and pedestrians during construction. Submitter requests that provisions, or an alternative route, be made on a 'like for like' basis to avoid cyclists sharing the road with vehicles. In particular:
  - Submitter suggests using Roads and Maritime owned land for an off-road route
  - Submitter requests signalised road crossings and not pedestrian crossings
- Concern about maintaining emergency services access during construction due to street closures
- Concern about traffic management measures for local roads, including England Street, to ensure easy access remains for residents
- Concern about the management of construction work, including complaints of inadequate road signage.

Response

Measures to address impacts on cyclists and pedestrians during construction

There would be a temporary closure or detouring of pedestrian pathways along either side of President Avenue during works along President Avenue. This would occur on one side at a time and diversions would be put in place so that a pedestrian pathway on one side of President Avenue would always be available. This would have a minor impact as there are a small number of land uses in the section between the pedestrian crossings at the West Botany Street and O'Connell Street intersections that would generate pedestrians. This temporary change is not expected to increase the risk to public safety as pedestrians would still have access to pedestrian pathways and pedestrian crossings.

It is planned that the pedestrian access between West Botany Street and Kings Road, which runs through Rockdale Bicentennial Park, would be maintained with potential relocation to the northern extent of the park area. It is not expected that there would be restrictions on access to Crawford Road through Bicentennial Park.

Construction would require the closure of the pedestrian bridge over Rockdale Wetlands for the duration of the construction works in the area. Pedestrians would be diverted along President Avenue or the pedestrian access between West Botany Street and King Street. This would have a moderate impact in the worst case scenario for pedestrians travelling between Ilinden Sports Centre and the residential streets around O'Neill Street and Sybil Lane as the diversion would increase the distance pedestrians and cyclists would need to travel by more than 200 metres but less than 500 metres. However, this diversion is required to enable construction of the cut-and-cover structures and to minimise interactions between pedestrians, cyclists and construction activities.

A strategy for ensuring pedestrian and cyclist access is maintained throughout construction will be included in the CTAMP. Further details on potential impacts on pedestrians and cyclists during construction can be found in Table 7-8 of Appendix D (Traffic and transport technical report) of the EIS.

Measures to mitigate road closures

A CTAMP will be prepared as part of the Construction Environmental Management Plan. The CTAMP will include the guidelines, general requirements and principles of traffic management to be implemented during construction. It will comprehensively communicate changes to roads or paths to all affected stakeholders, including emergency services providers.

England Street is not located close to the project and it is not expected that access to England Street would be affected by the project.

C Part C Response to community submissions

C8 Air quality

This chapter addresses issues raised in community submissions associated with the air quality assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 9 (Air quality) and Appendix E (Air quality technical report) of the EIS for further details on the air quality assessment.

Contents

C8.1 Level and quality of air quality assessment

59 submitters have raised issues regarding the Level and quality of air quality assessment. Refer to Chapter 9 (Air quality) and Appendix E (Air quality technical report) of the EIS for further details on the air quality assessment.

C8.1.1 Adequacy of the air quality assessment

Submitters expressed concern about the adequacy and independence of the air quality impact assessment, and how it addresses the impacts of emissions resulting from the project. Specific concerns include:

- The EIS and air quality assessment was prepared by the same consultants as the WestConnex EISs and includes repetition of the assessments
- Air quality impacts during construction and operation have been underestimated
- A submitter requests an independent review of the air quality data
- The air quality impacts have not been presented in a way that a layperson can understand, for example there are inconsistencies in the scales of figures
- The EIS states that the project would improve air quality and reduce emissions, however a road project has the opposite effect
- The assessment does not consider the impacts of the project separately from other stages of the F6 Extension, which invalidates the EIS as the project has not been considered as a stand-alone project
- The assessment needs to consider expansion of the project from the initial operation of two lanes to three lanes in each direction
- Query on what the maximum limit on discharges from ventilation outlets will be and if it will exceed the maximum value for the NorthConnex project
- Concern that the project would result in decreased air quality for local residents, and requested a comparison between the modelled air quality impacts in the project area and the parts of Sydney that are less exposed
- Concerns that the air quality assessment does not assess the potential benefits of filtration on human health.

Response

Adequacy of the assessment

The air quality assessment for the F6 Extension Stage 1 project (the project) assesses air quality impacts related to in-tunnel air quality, emissions from tunnel ventilation outlets, and ambient air quality. The assessment was undertaken in accordance with the requirements of the Planning Secretary's Environmental Assessment Requirements (SEARs) for the project, which is informed by relevant government agency requirements.

The methodologies for assessment of both construction and operational air quality impacts is consistent for different major road projects, including WestConnex, so some repetition is to be expected. However, the air quality assessment is specific to the project, and the health impact assessment (refer to Appendix F (Human health technical report) of the EIS) uses the project specific air quality results to assess receptor exposures and therefore provides project specific assessment of health risks.

The air quality impact assessment for the project has been reviewed by the NSW Environment Protection Authority (NSW EPA) (refer to responses to the NSW EPA submission in **Chapter B2**) and by international experts appointed by the Advisory Committee on Tunnel Air Quality (ACTAQ) (refer to responses to the ACTAQ submission in **Chapter B1**). The international experts concluded that:

'Our overall conclusion of the F6 Extension - Stage 1 EIS is that it constitutes a thorough review of high quality. It covers all of the major issues and areas that an EIS 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.'

'We find that the assessment methodology is sound and represents best practice. All of the models and data used are appropriate and expertly used.'

Air emissions from road projects

The project would divert surface road traffic into a tunnel so that vehicle emissions at street level are reduced and the emissions from the tunnel are released through elevated ventilation outlets. This would provide higher levels of dilution and dispersion of vehicle emissions than occurs at street level.

The assessment of air emissions from the project has been assessed according to different traffic related scenarios. These scenarios included an expected traffic scenario (eg the modelled demand for the project), a scenario for maximum traffic flow over 24 hours a day and 7 days a week, and a worst-case scenario for in-tunnel and ambient air quality at the surface, such as when there is a breakdown in the tunnels.

Inconsistencies with figures and style of reporting

Air quality data is presented in the figures at a scale that is appropriate to the range of results for each pollutant, given that they are assessed using different averaging periods and background levels, and in some cases are measured in different units in accordance with the assessment criteria.

The EIS, including the air quality chapter, has been prepared by a team of qualified professionals and presents a balanced merit-based environmental impact assessment in accordance with the EP&A Act, the SEARs and applicable NSW assessment policies. This required various detailed investigations and technical specialist studies to be completed to assess the potential environmental impacts of the project. While the technical working papers and other supporting documents appended to the EIS are by their nature technical documents, Roads and Maritime are working to make EISs easier to read and understand, while retaining technical aspects for those interested in more detailed technical assessments. This is evident in the development of the EIS interactive portal on the project webpage, the EIS project overview and project fact sheets, which were developed to enhance community understanding of the project's key features. A specific air quality portal[1] has also been developed by Roads and Maritime to enhance community understanding of Sydney's air quality.

Standalone vs cumulative project assessment

The 'Do something' scenario described in the EIS represents the standalone assessment for the project in the year of opening (ie 2026) and 10 years after opening (ie 2036), without future stages of the F6 Extension.

The SEARs require 'a cumulative assessment of the in-tunnel, local and regional air quality impacts from the operation of the project and due to the operation of and potential continuous travel through existing and committed future motorway tunnels and surface roads. Therefore, assumptions regarding ventilation outlets for future stages of the F6 Extension are included in the modelling for the '2036-Do something cumulative' scenario. Consideration of future stages of the F6 Extension also assumes that the number of operational lanes in the Stage 1 tunnels increase from the initial operation of two lanes to three lanes in each direction.

The inclusion of potential future projects means that a worst case scenario has been assessed. The scenarios took into account future changes over time in the composition and performance of the vehicle fleet, and predicted traffic volumes, as well as the speed and distribution of traffic on the network, as represented in the traffic model used for the traffic assessment. The objective of these scenarios was to demonstrate that the expected operation of the project would result in acceptable ambient air quality. The results from the modelling of these scenarios were also used in the health risk assessment for the project.

[1] www.rms.nsw.gov.au/airquality

Ventilation outlet discharge limits

The discharge limits that have been used in the assessment of the project are identical to the NorthConnex project, and are shown in **Table C-1**.

Table C-1 F6 Stage 1 ventilation outlet limits

Pollutant	Maximum value (mg/m^3)	Averaging period	Reference conditions
Solid particles	1.1	1 hour, or the minimum sampling period specified in the relevant test method, whichever is the greater	Dry, 273 K, 101.3 kPa
NO_2 or NO or both, as NO_2 equivalent	20	1 hour	Dry, 273 K, 101.3 kPa
NO_2	2.0	1 hour	Dry, 273 K, 101.3 kPa
CO	40	Rolling 1 hour	Dry, 273 K, 101.3 kPa
Volatile organic compounds (VOCs) (as propane)	4.0[1]	Rolling 1 hour	Dry, 273 K, 101.3 kPa

Notes:
1 Value amended from 1.0, as this was inaccurately included in the NorthConnex conditions of approval.

Assessment of air quality impacts across Sydney

The redistribution of air quality impacts across the study area as a result of the project was addressed through the use of density plots which show the distributions of the concentrations at all 17,509 Residential, workplace and recreational (RWR) receptor locations. This analysis was conducted for annual mean and maximum 24-hour $PM_{2.5}$ only, as it was considered that these metrics would be representative of other pollutants for this purpose.

In all traffic scenarios, the distributions of $PM_{2.5}$ with and without the project were very similar. In other words, there was no marked redistribution of air quality impacts across the study area. There was no significant increase in concentration predicted at receptor locations which already had a relatively high concentration in the 'Do minimum' scenarios.

The change in the annual mean $PM_{2.5}$ concentration at the 17,509 RWR receptors due to the project was small, with the largest predicted increase in concentration at any receptor as a result of the project of 0.44 $\mu g/m^3$, less than 6% of the national air quality goal for $PM_{2.5}$ – which is the most stringent in the world.

The project would have negligible impact on regional air quality across Sydney. No comparisons with air quality in other parts of Sydney were carried out, however all parts of Sydney are exposed to emissions from surface roads which is the dominant contribution to air quality impacts from the project. Air quality across Sydney can be seen on the OEH website[2] which displays current and historical air quality data from the OEH monitoring network.

Assessment of the potential benefits of ventilation outlet filtration

Potential operational air quality impacts associated with the project are described in section 9.6 of the EIS, which shows that under expected traffic conditions:

- The predicted contribution of tunnel ventilation outlets to pollutant concentrations was very small for all receptors
- Any predicted changes in concentrations were driven by changes in the traffic volumes on the modelled surface road network, not by the tunnel ventilation outlets.

In February 2018, the NSW Government announced reforms to the regulation of ventilation outlets for motorway tunnels in NSW. The reforms apply to the project and include:

- Ventilation outlets will be regulated by the NSW EPA. The NSW EPA will require tunnel operators to meet air quality limits and undertake air quality monitoring, where practicable

[2] www.environment.nsw.gov.au

- ACTAQ will coordinate a scientific review of a project's air emissions from ventilation outlets
- The NSW Chief Health Officer will release a statement on the potential health impacts of emissions from tunnel ventilation outlets
- The Minister for Planning will not approve a motorway tunnel project until the ACTAQ scientific review is considered.

The Chief Scientist's and ACTAQ review of tunnel ventilation is summarised in **Chapter B1**. The review stated '*Our overall conclusion of the F6 Extension – Stage 1 EIS is that it constitutes a thorough review of high quality. It covers all of the major issues and areas that an EIS 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 review of the project by the Chief Health Officer stated: *The draft EIS predicts that the contribution of emissions from road tunnel ventilation outlets to community exposures is small relative to the contribution of emissions from traffic on surface roads from other pollution sources. The primary source of community exposure to air pollution is from pre-existing regional air pollution, followed by pollution from surface road traffic. NSW Health considers that any potential air pollution-related health effects from the project are likely to be primarily a result of changes in volumes of traffic on the surface road network, not a result of the tunnel ventilation outlets*.

A subsequent review of the final EIS by the Chief Health Officer re-iterated the above conclusions.

A discussion of international projects of a similar nature that do and do not use air filtration systems, as well as information on the efficiencies of these systems, their cost effectiveness and how frequently they are used, is provided in section 9.2.2 of Appendix E (Air quality technical report) of the EIS.

C8.1.2 Adequacy of the air quality modelling

Submitters expressed concern that the air quality modelling is not sufficient. Specific concerns include:

- The air quality model has not been used in Australia before and cannot be verified by the NSW EPA
- Use of the GRAMM modelling domain is not appropriate, as it allows homogenisation of meteorological characteristics (in an area with diverse land use types and meteorological characteristics) and draws on data from meteorological stations that are too far away from the proposed ventilation outlet location. The potential errors from this approach could be large on a local scale
- The data should be re-modelled using a simplified model that considers all possible meteorological conditions. This would enable the quantification of short-term impacts expected from worst case (but routine) conditions
- The modelling does not account for vehicle manufacturers that significantly understate pollutant emissions
- The modelling does not account for the probable increase in ultra-fine particles resultant from Euro design rules for diesel engines
- The air quality model does not measure the ultra-fine particles that are of most harm to humans
- The air quality model is based on flawed traffic modelling.

Response

Suitability of the model

The GRAL/GRAMM modelling system used for the air quality assessment for the project has been used for the three WestConnex projects and was reviewed by both local and international peer reviewers appointed by DP&E and ACTAQ.

A comprehensive evaluation of the GRAMM-GRAL system was conducted by Manansala et al. (2017), and a brief summary of this work is provided in section H.1 of Annexure H of Appendix E (Air quality technical report) of the EIS. The study showed that the system is capable of giving 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.

The study was also subjected to an external review by Dr David Carslaw of the University of York in the United Kingdom. This review is available on the website of the NSW Chief Scientist and Engineer[3] (). The reviewed noted that *'The report (and appendices) represent a thorough and comprehensive assessment of the GRAL/GRAMM models for use in Australia'.*

The results from the model evaluation based on the project-specific monitoring data are consistent with the findings of Manansala et al. (2017) in that GRAL tends to overestimate concentrations. However, the degree of overestimation at the F6 Extension project-specific stations is relatively large (eg a factor of 2.7 at the roadside station for annual mean NOx) compared with the more detailed study. Notwithstanding the considerable uncertainty associated with the comparison for the project-specific stations, this suggests that there is a considerable margin of safety built into the dispersion modelling for the F6 Extension.

In addition, there a number of reasons why the GRAMM/GRAL system has been selected for the dispersion modelling for the air quality assessment, including:

- It is suitable for regulatory applications and can utilise a full year of meteorological data
- It is a particle model and has the ability to predict concentrations under low-wind-speed conditions (less than one metre per second) better than most Gaussian models (eg CALINE)
- It is specifically designed for the simultaneous modelling of road transport networks, including line sources (surface roads), point sources (tunnel ventilation outlets) and other sources
- It can characterise pollution dispersion in complex local terrain and topography, including the presence of buildings in urban areas.

Use of the GRAMM modelling domain

The GRAMM modelling domain utilises comprehensive metrological data that has been collected using a full 12 months of hourly data for a typical year (8760 hours). The model also takes into account terrain and land use data to generate a detailed three dimensional wind-field that accounts for local conditions.

Although it is correct that a 'radius of influence' cannot be set for different stations, weighting factors for wind speed and direction can be defined by the user to gain the 'best fit' of data across the domain. This means that all meteorological data included in the matching process will affect the wind fields across the entire GRAMM domain, and to a greater or lesser degree depending on the weighting factors. The weighting factors are based on user judgment, taking into account, for example, the representativeness of the data for the study area.

Monitoring station data

The selection of meteorological monitoring stations for the assessment considered the following parameters:

- Distance from the study area
- Data availability - as the NSW Approved Methods require a meteorological dataset for modelling to be at least 90% complete to be deemed acceptable for a detailed impact assessment
- Instrumentation type and location (sitting).

To verify the meteorological station selection and weighting factors, a basic multi-criteria analysis was utilised to select the most appropriate meteorological stations for the GRAMM modelling.

[3] http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0008/138158/Comments-on-Optimisation-of-the-application-of-GRAL-in-the-Australian-context.pdf

The meteorological monitoring stations, comprising stations from the NSW Office of Environment and Heritage (OEH) network included selection of OEH Earlwood and OEH Randwick, as they showed most similar patterns to each other with dominant wind directions from the west, west northwest and northeast. With the exception of Sydney Airport, these stations are also closest to the project.

It is also worth noting that the chosen monitoring stations also had the most conservative meteorological conditions of those considered, with the lowest average wind speeds and highest percentage of annual calms.

Request for re-modelling of air quality data

Re-modelling using a simplified methodology is not required given the comprehensive modelling undertaken using a full 12 months of hourly meteorological data for a typical year (8760 hours), selected after analysis of 10 years of meteorological data from the selected monitoring stations, matched with 12 months of air quality data for the same year, in this case 2016.

Building wake effects in the vicinity of each ventilation outlet were undertaken as a sensitivity test. These tests indicated that, given the small absolute outlet contribution to $PM_{2.5}$, the exclusion of buildings is unlikely to represent a large source of uncertainty in the overall predictions in the assessment. The total predicted concentrations, and the conclusions of the assessment, would not change significantly with the inclusion of buildings.

Vehicle emissions factors

The emissions factors that have been used for the ambient air quality modelling are based on the NSW EPA emissions model. This model is based on real-world modelling data, and not on manufacturer's specifications.

The fuel split (petrol/diesel) for light vehicles, and the subdivision of heavy vehicles and buses has also been accounted for when combining the emissions factors with traffic data. These emission factors provide for heavy vehicles with and without the implementation of the Euro VI regulations. Given the uncertainty in the implementation of Euro VI in Australia, the (higher) 'without Euro VI' emission factors were used in the assessment.

In October and November 2013, the accuracy of the NSW EPA model in representing vehicle emissions (CO, NO_X, MO_2, PM_{10} and $PM_{2.5}$) was investigated, using measurements from the ventilation outlets of the Lane Cove Tunnel. The general results of the investigation found that on average, the model actually overestimated emissions of each pollutant in the tunnel, and by a factor of between 1.7 and 3.3, so the assessment is conservative.

Analysis of ultra-fine particles

There are currently no standards for assessment of 'ultra-fine' particles (UFPs). These are particles with a diameter of less than 0.1 micrometer (µm). While there is some evidence that particles in this size range are associated with adverse health effects, it is not currently practical to incorporate them into an environmental impact assessment. There are several reasons for this, including the rapid transformation of such particles in the atmosphere, the need to treat UFPs in terms of number rather than mass, the lack of robust emission factors, the lack of robust concentration response functions, the lack of ambient background measurements, and the absence of air quality standards for this particle type.

In relation to concentration response functions, the World Health Organization Regional Office for Europe (2013) has stated the following:

'the richest set of studies provides quantitative information for $PM_{2.5}$. 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.'

As UFPs are a subset of $PM_{2.5}$, potential health effects from UFPs are included in the dose-response functions for $PM_{2.5}$. For the purpose of the air quality assessment for the project, it has therefore been assumed that the effects of UFPs on health are included in the assessment of $PM_{2.5}$.

Traffic modelling

The air quality assessment used data from the Sydney Strategic Motorway Planning Model (SMPM), version 1, which is a strategic traffic model that covers the Sydney metropolitan area. The SMPM modelling has been developed by Roads and Maritime and provides a platform to understand changes in future weekday travel patterns under different land use, transport infrastructure and pricing scenarios. Further responses regarding the traffic modelling undertaken for the project are provided in **Chapter C7** (Traffic and transport).

C8.1.3 Adequacy of the methodology used to assess impacts on air quality

Submitters raised concerns about the adequacy of the methodology employed to assess air quality impacts during construction and operation. Specific concerns include:

- The use of construction air quality management guidelines published by the United Kingdom Institute of Air Quality Management4 is not appropriate for assessing NSW conditions
- The use of the Permanent International Association of Road Congresses (PIARC) conversion factor is unsuitable for the circumstances of this project, as the standards have been developed under the assumption that tunnel use would only last a few minutes.

Response

Applicable air quality standards in NSW are set by the NSW EPA, with regard to national and international practice, and taking into account local conditions and regulatory requirements.

The United Kingdom Institute of Air Quality Management Guidelines is an internationally accepted methodology for the identification and semi-quantitative assessment of risk of impacts from construction activities on various types of receptors. The guidelines have been adapted for use in Sydney taking into account such factors as the difference between the UK and NSW assessment criteria for ambient PM_{10}.

The development and application of PIARC conversion factors is unrelated to the duration of tunnel use. This is because the application of PIARC guidelines is calculated as an average over the length of the tunnel for NO_2, and CO and visibility limit values are calculated as rolling three and 15 minute averages, respectively.

The ‘tunnel average’ is interpreted as the ‘route average’, and includes ‘length-weighted average NO_2 concentration over a portal to portal route through the system’.

The PIARC detailed method used for the air quality assessment for the project used the local Sydney vehicle fleet emissions factors. In-tunnel air quality was assessed against the requirements of the NSW Governments In-Tunnel Air Quality (Nitrogen Dioxide) Policy.

C8.1.4 Adequacy of the assessment of background concentrations

Submitters expressed concern about the assessment of background concentrations used to support the air quality impact assessment. Specific concerns include:

- The background assessment is misleading and incorrect for some community receptors
- Some background conditions were assumed and not verified due to time constraints.

Response

The assessment of background concentrations has been carried out based on data captured from background air quality monitoring stations installed in urban locations within the air quality assessment study area, and from representative monitoring stations in urban environments similar to those in the study area.

Two project-specific monitoring stations were established by Roads and Maritime in late 2017. One of these was at a background location and the other at a roadside location. A roadside location is considered a ‘peak’ location as it is situated within about 10 metres of the road.

[4] IAQM (2014)*Guidance on the assessment of dust from demolition and construction*. Institute of Air Quality Management, London

At the time of the air quality study for the EIS, data from the two project-specific monitoring stations were only available for the period between December 2017 and June 2018. As data is now available up to December 2018, verification of the models has now been carried out. For the two F6 Extension monitoring stations, **Figure C-1** shows the hourly mean NO_X and NO_2/NO_X data for the full period. It can be seen that all the measurements from the F6 Extension monitoring stations were inside the envelope of the conversion function that was used in the air quality assessment, and this reflects the conservative nature of the NO_2 assessment for the specific area of the project.

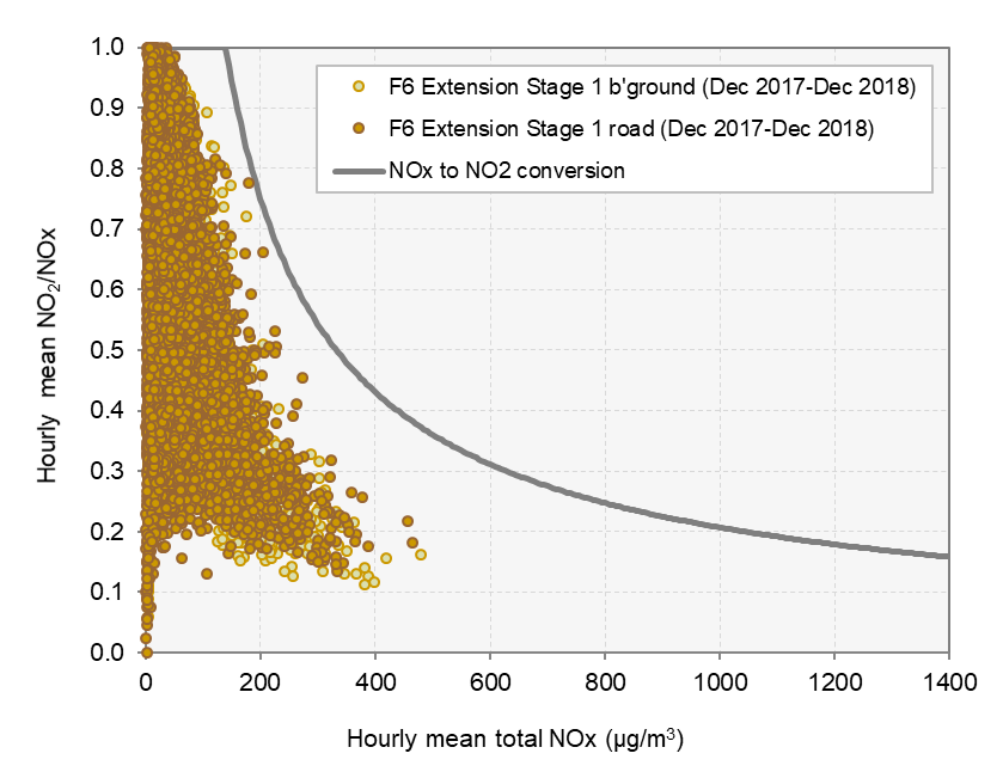


Figure C-1 Hourly mean NO_2/NO_X and NO_X at F6 Extension Stage 1 stations (December 2017 to December 2018)

For more detail on the selection of monitoring stations to inform the GRAMM modelling, see the responses in **section C8.1.2**.

For the purposes of establishing background concentrations of air quality, assessments draw upon datasets from urban areas that are situated away from major roads and industry to provide background concentrations that are not impacted by specific sources of air pollution. This approach is in accordance with the Australian Standard AS/NZS 350.1.1:2007 *Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment*. The background concentrations detailed in the air quality assessment for the project have been derived from monitoring stations with (full or partial) sets of 2016 data.

Generally, similar pollution levels (when not influenced by local pollution sources - eg busy roads or industrial sites) and similar air quality trends (improvements over time) have been observed at different monitoring locations across Sydney. This means that although the assessment considers datasets from 2016 and draws on datasets from different sites across Sydney, the assessment remains valid. The reasons include:

- Air quality assessments are carried out in order to establish changes to air quality as a result of the project. These can only be predicted with the use of modelling. As the background levels are assumed to be unchanged whether or not the project proceeds, small variations in background levels do not affect the outcome of the assessment
- Using existing background information to predict future air quality trends (beyond 2023) is a conservative approach. This is because monitoring data over the last few decades have shown that the contribution of road vehicles to pollution levels in Sydney has fallen, despite traffic growth. Improvements in fuel and pollution management systems in vehicles on the road network have led

to a reduction in vehicle generated pollution. It is expected that this will continue into the future as older vehicles that generate greater pollution are replaced by newer vehicles that generate less pollution.

The air quality monitoring peer review, carried out by ACTAQ, noted that despite some limitations, the assessment of background air quality was considered to be fit for purpose (refer to **Chapter B1**). The following comment was made by ACTAQ regarding the adequacy of the background air quality assessment:

'[T]his project benefits from a much larger database of air quality measurements than any previous Sydney tunnel project, as far more data from the WestConnex monitoring sites are now available and have been used in the F6 EIS. Furthermore, sufficient data from the F6 project monitoring is provided in the EIS (Annexure D) to assess the likely implications of not using it directly to assess background concentrations'.

ACTAQ further concluded that:

'Although not making full use of the data available, we do not believe that the weakness in background air quality assessment is seriously influencing the key conclusions of the EIS, and in particularly does not impact the health risk assessment. Therefore, despite these limitations, we find the current assessment of background air quality to be fit for purpose.'

Refer to Annexure D of Appendix E (Air quality technical report) of the EIS for existing air quality and background concentrations.

C8.1.5 Adequacy of the elevated receptors assessment

Submitters expressed concern regarding the adequacy and completeness of the air quality assessment completed for elevated receptors. Specific concerns include:

- The air quality assessment has not predicted concentrations of air pollutants on elevated receptors
- The chapter does not identify planning buffers or height restrictions that would be associated with the ventilation facilities
- The assessment fails to take sufficient account of the problems that occur when air flows ricochet off buildings in different locations, particularly in Arncliffe.

Response

The potential impacts of the project on elevated receptors were subject to a separate assessment (refer to section 9.6.4 of the EIS). This assessment also considered how future building developments (eg apartment blocks) in the modelling domain may be restricted due to air quality changes as a result of the project.

Receptor heights in proximity to ventilation outlets include:

- Land in the immediate vicinity of the Rockdale ventilation facility is zoned industrial with a building height limit of 14.5 metres in the Rockdale Local Environmental Plan (LEP) 2011. The low density zoned residential land which surrounds the industrial zoned land has a building height limit of 8.5 metres. A high density residential zoned area with a building height provision of 14.5 metres is located around 250 metres to the west of the ventilation facility. At these heights there would be minimal influence from the ventilation outlets and the local air quality is influenced by emissions from the surface road which diminishes at heights towards 10 metres
- Land in the immediate vicinity of the Arncliffe ventilation facility is regulated under the Rockdale LEP 2011 and Sydney Regional Environmental Plan No 33 – Cooks Cove (SREP 33). The areas to the site's immediate north and northeast are zoned for low density residential development and have maximum building heights of 8.5 metres. At this height there is minimal influence from the ventilation outlets and the local air quality is influenced by emissions from the surface road which diminishes at heights towards 10 metres
- North of the Arncliffe ventilation facility towards Cahill Park, building heights are significantly higher and range between 17.5 metres and 29.5 metres in the high density residential zoned area and 46 metres in the mixed use zoned areas. This area is located around 260 metres away (at its closest point). The closest elevated receptors to the Arncliffe ventilation facility are in the area bounded by Marsh Street, Innesdale Road and Levey Street, around 240 metres away and the receptors in these buildings are lower than the 46 metres mixed use height restriction in the LEP.

The future development of land (including rezoning) in the vicinity of the project ventilation outlets that may involve multistorey buildings above 30 metres in height would need to consider the air dispersion performance of the outlets. Roads and Maritime would assist Bayside Council in determining relevant land use considerations applicable to future development for inclusion in local environmental plans or development control plans, where required.

Building wake effects, that is, the effect of buildings on air flows, was not included in the dispersion model due to the finer scale of modelling required, which is not compatible with dispersion modelling over the entire study area (which is done at a different scale). A sensitivity test was therefore undertaken using a smaller area around the ventilation outlets. These tests indicated that, given the small absolute outlet contribution to $PM_{2.5}$, the exclusion of buildings is unlikely to represent a large source of uncertainty in the overall predictions in the assessment. The total predicted concentrations, and the conclusions of the assessment would not change significantly with the inclusion of buildings.

C8.2 Construction air quality impacts

18 submitters have raised issues regarding air quality impacts during construction. Refer to section 9.5 and section 7 of Appendix E (Air quality technical report) of the EIS for details of the construction air quality assessment.

C8.2.1 Generation of dust and odour impacts during construction

Submitters raised concern regarding dust and odour impacts during construction. Specific concerns include:

- Concern about dust and particulate matter generation from construction activities and increased heavy vehicle emissions
- Concern about dust generation from the construction of the cut-and-cover structures at the President Avenue construction ancillary facility (C3), and the impact of this dust on sensitive receptors and machinery at locations such as Brighton-Le-Sands Public School and the industrial properties on West Botany Street
- Concern about potential for odour impacts, including:
  - Impacts on sensitive receptors at President Avenue and West Botany Street
  - Impacts from the groundwater treatment basin at the President Avenue construction ancillary facility (C3).

Response

Dust impacts during construction

The risks associated with construction dust emissions have been assessed in the EIS for four types of activities, including: demolition, earthworks (including tunnelling), construction, and from construction vehicles exiting work sites. The assessment also considered annoyance impacts due to dust soiling, human health impacts, and ecological impacts. The findings of these assessments detailed the risks of dust impacts without the application of mitigation measures.

Several locations and activities were determined to be of high risk. The assessment found that all activities carried a high level of risk for construction dust impacts at the proposed construction sites at Rockdale, President Avenue, Princes Highway, and at the construction sites for the shared cycle and pedestrian pathways.

Consequently, a number of management measures have been proposed to mitigate the effects of construction work on local air quality at these locations (refer to **Chapter D1** (Environmental management measures)).

These measures would be outlined in a Construction Air Quality Management Plan (CAQMP) to be developed prior to construction. As outlined in environmental management measure AQ1 in **Chapter D1** (Environmental management measures), the CAQMP will include measures to minimise dust generation from stockpiles, haulage routes, work activities, exposed ground surfaces and spoil sheds. The implementation of the CAQMP would minimise potential impacts on locations such as Brighton-Le-Sands Public School and the industrial properties on West Botany Street.

Odour impacts during construction

An odour assessment was completed in accordance with the NSW Approved Methods, which outlines criteria for various odorous pollutants. The assessment concluded that the main potential source of odour for the project is the release of hydrogen sulphide gas should excavation activities for the construction of the cut-and-cover structures at the President Avenue construction ancillary facility (C3), may disturb acid sulfate soils. The release of odorous hydrogen sulphide gas (H_2S) into the atmosphere has the potential to impact nearby receptors.

The dispersion modelling for odour shows that there are not expected to be exceedances of the H_2S criteria at sensitive receptors. This is not to say that there will be no odour experienced at these locations, but that it is not predicted to be above the criteria for more than one per cent of the time. The level of odour emission is dependent on the odour concentration of the material being excavated and the sizes of the areas left exposed.

As outlined in environmental management measure AQ3 in **Chapter D1** (Environmental management measures), odour impacts during construction would be managed as follows:

- Odorous material would be treated immediately on-site, and removed from site where necessary. Areas of odorous materials would be excavated in a staged process to allow for treatment and handling. Exposed areas of odorous material would be kept to a minimum to reduce the total emissions from the site
- On-site odour measurements would be carried out during excavation works to determine odour emission rates. Results from the monitoring would be used to inform future excavation and treatment activities on site.

C8.3 Operational air quality impacts

118 submitters have raised issues regarding operational air quality impacts. Refer to section 9.6 of the EIS and section 8 of Appendix E (Air quality technical report) of the EIS for details of the operational air quality assessment.

C8.3.1 Surface and in-tunnel air quality impacts

Submitters raised concerns regarding air quality impacts during operation. Specific concerns include:

- Concern over vehicle emissions in the tunnel and from the tunnel portals
- Concern that the project will promote an over dependence on cars, will increase smog, and reduce visibility and air quality for the community
- Concern with air quality impacts on nearby schools, including Ramsgate Public School and St George School.
- Submitters raised concern that the project would result in more air pollution, in an area where air quality is already poor.

Response

In-tunnel and portal emissions

A key operating restriction for road tunnels over one kilometre long in Sydney since 2001, and indeed in most Australian road tunnels, is the requirement for there to be no emissions of air pollutants from the portals. To avoid portal emissions, the polluted air from within a tunnel must be expelled from one or more elevated ventilation outlets along its length. There are some circumstances when portal emissions may be permitted, such as emergency situations and during major maintenance periods.

The air quality assessment carried out for the project found that use of the proposed ventilation system would enable the project to meet the in-tunnel air quality criteria for all traffic scenarios. The traffic scenarios analysed included worst case scenarios where maximum traffic volumes[5] were travelling at

[5] 'maximum traffic volumes' – ie the capacity of the tunnels. The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a given time period under prevailing roadway conditions)

20km/h through the tunnels. The assessment also accounted for portal-to-portal travel through the project tunnels by accounting for interconnecting travel through the WestConnex tunnels.

The tunnel and ventilation system has been designed to meet ACTAQ's *In-tunnel Air Quality (Nitrogen Dioxide) Policy*[6], which was released in February 2016. This policy requires tunnels to be *'designed and operated so that the tunnel average nitrogen dioxide (NO_2) concentration is less than 0.5 ppm as a rolling 15-minute average'*. The air quality assessment found that travel through the F6 Extension Stage 1 into the M4-M5 Link past St Peters, meets the route average criteria. Further, as each portion of prospective trips through the F6 Extension Stage 1 tunnels and WestConnex tunnels will meet the air quality criteria on their own, the average of the entire route from origin portal to destination portal will meet or be better than the air quality criteria.

Over-dependence of cars, reduced visibility and increased smog

Vehicle emissions have improved in recent decades and continue to improve as fuel and emission standards are tightened and vehicles are more fuel efficient with better emission management systems. Despite an increase in vehicle use, emissions from road transport in Sydney are projected to continue to decrease for around the next 10 years (refer to **Figure C-2**). These projections only include current technology. Any significant shift to electric vehicles would further reduce emissions.

During operation, the project would also deliver new shared cycle and pedestrian pathways that would enhance access and connectivity for pedestrians and cyclists, and would provide further socio-economic benefits including reduced car dependency and reduced cost of travel.

[6] ACTAQ (2016) In-tunnel air quality (nitrogen dioxide) policy. Advisory Committee on Tunnel Air Quality. NSW Government, Sydney, February 2016. http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/81778/In-Tunnel-Air-Quality-Policy-FINAL.pdf

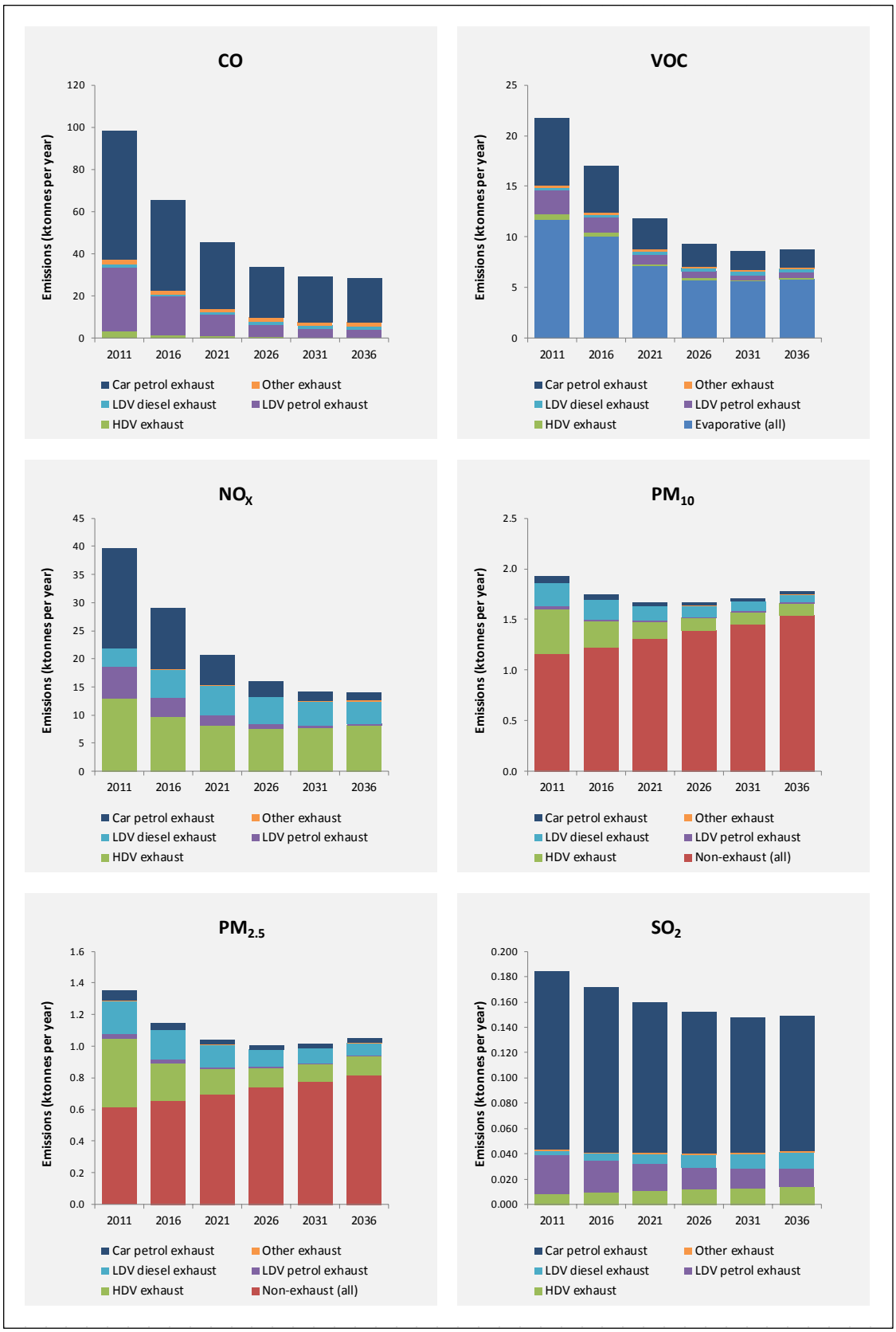


Figure C-2 Projections of road transport emissions – Sydney, 2011-2036[7]e

[7] Source: NSW EPA (2012) 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, Sydney South

Air quality impacts near schools

Air quality was assessed at 17,509 residential, workplace and recreational (RWR) receptors. This included all schools, childcare centres and pre-schools in the vicinity of the project. The assessment found the highest concentrations of annual mean NO_2 along the most heavily trafficked roads in the GRAL domain, such as General Holmes Drive and Southern Cross Drive. Tunnel ventilation outlets had little impact on total annual mean NO_2 concentrations, with spatial changes in pollutant concentrations qualitatively similar for all pollutants.

Air quality was also assessed in greater detail at a representative sample of 30 community receptors, including the following educational facilities: Ramsgate Public School, Ramsgate Beach (CR03), St George School, Kogarah (CR06), and Brighton-Le-Sands Public School, Brighton-Le-Sands (CR08).

The percentage changes in the annual mean for the criteria pollutants that are most relevant to human health risks ie NO_2 and $PM_{2.5}$, were analysed. The air quality assessment demonstrates that changes in air quality as a result of the project are minimal and would not result in changes to health risks at these community receptors (refer to the executive summary in Appendix F (Human health technical report) of the EIS).

C8.3.2 Predicted emissions generated by traffic changes

Submitters requested information regarding the current air quality modelling for emissions generated by traffic in locations including:

- West Botany Street, Rockdale
- Rockdale Bicentennial Park, Rockdale
- President Avenue, Kogarah
- General Holmes Drive, Brighton-Le-Sands
- Princes Highway, Rockdale
- O'Connell Street, Monterey.

Response

The air quality assessment for the project predicted marked reductions in air emission concentrations along some major roads as a result of project and increases on other roads.

These changes broadly reflect the effects of the project on traffic, also taking into account factors such as road gradient and meteorology.

With the inclusion of the project, there were noticeable decreases in $PM_{2.5}$ along several roads, including West Botany Street, General Holmes Drive, The Grand Parade to the North of President Avenue, President Avenue to the east of the project, and Marsh Street. This correlates with predicted reductions in traffic of between 2 - 22 per cent on these roads.

There were predicted increases in concentrations of $PM_{2.5}$ along President Avenue to the west of the project and on the Princes Highway to the south of the junction with Rocky Point Road. These were associated with increases in traffic volume on these roads. Similar spatial changes to these were also predicted for the 2036-Do something scenario.

Air quality changes on O'Connell Street are predicted to be very small, with the only increases being 1 microgram per cubic metre for annual mean NO_2 and 0.2 micrograms per cubic metre for annual mean $PM_{2.5}$ in the 2036-Do something scenario. Changes of this magnitude are well below the levels of change that would affect human health.

For the 2036-Do something cumulative scenario, there were some additional changes associated with the introduction of the full F6 Extension. These included reductions in $PM_{2.5}$ concentration along The Grand Parade to the south of President Avenue, Sandringham Street and Rocky Point Road. In addition, the increase in concentration on the Princes Highway in the Do something scenarios was converted to a reduction in concentration in the cumulative scenario.

General improvement in air quality

Air quality in the Sydney region has improved over the last few decades. The improvements have been attributed to initiatives to reduce emissions from industry, motor vehicles, businesses and residences.

Air quality in Sydney has improved significantly since the 1980s with initiatives to reduce emissions implemented across industry, business, homes and motor vehicles. Annual average CO, NO_2 and SO_2 concentrations have declined since 1995, and are consistently well below national standards. Ambient levels of ozone and particles can exceed national standards in the Sydney region, with no definite downward trend in the concentrations of these pollutants apparent[8].

Ozone and particulate levels are affected by:

- The annual variability in the weather
- 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[9].

The air quality along major roads (as discussed in **section C8.3.2**) would improve as traffic would be diverted into the tunnels from the surface roads.

Vehicle emissions at street level would therefore be reduced and the emissions from the tunnel would be released through elevated ventilation outlets. This allows for higher levels of dilution and dispersion of vehicle emissions than at street level.

C8.4 Air quality impacts of the project ventilation facilities

143 submitters have raised issues regarding the operational air quality impacts of ventilation facilities. Refer to section 9.5 of the EIS and section 9.6 and Annexure K of **Appendix E** (Air quality technical report) of the EIS for details of the operational air quality assessment.

Submitters raised concern over the air quality impacts from the project ventilation facilities located at the Arncliffe motorway operations complex (MOC1) and the Rockdale (south) motorway operations complex (MOC3). Specific concerns include:

- Concern that the emissions from ventilation facilities will exceed guidelines
- Concern about increased air pollution from the ventilation facilities impacting on air quality at local schools (eg Brighton-Le-Sands Public School), sporting fields and the community, including high rise buildings, particularly because they are unfiltered.

Response

Ventilation system emission criteria

The ventilation outlets have been designed to ensure that the local communities will experience little, if any, change in air quality. The air quality and health assessments have been reviewed by the NSW EPA, international experts appointed by ACTAQ (refer to responses to the ACTAQ and NSW EPA submissions in **Chapter B1** and **Chapter B2** respectively), and by NSW Health, who concluded that:

'The EIS describes a redirection of traffic from surface roads into the F6 Extension road tunnels. Hence, traffic-related air pollution will be released in the tunnels rather than on the surface roads. Well-designed and operated road tunnel ventilation outlets discharge in-tunnel air to the atmosphere at a height and velocity that promotes dispersion of the in-tunnel air, minimising ground-level impacts.

The EIS predicts that the contribution of emissions from road tunnel ventilation outlets to community exposures is small relative to the contribution of emissions from traffic on surface roads from other pollution sources. The primary source of community exposure to air pollution is from pre-existing regional air pollution, followed by pollution from surface road traffic.

[8] http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0008/192491/TP02_Air-Quality-Trends-in-Sydney.pdf
[9] OEH (2015) New South Wales Air Quality Statement 2014. NSW and Office of Environment and Heritage, Sydney, January 2015

Any potential air pollution-related health effects from the project are likely to be primarily a result of changes in volumes of traffic on the surface road network, not a result of the tunnel ventilation outlets'.

Under the NSW Government Tunnel Ventilation Initiative, the NSW EPA will licence the operation of the ventilation facilities and set the discharge limits and monitoring requirements to demonstrate compliance with the emission limits.

The ventilation system would be controlled using real-time air velocity and air quality sensor data so that in-tunnel and outlet conditions are to ensure compliance with the emission limits. Specific ventilation modes will be developed to manage breakdown, congested and emergency situations.

Impacts of the ventilation outlets at ground level

Under the forecast traffic conditions with the inclusion of the project, the predicted contribution of tunnel ventilation outlets to pollutant concentrations was found to be negligible for all receptors. As such, predicted changes in concentrations at locations such as Brighton-Le-Sands Public School and sporting fields were driven by changes in the traffic volumes on the modelled surface road network, not by the tunnel ventilation outlets.

The impacts of the ventilation outlets at heights up to 45 metres

The air quality modelling predicts that there will be no change in air quality at buildings up to 30 metres in height in proximity to the ventilation outlets. The nearest existing buildings to the Rockdale ventilation facility that are above 30 metres are more than 500 metres away and would not experience measurable impacts. The nearest existing buildings to the Arncliffe ventilation facility are more than 200 metres away and similarly would not experience measurable impacts from the facility. Roads and Maritime would assist Bayside Council to develop planning controls which would require detailed modelling addressing all relevant pollutants and averaging periods for future developments higher than 30 metres in proximity to the ventilation facilities.

C8.5 Cumulative air quality impacts

One submitter raised concerns about cumulative air quality impacts. Refer to section 9.6 and Appendix E (Air quality technical report) of the EIS for details of the potential cumulative impacts of the project.

C8.5.1 Cumulative air quality impacts during operation

Submitters raised concern about the cumulative air quality impacts of the project with the other interrelated projects presented in the cumulative scenario, including potential future stages of the F6 Extension and the WestConnex program of works.

Response

The air quality assessment includes consideration of the impacts of the project with other major infrastructure projects, including the WestConnex program of works and future stages of the F6 Extension. The air quality scenarios that were assessed include:

- 2026 – 'Do minimum' (2026-DM). In this scenario it is assumed that the following projects would be open (excluding the F6 Extension Stage 1): WestConnex (including M4 Widening, M4 East, New M5 and M4-M5 Link), King Street Gateway and Sydney Gateway
- 2026 – 'Do something' (2026-DS). In this scenario it is assumed that the following projects would be open (including the F6 Extension Stage 1): WestConnex (including M4 Widening, M4 East, New M5 and M4-M5 Link), King Street Gateway and Sydney Gateway
- 2036 – 'Do minimum' (2036-DM). As for 2026 Do Minimum, but for 10 years after project opening
- 2036 – 'Do something' (2036-DS). As for 2036 Do Minimum, including the F6 Extension Stage 1 completed, but for 10 years after project opening
- 2036 – 'Do something cumulative' (2036-DSC). In this scenario it is assumed that the following projects would be open: WestConnex (including M4 Widening, M4 East, New M5 and M4-M5 Link), King Street Gateway, Sydney Gateway, F6 Extension Stages 1, 2 & 3, Western Harbour Tunnel, and Beaches Link.

There is no 2026 'Do something cumulative' scenario as there are no other major road projects expected to be open in that year in addition to those included in the 2026 'Do something' scenario.

The air quality assessment uses changes in background air quality over time, surface traffic flows and emissions from ventilation outlets as key contributors to changes in air quality within and around the project footprint.

A summary of operational air quality impacts, including cumulative impacts, is presented in section 10.2 of Appendix E (Air quality technical report) of the EIS.

Future stages of the F6 Extension, including tunnels and ventilation systems, would be designed to meet the air quality standards current at the time they are designed.

C8.6 Air quality environmental management measures

Eight submitters raised concerns about the proposed air quality environmental management measures. Refer to **Chapter D1** (Environmental management measures) for details of the proposed air quality environmental management measures.

C8.6.1 Air quality environmental management measures during construction

Submitters raised concerns about the proposed mitigation measures to be implemented during construction of the project. Specific concerns include:

- Mitigation measures to address air pollutants have not been addressed
- The EIS states that 'with mitigation measures, the overall risk due to dust in construction is insignificant' – the submitter states that this is inaccurate due to experience of residents affected by WestConnex
- Submitter requests that physical barriers (such as stacked shipping containers) be installed during construction to manage potential dust impacts
- Submitter queried which management measures would be in place to protect residents from dust impacts during construction from within construction ancillary facilities and from hazards such as dust falling from spoil trucks.

Response

Roads and Maritime sought feedback from Sydney Motorway Corporation, construction contractors, DP&E and other relevant government agencies, including NSW EPA, on the M4 East, New M5 and M4-M5 Link construction processes to identify lessons learnt and areas for improvement to work processes and mitigation measures. This feedback, together with issues raised by communities during the construction stages of those projects to date as well as during consultation for the F6 Extension Stage 1, has been considered in the preparation of the EIS for the project. Conditions of approval for the M4 East, New M5 and M4-M5 Link projects have also informed the environmental management measures proposed for the project.

Managing dust impacts

Environmental management measures to minimise air quality impacts, including dust impacts during construction, are described in **Chapter D1** (Environmental management measures).

As discussed in **section C8.2.1**, dust management measures will be outlined in the CAQMP for the project, prior to construction. The CAQMP will be prepared in consultation with the local council and other relevant stakeholders and will include site specific management measures, including, for example:

- Erection of acoustic sheds around tunnelling activities at tunnel sites such as the Rockdale construction ancillary facility (C2) and the Arncliffe construction ancillary facility (C1).The acoustic sheds would also serve to minimize dust emissions at these locations
- Spoil would be transported from construction ancillary facilities to spoil disposal locations, generally via arterial roads and the motorway network, and all spoil trucks would be covered.

The CAQMP will also outline protocols to modify or cease dust generating works during unfavourable weather conditions, and will include appropriate dust monitoring procedures.

C8.6.2 Air quality environmental management measures during operation

Submitters raised concerns about the proposed mitigation measures to be implemented during operation of the project, including:

- Concern that there are minimal mitigation options available during operation of the project
- Concern about restrictions on heights of future buildings or building expansion
- Monitoring should not be carried out to assess compliance, but rather to assess the level of health impact
- Air quality monitors will only be placed at the ventilation outlet locations to check pollution levels, rather than at President Avenue where there will be more hazardous pollution from an increase in surface traffic
- Submitter requests the monitoring of vehicle exhaust emissions before, during and after construction to ensure a safe environment is maintained for students in the area
- The air quality mitigation measures are not adequate, as without consideration of filtered ventilation outlets to reduce pollution at the source, they do not adhere to the *Protection of the Environment Operations Act 1997* (POEO Act)
- The assessment does not mention plans to re-assess the impacts resulting from an increase in concentration of pollutants on the facades of existing or possible future multi-storey buildings in the vicinity of the ventilation facilities.

Response

In managing operational air quality impacts of the project, the proposed approach includes designing the tunnel and ventilation system in a manner that minimises pollutant emissions from vehicles and maintains adequate in-tunnel and surface air quality. Details of the environmental management measures for the project are described in **Chapter D1** (Environmental management measures).

Managing in-tunnel air quality

The in-tunnel infrastructure will be designed to:

- Minimise gradients that may cause vehicles to slow down (which increases emissions)
- Provide large cross-sectional areas and increased tunnel height, averaging at 12.5 metres wide and around 6.5 metres high. This large cross-sectional area in the tunnel will reduce pollutant concentrations of emissions in the tunnels through increased fresh air volume entering the tunnels, reduce the risk of incidents involving tall vehicles blocking the tunnel, and reduce the risk of higher pollutant concentrations associated with slower traffic speeds.

In-tunnel air quality will be managed through continuous in-tunnel monitoring. This monitoring will include constant monitoring of in-tunnel air quality, traffic volumes and average traffic speeds through the project tunnels from the Motorway Control Centre. This will allow for decisions about the operation of the project's ventilation system to be made in real time. Operating procedures will be developed and applied to the operation of the ventilation system, including triggers for intervention in the case of elevated concentrations of vehicle emission in the project tunnels, congested traffic conditions or incidents, breakdowns or emergencies.

Managing surface air quality

The ventilation system will be designed to:

- Minimise local air quality impacts through the location, height, diameter and emission ventilation rate of the proposed tunnel ventilation system
- Meet the in-tunnel air quality criteria, so that emissions are dispersed with minimal or no effects on local air quality
- Minimise portal emissions as far as practicable.

The ventilation outlets will be regulated by the NSW EPA.

The future development of land (including rezoning) in the vicinity of the project ventilation outlets would need to consider the air dispersion performance of the outlets. Roads and Maritime would assist Bayside Council in determining relevant land use considerations applicable to future development for inclusion in local environmental plans or development control plans, where required.

Compliance monitoring

The air quality criteria against which compliance is assessed is based on the national standards developed to provide adequate protection for human health and wellbeing. Air quality criteria are based on the best current knowledge, are set to protect the health of populations and are relevant to the local environment and background levels. This includes the protection of sensitive populations such as children, the elderly, and individuals suffering from respiratory disease, but may relate to other adverse effects such as damage to buildings and vegetation. As such, while monitoring adherence to relevant air quality criteria does not necessarily assess the level of health impact, air quality impacts would remain within acceptable limits for the protection of human health.

Location of air quality monitoring stations

The number and locations of ambient air quality monitoring stations during the operation of the project will be developed in consultation with ACTAQ.

Adherence to the POEO Act

The NSW EPA will regulate the ventilation outlets as part of an Environment Protection Licence issued under the POEO Act. The limits set on the outlets would be designed to protect human health and the environment and continuous monitoring to ensure compliance with the limits will be undertaken.

The regulation of fuel and emissions standards is the responsibility of the Australian Government and the 2016 review of the *Fuel Quality Standards Act 2000* found 'the Act led to a significant reduction in the level of pollutants and emissions arising from the use of fuel' (National Clean Air Agreement mid-term review). Other initiatives under the National Clean Air Agreement included updated particle standards, the woodheater emissions and efficiency standards and the NSW EPA Diesel and Marine Emissions Management Strategy.

C Part C Response to community submissions

C9 Health safety and hazards

This chapter addresses issues raised in community submissions associated with the health, safety and hazards assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 10 (Health, safety and hazards) and Appendix F (Human health technical report) of the EIS for further details on health, safety and hazards.

Contents

C9.1 Level and quality of health, safety and hazards assessment

72 submitters have raised issues regarding the level and quality of the health, safety and hazards assessment. Refer to section 10.1 and Appendix F (Human health technical report) of the EIS for further details on the health, safety and hazards assessment.

C9.1.1 Adequacy of the health, safety and hazards assessment

Submitters raised concern about the adequacy and scope of the health, safety and hazards assessment. Specific concerns include:

- The assessment does not meet legislative requirements, including the objectives of the NSW *Protection of the Environment Operations Act 1997* (POEO Act) as filtration has not been considered for the ventilations facilities
- The assessment does not address the Planning Secretary's Environmental Assessment Requirements (SEARs) including:
  - How the design minimises adverse health impacts and maximises health benefits
  - Objectively assessing how the design minimises health impacts
  - Identifying mitigation measures that would be implemented to minimise adverse health impacts.
- The assessment is too complicated for community members to understand actual health impacts.

Response

Adequacy of the assessment

The EIS, including the health, safety and hazards assessment, has been prepared in accordance with Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), the SEARs and Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW). The applicable SEARs, and the location in which they are addressed in the EIS, can be found in Table 10-1 of the EIS.

The NSW Environment Protection Authority (NSW EPA) will regulate the ventilation outlets as part of an Environment Protection Licence (EPL) issued for the project under the POEO Act, should it be approved. Continuous monitoring to ensure compliance with the limits in the EPL will be undertaken.

The NSW Chief Health Officer completed a review of the ventilation outlet assessment and stated that the methodology used for air quality modelling presented in the EIS is logical and reasonable. The full review is accessible on the NSW Department of Planning and Environment website[1] (under Attachments & Resources). The Advisory Committee for Tunnel Air Quality (ACTAQ) also found that the air quality assessment and modelling completed for the project constitutes a 'thorough review of high quality'. Responses to ACTAQ's submission on the EIS are located in **Chapter B1**.

Design considerations of potential health impacts

The project has been designed with consideration of measures that would minimise impacts on the community, including on health and wellbeing. Some of the key design changes that have been incorporated into the project to minimise impacts on community health include:

- Selection of a road tunnel instead of the development of a surface road, thereby reducing potential impacts on air quality, visual amenity and noise for residents along the reserved corridor and providing increased use of existing surface roads for cyclists, pedestrians and public transport
- Tunnel and portals designed to minimise impacts on surrounding parkland

[1] http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8931

- Extension of the shared cycle and pedestrian pathway in the southern part of the project footprint to provide greater active transport access and connectivity for the local community (refer to the preferred infrastructure report).

In addition, the tunnel ventilation system has been designed to meet the in-tunnel air quality criteria, ensure emissions are dispersed so that there are minimal or no effects on air quality, with no portal emissions. The design considerations included ensuring the location, height, diameter and emission ventilation rate from the ventilation outlets minimises local air quality impacts.

Mitigation measures

In addition to minimising adverse health impacts through project design, a number of mitigation measures have also been identified and are summarised in **Chapter D1** (Environmental management measures).

Complexity of the assessment

It is acknowledged that the methodology for the health, safety and hazards assessment is very technical and not accessible to the layperson. In writing the health, safety and hazards assessment, Roads and Maritime sought to use less technical terms and jargon and more common language, where possible. The EIS has been reviewed by technical editors and communications personnel with the intent of making the document readable for the general public. The consultation process for the project has been aimed at creating an open dialogue through many mediums (community information sessions, email, mail, social media, and doorknocking) to ensure information is communicated on a level that everyone is able to participate in.

C9.1.2 Adequacy of the health impact assessment

Submitters raised concern about the adequacy and scope of the health impact assessment (HIA). Specific concerns include:

- The assessment does not/should consider:
  - Current data
  - The wide range of health impacts associated with roads
  - Health impacts on residents of future high rise apartments
  - Health impacts from shorter term exposure to particulate matter (PM) and nitrogen dioxide (NO_2) which is less than the 24 hours prescribed in the NSW Department of Health guideline
  - Health impacts resulting from in-tunnel concentrations in the case of ventilation failure.
- Concern about the quality and scope of the quantitative aspect of the assessment, including:
  - The quantitative assessment of health impacts is inadequate as the baseline data against which an assessment of a variety of health impacts could be assessed has not been made available. This is of concern, as there are many health end points for which exposure-response relationships have been identified
  - There is no quantitative assessment of construction impacts, especially dust impacts.
- The assessment has used the change in annual average NO_2 and PM as the basis for assessment against the short term health endpoints. This is inappropriate, and is likely to result in diluted exposure and therefore an underestimation of potential risk
- Inadequate assessment of long term health impacts from construction.

Response

Adequacy and scope of the HIA

The HIA has been carried out to define, assess, and quantify where possible, potential risks to human health from the construction and operation of the project. The assessment has been carried out in accordance with current national and international guidelines that have been endorsed/accepted by Australian health and environmental authorities. This approach has been chosen to understand the wide range of potential human health impacts associated with the project, and to address the SEARs issued by the Planning Secretary of DP&E, as detailed in section 10.1 of the EIS.

The quantification of human health impacts has been informed by the findings of the air quality impact assessment (refer to Chapter 9 (Air quality) of the EIS) and noise and vibration assessment (refer to Chapter 11 (Noise and vibration) of the EIS). Thorough reviews of both the HIA and supporting assessments have been carried out by independent peer reviewers, including international experts engaged by ACTAQ and the NSW Office of the Chief Scientist and Engineer, amongst other reviewers. Further, the EIS, including the air quality assessment report, has been reviewed by specialists from key government agencies including the NSW EPA and NSW Health.

The HIA considers the key human health impacts the project would have in relation to local and regional air quality, in-tunnel air quality for tunnel users, noise and vibration, and social changes. This includes consideration of direct and indirect impacts from construction and operation of the project on both the local community and the wider Sydney population.

The future development of land (including rezoning) in the vicinity of the project ventilation outlets, that may involve multistorey buildings above 30 metres in height, would need to consider the air dispersion performance of the outlets. Roads and Maritime would assist Bayside Council in determining any relevant land use considerations applicable to future development for inclusion in local environmental plans or development control plans, where required, to minimise health impacts on residents of future high rise apartments.

In-tunnel exposure in the case of ventilation failure

In the unlikely event of the failure of the ventilation system, for example through loss of power or other system failure, the tunnel would be closed, so no impacts on health would occur. Redundancy has been built into the electricity supply system for the project. If electricity supply is not available despite the inbuilt dual redundancy, a system of uninterrupted power supply batteries would provide backup power for operation of essential equipment, including fire and life safety systems.

Quantitative assessments in the HIA

The HIA has been carried out using a mixed methods approach. This means that both quantitative and qualitative data has been used to understand potential project impacts or risks to health. In assessing potential impacts on air quality, for example, a *quantitative* hazard assessment was first carried out, which involved identifying the air quality change associated with the project, and identifying the health outcomes of this change. This is described as an exposure-response relationship. The exposure-response relationships have been derived from published peer reviewed sources and relate to the identified health endpoints (ie effects/outcomes).

In some cases, a *qualitative* approach has been taken to understand risks or impacts the project would have on health. While this approach does not specifically require the quantification of risk exposure, it provides a relative or comparative evaluation of whether the exposure or impact is considered to be positive or negative. In cases where there may be a negative impact; the assessment also considers whether this impact is acceptable or unacceptable in the local population.

The risk assessment carried out for the project has utilised exposure-response functions and relative risk values that relate to the more significant health endpoints where the most significant and robust positive associations have been identified. The approach does not include all possible subsets of effects that have been considered in various published studies. However, the assessment undertaken has considered the health endpoints/outcomes that incorporate many of the subsets, and has used the most current and robust relationships.

An assessment of the impacts on air quality during construction has been carried out using a semi-quantitative assessment approach. This approach included identifying the range of activities that would be carried out during construction, the potential emissions from these activities, and the location of these activities in relation to identified sensitive receptors. The potential health impacts of dust (for example) generated during construction was then allocated a risk classification, which considered the proximity of the source to the number and types of receptors. This approach identifies the relevant hazards, assesses or quantifies their likelihood of occurrence, including the consequences associated with these events occurring. This approach allows the provision of an estimate of the risk levels for people who could be exposed, to support the recommendation of appropriate mitigation measures.

Inadequate use of data

The data to establish the baseline health of the population in the study area and relevant information on the existing health aspects of the population, has been obtained from the Australian Bureau of Statistics (ABS) Census 2011, information relevant to local government areas (LGAs) and health districts (in particular South Eastern Sydney and Sydney Local Health District (LHD)). In some cases, where local data was lacking, information has been obtained (or compared with) data from larger population areas of Sydney and/or NSW. The data from the year 2011 was used because complete data from later years was not available at the time the health risk assessment was undertaken in 2018.

Assessment of short term health endpoints

The exposure assessment carried out as part of the HIA includes an assessment of acute (short term) and chronic (long term) inhalation exposures relevant to the project.

Short term inhalation averages of 1 hour for NO_2, and 24 hours for PM have been used as the basis for assessment against short term health endpoints.

Long term health impacts of construction

Issues related to health impacts from construction fatigue, where the community may be located close to construction facilities for extended periods of time, as a result of the number of construction projects being carried out in similar locations, are further addressed in section 10.8 and section 10.10 of Appendix F (Human health technical report) of the EIS. These sections also detail the definition and methodology for the assessment of impacts from longer duration construction (construction fatigue).

The assessment provides consideration for longer duration construction impacts arising from noise and vibration from several projects that are not considered to be transient and/or short-term. The key areas where these impacts may be of concern, both from consecutive and overlapping construction periods were identified and mitigation measures proposed to minimise these impacts.

Further responses to issues around cumulative impacts on health, safety and hazards are discussed **section C9.7** .

C9.1.3 Adequacy of the methodology used to assess impacts on human health and safety

Submitters raised concern about the methodology used to assess the health, safety and hazards of the project. Specifically concerns included:

- The guidelines against which the health impacts have been assessed are not justified
- Pollutants included in the assessment have been selected so that the assessment would show compliance with air quality guidelines, and does not consider other harmful pollutants, such as:
  - Compounds from tyres and brake pads
  - Metals
  - Dust particles from sandstone and other hard rocks
  - Biologically relevant exposure concentrations of odorous materials.
- The Permanent International Association of Road Congresses (PIARC) guidelines are not robust enough to provide sufficient protection from the health impacts that would occur as a result of using the tunnels for long journeys on a regular basis.

Response

Relevant guidelines

The guidelines chosen for the assessment, as detailed in section 3.2.1 of Appendix F (Human health technical report) in the EIS, have been adopted for use in the HIA, as they are in accordance with national and international guidance, and have been endorsed/accepted by Australian health and environmental authorities. The HIA has been produced in accordance with international best practice and general principles and methodology that have been accepted in Australia by groups/organisations, including the National Health and Medical Research Committee (NHMRC), National Environment Protection Council (NEPC) and enHealth. The guidelines against which potential health impacts resulting from changes to air quality are assessed are based on protection of the health of all members of the population for exposure to these pollutants over a short period of time as well as all day, every day. Similarly, for noise and vibration, the identified guidelines are based on the protection of health and wellbeing (including sleep disturbance) during all phases of the project, both construction and operation.

Pollutants of concern

The HIA includes an evaluation of the principal pollutants identified in the air quality assessment that may impact upon ambient air quality. These include NO_2, CO, PM_{10} and $PM_{2.5}$. It is important to note that PM_{10} and $PM_{2.5}$ are not in themselves a specific compound (such as NO_2), but rather are particles that are comprised of a variety of different compounds that are of a specific size (ie $PM_{2.5}$ is comprised of particles that are generally 2.5 micrometres or smaller). As such, in assessing changes to the concentrations of PM_{10} and $PM_{2.5}$ during construction and operation of the project, the assessment provides consideration for a variety of different pollutants, even if they have not been separately assessed. For example, compounds from tyres and break wear (including metals, organic materials and silicon compounds), and dust particles resulting from construction activities (including excavation activities) have been identified in Annexure A of Appendix E (Air quality technical report) of the EIS as a generator of PM.

For more detail on odour impacts during construction, refer to **section C9.2.1**.

PIARC guidelines

The development and application of PIARC conversion factors is unrelated to the duration of tunnel use. The detailed PIARC method used for the air quality assessment for the project used the local Sydney vehicle fleet emissions factors. The ventilation system has been designed to comply with, and will be operated in accordance with the NSW Government's In-Tunnel Air Quality (Nitrogen Dioxide) Policy, which includes some of the most stringent criteria in the world to protect tunnel users.

C9.2 Human health impacts during construction

79 submitters have raised issues regarding the human health impacts during construction of the project. Refer to section 10.3 of the EIS for details of the human health impacts during construction.

C9.2.1 Health impacts from changes to air quality during construction

Submitters raised concern about health impacts from changes to air quality around roads, emissions and fumes from construction equipment, dust generation and the release of odours during construction, including:

- Respiratory illness, lung cancer, asthma and heart disease
- Impairing lung and nervous system development in children
- Special concern for children and those with allergies.

Response

Emissions and fumes

The risks associated with exhaust emissions from construction traffic and diesel powered equipment from all proposed construction ancillary facilities and spoil haulage routes were assessed in section 9.5 of the EIS. Exhaust emissions from on-site plant and site traffic are unlikely to have a significant

impact on local air quality and therefore human health (eg respiratory health). The contribution of construction related heavy and light vehicle traffic would be relatively minor compared to existing background traffic flows and therefore potential increases in emissions would be minor. Heavy vehicles used for construction are expected to use major roadways and minimise the use of local roads.

The use of mains electricity would be favoured over diesel or petrol-powered generators, where practicable, to reduce site emissions. Engine idling will also be minimised when plant is stationary, and plant will be switched off when not in use to reduce emissions. Significant impacts on receivers from construction traffic and equipment (ie particulate matter and NO_2 from exhaust emission or residual dust emitted from vehicles) would be avoided through the implementation of effective, industry standard mitigation and management measures.

Construction dust

The risks associated with construction dust emissions have been assessed in the EIS for four types of activities, including: demolition, earthworks (including tunnelling), construction, and from construction vehicles exiting work sites. The air quality assessment also considered the impacts of these activities, including: annoyance due to dust soiling, human health impacts, and ecological impacts. The findings of the assessment details the risks of dust impacts without the application of any mitigation measures.

Several locations and activities were determined to be of high risk. The assessment found that all activities carried a high level of risk for construction dust impacts at the proposed construction sites at Rockdale, President Avenue, Princes Highway, and at the construction sites for the shared cycle and pedestrian pathways. Consequently, a range of management measures have been recommended to mitigate the effects of construction dust, as detailed in **Chapter D1** (Environmental management measures). Effective mitigation of construction dust would also mitigate potential impacts on human health (eg respiratory health).

Odours

Odour in itself would not have a significant impact on human health, although it can indicate the presence of pollutants in the air. Potential odour impacts during construction have been considered in the air quality impact assessment, as per the odour assessment criterion in the NSW Approved Methods.

The assessment concluded that the main potential source of odour for the project is the release of hydrogen sulphide (H_2S) gas when excavation activities for the construction of the cut-and-cover structures at the President Avenue construction ancillary facility (C3) may disturb acid sulfate soils. These soils have the potential to release odorous H_2S into the atmosphere, thereby impacting nearby receptors.

The dispersion modelling for odour shows that there are not expected to be any exceedances of the H_2S criteria at sensitive receptors and therefore is not expected to impact on human health. This is not to say that there will be no odour experienced at these locations, but that it is not predicted to be above the criteria for more than 1% of the time. The level of odour emission is dependent on the odour concentration of the material being excavated and the sizes of the areas left exposed.

As outlined in environmental management measure AQ3 in **Chapter D1** (Environmental management measures), odour impacts during construction will be managed as follows:

- Odorous material will be treated immediately on-site, and removed from site where necessary. Areas of odorous materials will be excavated in a staged process to allow for treatment and handling. Exposed areas of odorous material will be kept to a minimum to reduce the total emissions from the site
- On-site odour measurements will be carried out during excavation works to determine odour emission rates. Results from the monitoring will be used to inform future excavation and treatment activities on site.

In addition, acid sulfate soil management plans will be developed for all excavation works within the ancillary facilities and along the shared cycle and pedestrian pathways construction area to minimise any odour impacts from acid sulfate soils.

C9.2.2 Health impacts from noise and vibration during construction

Submitters raised concern about the health impacts of 24/7 noise and vibration generation during construction (from road works, machinery and construction traffic). Submitters were also concerned about construction extending into night-time when works are behind schedule. Specific health concerns relate to:

- Reduced sleep and sleep disturbance
- Hearing impairment.

Response

Health impacts from noise and vibration during construction

The construction noise modelling and assessment has been informed by applicable NSW legislation and guidelines. The recommended noise mitigations are in accordance with these guidelines, which have been developed with consideration for current international practices, health impacts of noise and to protect vulnerable people.

Potential increases in noise for sensitive receivers due to construction traffic have been assessed separately from the assessment of noise from other construction activities.

Noise from construction traffic

Heavy vehicles used for construction are expected to use major roadways and minimise the use of local roads. In all, traffic noise from construction road traffic was estimated to be generally compliant with the noise levels in the relevant noise guidelines (ie increases of up to 2 dB(A) are considered to not be a discernible change). Exceptions to this include:

- Bruce Street – Increased traffic noise during day time haulage for the construction of the shared cycle and pedestrian pathways, where exceedances were predicted to be up to 2.4 dB(A). However, work is expected to last less than three months at this location and the impact when compared to the overall construction program is considered insignificant. In addition, the noise modelling is conservative, meaning that it is unlikely the predicted impact will be realised
- Rockdale construction ancillary facility (C2) – Increases in noise of up to 7.3 dB(A) during potential night-time spoil haulage activities
- Wickham Street – Increases in road traffic noise of 2.5 dB(A) during night-time off-peak periods (noting a change of less than 3 dB(A) is generally considered indiscernible).

Construction vehicle movements (on- and off-site) will be managed to avoid or minimise noise impacts. Where reasonable and feasible, spoil will only be removed from site during the day. Mitigation measures for vehicle movements outside of standard construction hours will be included in a Construction Noise and Vibration Management Plan (CNVMP). Refer to **Chapter D1** (Environmental management measures) for more details on the management of noise impacts during construction.

Noise from construction machinery

The modelling of noise from construction machinery has been based on the type of equipment to be used, where the equipment would be located in relation to the community receptors, the hours of work, the duration of the activities to be carried out, and the local terrain. This modelling has been carried out for a number of construction sites within the study area, and has assessed worst case scenarios, in accordance with the Roads and Maritime *Construction Noise and Vibration Guideline* (CNVG).

The assessment found that overall, exceedances of over 25 dB(A) would likely occur during different phases of construction at different construction sites for over one hundred receptors. The noise criteria for sleep disturbance or awakening were also exceeded for several hundred identified receptors during the course of construction.

Proposed mitigation measures have been identified to address these noise impacts. These include work scheduling, temporary noise hoarding, respite periods, plant and equipment selection, and traffic management.

Noise impacts from the construction of the powerline from the Ausgrid Canterbury sub-transmission substation to the Rockdale (south) motorway operations complex, has also been assessed. It was predicted that noise impacts would exceed the noise management levels by up to 36 dB(A), with maximum L_{Aeq} noise levels predicted up to 84 dB(A). Receptors experiencing these noise levels are likely to be highly affected and it is predicted that these impacts could last up to a few weeks.

All residents affected by noise from the construction of the project which are expected to experience an exceedance of the construction noise management levels will be notiifed about the project prior to the commencement of the particular activity, with the highest consideration given to those that are predicted to be most affected as a result of the works. A CNVMP would also be prepared for the project which will describe the process(es) that will be adopted for carrying out location and activity specific noise and vibration impact assessments to assist with the selection of appropriate mitigation measures (for example, respite periods). The CNVMP will include standard and additional mitigation measures from the *Construction Noise and Vibration Guideline*[2].

Roads and Maritime would consult with vulnerable members of the community who are likely to be more susceptible to adverse health effects of noise (especially those who are elderly, who do not speak English, are housebound, or who may be unwell) to accommodate their preferences for noise mitigation, as far as practicable.

A Complaints Management System would be in place for the duration of construction. This system would include the recording of complaints and how the complaint has been addressed (within a Complaints Register). Complainants would be contacted within 24 hours to follow up and respond to their complaint. A Community Complaints Commissioner, who is an independent specialist, would oversee the system and would follow-up on any complaint where the public is not satisfied with the response.

In addition, where properties have been identified for architectural treatment to attenuate operational noise and where properties would be impacted by noise from construction works, Roads and Maritime would consult with those property owners on the early installation of treatments to provide noise mitigation during the construction of the project.

Although noise impacts from tunnelling activities are likely to be discernible for up to five days at each affected receiver, with exceedances occurring for up to two days, It is predicted that only one receiver would exceed the ground-borne noise criteria. This exceedance would be up to 1 dB(A) during the night-time period.

Noise and vibration from night-time work

While Roads and Maritime would seek to limit construction activity to standard construction hours wherever practical, it is inevitable that work on major infrastructure projects require some construction activities to be carried out outside of these hours.

Activities to be carried out outside of standard construction hours would include tunnelling and tunnelling support work (including spoil removal), which would need to be carried out on a 24 hour basis. This is required to limit the overall duration of the project. It should be noted however that certain aspects of construction activities cannot be carried out during standard construction hours. For example, Transport for NSW's Traffic Management Centre is unlikely to permit roadworks on main roads such as President Avenue during the day. As such, construction would only be able to be carried out at times that are outside of standard construction hours. Other work may be required outside of standard construction hours for health and safety reasons, or for particular construction requirements. Such works would include:

- Relocation of utilities (where the location is in close proximity to traffic)
- Pavement and median works
- Asphalt works and line-marking
- Use of construction ancillary facilities
- Shared cycle and pedestrian pathway bridgeworks
- Diaphragm wall construction (proposed during the evening period only (6.00pm to 10.00pm).

[2] Roads and Maritime Services (2016) *Construction Noise and Vibration Guideline*

The results of construction noise modelling for out of hours work at each construction ancillary facility and for all surface works is provided in section 11.3.1 of the EIS. Work carried out at times outside of standard construction hours have the potential for noise exceedances and the noise assessment also indicates that the sleep disturbance screening criterion is likely to be exceeded at various locations when night-time work is occurring in close proximity to some residential receivers. Given the nature of the construction work, these impacts are unavoidable. Roads and Maritime will aim to minimise such impacts through the application of standard and, if necessary, additional mitigation measures, as outlined in **Chapter D1** (Environmental management measures). It is recognised however that these measures may not ameliorate all noise impacts upon all sensitive receivers for all works.

A CNVMP will be developed for the project prior to construction and will include protocols that will be adopted to manage works required outside standard construction hours, in accordance with relevant guidelines. Consultation with affected residents for out of hours work will take place with consideration CNVG and Strategy 2 of the NSW EPA's *Interim Construction Noise Guideline*[3].

Noisy work (to be defined in the EPL and/or the conditions of approval for the project) will be scheduled to be carried out during standard construction hours as far as possible. Work or activities that cannot be carried out during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods.

Respite measures will be implemented for noisy work in a manner consistent with EPL and Roads and Maritime guideline requirements.

C9.2.3 Health impacts from increased construction traffic during construction

Submitters raised concern about the health impacts of increased traffic for both road users and residents adjacent to the road including:

- Annoyance, stress and reduced quality of life
- Hypertension and ischemic heart disease.

Response

Changes to local roads are proposed to facilitate construction of the project. These changes would be temporary for the most part, with an expectation that access to all properties would be maintained during construction. There would, however, be some temporary and permanent closures and/or traffic changes that would result in reduced capacity for local roads and affect the movement of local traffic through the area. This could result in an increase in travel times for motorists, public transport users, pedestrians and cyclists. These changes have the potential to result in increased levels of stress and anxiety in the local community during construction over the shorter term however these effects are difficult to quantify in general, or for the project. Longer-term effects on health are also difficult to quantify and only tentative links have been drawn between noise exposure and hypertension, as well as the occurrence of ischaemic heart disease. This is because there are a wide range of complex factors that influence health and wellbeing, specifically mental health. It is also not possible to determine any specific outcomes that may occur as a result of a specific project.

A Construction Traffic and Access Management Plan (CTAMP) will be prepared for the project, detailing temporary road closures and including traffic control procedures, signage requirements, construction traffic management requirements of the relevant Roads and Maritime manuals and procedures and Australian Standards.

Construction road traffic noise was estimated to be generally compliant with the relevant guidelines and is therefore considered unlikely to significantly impact human health. The exception is for some roads around the Rockdale construction ancillary facility (C2) (especially Wickham Street) during night time periods where increased traffic noise was predicted to be up to 7.3 dB(A) above the existing level of road traffic noise. Night-time haulage would be avoided during night time off-peak traffic periods to minimise noise impacts where feasible. Sensitive receptors are likely to be highly affected by construction of the permanent power supply when the works are directly opposite the receptor location. As the works move further away from receptors, noise levels would reduce significantly. High noise impacts at any one receptor are unlikely to last for more than a few days for each sensitive receptor.

[3] NSW Department of Environment and Climate Change (2009) *Interim Construction Noise Guideline*

The design of mitigation measures will be outlined in the CNVMP. The aim of the measures would be to reduce noise and vibration to levels that comply with the management goals established in this assessment.

The overall aim of the project is to improve infrastructure, connections and access within the urban environment. Hence on a broader scale, while this project requires long-term management to minimise construction impacts, it may assist in reducing stress and associated physiological and mental health impacts within the urban environment.

C9.3 Hazards and risks during construction

18 submitters have raised issues regarding hazards and risks during construction. Refer to section 10.3 of the EIS for details regarding health, safety and hazards during construction.

Submitters raised concern about hazards and risks to the public during construction. Specifically concerns include:

- Reduced safety from poor repair works on roads and walking and cycling paths adjacent to construction ancillary facilities
- Use of the Roads and Maritime Depot in Rockdale will be unsafe, as it is situated on a major arterial road.

Response

During construction, pedestrian footways and cycling paths may need to be diverted or closed. Alternative cycle or pedestrian access will be provided where it is safe and practical to do so during construction. Pedestrian footways and cycling paths would be reinstated following the completion of construction. Pathways would be reinstated along the widened President Avenue.

The construction ancillary facilities have been proposed at locations that allow vehicles (particularly heavy vehicles) to access and egress via the arterial road network. This is to minimise impacts on the local road network, and utilise existing freight routes. Construction road traffic volumes are expected to be low compared with existing traffic volumes and, as such, is not expected to substantially impact on road safety.

Prior to construction, a CTAMP will be developed, and will address:

- Cycle and pedestrian access arrangements during construction
- Staggered scheduling of spoil truck movements, to minimise the queuing of heavy vehicles.

C9.4 Social impacts on health from changes to open space

17 submitters have expressed concerns about the social impacts on health from changes to open space during construction and operation. Refer to section 10.3 and 10.4 of the EIS for details on the assessment of social impacts on community health.

Submitters raised concern about health impacts and increased stress from changes to open space during construction and operation. Specifically concerns include health impacts associated with:

- The removal of trees and other vegetation as it currently provides shade, improves local air quality and provides noise screening
- Changes to the availability of, or preventing access to, open space or public facilities, including that barriers to open space can result in a reduction of physical activity, visual amenity, wellbeing and an increase in stress.

Response

Vegetation removal

Where reasonable and feasible, impacts on vegetation would be avoided during detailed design or through protecting and retaining trees during construction. Roads and Maritime will also work with local councils and relevant stakeholders to identify suitable spaces to provide replacement trees.

Where removal of trees is unavoidable, trees will be replaced in accordance with the tree management strategy for the project (refer to environmental management measure LVIA5 in **Chapter D1** (Environmental management measures)). The strategy will be used to guide the management of trees that need to be removed and to consider options for their replacement. The replacement of trees will result in a net increase in the overall number of trees present compared to the existing conditions, though it is noted that replacement vegetation would take time to reach maturity.

Access to open space and recreational facilities

The project has been designed to minimise the need for land acquisition, where feasible and reasonable. This includes minimising impacts on private property, which means that some public land, including open space, will be required in order for the project to be constructed. The tunnel entrance on President Avenue has been located to maximise the future functionality of the remaining areas of the Rockdale Bicentennial Park.

Table C9-1 provides clarification of project impacts on open space during construction and operation.

Table C9-1 Impacts on open space during construction and operation

Construction impacts on open space	Operational impacts on open space
Rockdale Bicentennial Park	
Acquisition of about 1.1 hectares plus temporary lease of 7.6 hectares. Works would temporarily restrict access to much of Rockdale Bicentennial Park and the recreational facilities located within the park including the Rockdale Skate Park and disability playground. These facilities would be temporarily relocated to a nearby area of open space to allow the community to continue to benefit from their use during the construction period. The Bicentennial East soccer fields would be temporarily relocated and Brighton Memorial Playing Fields may be reconfigured at their current location to allow the community to continue to benefit from their use during the construction period.	The intent is that much of the space would be reinstated as parkland and would include landscaping works. A concept design for urban design and landscaping works at Rockdale Bicentennial Park has been prepared (refer to Appendix C (Place making and urban design)). Parts of the Park may be subject to minor increases in emissions associated with the tunnel entry/exit ramps and additional traffic on President Avenue. These increases would also be highly localised around the road alignments, with the air quality of the main playing fields of Ilinden Sports Centre and Memorial Fields remaining unaffected. Moderate visual impacts on users of Rockdale Bicentennial Park North as a result of the new shared cycle and pedestrian pathways and bridge and President Avenue surface works.
Scarborough Park North	
Acquisition of about 0.5 hectares plus temporary lease of 0.5 hectares	During operation, the Park will continue to function as open space however there may be some restricted access and detours surrounding the shared cycle and pedestrian pathways and bridge abutments. Parts of Scarborough Park North may be subject to minor increases in emissions associated with the tunnel entry/exit ramps and additional traffic on President Avenue. These increases would also be highly localised around the road alignments. Moderate visual impacts on users of Scarborough Park North as a result of the new shared cycle and pedestrian pathways and bridge and President Avenue surface works.
Kogarah Golf Course	
Acquisition of about 0.7 hectares plus temporary lease of 6 hectares. Reduction of golf course from 18 holes to 9 holes.	Loss of about 0.7 hectares of the golf course. The remainder of land at Kogarah Golf Course to be occupied by the Arncliffe construction ancillary facility (C1) would be returned to the golf club for its former use as a public space. The permanent loss of 0.7 hectares wold not impact on the functionality of the course as an 18-hole course. The new project facilities would not significantly alter local amenity for the golf course or pedestrian and cycle path in terms of air

Construction impacts on open space	Operational impacts on open space
	quality or traffic compared to the approved New M5 Motorway facility. The F6 Extension Stage 1 infrastructure would increase the extent of noise impacts on users of the golf course and pedestrian and cycle path, though these are expected to be minimal on the basis that the noise at the nearest affected residential receptor would not exceed operational criteria. The additional operational footprint of this facility would initially result in a low visual impact to users of the golf course and pedestrian and cycle path. Over time screening vegetation around the facility would mature, obscuring most views to the single-storey building.
Bardwell Valley Golf Course	
The installation of an underground power cable from Canterbury sub-transmission station to the project in Rockdale would require temporary occupation of some parts of the golf course. It is expected that impacts would be limited to discrete construction areas and would not require the full closure of any particular holes, though some may be temporarily shortened during construction.	Nil. The impacted areas of the golf course would be reinstated in full.

Roads and Maritime is continuing discussions with Bayside Council regarding the reinstated layout of Rockdale Bicentennial Park following construction and compensatory facilities during construction.

Some of these facilities would be offset with new facilities at nearby locations to ensure continuity of facilities for the community. The construction and installation of these facilities would be subject to separate planning approvals and are outside the scope of the EIS. Roads and Maritime will continue to work with Bayside Council to complete the Recreation Needs Analysis for the area, including the final relocation plan and permanent reconfiguration of the Rockdale Bicentennial Park facilities. Roads and Maritime will also consult with key stakeholders through the Stakeholder Liaison Group during the development of offset facilities and permanent reconfiguration of the Rockdale Bicentennial Park facilities. The outcome of the Recreation Needs Analysis will confirm the features that will be provided at the reinstated Rockdale Bicentennial Park.

Although changes to visual amenity can increase levels of stress and anxiety, these impacts are expected to be of short duration as most people adapt to changes in the visual landscape. This is particularly the case when these changes occur within an already urbanised area. Most changes in visual impacts are not expected to have a significant impact on the health of the community.

C9.5 Human health impacts during operation

269 submitters have raised issues regarding health impacts during operation of the project. Refer to section 10.4 and Appendix F (Human health technical report) of the EIS for details of human health impacts during operation.

C9.5.1 Health impacts from changes to air quality during operation

Submitters raised concern about health impacts during operation. Specifically concerns related to health impacts from changes to air quality at the tunnel entry points, within the tunnels, on surrounding roads, and emissions released from unfiltered ventilation facilities (particularly the ventilation facility proposed on West Botany Street) including:

- Respiratory illness, lung cancer, asthma and heart disease
- Impairing lung and nervous system development in children
- Special concern for the wellbeing of students at local schools, and those with allergies

- Special concern for regular users of the tunnels, and concern that the in-tunnel criteria for NO_2 emissions would be exceeded.

Response

A key operating restriction for road tunnels over one kilometre long is the requirement for there to be no emissions of air pollutants from the portals. The ventilation system for the tunnel is designed to prevent portal emissions and air velocity monitors will be placed near the portals to ensure that this requirement is met.

To avoid portal emissions, the polluted air from within a tunnel would be expelled from the ventilation facilities at the Arncliffe motorway operations complex (MOC1) and the Rockdale motorway operations complex (MOC3). There are some circumstances when portal emissions may be permitted, such as emergency situations.

An assessment of ambient air quality impacts on community health is provided in section 10.4.2 of the EIS and the assessment includes consideration of risks relating to particulate matter and NO_2.

The HIA has been undertaken to consider both cumulative exposure impacts and incremental exposure impacts associated with changes in $PM_{2.5}$ and PM_{10} concentrations that are associated with the project. Specific health endpoints that were explicitly evaluated as part of the HIA include:

- Primary health indicators: $PM_{2.5}$
  - Mortality all causes (long term effects, ages 30+)
  - Cardiovascular hospitalisations (short term effects, ages 65+)
  - Respiratory hospitalisations (short term effects, ages 65+)
- Secondary health indicators: $PM_{2.5}$
  - Mortality all causes (short term effects, all ages)
  - Mortality, cardiopulmonary (long term effects, ages 30+)
  - Mortality, cardiovascular (short term effects, all ages)
  - Mortality, respiratory (short term effects, all ages)
  - Asthma emergency department hospitalisations (1–14 years)
- Health indicators: NO_2
  - Mortality all causes (short term effects, all ages)
  - Mortality, respiratory (short term effects, all ages)
  - Asthma emergency department hospitalisations (1–14 years).

Review of the calculated changes in risk indicates the following in relation to impacts associated with the expected operation of the project in 2026 and 2036, including the cumulative scenario:

- A number of the calculated individual risks for the community receptors are negative, meaning that the operation of the project would result in lower levels of health risk, when compared with the situation where the project is not operating
- The maximum risks calculated for exposures in residential areas are considered to be tolerable/acceptable
- The maximum risks calculated for exposures in commercial/industrial areas are and considered to be tolerable/acceptable
- All maximum risks calculated for continuous exposures in childcare centres, schools, aged care homes and open space areas are considered to be tolerable/acceptable
- In relation to impacts on the health of the population in the local community, the calculated change in incidence of the health indicators evaluated shows that the increased incidence of the evaluated health effects occurring in the population in the study area ranges from 0.001 to 0.11 cases per year, which would not be measurable and is considered to be negligible.

Review of the calculated impacts in terms of the change in incidence of the relevant health effects for $PM_{2.5}$ in the community, predicts the following:

- There would be a decrease in incidence of health effects for $PM_{2.5}$ with the project, predicated for 2026 and 2036. The number of cases however is very small, less than one for all health effects considered. As a result, these changes would not be measurable within the community
- Most individual local government areas (LGAs) show a total decrease in health incidence. There are two LGAs (Kogarah - Rockdale and Hurstville) where there is an increase. These increases and decreases are also very small, less than one for all health effects considered. As a result, these changes would not be measurable in the community
- Review of the incidence calculated for the individual suburbs indicates that these predominantly relate to small decreases in health incidence with some suburbs showing an increase. The largest increase in health incidence for any individual suburb is less than 0.1 cases. Hence there are no individual suburbs within the LGAs where there is a change incidence that is of significance or would be measurable.

The potential human health impacts of the project have been modelled, assessed and management measures proposed. Refer to **Chapter D1** (Environmental management measures).

The project is expected to result in an overall decrease in total ground level pollutant levels in the local area. The project is expected to result in a redistribution of impacts associated with vehicle emissions, specifically in relation to emissions derived from vehicles using surface roads. 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 air quality (specifically nitrogen dioxide and particulates) within the local community have been assessed and are considered to be tolerable/acceptable. The air quality guidelines currently available from NEPC are consistent with health based guidelines currently available from the World Health Organisation and the United States Environment Protection Agency, which are specifically listed to be protective of exposures by sensitive populations including asthmatics, children and the elderly.

Repeated tunnel use was also considered in the HIA, with available data on the health effects associated with short-duration exposures indicating that the effects are transient, meaning that they only relate to the peak exposure that has occurred. Repeated exposures that may occur as a result of morning peak and afternoon peak travel are not considered to be additive. Provided the average nitrogen dioxide concentrations that occur during the travel times in the vehicle are below the health based guidelines, which is expected to be the case for the expected traffic conditions, then no significant adverse health effects are expected.

Individuals that regularly use the road network, including taxi and courier drivers, should keep their windows up and ventilation on recirculation to minimise exposures throughout the day.

Modelling of the in-tunnel air quality demonstrates that the ventilation system design will ensure that the in-tunnel goal for NO_2 will be achieved for all scenarios. This goal of 0.5 ppm (parts per million) is a 15 minute average over the length of all possible trips through the F6 tunnels and adjoining WestConnex tunnels.

C9.5.2 Health impacts from increased noise during operation

Submitters raised concern about the health impacts of increased noise from changed traffic conditions, including:

- Reduced sleep and sleep disturbance
- Hearing impairment.

Response

Noise sensitive receivers in the vicinity of the project (for example at the surface along President Avenue) are currently affected by appreciable levels of road traffic noise which exceed the noise criteria in most instances. Existing noise issues outside the extent of the project are addressed through the Roads and Maritime noise abatement program (NAP).

Notwithstanding, the noise assessment predicts that noise criteria will be exceeded at a number of properties adjacent to the project without mitigation measures, with 109 properties considered eligible for additional mitigation measures due to operational noise. These properties are primarily along the Princes Highway and President Avenue. While 109 properties have been identified as appropriate for additional mitigation measures, many of these properties currently experience elevated noise levels so mitigation measures may provide a net benefit to these receptors.

Mitigation measures will be applied at the source where possible with at-property architectural treatments for noise only considered when all other options are exhausted. Refer to environmental management measure NV08 in **Chapter D1** (Environmental management measures).

C9.5.3 Health impacts from increased traffic during operation

Submitters raised concern about the health impacts of increased traffic on both motorists and residents adjacent to the road, including:

- Annoyance, stress and reduced quality of life
- Sleep disturbance
- Hypertension and ischemic heart disease.

Response

The existing emissions associated with motor vehicle use on surface roads would be displaced into the mainline tunnels and emitted via the ventilation outlets. The air quality assessment for the project predicted outlet concentrations to be below the relevant air quality criteria.

Air quality modelling predicted noticeable decreases for the key pollutant $PM_{2.5}$ along several roads, including Botany Street, General Holmes Drive, The Grand Parade to the north of President Avenue, President Avenue to the east of the F6 Extension Stage 1, and Marsh Street. These changes reflect reductions in the surface road traffic of between 2-22 per cent on these roads.

Tunnel infrastructure will be designed in such a way that the generation of pollutant emissions by the traffic using the tunnel is minimised. In-tunnel air quality will be managed through monitoring and management of the ventilation systems and, where necessary, traffic management (refer to environmental management measure AQ4 in **Chapter D1** (Environmental management measures)).

Traffic congestion and long commuting times can contribute to increased levels of stress and fatigue, more aggressive behaviour and increased traffic and accident risks on residential and local roads as drivers try to avoid congested areas[4]. Increased travel times reduce the available time to spend on heathy behaviours such as exercise, or engage in social interactions with family and friends. Long commute times are also associated with sleep disturbance, low self-rated health and absence from work. Reducing travel times and road congestion is expected to reduce these health impacts.

[4] Hansson, E, Mattisson, K, Björk, J, Östergren, P-O & Jakobsson, K (2011) 'Relationship between commuting and health outcomes in a cross-sectional population survey in southern Sweden', BMC Public Health, vol. 11, no. 1, p. 834

C9.5.4 Health impacts from increased car usage

Submitters raised concern that the project would result in increased car use, which would cause impacts on health including:

- Increased stress and anxiety, including feelings of isolation and depression
- Increased risk of diseases such as diabetes, heart disease and obesity
- Increased alcoholism and respiratory problems
- Discouraged use of active transport leading to reduced health within the community.

Response

Over half (57.5 per cent) of the traffic and transport assessment study area currently travel to work by car (as a driver). The project would reduce the time these commuters spend in their vehicles by improving journey times. The project would not preclude rail and bus service infrastructure improvements from occurring as they would address different objectives. Any rail infrastructure and bus service improvements are likely to be complementary to the project as they would further reduce the number of vehicles on surface roads and would provide opportunity for place making at key strategic centres.

During operation, the project would also deliver new shared cycle and pedestrian pathways that would enhance access and connectivity for pedestrians and cyclists, and would provide further socio-economic benefits through health benefits, increased opportunities for social interaction and community cohesion, reduced car dependency and reduced cost of travel.

C9.6 Hazards and risks during operation

Three submitters have raised concerns about hazards and risks during project operation. Refer to section 10.4 of the EIS for details of the hazards and risks during project operation.

Submitters raised concern over the hazards and risks to the public during operation. Specific concerns include public safety from changes to:

- The increase in the amount of accidents involving heavy vehicles such as trucks and other freight vehicles
- The tunnel design disregards safety recommendations previously provided for the NSW Government by Judge Coate following the Burnley Tunnel traffic crash coronial inquest in 2007, by not providing emergency lanes and eliminating the need for lane-changing
- Existing walking and cycling paths may no longer be safe.

Response

Traffic crashes and fires

Section 10.4.5 of the EIS describes the potential public safety risks to the community during operation of the project. Any road project carries an inherent risk of vehicle collision associated with its operation.

The project has been designed to provide for efficient, free-flowing traffic in the tunnels with physical capacity to accommodate predicted traffic volumes. The design has incorporated all feasible and reasonable design measures in relation to geometry, pavement, breakdown bays, lighting and signage. The design is consistent with current Australian Standards, road design guidelines and industry best practice, inherently minimising the likelihood of incidents and crashes. The management and improvement of road design guidelines by the NSW Government are outside the scope of the project.

Tunnel features designed to minimise the disruption caused by incidents and crashes include:

- Height detection system prior to the tunnel entry portals
- Tunnel barrier gates to prevent access in the event of tunnel closure
- Closed-circuit television (CCTV) throughout the tunnel and approaches

- Adjustable speed signs
- Appropriately spaced breakdown bays (large enough for vehicles to park safely without interrupting traffic flow) and emergency telephones
- Vehicular cross-passages to allow for emergency services vehicles to switch between the northbound and southbound tunnels.

The project has also been designed to meet appropriate fire and life safety requirements in the event of an incident or accident in the tunnel, as described in Chapter 6 (Project description) of the EIS. Consultation has been undertaken and would be ongoing with Fire and Rescue NSW and other emergency services to ensure the fire and life safety requirements are achieved.

Each project tunnel would be one-directional, reducing the risk of crashes through head-on collisions and simplifying smoke management and egress requirements. The transport of dangerous goods and hazardous substances would be prohibited through the mainline tunnels and entry and exit ramps, reducing the risk of very large fires or the release of toxic materials in the tunnel.

The likelihood of a fire during operation of the project cannot be entirely removed. Uncontrollable human factors inherently lead to a residual risk of incidents and crashes, although the likelihood of such events would be low.

In the event of an incident, approaching traffic would be prevented from entering the mainline tunnels. Vehicle occupants at the location of the fire and upstream of the fire source would be instructed to stop their vehicles, and exit in the opposite direction through the section of carriageway that would be protected by the smoke management system, or through an exit door to a cross-passage leading to the other ('non-incident') mainline tunnel.

Occupants downstream of the fire source would be encouraged to continue driving out of the tunnel. If this is not possible and they are forced to evacuate on foot, egress would be provided via an exit door to a cross-passage leading to the non-incident mainline tunnel. Emergency services would be able to reach the fire source via the non-incident tunnel (by vehicle or foot), or from the upstream direction in the affected tunnel (by foot).

The frequency of crashes on the roads in the vicinity of the President Avenue intersection would be expected to increase in proportion to forecast traffic volume growth. The potential for crashes – indicated by the crash rates per vehicle kilometres travelled on the existing road network would remain. By 2036, the growth in traffic volumes in the 'do minimum' scenario is forecast to result in a proportional rise in crash frequencies and costs along some road sections in the vicinity of the project including along President Avenue and The Grand Parade (refer to section 8.3.5 of Appendix D (Traffic and transport technical report) of the EIS.

The frequency of crashes on the roads in the vicinity of the St Peters interchange would be expected to increase in proportion to forecast traffic volume growth in the future. The potential for crashes indicated by the crash rates per vehicle kilometre travelled would remain. By 2036, the growth in traffic volumes would create a proportional rise in crash frequencies and costs along the road sections outlined in section 8.3.5 of Appendix D (Traffic and transport technical report) of the EIS, which includes sections along Princes Highway and Euston Road.

This analysis has been undertaken assuming the future frequency, type, and severity of crashes would be consistent with historic trends. On this basis the forecast growth in traffic would be expected to result in both the total number and cost of crashes increasing.

Active transport safety

Impacts on active transport (walking and cycling) facilities during operation of the project are assessed in section 8.2.7 of Appendix D (Traffic and transport technical report) of the EIS.

Although President Avenue does not currently form part of the mapped cycle network, cyclists may currently use President Avenue to connect to the existing cycle network. While increased traffic along President Avenue could increase the safety hazard for cyclists, removal of on-street parking as part of the project would have the following benefits for cyclists:

- Removal of the potential hazard for cyclists of car doors opening in front of them
- Removal of the safety hazards associated with cyclists moving into and out of the parking lane.

With three lanes of traffic proposed along President Avenue, the cyclists could ride in the middle of the left lane (as allowed by the road rules, and recommended by cycle bodies).

Once completed, the project would deliver new pedestrian and cyclist infrastructure project in the form of shared cycle and pedestrian pathways. The shared cycle and pedestrian pathways would be developed from Bestic Street, Brighton-Le-Sands south to Civic Avenue, Kogarah through the reinstated Rockdale Bicentennial Park. A dedicated shared bridge would be built over President Avenue as part of the shared cycle and pedestrian pathways, providing a safe connection. An extended cycle and pedestrian pathway is also proposed in the southern part of the project footprint, connecting to Chuter Avenue/O'Connell Street (refer to a detailed description and assessment in the preferred infrastructure report).

Improvements in the active transport network, including improvements in transport connections, will have a positive benefit on community health.

C9.7 Cumulative health, safety and hazards impacts

29 submitters have raised issues regarding the cumulative health, safety and hazards impacts of the project. Refer to section 8.4 of Appendix F (Human health technical report) of the EIS for details of cumulative health and safety impacts of the project.

Submitters raised concern about cumulative health, safety and hazard impacts of the project. Specifically, concerns include the cumulative health risks to the community from:

- Vehicle emissions and poor air quality (smog) leading to serious health impacts
- Large numbers of people experiencing sleep disturbance due to increased traffic noise
- Traffic crashes including traumatic injuries and mortality
- Psychological and physiological impacts from construction fatigue.

Response

Cumulative impacts from vehicle emissions

Various pollutants associated with vehicle exhaust emissions were assessed for the project and cumulative scenarios in the HIA.

For the assessment of exposure to volatile organic compounds and polycyclic aromatic hydrocarbons, the HIA found no acute or chronic risks to the community with the inclusion of the project (refer to section 10.4 of the EIS).

A cumulative assessment of carbon monoxide and nitrogen dioxide found the concentrations to be below the relevant health based guidelines, with no adverse health effects expected on local communities around the project footprint.

Cumulative operational noise impacts

A cumulative assessment of operational noise impacts associated with increased traffic is discussed in section 6.1 of Appendix G (Noise and vibration technical report) of the EIS. Noise levels are predicted to exceed the cumulative noise limit at 92 sensitive receivers. These receivers are considered eligible for the consideration of feasible and reasonable noise mitigation measures, as described in **Chapter D1** (Environmental management measures).

Cumulative increase in road traffic incidents

The traffic assessment undertaken in the EIS has assessed the cumulative impact of the project together with other approved or planned road projects. In the 'Do something' scenario, the cumulative impact of the project and other major road projects including NorthConnex, the WestConnex program of works and Sydney Gateway, have been assessed. In the 'Cumulative' scenario, the cumulative impact of the projects included in the 'Do something' scenario, as well as the Western Harbour Tunnel and Beaches Link, and future stages of the F6 Extension between Kogarah and Loftus have been assessed. With the project, there would be a higher number of vehicles using the New M5 Motorway which could potentially result in a higher number of crashes on this section of road.

However, the crash rate for motorway tunnels is significantly lower than for surface roads and the impact of the project in reducing surface road crashes by reducing distance travelled on surface roads should be considered as well. This can be seen around the President Avenue interchange where the assessment showed that the project would result in an overall reduction in traffic crashes. At the St Peters interchange, the project was found to have a minimal overall impact on the number of traffic crashes of about one per cent or less.

Construction fatigue

Construction fatigue has been considered in section 10.3.6 in the EIS, particularly in relation to the community surrounding the Arncliffe construction ancillary facility (C1), a facility anticipated to be used for both the New M5 Motorway and the project. The assessment also considers potential construction fatigue risk areas in the vicinity of the C2, C3 and the C6 facilities, including the Princes Highway/President Avenue intersection upgrade, where construction requires extended construction timeframes or coordination with other works such as utility relocations or reconfigurations.

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 project team would ensure the expectations of these stakeholders or community members are managed for the project.

The potential for construction fatigue would be taken into account when finalising the management measures for the project, and the project team would ensure the implementation of these measures is timely.

A Construction Fatigue Protocol would be prepared and implemented for the project (as part of the Construction Noise and Vibration Management Plan) to address construction fatigue impacts. The Protocol will include consideration of noise attenuation and periods of respite for affected stakeholders, where reasonable and feasible, and restricting out of hours work where practicable.

Receptors identified as requiring at-property or operational noise mitigation will be identified and offered treatment prior to commencement of construction works that affects them.

C9.8 Health, safety and hazards environmental management measures

52 submitters have raised concerns about the health, safety and hazards environmental management measures. Refer to **Chapter D1** (Environmental management measures) for details on the health, safety and hazards environmental management measures.

C9.8.1 Health, safety and hazards environmental management measures

Submitters raised concern over the health, safety and hazard environment management measures. Specifically concerns included that environmental management measures:

- Are not made specific to manage health impacts
- Will not manage the potential health risk of:
  - People travelling through the tunnel - the suggested measure to close automobile windows and use air conditioning is inadequate and the ventilation system should be designed to ensure pollutant levels in the tunnel are safe to people exposed to in-tunnel air
  - Dust, such as silica dust (which has carcinogenic potential) could be generated during construction activities such as drilling and grinding of sandstone or other hard rock substrate
  - Stress and anxiety (based on measures implemented on WestConnex projects).

Response

Measures to manage health impacts are multi-faceted and draw on the measures proposed for air quality, noise and vibration and traffic impacts.

The tunnel ventilation system is designed to ensure that the in-tunnel air quality criteria will be met. The in-tunnel air quality criteria are designed to protect the health of motorists and any workers in the tunnel. Appendix E (Air quality technical report) of the EIS states that the ventilation systems are designed to maintain in-tunnel air quality well within operational limits for all scenarios.

Appendix E (also presents a summary of the maximum (by time of the day) predicted average concentrations of nitrogen dioxide for the routes of travel with the highest NO_2 concentrations, using the project and different parts of the tunnel system (assuming all motorway tunnel projects are completed in 2033), for expected traffic within the tunnel. Average nitrogen dioxide levels in some of the travel routes have also been calculated for the extreme congestion scenario of traffic travelling at 20 kilometres per hour. The predicted worst case in-cabin concentration of nitrogen dioxide, where windows are up and ventilation is on recirculation, is also presented.

All trips estimated (eg those entering the F6 Stage 1 tunnels and exiting at St Peters, Iron Cove, Concord Road), the exposure to NO_2 is below the relevant health guidelines and therefore it is unlikely that significant health effects would occur.

The EIS notes that the NO_2 guideline may not be protective of all health effects for all individuals. There is the potential for severe asthmatic individuals, especially if they use motorbikes, to experience some change in respiratory response after using the tunnels, particularly when congested. In addition, for individuals involved in occupations that may require more regular use of the road network, such as taxi and courier drivers, there is the potential for these individuals to make more frequent and varied trips over different travel segments in any one day.

For these sensitive drivers, it is recommended that they keep their windows up and ventilation on recirculation to minimise exposures throughout the day.

Individuals using motorbikes would not have the opportunity to reduce exposure inside the tunnel through the use of ventilation controls. However, the time spent inside tunnels would be less than for other users, particularly in heavy traffic, as motorcyclists can lane filter when traffic is travelling at 35 kilometres per hour and slower. This would limit the amount of time that motorcyclists spend inside the tunnel, even during worst case congested conditions.

No guidelines are currently available for assessing potential health effects that may occur as a result of exposures to particulates that may occur for minutes or hours.

The implementation of environmental management measures for the project would avoid, to the greatest extent possible, risk to public safety. This includes management of dust. If silica dust is encountered it would be managed under the provisions of the *Workplace Health and Safety Act 2011.* In addition, standard environmental management measures will manage any contaminants which may arise during construction and demolition activities (refer to **Chapter D1** (Environmental management measures)).

In addition to these measures, a Construction Environmental Management Plan will be developed and implemented for the project which would be supplemented by site and activity specific Safe Work Method Statements.

C Part C Response to community submissions

C10 Noise and vibration

This chapter addresses issues raised in community submissions associated with the noise and vibration assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 11 (Noise and vibration) and Appendix G (Noise and vibration) of the EIS for further details on the noise and vibration assessment.

Contents

C10.1 Level and quality of noise and vibration assessment

Two submitters have raised issues regarding the adequacy of the noise assessment. Refer to section 11.1 of the EIS and section 4.0 of Appendix G (Noise and vibration technical report) for details of the assessment methodology.

Submitters raised concern over the level and quality of the noise and vibration assessment. Specifically concerns include:

- Not considering noise pollution impacts on residents in relation to vehicles exiting the F6 tunnels
- Not modelling operational noise impacts at the tunnel portals.

Response

Sensitive receivers occupying land that is directly above the tunnel alignment would not experience any detection of road traffic noise from the tunnels. Operational road traffic noise generated by the project would only be discernible at locations surrounding the project at the surface, including at the tunnel portal. Table 6-4 of Appendix G (Noise and vibration technical report) of the EIS provides a summary of all sensitive receivers where road traffic noise levels exceed the applicable noise criteria. This includes receivers at the entry and exit ramps of the tunnel along President Avenue. There are a total of 14 receivers located on O'Neill Street which would be impacted by an increase in noise as a result of the tunnel portals. These receivers are all residential properties. The increase in noise is a result of the removal of houses which were providing shielding from President Avenue (removed to make room for the portal), rather than an increase in road traffic noise from the portal itself.

The operational noise assessment, which included operational noise modelling, considered the impacts on these sensitive receivers. Refer to **section C10.4** for the management measures associated with the properties near the tunnel portals.

C10.2 Noise impacts during construction

14 submitters have raised issues regarding the noise impacts during construction. Refer to section 11.3 and section 5.0 of Appendix G (Noise and vibration technical report) of the EIS for details of the noise impacts during construction.

Submitters raised concern over the noise and vibration impacts during construction. Specific, concerns include:

- Increased noise levels due to construction and its impacts on residents (particularly around President Avenue)
- Noise impacts from construction vehicles in areas:
  - Around construction ancillary facilities
  - Adjacent to spoil haulage routes
- Vibration impacts from tunnelling on the Kirby Industrial Park in Rockdale.

Response

Construction of the project is likely to primarily occur during standard construction hours with the exception of the tunnelling and associated support activities, bridge works, and diaphragm wall construction (by exception only). However, other works undertaken outside of standard construction hours (commonly referred to as 'out of hours work'), would also be required. For example, these may include road and traffic changes to minimise impacts on the road network, relocation of utilities and delivery and removal of over-sized plant and equipment.

The assessment of noise associated with the construction of the project indicates some exceedances of the *Interim Construction Noise Guideline* noise management levels at the sensitive receivers. Exceedances of the noise management levels (NMLs) occur during the day and night at the most affected sensitive receivers only during certain activities. The magnitude of these impacts is consistent with other major works projects and highlights the need for effective noise mitigation and management planning.

Measures are proposed to mitigate the construction noise impact at adjacent sensitive receivers (refer to **Chapter D1** (Environmental management measures)). The specific noise management and mitigation measures would be detailed in a Construction Noise and Vibration Management Plan (CNVMP). The recommended management and mitigation measures which would be considered in the plan include:

- Use of temporary noise barriers
- Noise performance monitoring
- Appropriate selection and maintenance of equipment
- Scheduling of work for less sensitive time periods
- Situating plant in less noise sensitive locations
- Provision of respite periods
- Effective community consultation
- Training of construction site workers on the issue.

As detailed in environmental management measure NV4, respite measures will be implemented for noisy work and vibration intensive activities in a manner consistent with the Environment Protection Licence (EPL) for the project and Roads and Maritime guideline requirements. Detailed monitoring will also be undertaken as part of the Construction Noise and Vibration Management Plan (CNVMP) to confirm project performance in relation to noise and vibration performance criteria.

Construction noise impacts in the vicinity of President Avenue

The assessment of construction noise provided in section 11.1.4 and section 4.0 of Appendix G (Noise and vibration technical report) of the EIS included an assessment of construction activities proposed along President Avenue as well as at the President Avenue construction ancillary facility (C3). The assessment indicated exceedances of relevant NMLs during standard construction hours for the following activities due to the close proximity of the works to residential receivers:

- Temporary stockpiling of spoil and fill materials
- Construction of the shared cycle and pedestrian pathways and bridge over President Avenue
- Cut-and-cover surface works
- President Avenue intersection surface works.

In addition, exceedances of NMLs and sleep disturbance screening criteria were predicted for ‘out of hours’ work (including cut-and-cover surface works and President Avenue/Princes Highway intersection works) due the close proximity of the works to residential receivers combined with low background noise levels.

As stated previously, the magnitude of impact will be managed through the implementation of noise mitigation measures. Detailed noise assessments will be carried out for all ancillary facilities required for construction of the project. The requirement for temporary noise walls within ancillary facilities and adjacent to construction works, and the requirement for other appropriate noise management measures, will be assessed and implemented prior to the commencement of activities which have the potential to cause noise or vibration impacts.

All residents affected by noise from the construction of the project which are expected to experience an exceedance of the construction NMLs will be notified about potential noise impacts prior to the commencement of construction works.

Noise impacts from construction vehicles

The assessment of construction noise provided in section 11.1.4 and section 4.0 of Appendix G (Noise and vibration technical report) of the EIS included an assessment of construction traffic noise generated by the project at construction ancillary facilities and haul routes. The nominated construction vehicle routes to and from construction ancillary facilities have been selected to minimise the use of local roads such that the majority of construction road traffic would occur on major arterial roads only.

The construction traffic noise assessment indicated that the predicted increase in road traffic noise for daytime and night-time periods would generally be less than the recommended construction traffic noise goal of 2 dB(A), as outlined in the *Road Noise Policy*. Exceptions were predicted at:

- Bruce Street – increased traffic noise during day time haulage for the construction of the shared cycle and pedestrian pathways, where exceedances were predicted to be up to 2.4 dB(A). However, work is expected to last less than three months at this location and the impact when compared to the overall construction program is considered insignificant. In addition, the noise modelling is conservative, meaning that it is unlikely the predicted impact will be realised Rockdale construction ancillary facility (C2) – increases in noise of up to 7.3 dB during potential night-time spoil haulage activities
- Wickham Street – Increases in road traffic noise of 2.5 dB(A) during night-time off-peak periods (noting a change of less than 3 dB if generally considered indiscernible).

Construction vehicle movements (on- and off-site) will be managed to avoid or minimise noise impacts on sensitive receivers. Where reasonable and feasible, spoil would only be removed from site during the day. Mitigation measures for vehicle movements outside of standard construction hours will be included in the CNVMP. Refer to **Chapter D1** (Environmental management measures) for more details on the management of noise impacts during construction.

Vibration impacts from tunnelling at Kirby Industrial Park

As described in section 9.0 of Appendix G (Noise and vibration technical report) of the EIS, the tunnel alignment is deep overall, ensuring that sensitive receivers above the tunnel are unlikely to be adversely impacted by the tunnelling activity.

Vibration associated with the use of road headers has been calculated for properties located above the main tunnel alignments. Potential vibration contours have been mapped (including in the area of the Kirby Industrial Park) and are included in Annexure G of Appendix G (Noise and vibration technical report) of the EIS.

Tunnelling activities are predicted to be compliant with both the preferred and maximum human comfort peak particle velocity criteria. Potentially affected receptors will be notified that they may feel vibration.

C10.3 Noise impacts during out of hours construction works

13 submitters have raised issues regarding the noise impacts during out of hours construction works. Refer to section 11.3 and section 5.0 of Appendix G (Noise and vibration technical report) of the EIS for details of the noise impacts during out of hours.

Submitters raised concern over the noise and vibration impacts from construction activities being undertaken outside of standard construction hours (ie Monday to Friday 7am to 6pm, Saturday 8am to 1pm, with no work on Sundays or public holidays). Submitters are concerned that impacts would occur on a 24-hour basis.

Response

Section 5.2.2 of Appendix G (Noise and vibration technical report) of the EIS discusses the construction impacts associated with activities that need to be undertaken outside of standard construction hours. This out of hours work includes tunnelling works which would be undertaken on a 24-hour, ‘round the clock’ basis. Other out of hours work may be required for public and occupational health and safety reasons. This could relate to operational constraints on the road network, to prevent traffic congestion on major roads during peak periods, or for construction requirements.

Works undertaken outside of standard construction hours have the potential for noise exceedances and the noise assessment also indicates that the sleep disturbance screening criterion is likely to be exceeded at various locations when night-time work is occurring near some residential receivers. Given the nature of the construction works, these impacts are unavoidable.

Roads and Maritime will aim to minimise such impacts through the application of standard environmental management measures and, if necessary, additional mitigation measures, as outlined in section 8.2.5 of Appendix G of the EIS. It is recognised however that these measures may not ameliorate all noise impacts upon all sensitive receivers for all works. As described in section 8.4.1 of Appendix G, details of out of hours work required for the project would form part of the CNVMP.

Noisy work would be scheduled to be undertaken during standard construction hours as far as possible. Noisy activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods. Particularly noisy activities such as the use of impact piling rigs, road and concrete saws and rock hammers, will be scheduled, where feasible and reasonable, around times of higher background noise to provide masking.

Deliveries will be carried out during standard construction hours where feasible and reasonable. Respite measures will also be implemented for noisy work and vibration intensive activities in a manner consistent with the EPL for the project and Roads and Maritime guideline requirements. Further detail of the noise management measures are provided in **Chapter D1** (Environmental management measures).

C10.4 Noise and vibration impacts during operation

15 submitters have raised issues regarding the noise impacts during operation. Refer to section 11.4 and section 6.0 of Appendix G (Noise and vibration technical report) of the EIS for details of the noise impacts during construction.

Submitters raised concern over the noise and vibration impacts during operation. Specifically concerns include:

- Noise impacts from increased traffic in the following areas:
  - Around Moorefield Estate and Civic Avenue
  - Around President Avenue, O'Connell Street and Green Street (Kogarah)
- Noise impacts would make the following open space areas unusable:
  - Reinstated parklands at Rockdale Bicentennial Park
  - Scarborough Park North
- The tunnel depth would be too shallow to minimise the impacts on noise and vibration
- Raising President Avenue would result in noise overspilling onto surrounding low-lying residences
- Submitters raised concern noise and vibration impacts on users of the Brighton-Le-Sands Public School.

Response

Operational noise impacts from increased traffic including around Moorefield Estate (including Civic Avenue)

A screening assessment of roads within the noise assessment study area identified potential issues at Civic Avenue, which is part of Moorefield Estate. The use of local streets for non-local trips has been identified for westbound President Avenue traffic, turning left onto Civic Avenue, then right onto Marshall Street, and left onto Rocky Point Road. This route has been identified in preference to traffic travelling east on President Avenue, south on The Grand Parade and then accessing Rocky Point Road from Ramsgate Road or Sandringham Street. The screening assessment identified that the most affected noise scenario would be the 'Year 2036 Build night-time' (10pm to 7am) scenario, which is for a future case with the project operating at night-time. In this scenario, noise levels on Civic Avenue would increase by about 2.6 dB(A). Traffic calming and/or other control measures would be investigated to encourage heavy vehicles to take major routes in preference to this route (such as President Avenue, the Princes Highway and The Grand Parade). This would be reviewed and examined further during detailed design. Roads and Maritime will, in consultation with Council, implement Local Area Traffic Management (LATM) measures, such as heavy vehicle load limits, raised pedestrian crossings and speed humps, to reduce traffic demand of the project on O'Connell Street/Chuter Avenue as well as Civic Avenue/Marshall Street.

Civic Avenue currently has a heavy vehicle limit of 3 tonnes along some sections of the road, and measures may include extending the length of these heavy vehicle limits.

As outlined in **Chapter D1** (Environmental management measures), an Operational Road Network Performance Review will be undertaken within 12 months and five years from commencement of operation to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. The review will identify relevant mitigation measures, if required, to address impacts on road network performance. The results of the review will be considered in future operational network performance planning carried out by Roads and Maritime. The Review will be undertaken in consultation with Transport for NSW and relevant councils.

Proposed changes to access arrangements at Moorefield Estate in response to community and stakeholder feedback are described and assessed in the preferred infrastructure report. As part of the proposed changes, a signalised intersection would be provided for movements between Civic Avenue and President Avenue.

Noise impacts from increased traffic and heavy vehicles along President Avenue, O'Connell Street and Green Street (Kogarah)

<u>President Avenue</u>

Noise sensitive receivers along President Avenue are currently affected by appreciable levels of road traffic noise which exceed the noise criteria in most instances. Existing noise issues outside the extent of the project, such as residential receivers exceeding acute noise levels ($L_{Aeq(15\ hr)}$ ≥65 dB(A) or $L_{Aeq(9\ hr)}$ ≥60 dB(A)), are addressed through the Roads and Maritime noise abatement program (NAP).

Notwithstanding, the project would result in the exceedances of the relevant road traffic noise criteria in the daytime and night-time period for a number of receivers on President Avenue. These receivers would be eligible for additional mitigation measures such as at-property acoustic treatments and are listed in in Table 6-4 of Appendix G (Noise and vibration technical report) of the EIS.

<u>O'Connell Street</u>

With the proposed project off-ramps at President Avenue, the strategic traffic model predicts heavy vehicles would travel down O'Connell Street and Chuter Avenue until Ramsgate Road. This would result in a noise increase on O'Connell Street as a result of both heavy and light vehicles of about 2.8 dB(A).

As O'Connell Street is an unclassified regional road, Roads and Maritime will, in consultation with Council, implement Local Area Traffic Management (LATM) measures, such as heavy vehicle load limits, raised pedestrian crossings and speed humps, to reduce traffic demand and minimise the impacts of the project on O'Connell Street/Chuter Avenue as well as Civic Avenue/Marshall Street. There is also currently a 4.5 tonne load limit on O'Connell Street which will be adhered too.

Green Street (Kogarah)

Predicted noise levels for sensitive receivers on Green Street, Kogarah are provided graphically in Annexure J of Appendix G (Noise and vibration technical report) of the EIS. With the project, daytime noise levels in 2036 would generally be between 45 dB(A) to 60 dB(A) on Green Street, Kogarah, which is compliant with the daytime $L_{Aeq(15hour)}$ noise criterion of 60 dB(A).

Noise impacts at Rockdale Bicentennial Park and Scarborough Park

As discussed in section 15.4.3 of the EIS, open space areas are particularly sensitive to changes in noise levels. Increased noise levels in proximity to Rockdale Bicentennial Park and Scarborough Park North may affect a person's desire to use the parks in the future given elevated noise levels in the surrounding area.

Noise levels from President Avenue have generally been predicted to increase by less than 2 dB(A) as a result of the project. A change in noise of 2 dB(A) or less is generally considered to be indiscernible. The operational noise assessment determined that both Bicentennial Park and Scarborough Park North would have no discernible change in noise levels as a result of the project. The exception to this would be the parkland area directly adjacent to the tunnel ramps north of President Avenue.

Mitigation in the form of architectural treatment will be considered in more detail during the detailed design phase.

Noise and vibration impacts at shallow tunnel depths

Ground-borne noise and vibration from traffic movements inside the operational tunnel is considered to be negligible and would not be noticeable at surface level properties. This is because rubber tyres and suspension systems of motor vehicles provide vibration isolation; therefore it is unusual for motor vehicles to cause ground-borne noise or vibration impacts.

As the tunnel approaches the surface, there is the potential for noise impacts at the tunnel portal and surrounds. Refer to the previous response 'Noise impacts from increased traffic and heavy vehicles along President Avenue, O'Connell Street and Green Street (Kogarah)' for details on noise impacts in the vicinity of the tunnel portal.

Noise spill from raised President Avenue

The operational noise modelling and assessment considered the raising of President Avenue. Noise levels have been predicted at sensitive receiver locations throughout the project footprint for both the daytime and night-time scenarios. The additional traffic from the project would generally cause a moderate increase in noise (less than 2 dB(A)) on President Avenue.

For the 'Year 2026 and 2036 Build' scenarios (refer to section 11.4.1 of the EIS), a total of 109 receptors (including residential and school receptors) are predicted to experience exceedances of the operational road traffic noise criteria for the project and are therefore eligible for consideration of additional noise mitigation.

Additional noise mitigation may include at-property architectural treatment. Changes in the project design may mitigate the design sufficiently at the source so that at-receptor/at-property noise mitigation is no longer required. These details would be confirmed in the Operational Noise and Vibration Review (ONVR) that would be developed during the detailed design phase of the project. Refer to **Chapter D1** (Environmental management measures) for further information regarding noise mitigation measures.

Brighton-Le-Sands Public School

During project operation, Brighton-Le-Sands Public School would be located around 250 metres north of the President Avenue intersection and around 350 metres east of the Rockdale (south) motorway operations complex (MOC3), which includes the Rockdale ventilation facility.

During operation, the project would contribute to noise exceedances at Brighton-Le-Sands Public School. Existing road traffic noise levels exceed the *Road Noise Policy* limits and noise levels would increase by more than 2 dB(A) due to the project. Affected buildings within this facility may be eligible for consideration of at-property architectural treatment, should noise impacts not be able to be managed through design measures as part of the detailed design, including mitigation at the source.

Operational noise performance will be monitored and the need for new or revised management measures will be identified and implemented where reasonable and feasible.

Brighton-Le-Sands Public School is located around 60 metres from the north eastern extent of the President Avenue construction ancillary facility (C3) and around 150 metres south of the Rockdale construction ancillary facility (C2). A section of the shared cycle and pedestrian pathways would also be constructed around 50 metres to the west of the school. Construction activities in the north eastern extent of the President Avenue construction ancillary facility (C3) would be limited to construction works for the shared cycle and pedestrian pathways. The remainder of this section of the construction ancillary facility is a vegetation exclusion zone.

The construction vibration assessment undertaken for the project assessed the impact on human comfort from the use of plant and machinery in close proximity to receptors. The assessment did not identify receptors (including the Brighton-Le-Sands Public School) that would exceed the vibration criteria for human comfort, meaning that the school is a sufficient distance away from vibration generating activities.

Construction noise impacts on amenity may affect classes and activities undertaken at Brighton-Le-Sands Public School. Due to large offset distances, construction works on President Avenue would generally comply with the internal noise criteria at the Brighton-Le-Sands Public School. There is the potential for exceedances associated with site establishment activities at the President Avenue construction ancillary facility (C3), however the exceedances associated with these activities would be limited to around two months and would be carefully managed to ensure potential impacts are minimised. As described in **Chapter D1** (Environmental management measures), a CNVMP will be prepared and implemented to assess, monitor, minimise and mitigate noise and vibration impacts during construction.

C10.5 Cumulative noise and vibration impacts

Two submitters have raised issues regarding cumulative noise and vibration impacts. Refer to section 11.3.6, section 11.4.4 and section 7.0 of Appendix G (Noise and vibration technical report) of the EIS for details of the potential cumulative noise and vibration impacts.

Submitters raised concern over cumulative noise and vibration impacts. Specific concerns include:

- Not adequately addressing cumulative construction noise impacts on residents exposed to the F6 Extension Stage 1, WestConnex New M5 Motorway and Sydney Gateway construction
- Communities that would be exposed to construction for 7-8 years
- Overlapping construction periods between all stages of WestConnex and the project.

Response

Cumulative construction noise impacts

Potential cumulative construction noise impacts and the potential for construction fatigue are discussed in section 11.3.6 and section 7.2 of Appendix G (Noise and vibration technical report) of the EIS.

As described in section 11.3.6 of the EIS, there is the potential for cumulative noise impacts and construction noise fatigue for sensitive receptors around the Arncliffe Motorway Operations Complex (MOC1), which is being constructed as part of the New M5 Motorway project.

With regard to cumulative impacts, there is the potential for some overlap of works between the two projects. However, given the nature of the works and the limited size of the site for the F6 Extension Stage 1 project, cumulative impact arising from noise intensive activities would be unlikely. For example, spoil haulage from both the New M5 Motorway and the F6 Extension Stage 1 projects would not occur at the same time. Increase in cumulative noise levels as a result of the project would be less than 3 dB above the predicted noise levels stated in the EIS. A change of less than 3 dB is generally considered indiscernible, so cumulative noise impacts are unlikely to represent a noticeable noise impact to the local community.

Construction noise impacts from the project are not predicted to be significant, however the extended duration of noise impacts from consecutive construction projects may result in construction noise fatigue. There are currently no guidelines available to assess construction noise fatigue, so this impact would primarily be managed through consultation with the affected community, discussions with other project developers, and the careful planning of potential mitigation measures, such as respite periods.

Construction planning has not been carried out for the Sydney Gateway project and therefore potential cumulative noise impacts cannot be identified at this stage. The Sydney Gateway project is subject to ongoing design, environmental assessment; and Federal and State planning approval. Potential cumulative noise impacts with the F6 Extension Stage 1 project, if any, would be identified as part of the environmental assessment for the Sydney Gateway project.

Construction fatigue

As discussed in section 11.3.6 and Section 7.2 of Appendix G (Noise and vibration technical report) of the EIS, there is the potential for construction fatigue from noise generated associated with the project at the Arncliffe construction ancillary facility (C1). The construction of the New M5 Motorway project is due for completion during 2019. Construction of the two projects would occur sequentially, extending the impacts on receptors in Arncliffe.

The extended duration of noise impacts from consecutive construction projects may result in construction noise fatigue. There are currently no guidelines available to assess construction noise fatigue, so this impact would primarily be managed through consultation with the affected community, discussions with other project developers, and the careful planning of potential mitigation measures. As per environmental management measure SE4, Roads and Maritime would prepare and implement a Construction Fatigue Protocol as part of the CNVMP to address potential construction fatigue impacts. The protocol will include consideration of noise attenuation and periods of respite for affected stakeholders, where reasonable and feasible, and restricting out of hours work where, practicable.

Overlapping construction noise and vibration impacts

Sydney Water is considering future rehabilitation of Muddy Creek, around the proposed shared cycle and pedestrian pathways in Brighton-Le-Sands. If the works do coincide, both projects would be managed to ensure that impacts on the local community are minimised. Consultation will be undertaken with other contractors, utility providers and the community to manage cumulative impacts on sensitive receivers within common areas, for example the consideration of respite periods.

The cumulative noise impacts of nearby major projects will be further considered by the appointed construction contractor when the detailed construction schedule for the project is developed. Consultation will be undertaken with other contractors and utility providers to manage cumulative impacts on sensitive receivers within common areas.

Community consultation regarding construction noise and vibration impacts will be detailed in the Community Communication Strategy for the construction of the project, which will include a complaint handling process. The community will be able to provide feedback via a 24-hour, toll-free project information and complaints line, a dedicated email address and postal address for the project.

C10.6 Noise and vibration environmental management measures

104 submitters have raised issues regarding the noise and vibration environmental management measures. Refer to **Chapter D1** (Environmental management measures) for details of the proposed noise and vibration management measures.

Submitters raised concern over the noise and vibration environmental management measures. Specifically concerns include:

- At-property acoustic treatments are not available for receivers impacted by construction noise because impacts are considered to be ‘temporary’ despite impacts occurring over four years
- Mitigation measures are not available for receivers impacted by cumulative construction noise
- Mitigation measures for construction noise in regards to the following:
  - Management of noise impacts from spoil haulage routes
  - Night-time or out of hours construction noise impacts
- The management of construction noise impacts on similar motorway projects has been ad-hoc and inconsistent and complaints have not been managed appropriately
- Mitigation measures for operational noise, including:
  - Availability of at-property noise attenuation

  - Additional opportunity for the project to minimise the noise impact of high traffic noise

- Submitter suggested the use of noise monitoring cameras
- Requests for monitoring information and assessment of noise before, during and after construction at certain locations, such as St George TAFE.

Response

Construction noise and vibration environmental management measures

A range of environmental management measures are proposed to manage potential construction noise impacts (refer to **Chapter D1** (Environmental management measures)).

A CNVMP will be prepared for the project prior to construction. The CNVMP will include processes and responsibilities to assess, monitor, minimise and mitigate noise and vibration impacts during construction. The CNVMP will include standard and additional mitigation measures from the CNVG and details about when each will be applied. Mitigation measures will be implemented based on the outcomes of the CNVMP and/or the environmental management measures and conditions of approval for the project (if approved).

At-property treatments

The use of at-property treatments is not considered to be a suitable method of construction noise mitigation based upon the varying nature of such noise throughout the construction period. The construction noise levels presented in the EIS are worst-case predictions these noise levels would not occur continuously over the full proposed duration of construction. For most construction activities, it is expected that the actual construction noise level would generally be lower than the worst case prediction made at the most-exposed receiver. This is because noise level varies depending on the combination of construction plant in operation at one time and the position of the plant item or noise sensitive receiver. Actual noise levels would vary across different stages of construction.

Impacts would instead be effectively managed through the implementation of the relevant environmental management measures **Chapter D1** (Environmental management measures). Notwithstanding, where properties have been identified for architectural treatment to attenuate operational noise and where properties would be impacted by noise from construction works, Roads and Maritime would consult with those property owners on the early installation of treatments to help manage noise during the construction of the project.

Management of cumulative construction noise impacts

The management of cumulative construction noise impacts is discussed in **section C10.1** and **section C10.5**. Cumulative construction noise impacts would primarily be managed through discussions with the affected community and the careful planning of potential mitigation measures such as respite periods. The cumulative noise impacts of nearby major projects will be further considered by the appointed construction contractor when the detailed construction schedule for the project is developed.

Management of construction road traffic noise

Potential impacts associated with construction traffic noise are discussed in **section C10.2**. The predicted increase in road traffic noise for daytime and night-time periods would generally be less than the recommended construction traffic noise goal of 2 dB(A), as outlined in the Road Noise Policy. Exceptions were predicted at:

- Bruce Street - increase in road traffic noise of 2.4 dB(A) (exceeding the 2 dB(A) goal) during daytime off-peak periods for the construction of shared cycle and pedestrian pathways. However, work is expected to last less than three months at this location and the impact when compared to the overall construction program is considered insignificant
- Wickham Street - increases in road traffic noise of 2.5 dB(A) during night-time off-peak periods, (noting a change of less than 3 dB is generally considered indiscernible)
- Rockdale (north) ancillary facility - increases in noise of up to 7.3 dB during potential night-time spoil haulage activities.

Construction vehicle movements (on and off site) will be managed to avoid or minimise noise impacts in accordance with environmental management measure NV6.

Management of noise from out of hours works

The management of impacts from out of hours works is discussed in **section C10.3**. Roads and Maritime will aim to minimise such impacts through the application of standard and, if necessary, additional mitigation measures and details of out of hours work required for the project would form part of the CNVMP.

Poor management of construction noise impacts on other projects

The respective proponent and design and construction contractor(s) of other motorway projects are required to comply with the conditions of approval for these projects (including implementation of measures outlined in the Construction Environmental Management Plan) and requirements of Environmental Protection Licences (EPLs).

The project (if approved) would be required to be consistent with the commitments and environmental management measures relevant to the management of construction noise impacts as well as relevant conditions of approval and requirements of EPLs. The conditions and requirements of the project approval and EPLs are enforced by the NSW DP&E and NSW Environment Protection Authority respectively.

Operational noise and vibration environmental management measures

Receivers are eligible for consideration of additional mitigation measures including at-property acoustic treatments where road traffic noise levels trigger consideration of noise mitigation. Receivers eligible for consideration of additional mitigation measures are identified in Table 6-4 of Appendix G (Noise and vibration technical report) of the EIS.

Opportunities to further reduce operational road traffic noise would be investigated during detailed design. Controlling noise at the source is always the preferred approach to noise control, and changes in the design may mitigate the design sufficiently so that at-receiver noise mitigation is no longer required, or a lower level of treatment required instead. Specific details regarding noise mitigation for each ‘eligible’ property would be confirmed in the Operational Noise and Vibration Review (ONVR) which would be developed at the detailed design phase of the project.

Noise monitoring

Cameras monitoring high noise events are typically only employed in remote sites where it is difficult to confirm specifically what created a high noise event.

Noise monitoring has been carried out to inform the EIS (refer to section 3 of Appendix G (Noise and vibration technical report) of the EIS) and would be carried out during the construction and operation of the project. A noise monitoring program would be presented in the CNVMP to confirm project performance in relation to noise and vibration performance criteria.

Within 12 months of the commencement of the operation of the project, actual operational noise performance will be compared to predicted operational noise performance via noise monitoring.

The monitoring locations during construction and operation would be subject to the development CNVMP and review of actual operational noise performance and would consider sensitive and/or highly impacted receivers as required.

C Part C Response to community submissions

C11 Biodiversity

This chapter addresses issues raised in community submissions associated with the biodiversity assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 12 (Biodiversity) and Appendix H (Biodiversity) of the EIS for further details on the biodiversity assessment.

Contents

C11.1 Level and quality of biodiversity development assessment

Eight submitters have raised issues regarding the level and quality of the biodiversity assessment. Refer to section 12.1 of the EIS for an overview of the assessment approach for the biodiversity assessment.

Submitters have expressed concern about the level and quality of the biodiversity development assessment. Specific concerns include:

- More detail is required in relation to vegetation removal and retention, stating that an adequate list of vegetation types is not listed
- The information regarding tree removal that was provided at the community information sessions was different to the information provided in the EIS (449 trees in the information sessions versus 237 trees in the EIS)
- The aquatic biodiversity and wetlands section in the assessment is inadequate. Specific concerns include:
  - The impacts from cut-and-cover construction have not been assessed
  - No aquatic studies have been undertaken
  - Concern that the degree of groundwater dependence identified in the project area is incorrect and that the assessment is dismissive of ecosystems other than high priority groundwater dependent ecosystems (GDEs)
  - The amount and type of vegetation being removed from Kings Wetland is unclear and it hasn't been included in the total native vegetation being removed in Table 12-4.
- An adequate assessment of flora and fauna is not provided. Specifically, in regards to eels, turtles and Green and Golden Bell Frogs (where the assessment is reliant on the New M5 Motorway assessment)
- The assessment incorrectly states that the study area does not contain connectivity features
- The assessment incorrectly states that migratory species have not been found in the study area
- An assessment of the permanent power supply connection and its construction was not completed as part of the biodiversity development assessment report (BDAR).

Response

Adequacy of the biodiversity development assessment

The EIS, including the biodiversity development assessment report (BDAR) provided in Appendix H (Biodiversity development assessment report) of the EIS, was prepared by a team of qualified and Biodiversity Assessment Methodology (BAM)[1] accredited professionals (refer to Table 1-2 of Appendix H (Biodiversity development assessment report) of the EIS for details on the professionals involved in the assessment). Accredited professionals under the BAM are deemed accredited assessors by the NSW Office of Environment and Heritage (OEH). The accreditation scheme is designed to ensure that the BAM is applied by people with appropriate ecological skills, knowledge and experience, and a demonstrated understanding of the method. The BDAR is consistent with the key issues outlined in the Planning Secretary's Environmental Assessment Requirements (SEARs), which include requirements issued by key government regulatory agencies as well as industry standards, guidelines and policies relevant to biodiversity.

[1] The Biodiversity Assessment Method (BAM) is the assessment manual that outlines how an accredited person assesses impacts on biodiversity at development sites, in accordance with the *Biodiversity Conservation Act 2016* (NSW).

Assessment of terrestrial flora

Existing vegetation community mapping[2] was reviewed within the study area. Vegetation communities, and the presence or absence of threatened ecological communities (TECs), was then verified through floristic surveys and transect traverses conducted in September 2017. Plant community types (PCT) were assigned to vegetation by comparing the dominant canopy species, the general description of location, soil type and other attributes as described in OEH's BioNet Vegetation Classification[3]. Where vegetation was present but it could not be classified as any particular PCT, it was combined into the vegetation type 'Urban Exotic and Native Cover' (refer to section 12.2.2 of the EIS for further information).

Street trees were not included in the assessment as a separate vegetation type as they are not part of a PCT assessable under the BAM. It is recognised that the ecological function provided by these trees is generally low, based on their sometimes tenuous connection to the original vegetation communities of the area and their location adjacent to active roadways.

Total number of trees to be removed

Section 12.3 of the EIS provides a summary of the potential impacts on flora during construction. The assessment outlines that around 237 native trees (or small groups of trees) within the construction boundary may require removal.

However, the arboricultural assessment (refer to Annexure A of Appendix C2 (Landscape and visual impact assessment) of the EIS) determined that around 449 trees in total (ie including native and non-native trees) may require removal within the construction boundary. Around 41 of these trees had high retention value in accordance with the Institute of Australian Consulting Arboriculturists Significance of a Tree Assessment Rating System[4].

The information provided at the community information session made reference to this total number of trees (449) rather than the total number of 'native' trees (227) identified in the EIS.

Impacts on aquatic biodiversity – wetlands and GDEs

Section 12.2.4 of the EIS provides a description of aquatic habitats within the vicinity of the project. Detail of the assessment of specific impacts upon aquatic ecology, as per the SEARs, are outlined in section 5.5 of the BDAR. An assessment of the aquatic habitat was undertaken during field surveys (refer to section 12.1.3 of the EIS) in the wetland within Rockdale Bicentennial Park through Rockdale Wetlands, the wetland entering Scarborough Park North, Muddy Creek upstream of Bestic Street and the Cooks River near Kogarah Golf Course.

Section 12.2.5 of the EIS provides a summary of the types of potential and known groundwater dependent ecosystems (GDEs) that are likely to be present in the study area. Impacts on these GDEs are discussed in sections 12.3.4 and 12.4.4 of the EIS. Some of the potential GDEs within the project footprint are identified as having low groundwater dependence (as flow is mediated by stormwater eg at Rockdale Wetlands), however potential impacts of the project were still considered and assessed in the above mentioned sections.

The potential impacts on fish habitats and nurseries were assessed in the BDAR. The assessment was undertaken in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (update 2013)[5] which incorporates *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*[6].

Kings Wetland has been assessed as part of wetland complex within Rockdale Bicentennial Park and the Rockdale Wetlands corridor more generally. The vegetation being removed during construction of the project is included in Table 12-4 of the EIS.

[2] NSW OEH (2016) Sydney Metropolitan Catchment Management Authority Vegetation Mapping v 3.0
[3] NSW OEH (2017) Visual information system online Vegetation Classification database.
[4] IACA (2010) IACA Significance of a Tree, Assessment Rating System (STARS), Institute of Australian Consulting Arboriculturalists, Australia, www.iaca.org.au
[5] NSW Department of Primary Industries (DPI) (2013). *Policy and Guidelines for Fish Habitat Conservation and Management (update 2013)*
[6] Fairfull and Witheridge (2003) *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*

Assessment of fauna

Section 12.2.3 of the biodiversity development details that the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool[7] and the Atlas of NSW Wildlife identified 90 threatened fauna species (or their habitat) listed under the *Biodiversity Conservation Act 2016* (BC Act) or EPBC Act as potentially occurring within 10 kilometres of the project. The BDAR (Appendix H) provides a full list of these species.

As part of the fauna assessment, targeted threatened species surveys were conducted for the Green and Golden Bell Frog and Southern Myotis given their potential to occur in the study area. The Grey-headed Flying Fox was also considered likely to use some of the study area.

Green and Golden Bell Frog

The assessment of impacts was undertaken in line with the *Matter of National Environmental Significance Significant Impact Guidelines*[8]. The assessment outlined the context of this species within the area, including previous impacts approved as part of the construction of the New M5 Motorway at Arncliffe.

Southern Myotis

Field surveys were undertaken for the *Myotis Macropus* (Southern Myotis) in the southern area of the project footprint to inform the impact assessment in the BDAR.

Native turtle population

Observations made during field surveys suggests that the Rockdale Wetland provides habitat for the Eastern Long-necked Turtle and other aquatic reptiles, as turtles were observed basking on the banks of the Rockdale Wetland. The Eastern Long-necked Turtle is not a threatened species and therefore there is no requirement to survey for these species under the BAM.

Eels

Impacts on aquatic fauna were considered in section 8.5 of the BDAR. Section 9 of the BDAR refers to the Roads and Maritime Services guidelines for protecting and managing biodiversity on their projects, which will be implemented during all phases of the project. These guidelines specify the minimum requirements to manage impacts on fauna, including on eels and other aquatic fauna.

Migratory birds

Fauna surveys were carried out over several days at Rockdale Bicentennial Park and surrounds and in the vicinity of the Arncliffe construction ancillary facility, as these areas were considered the only potential habitat for species within the construction boundary. Surveys for migratory birds were completed at dawn for two hours per session, over three months to account for temporal and tidal variation.

Migratory species were not observed to occur within the construction boundary during the field surveys.

Migratory species occasionally visit the Landing Lights Wetland (around 400 metres southwest of the northern surface works, and 600 metres north-west of the southern surface works, but not within the construction boundary), preferring to use the resources at Towra Point Wetland and Shell Point Botany Bay.

Connectivity features

The biodiversity study area was not identified to contain ecological connectivity features. However, section 4.1 of Appendix H (Biodiversity development assessment report) of the EIS does identify that there is a corridor of land extending south from Brighton-Le-Sands to Ramsgate which is primarily open space and is a local wildlife corridor. This corridor forms part of the existing F6 reserved road corridor.

[7] Commonwealth Department of Environment and Energy (2017) EPBC Act Protected Matters Search Tool
[8] Commonwealth of Australia (2013) *Matter of National Environmental Significance Significant Impact Guidelines*

The open space and minor areas of native vegetation do not connect large patches of intact native vegetation or habitat. However, they would provide 'stepping stones' for relatively common urban wildlife. The ecological values of this open space corridor was one of the factors Roads and Maritime considered when deciding to underground the tunnel and avoid a motorway at the surface, within the existing F6 reserved corridor.

Assessment of permanent power supply route

A desktop biodiversity assessment was completed for the construction of the permanent power supply line. The assessment is provided across section 12.3 and section 12.4 of the EIS, which identified that there would be minimal to nil impact on biodiversity values as a result of this power supply route.

The alignment of the permanent power supply is subject to ongoing discussions with Ausgrid and other stakeholders, including Bayside and Canterbury-Bankstown councils. A detailed review of the permanent power supply route will be undertaken, in accordance with the Biodiversity Assessment Method (BAM), once the route is confirmed. The review will include consideration of any Coastal Management SEPP[9] wetlands areas and will update the BAM Calculation for the project and provide this to the NSW Office of Environment and Heritage.

C11.2 Biodiversity impacts during construction

39 submitters have raised issues regarding the biodiversity impacts during construction. Refer to section 12.3 and section 8 of Appendix (Biodiversity development assessment report) of the EIS for details of biodiversity impacts during construction.

Submitters have expressed concern about the biodiversity impacts during construction. Specific concerns include:

- The loss of native vegetation, especially within Rockdale Bicentennial Park
- The project will cause irreversible biodiversity loss
- The amount of tree removal and the locations identified for tree removal. Specifically, in locations including:
  - Rockdale Bicentennial Park (the Swamp Oak floodplain in Kings Wetland and the endangered Swamp Mahogany tree)
  - Scarborough Park North (Patmore Swamp, Scarborough Ponds and President Avenue)
  - Trees on West Botany Street
- The potential impacts on fauna, specifically in regards to:
  - The Southern Myotis micro-bat
  - The Grey-headed Flying-fox
  - The Green and Golden Bell Frog
  - Migratory birds
- Collision of fauna with construction vehicles or equipment.

Response

Section 12.3 of the EIS outlines the potential impacts on terrestrial biodiversity during construction. Key points from the assessment are provided below to address the issues raised.

Vegetation clearance

As mentioned in **section C11.1** above, over 237 native trees (or small groups of trees) were assessed within the construction boundary and may require removal to facilitate the project. Of these trees, it was determined that around 41 of these trees had 'high retention value' in accordance with the Institute of Australian Consulting Arboriculturists Significance of a Tree Assessment Rating System.

[9] State Environmental Planning Policy (Coastal Management) 2018

The environmental impacts (including vegetation removal) of the project have been minimised by locating the majority of the project underground, with permanent surface infrastructure located within the existing F6 reserved corridor. A motorway tunnel option for the project avoids significant impacts on ecological and recreational resources within the existing F6 reserved corridor that would occur if a new surface road alternative had been adopted. Nevertheless, vegetation removal would be unavoidable to facilitate construction and operation of the project. Impacts on vegetation would be avoided and minimised where feasible and reasonable.

Where impacts on native vegetation or planted vegetation are unavoidable, mitigation measures have been proposed to minimise the potential for indirect impacts. Some threatened flora species would be impacted by the project. Consistent with the *Biodiversity Conservation Act 2016* and the SEARs, a biodiversity offset strategy has been developed to compensate for the unavoidable loss of ecological values as a result of the project.

Impacts on trees (including native and non-native trees (eg street trees along West Botany Street)), such as tree removal, would be minimised during detailed design and construction, wherever practicable. Where removal of trees is unavoidable, trees would be replaced in accordance with the tree management strategy for the project, which would be prepared in consultation with relevant stakeholders (including local councils) (refer to environmental management measure LVIA5 in **Chapter D1** (Environmental management measures)). The strategy would be used to guide the management of trees that need to be removed and to consider options for their replacement. The replacement of trees would result in a net increase in the overall number of trees present compared to the existing conditions.

Impacts on fauna

While the project would result in unavoidable impacts on threatened fauna such as direct disturbance from noise, vibration and light, or in the unlikely event of construction vehicle strikes, overall impacts are not expected to be significant. This is based on the lack of suitable habitat throughout the majority of the project footprint. The management measures for the project would include an unexpected finds procedure for both flora and fauna (including bats) during construction. These measures will be outlined in a Construction Flora and Fauna Management Plan (CFFMP) (refer to environmental management measure B4 in **Chapter D1** (Environmental management measures)).

It is noted that some species may not be suitably mobile to be able to move away from nearby construction activity, particularly aquatic species. The CFFMP will include specific management procedures to identify and remove fauna as far as practical prior to vegetation or habitat clearance. This includes a process for dewatering and restoration of the Rockdale Wetland, including measures developed by an aquatic ecologist to handle and relocate aquatic fauna.

A Wetlands Management Plan will also be prepared and implemented (refer to measure B3), in consultation with relevant stakeholders, to manage waterbodies and riparian land within the project footprint that may be impacted by the project during construction.

The plan will include:

- Consideration of potential water quality, hydrology, amenity and flora and fauna impacts and mitigation
- A process for dewatering and restoration of the Rockdale Wetland, including measures developed by an ecologist to handle and relocate aquatic fauna
- A monitoring program to assess the effectiveness of the mitigation measures and to identify new measures that may be required.

The plan will be prepared by a suitably qualified ecologist with experience in wetlands management.

Impacts upon specific threatened fauna species identified by submitters are included below.

Green and Golden Bell Frog

Green and Golden Bell Frog habitat would not be directly affected by the construction of the project. This is because the project would use the existing Arncliffe construction ancillary facility, currently in use for the construction of the New M5 Motorway project (an area of 7.6 hectares). Offsets have already been provided for the permanent removal of 7.6 hectares of habitat under the approval for that project.

The construction of the project would however delay the habitat reinstatement of the Arncliffe construction ancillary facility following the construction of the New M5 Motorway project. Given the low occurrence of Green and Golden Bell Frogs in the vicinity of the construction ancillary facility, the impact of this delay on the population is not expected to be significant.

The construction of the project is likely to result in the prolongation of indirect impacts (such as noise, dust and vibration impacts) on the Green and Golden Bell Frog, currently arising from the use of the area at C1 for construction of the New M5 Motorway. These impacts would be temporary and are not expected to significantly impact the Green and Golden Bell Frog population given the implementation of management measures identified in **Chapter D1** (Environmental management measures).

All construction site inductions will contain a relevant section on identifying and managing potential risks to the Green and Golden Bell Frog. This will include identification of the frog and its habitat, a clear outline of the location of no-go zones for construction personnel, equipment and materials (including herbicides and pesticides), hygiene protocols and what to do in the event of an unexpected find. Any Green and Golden Bell Frogs encountered within the construction boundary during construction would be collected and relocated by a qualified and experienced herpetologist.

Grey-headed Flying Fox

The construction of the project would remove foraging habitat for this species, particularly around the President Avenue construction ancillary facility (C3). There may also be direct impacts upon this species where individuals may be injured or stressed due to disturbances associated with noise, dust or light. Direct mortality is unlikely. Individuals are likely to actively avoid the area during works and therefore risk to this species would be low. An assessment of significance undertaken for this species indicates that there would be no significant impact upon it or its overall habitat.

Migratory birds

For migratory birds, the BDAR found that the impacts are unlikely to be significant during construction. Migratory species occasionally visit the Landing Lights Wetland (around 400 metres southwest of the northern surface works and 600 metres northwest of the southern surface works, but not within the construction boundary), preferring to use the resources at Towra Point Wetland and Shell Point Botany Bay.

While the species do occasionally occur close to the project, species specifically protected by the EPBC Act have not been observed to occur within the construction boundary. Indirect impacts that may potentially impact these species include hydrological changes, such as a reduction in groundwater supply to wetlands that supply habitat for a species.

The BDAR deemed impacts on these species as not being significant.

Southern Myotis

The BDAR determined that it is likely that the *Myotis macropus* (Southern Myotis) habitat would be directly affected by the construction of the President Avenue intersection and upgrade works. President Avenue crosses over a culvert which conveys a waterway running from north (Rockdale Bicentennial Park) to the south (Scarborough Park North). The culvert may be potential habitat for this threatened bat, listed as vulnerable under the BC Act. Given the high urbanisation and number of culverts in the vicinity of the project, the consequences of the replacement of this culvert are not expected to be significant for this species.

C11.3 Aquatic biodiversity and wetland impacts during construction

79 submitters have raised issues regarding the aquatic biodiversity and wetlands impacts during construction. Refer to section 12.3 and section 8.5 of Appendix H (Biodiversity development assessment report) of the EIS for details of the aquatic biodiversity impacts during construction.

Submitters have expressed concern about the aquatic biodiversity and wetland impacts during construction. Specific concerns include:

- The diversion of the pond within Rockdale Bicentennial Park and the potential impact on aquatic biodiversity (Murray River Short-neck Turtles and migratory birds)

- The construction impacts on flora and fauna including ecosystems and endangered species in the wetlands in locations such:
  - Rockdale Bicentennial Park (Kings Wetland), for example due to the construction of the shared cycle and pedestrian pathways
  - Scarborough Park North (Patmore Swamp, Scarborough Ponds and President Avenue)
  - Kogarah Golf Course.

Response

Section 12.3.3 in the EIS outlines the potential impacts on aquatic biodiversity during construction. The biodiversity development assessment found that impacts on aquatic habitat during construction would be relatively minor, considering existing conditions, scale and recovery potential. Protected aquatic flora listed under the *Fisheries Management Act 1994* was observed at Muddy Creek in the vicinity of the proposed C5 facility. However, the marine vegetation was growing under disturbed conditions forming a patchy and narrow strip. Although these types of marine vegetation provide important functions in an estuary, their value and potential to expand is reduced by past development, concrete-lined channels and seawalls.

Construction water discharges are considered unlikely to impact the aquatic ecology within receiving environments for the project (Scarborough Ponds, Rockdale Wetland, Muddy Creek and the Cooks River), given the monitoring and treatment of water as outlined in **Chapter D1** (Environmental management measures). In the instance that during detailed design it cannot be demonstrated that treated construction wastewater would meet the discharge criteria for Scarborough Ponds, in particular nutrient concentrations, treated construction wastewater from C2 and C3 will be discharged to the less sensitive Muddy Creek stormwater catchment.

The project is considered unlikely to impact protected aquatic flora or fauna, and no marine vegetation would be harmed.

Observations made during field surveys suggests that the Rockdale Wetland provides habitat for the Eastern Long-necked Turtle (a common, non-threatened species) and other aquatic reptiles, as turtles were observed basking on the banks of the Rockdale Wetland. The Eastern Long-necked Turtle is not a threatened species and therefore there is no requirement to survey for these species under the BAM.

The Murray River Short-neck Turtle (a common, non-threatened species) was not observed during the field surveys and has not been previously recorded within the construction boundary for the project. However, hybridisation of turtle species is known to occur in the region, therefore a hybrid of the Murray River species with other turtle species may occur within construction boundary.

Impacts on aquatic fauna will be managed through the implementation of the CFFMP, which will include specific management procedures to identify and remove fauna as far as practical prior to vegetation or habitat clearance. This includes a process for dewatering and restoration of the Rockdale Wetland, including measures developed by an aquatic ecologist to handle and relocate aquatic fauna.

The biodiversity development assessment outlines that actions such as fauna rescue and relocation during dewatering and bunding on the wetland within the President Avenue construction ancillary facility (C3) would reduce the potential injury to aquatic fauna, such as the Eastern Long-necked Turtle if they were encountered. Mortality of fish and turtles are expected to be minimised through standard rescue and release protocols.

In regards to frog habitats, no additional Green and Golden Bell Frog habitat would be directly disturbed by the project, over and above that already disturbed by the ongoing construction of the New M5 Motorway project. Construction of the F6 Extension Stage 1 project would, however, result in the prolongation of indirect impacts (such as noise, dust and vibration), particularly around Arncliffe.

The loss of flora and fauna habitat and wetlands associated with the project has been assessed within the BDAR. Generally the biodiversity impacts associated with the project are considered to be minor. As required by the BC Act, biodiversity offsets would be sought for impacts on native vegetation communities within the construction boundary (including within Rockdale Wetland). A Wetlands Management Plan will also be prepared for the project in consultation with Bayside Council and other stakeholders (refer to environmental management measure B3 in **Chapter D1** (Environmental management measures)). The Wetlands Management Plan will be implemented to manage project impacts on wetlands in the project footprint including water quality impacts (from sedimentation, contamination or increased salinity) and would identify a range of site-specific management measures.

C11.4 Biodiversity impacts during operation

Eight submitters have raised issues regarding the biodiversity impacts during operation. Refer to section 12.4 and section 8 of Appendix H (Biodiversity development assessment report) of the EIS for details of the aquatic biodiversity impacts during operation.

Submitters have expressed concern about biodiversity impacts during operation. Specific concerns include:

- The operational impacts on biodiversity (native flora and fauna) in locations including Rockdale Bicentennial Park
- The biodiversity development assessment does not consider impacts from roads or an increase in traffic.

Response

Section 12.4 of the EIS provides an overview of the potential impacts on terrestrial flora and fauna during operation.

Where the removal of trees is unavoidable during construction, trees would be replaced in accordance with the tree management strategy for the project. The plan includes species recommendations for the landscape design to consider foraging trees for the Grey-headed Flying-fox.

Lighting would be provided along the shared cycle and pedestrian pathways and bridge. Lighting would be downward facing to minimise light spill, therefore reducing impacts on fauna, including the Grey-headed Flying Fox. Lighting is not expected to result in a significant impact on this species as the project boundary does not contain breeding habitat or camps for the species.

Following construction of the project at the Arncliffe construction ancillary facility (C1), there would be an increase in the permanent take of land (that is potential Green and Golden Bell Frog habitat) for the project, above that approved for the New M5 Motorway. The area of permanent take is still within the 7.6 hectare area which was included in the offsets acquired as part of the New M5 Motorway project.

The area of permanent take previously comprised fairways and small unmanaged ponds (water hazards) at Kogarah Golf Course. While there would be less area available to be reinstated as a golf course if the project were approved, the impact on the population of Green and Golden Bell Frog is not likely to be significant. The area of permanent take is not likely to sever any habitat corridor or prevent frogs from dispersing across the golf course. The area of permanent take was included in the biodiversity offsets sought for the New M5 Motorway project.

The remainder of the ground surface within the Arncliffe construction ancillary facility (excluding the operational footprint) will be reinstated to a condition the same or better than prior to the commencement of construction of the New M5 Motorway project in consultation with relevant stakeholders.

There would also be the potential for indirect impacts on the Green and Golden Bell Frog during operation at the Arncliffe Motorway Operations Complex (MOC1), including noise and light spill. Refer to environmental management measure B5 in **Chapter D1** (Environmental management measures) for measures to manage impacts on Green and Golden Bell Frog.

Impacts from new roads and increased operational traffic

Injury and mortality of fauna is assessed in section 8.3.3 of the BDAR. This assessment outlines potential impacts upon fauna during operation of the project though indicates that no one measure would completely eliminate the risk of vehicle strike during operation. Despite this, suitable measures would be put in place to reduce the risk of such incidents, including fencing or other suitable mechanisms (such as appropriate landscaping) for reducing the ability for fauna to enter the active roadway.

Edge effects and habitat fragmentation

Edge effects and habitat fragmentation impacts are discussed in section 8.7 of the BDAR. Edge effects on native vegetation are considered likely to occur as a result of the works during construction and operation, however the suitability/quality of habitat provided for threatened species within the project footprint is already considered to be low. At the President Avenue construction ancillary facility (C3), there would be native vegetation remaining south of President Avenue in the area dominated by Common Reedlands (PCT1808). The reedlands retained would potentially be subject to increased light and weed invasion because of the project. These impacts would occur during construction and operation. Only a small area of reedlands is proposed to be cleared (about 0.77 hectares) and about 10 hectares would remain. Environmental management measures are proposed to minimise vegetation clearing, reduce light spill and prevent the spread of weeds (refer to **Chapter D1** (Environmental management measures)).

C11.5 Aquatic biodiversity and wetland impacts during operation

Four submitters have raised issues regarding the biodiversity impacts during operation. Refer to section 12.4 and section 8.5 of Appendix H (Biodiversity development assessment report) of the EIS for details of the aquatic biodiversity impacts during operation.

Submitters have expressed concern about aquatic biodiversity and wetland impacts during operation. Specific concerns include:

- The operational impacts on biodiversity (flora and fauna) in the wetlands and other groundwater dependent ecosystems as a result of groundwater drawdown in locations including:
  - The wetlands within Rockdale Bicentennial Park (including Kings Wetland), including pollution impacts from the unfiltered ventilation facility
  - The wetland entering Scarborough Park North (Patmore Swamp)
  - Marsh Street Wetlands.
- Pollution of the Rockdale Wetlands from the Rockdale ventilation facility
- The cumulative groundwater level impacts of motorway projects on biodiversity.

Response

Impact to aquatic biodiversity and wetlands

Section 12.4.2 of the EIS provides an overview of the potential impacts on specific aquatic habitats during operation.

The project would not affect the Marsh Street wetlands as no construction or operation of the project would occur in this area.

Cumulative groundwater impacts on biodiversity

Appendix K (Groundwater technical report) of the EIS includes an assessment of cumulative groundwater impacts when considered alongside other large underground infrastructure, including the WestConnex projects and existing tunnels such as the M5 East Motorway.

The groundwater report indicates substantial long term drawdown in the northern parts of the F6 Extension Stage 1 project, with impacts towards the southern end of this project not being affected cumulatively. In general, these impacts are localised, extending up to 650 metres horizontally at the intersection of F6 Extension Stage 1 and the New M5 Motorway. On this basis, the impacts assessed in the south of the F6 Extension Stage 1 project would remain as per the 'project alone' assessment above.

The BDAR outlines that groundwater impacts based on the 'project alone' scenario to the north of the F6 Extension Stage 1 project would not be of concern as the wetlands in this location are not dependent on groundwater. As such, the cumulative impact of the above mentioned projects would also be negligible.

C11.6 Cumulative biodiversity impacts

Five submitters have raised issues regarding cumulative biodiversity impacts. Refer to section 12.4.7 and section 8.6 of Appendix H (Biodiversity development assessment report) of the EIS for details of cumulative biodiversity impacts.

Submitters have expressed concern about cumulative biodiversity impacts by various projects working in reasonable proximity to, and with similar timeframes as the F6 Extension Stage 1 project. Specific concerns include that the Rockdale Wetland corridor has previously been impacted by decisions made by Rockdale Council. For example, the placement of debris in the Rockdale Wetland from nearby construction sites, the introduction of a dog exercise area where vegetation provides natural biofiltration of stormwater, resulting in poor stormwater runoff and an increase in weeds in the area.

Response

The BDAR assesses cumulative impacts with current road projects such as the New M5 Motorway and other major Roads and Maritime projects. Cumulative impacts associated with these projects include prolongment of biodiversity impacts, and deferment of habitat rehabilitation works. Overall the potential for substantial cumulative impacts form these projects is considered to be minimal based on their limited surface occupation and the somewhat degraded biodiversity values of their locations given their heavily urbanised context. Species currently inhabiting the study

area are therefore likely to be those tolerant of urban pressures, such as poor water quality.

Historic impacts on the wetlands within and in the vicinity of the project have not been considered as part of this assessment. As such, the existing state of these areas has been assumed as the baseline for the assessment, with a view to minimising the project's residual impacts and therefore cumulatively contributing to historic impacts as little as possible. In certain cases this may include restoration of habitat to an improved ecological condition upon operation of the project.

C11.7 Biodiversity environmental management measures

20 submitters have raised issues regarding biodiversity environmental management measures. Refer to **Chapter D1** (Environmental management measures) for details on the biodiversity environmental management measures.

Submitters have expressed concern about the biodiversity environmental management measures. Specific concerns include:

- Suggestion that a wetland environmental management and maintenance plan needs to be developed for the construction phase of the F6 Extension
- Suggestion regarding the inclusion of site specific management measures for locations such as Bicentennial Park, the waterway and other vulnerable areas
- The proposed management measures for trees. Specific concerns include:
  - Replacement trees will struggle to grow where they are planted
  - The replacement of mature trees with low level trees and shrubs in insufficient

- The assessment does not provide an adequate biodiversity offset strategy, for example offsets should be required for the impacts on the Green and Golden Bell Frog in the vicinity of the Arncliffe construction ancillary facility (C1).

Response

The biodiversity mitigation measures for the project will be detailed in a CFFMP which will include: site-specific environmental induction for workers; identification of vegetation clearing limits and use of protective fencing; vegetation clearance procedures; pre-clearance surveys; and weed and pest management and monitoring. Where required or relevant, site specific management measures will be developed and implemented, including at areas such as the President Avenue construction ancillary facility (C3), Rockdale Bicentennial Park and Scarborough Park North.

Where removal of trees is unavoidable, trees will be replaced in accordance with the tree management strategy for the project, which will be prepared in consultation with relevant stakeholders (including local councils). The strategy will be used to guide the management of trees that need to be removed and to consider options for their replacement. The replacement of trees will result in a net increase in the number of trees. Roads and Maritime would seek to replace trees on a like for like basis with regard to species, growing style, origin and amenity value, wherever practical. The size of the trees will be determined in consultation with the relevant council and consistent with the council's tree replanting plans for the specific location.

In regards to the management of impacts for areas such as Rockdale Wetland, temporary barriers will be installed to isolate the excavation works from the rest of the pond and prevent mobilisation of sediment and pollutants into adjacent areas. In addition, water within the construction zone will be treated at a construction water treatment plant. Sediment mobilised during construction would be managed according to the requirements of the Blue Book[10]. The CFFMP will include a process for dewatering and restoration of the Rockdale Wetland, including measures developed by an aquatic ecologist to handle and relocate aquatic fauna.

A Wetlands Management Plan will also be prepared for the project in consultation with Bayside Council and other stakeholders. The Wetlands Management Plan will be implemented to manage project impacts on wetlands in the project footprint including water quality impacts (from sedimentation, contamination or increased salinity) and would identify a range of site-specific management measures.

Biodiversity offset strategy

The strategy which Roads and Maritime will implement to seek to secure biodiversity offsets is outlined in section 12.5 of the EIS. The strategy includes seeking offset credits. Offsets have been calculated in line with the Biodiversity Assessment Method.

The continued use of the New M5 Motorway construction compound at Arncliffe is considered unlikely to significantly affect Green and Golden Bell Frog, because the species is not likely to be present due to a decline in the population, and the removal of adult frogs for the captive breeding program (as part the of the New M5 Motorway project).

The construction impacts would be temporary and are not expected to significantly impact the Green and Golden Bell Frog population given the implementation of management measures identified in **Chapter D1** (Environmental management measures).

As a significant impact on the Green and Golden Bell Frog is not expected to occur, it was identified that biodiversity offsets and a referral to the Commonwealth Department of Environment and Energy are not required.

[10] Landcom (2004) *Managing Urban Stormwater – Soils and Construction,* Volume 1, 4th Edition

C Part C Response to community submissions

C12 Landscape and visual

This chapter addresses issues raised in community submissions associated with the landscape character and visual impact assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 13 (Landscape and visual) and Appendix C2 (Landscape character and visual impact assessment) of the EIS for further details.

Contents

C12.1 Level and quality of landscape character and visual impact assessment

Three submitters have raised issues regarding the level and quality of the landscape character and visual impact assessment. Refer to section 4 of Appendix C2 (Landscape character and visual impact assessment) of the EIS for further details.

Submitters have expressed concern about the level and quality of the landscape character and visual impact assessment in the EIS. Specific concerns included:

- Concern regarding the visual impact of the shared cycle and pedestrian pathways. Specifically:
  - Concern regarding the viewpoints chosen to assess the visual impact of the shared cycle and pedestrian pathways on Patmore Swamp. Suggest that the visual impact would be greater if it was assessed from other viewpoints, including:
    - Viewpoint 10A (an alternative to Viewpoint 10 in the EIS) is a view east from Civic Avenue at the corner of Annette Avenue
    - Viewpoint 11A (an alternative to Viewpoint 11 in the EIS) is along the south side of President Avenue, looking east towards Botany Bay from the corner of Civic Avenue
  - Concern about the lack of information in regards to the landscape character and visual impact of the shared cycle and pedestrian pathways on Patmore Swamp.

Response

Level and quality of the assessment

The EIS, including the Landscape character and visual impact assessment report, was prepared by a team of qualified professionals in accordance with the Planning Secretary's Environmental Assessment Requirements issued by the Planning Secretary and the Roads and Maritime Services *Guidance Note EIA-N04 Guidelines for Landscape Character and Visual Impact Assessment*.

Selection of viewpoints

Viewpoints were selected to illustrate the potential visual impacts of the project and represent publicly accessible viewpoints from a range of locations and viewing situations. Particular attention was paid to views from places where viewers are expected to congregate such as parks, recreation areas, public transport routes and commercial areas, as well as views to and from heritage items.

Fifteen viewpoints were selected from the visual catchment of the project as representative of a broad range of potential views to the project in the southern surface works area. These views include views to the proposed surface roadworks, Rockdale ventilation facility and shared cycle and pedestrian pathways.

Viewpoint 10: View east from Civic Avenue, represents the view from residential areas at Civic Avenue to the shared cycle and pedestrian pathway through Patmore Swamp

Viewpoint 10 was selected to capture the view from the residences and open space areas in the vicinity of Civic Avenue and to include the ramping structure. The presence of street trees on the north and south of Civic Avenue between President Avenue and Fairway Avenue did not impact the assessment of the visual change of the view. Viewpoint 10 also includes the views of the bridge spanning the motorway for motorists who are travelling west along President Avenue.

It was determined that the suggested alternative, Viewpoint 10A, would be assessed as having the same level of visual impact. In addition, this viewpoint was not considered to be of high visual sensitivity.

The suggested alternative, Viewpoint 10B was taken from an unformed track within the wetlands. Although Patmore Swamp holds visual importance to the local community, it does not include the traditional values of an important landscape from a regional or city-wide perspective. Patmore Swamp has a low level of public access and visual amenity due to the weed infestation and overgrown nature of the area. This section of wetland has less amenity value than the northern section which includes larger trees, islands and fewer weeds. The sensitivity of this landscape, however, was identified as moderate.

The suggested Viewpoint 10B includes the road, moving vehicles and road furniture including signage. During construction, works would extend across the background of this view and include the removal of trees, drainage and earthworks. During operation, the road would be elevated and closer, which would increase the visual prominence of the road infrastructure in this view. However, there would be new street trees and landscape works aimed at visually integrating the roads into these views. This would result in a high to moderate adverse visual impact during construction and a moderate adverse visual impact during operation as the landscape works would assist in the visual integration of these works. The impact would not be assessed as high adverse impact as suggested.

Viewpoint 11: Looking east from President Avenue

Viewpoint 11 (looking east from President Avenue) was selected because it represents the view from a collection of businesses where people are most likely to congregate. This corner is also the location for a north south pedestrian crossing, and offers a vantage point where both the northern and southern road verges can be seen as President Avenue intersects through the parkland. This would also include the shared cycle and pedestrian pathway.

The potential visual impact of the widening of President Avenue has been addressed through a combination of viewpoints including:

- Viewpoint 11 (looking east from President Avenue)
- Viewpoint 9 (looking northwest from President Avenue)
- Viewpoint 8 (looking north from Colson Crescent.

Together, these viewpoints cover a range of views towards the proposed road widening on President Avenue.

The suggested Viewpoint 11A (an alternative to Viewpoint 11 in the EIS) is along the south side of President Avenue, looking east towards Botany Bay from the corner of Civic Avenue and is located half way between Viewpoint 11 and Viewpoint 9.

Viewpoint 9 (looking northeast from President Avenue) is located on the footpath and captures the change in views from President Avenue, focusing on the northern side of the road where the greatest visual impact is expected. This viewpoint was considered to have a moderate visual sensitivity and a high magnitude of change which combine to result in a high-moderate adverse visual impact during construction and operation. This assessment would have been the same for Viewpoint 11A.

The visual impact level is considered to be moderate in accordance with *Guidance Note EIA-N04 Guidelines for Landscape Character and Visual Impact Assessment*.

Viewpoint 8 (view looking north from Colson Crescent) provides a change in the view towards President Avenue and was assessed as having a moderate adverse visual impact.

The visual impact of the shared cycle and pedestrian pathway bridge has been addressed in the photomontage within Figure 8-19 and Figure 8-20 of Appendix C2 (Landscape and visual impact assessment) of the EIS.

Assessment of impacts on Patmore Swamp

The landscape character and visual impact assessment of the shared cycle and pedestrian pathway on Patmore Swamp is assessed in detail in Appendix C2 (Landscape character and visual impact assessment) of the EIS. Section 6.2 of Appendix C2 describes the landscape character zone (LCZ) of Patmore Swamp as LCZ4: Rockdale Bicentennial and Scarborough Parks open space and recreation area. The information provided describes the existing conditions within the LCZ and assesses the construction and operation impacts of the project. The assessment found that there a high-moderate landscape impact on the Rockdale Bicentennial and Scarborough Parks landscape (LCZ4) during construction and operation. Refer to **Chapter C18** (Non-Aboriginal heritage) for an assessment of the visual impacts on the heritage value on Patmore Swamp.

A detailed visual impact assessment is provided in section 8.2 of Appendix C2. This includes the impacts for each individual viewpoint and a summary of the impacts on recreational open space areas (including Patmore Swamp).

C12.2 Visual impacts during construction

Two submitters have raised issues regarding visual impacts during construction. Refer to section 13.6 of the EIS for further details.

Submitters have expressed concern about the visual impact of the project during construction. Specific concerns relate to:

- The visual impact during construction works at President Avenue, including:
  - The removal of vegetation and loss of open space
  - The installation of hoarding
  - The alteration of view corridors to non-Aboriginal heritage items such as Patmore Swamp
  - The alteration of water bodies
- The covering of the groundwater pre-treatment basin with a concrete structure would impact on visual amenity.

Response

Visual impacts at President Avenue

The construction of the project would result in visual impacts, particularly in the vicinity of the President Avenue intersection. These impacts include alterations to the views to heritage-listed Kings Wetlands in Rockdale Bicentennial Park and Patmore Swamp in Scarborough Park, specifically as result of tree removal.

Where reasonable and feasible, visual impacts will be avoided through retaining trees. Roads and Maritime will also work with Bayside Council and relevant stakeholders to identify suitable spaces to provide replacement trees.

A tree management strategy will be developed for the project which will require replacement trees to be provided. A vegetation exclusion zone will be established within the President Avenue construction ancillary facility (C3) to preserve some of the threatened vegetation during construction (refer to Figure 7-5 of the EIS).

Construction hoarding may also have visual impacts on receivers during construction. The design and maintenance of construction hoardings will aim to minimise visual impacts and landscape character impact, for example, by making the design consistent with the surrounding environment where possible.

The construction of the project would require the diversion of the waterway within Rockdale Bicentennial Park, which is associated with the Rockdale Wetlands corridor. The waterway will be reinstated following construction.

Refer to **Chapter D1** (Environmental management measures) for the management measures that will be implemented, specifically in relation to surface infrastructure, to mitigate landscape and visual impacts during construction and operation.

Groundwater treatment basin

The temporary water treatment plants to be located at the construction ancillary facilities for the project are not proposed to be covered with a concrete structure. Site establishment works at these facilities would involve the installation of site fencing and hoarding to minimise the impacts on views from the construction of the project.

The final design of the water treatment plant will be subject to detailed design and in accordance with the Construction Soil and Water Management Plan.

C12.3 Landscape character, place making and urban design during operation

One submitter raised concerns about landscape character, place making and urban design during operation. Refer to section 13.4 and Appendix C1 (Place making and urban design) of the EIS for further details.

The submitter expressed concern about landscape character, place making and urban design during operation. Specific concerns included the impact of the Rockdale ventilation facility along West Botany Street on the local landscape, including the adjacent open space and President Avenue.

Response

The visual appearance and materiality of the Rockdale ventilation facility would reflect the light industrial built form elements of the surrounding urban character. As this landscape character has low sensitivity and the ventilation facility would be compatible with existing land uses, there would be a low landscape character impact.

During detailed design, there would be a detailed review and finalisation of the architectural treatment of the Rockdale ventilation facility. The architectural treatment of these facilities would be guided by, the outcomes of community consultation and urban design principles. Landscaping works would be carried out next to disturbed areas, including around operational infrastructure (such as ventilation facilities).

Existing and new vegetation to be replaced as part of the project would assist in providing a visual screen between the open space within Rockdale Bicentennial Park and from President Avenue towards the Rockdale ventilation facility.

An overshadowing assessment was completed for the Rockdale ventilation facility (within MOC3) (refer to Annexure B of Appendix C2 (Landscape and visual impact assessment) of the EIS)). The overall impact of overshadowing as a result of the ventilation facility is considered to be negligible.

C12.4 Visual and landscape character impacts during operation

111 submitters raised issues regarding visual impacts during operation. Refer to section 13.7 and Appendix C2 (Landscape and visual impact assessment) of the EIS for further details.

Submitters have expressed concern about visual impacts during operation. Specific concerns include:

- The visual impact of the proposed shared cycle and pedestrian pathway bridge. Specifically, the impact on views from Patmore Swamp along President Avenue, and the views to Botany Bay and the Norfolk pines
- Views to the wetlands will be blocked by the raising of President Avenue
- The ventilation outlet at West Botany Street will be visually obtrusive and impact on visual amenity
- Concern that the project will result in light pollution from the tunnels and this will impact on nearby residents and fauna
- Disagreement with the 'low' visual impact rating associated with road widening on the western half of President Avenue. Suggestion that the rating should be high to moderate which is consistent with the eastern half of the works
- Concern about the visual impact of the noise walls.

Response

Section 13.7 of the EIS provides an overview of the potential landscape and visual impacts during operation. As part of this assessment, an overview of the impacts was provided as well as a summary of the impact assessment ratings. Responses for specific locations are provided below.

Shared cycle and pedestrian bridge

The shared cycle and pedestrian pathways would be developed through collaboration between the engineer and urban designer to provide a visually integrated outcome. The landscape character and visual assessment determined that the shared cycle and pedestrian pathway would have a low visual impact on views from the surrounding open space and adjacent roads. As replanted vegetation within Rockdale Bicentennial Park and Scarborough Park North matures, it would assist in visually integrating with the viaduct structure over time and screening views towards the bridge. Impacts on the views towards Botany Bay looking from the east of the President Avenue intersection has been assessed from Viewpoint 11 and Viewpoint 13.

From Viewpoint 11, President Avenue is lined with street trees and there is a high rise residential tower at Grand Parade along the Brighton-Le-Sands foreshore visible in the background. There are no clear existing views of Botany Bay or the Norfolk pines from this location.

At Viewpoint 11, President Avenue would be raised and widened to have to three lanes in each direction with central median, footpaths, and a new signalised intersection at West Botany Street. The new President Avenue intersection with the F6 Extension Stage 1 entry and exit ramps would be signalised and seen in the middle ground of the view. Subject to consultation with Council streetscape planting would be provided, improving streetscape amenity over time. The shared cycle and pedestrian bridge over President Avenue would be seen in the centre of view.

At Viewpoint 13, the Brighton-Le-Sands foreshore can be seen in the distance, in the centre of the view. The shared cycle and pedestrian bridge over President Avenue would also be seen in the middle ground, between Rockdale Bicentennial and Scarborough Parks, adding to the built character of this view.

To reduce visual and landscape impacts during operation, an Urban Design and Landscape Plan (UDLP) will be prepared and implemented. The UDLP will detail built and landscape features to be implemented prior to operation of the project. The UDLP will be developed in consultation with local councils, other key stakeholders and the community and made available to the public.

President Avenue

For views directly to the works at President Avenue during the daytime, a change in the view from open space to a major intersection, entry and exit ramps and tunnel portal, would have a high-moderate visual impact. Whereas, from middle distance locations, such as Brighton-Le-Sands Public School and residential areas of Brighton-Le-Sands, the location of this intersection and tunnel portal within the Rockdale Bicentennial Parklands would be screened by vegetation, resulting in a moderate-low visual impact.

Rockdale ventilation facility

The Rockdale ventilation facility would be visually intrusive. However, the design of the facility will aim to be sympathetic to the surrounding environment. The location of the Rockdale ventilation facility within a setting of light industrial built form would allow the impact to be reduced. There would be a low visual impact in views of the Rockdale ventilation facility from West Botany Street and adjacent areas due to the compatibility of this structure with the surrounding industrial and commercial setting.

The visual appearance and materiality of the ventilation facility would reflect built form elements of the surrounding urban character. Construction of the Rockdale ventilation facility and diversion of West Botany Street would result in a moderate visual impact due to the scale of the works.

Light pollution

At night, the new President Avenue intersection, entry and exit ramps and tunnel portal would be brightly lit. President Avenue would also have upgraded lighting. This would contrast with the relatively darker setting of the park, resulting in a moderate-low visual impact, however the park already provides some lighting during the evening for the sports fields. The tunnel portals would be at lower levels than the existing levels and would therefore result in lower light spill. There would be vegetation planting in the vicinity of the President Avenue intersection with the project tunnels which would assist in reducing light spill.

Lighting at the President Avenue and Princes Highway intersection, and at the Rockdale (south) Motorway Operations Complex (MOC3) (including the Rockdale ventilation facility), would result in low and negligible visual impact due to the consistency of the lighting levels with the existing setting.

During construction and operation, lighting will be oriented to minimise glare and light spill impacts on adjacent receptors.

Visual impacts on LCZ6

Landscape Character Zone (LCZ) 6 consists of the Kogarah residential and local centre, located between the Rockdale Wetlands area and Princes Highway. The landscape values of this zone are considered to be of low sensitivity as it is a predominantly suburban zone, experienced by small numbers of visitors and residents.

President Avenue would be wider during operation of the project, influencing the character of a small area within this LCZ. The road corridor would include a right turning lane into Lachal Avenue with central medians west of Cross Street. Overall, a minor portion of the landscape zone would be changed in the vicinity of President Avenue. In this area the landscape qualities of this suburban zone would be slightly altered due it being a wider corridor with increased traffic. This would result in a low magnitude of change. Therefore, as the landscape zone is of low sensitivity, this results in a low landscape character impact.

To reduce visual and landscape impacts during operation, an Urban Design and Landscape Plan (UDLP) will be prepared and implemented. The UDLP will detail built and landscape features to be implemented prior to operation of the project. The UDLP will be developed in consultation with local councils, other key stakeholders and the community and made available to the public.

Noise walls

Noise walls/barriers are currently not proposed as part of the design of the project. Access needs to be maintained for receivers located on President Avenue and the Princes Highway and therefore for the majority of the project footprint, noise barriers are not feasible. A noise barrier has been considered on the east side of the on- and off-ramps at the intersection of President Avenue. However, an assessment found that the road traffic noise levels at the nearby sensitive receivers are controlled by President Avenue rather than the project ramps, resulting in a relatively minor noise reduction with the barrier. Therefore, noise barriers were not considered reasonable for the project.

C12.5 Cumulative landscape and visual impacts

Two submitters have raised issues regarding cumulative landscape and visual impacts. Refer to section 13.7 and Appendix C2 (Landscape and visual impact assessment) of the EIS for further details.

Submitters have expressed concern about the impact of cumulative motorway projects on visual amenity. Specifically in relation to the cumulative impacts of ventilation outlets, concrete interchanges and concrete flyovers.

Response

The assessment of cumulative impacts for the project have been divided into the northern surface works area (Arncliffe) and southern surface works area (President Avenue).

Northern surface works area (Arncliffe)

Construction impacts

In the northern surface works area, during construction, there is potential for the project to interact with the WestConnex New M5 Motorway project. The construction works for the project would be undertaken on part of an area formerly used as a New M5 Motorway construction compound (ie the Arncliffe construction ancillary facility). While there is a small increase in the project footprint during operation, the duration of construction works at this location would be extended and would result in visual and landscape character impacts for similar receptors.

Operational impacts

Cumulative visual impacts have been minimised in Arncliffe as the project connection with the New M5 Motorway is underground. There would be some additional project infrastructure at the New M5 Motorway Operations Complex facility during operation. It was determined that the Arncliffe Motorway Operations Complex (MOC1) would have a low visual impact from Marsh Street, where it would appear larger than the existing New M5 Motorway Operations Complex within views across the existing Kogarah Golf Course. In other areas, the MOC1 would be screened by the New M5 Motorway Operations Complex and would have a negligible visual impact.

Southern surface works area (President Avenue)

Future stages of the F6 Extension may be constructed and operated within the study area of the project. This work may result in cumulative landscape character impacts on LCZ4: Scarborough Parks open space and recreation area, LCZ5: Brighton-Le-Sands coastal low density residential area and LCZ6: Kogarah residential and urban local centre. These locations may experience a change in landscape character as they would include additional motorway infrastructure.

There may also be a cumulative impact on views from or to the study area, for example due to construction activities, construction equipment, light during construction and operation, vegetation removal or loss of open space.

Details of the potential impacts from future stages of the F6 Extension (and relevant mitigation measures) would be identified in the separate assessments and approvals undertaken for those projects.

C12.6 Landscape and visual environmental management measures

Two submitters have raised issues regarding landscape and visual environmental management measures. Refer to **Chapter D1** (Environmental management measures) for further details.

Submitters have expressed concern about the consideration of landscape and visual management measures in the EIS. Specific concerns include:

- Concern that landscaping treatment would not be effective in managing the visual impact (at night and during the day) of the President Avenue surface works and tunnel portal
- Concern that the project would not look anything like the artist's impressions
- Concern that there would be limited budget to implement the landscape and visual environmental measures
- Suggestion that after construction, further opportunities are investigated to minimise the visual impact of noise walls
- Suggestion that the F6 intersection at President Avenue should be enclosed by an artificial low hill (ie a land bridge).

Response

Landscaping treatments

The President Avenue intersection, including the President Avenue surface works and tunnel portal within Rockdale Bicentennial Park, will be designed to minimise visual and landscape impacts.

During detailed design, there would be a detailed review and finalisation of the architectural treatment of all permanent infrastructure, including the President Avenue intersection and tunnel portals. The architectural treatment of these facilities will be guided by the outcomes of community consultation and urban design principles. Landscaping works will be carried out next to disturbed areas and around operational infrastructure.

Operational lighting at President Avenue will be oriented to minimise glare and light spill impacts on adjacent receptors, where possible.

Artist's impressions

The artist's impressions included in the EIS are provided to visually represent the key features of the project within the existing landscape and do not incorporate architectural design treatments. A detailed review and finalisation of architectural treatment of the project's operational infrastructure will be undertaken during detailed design. The architectural treatment of these facilities will be guided by urban design principles and the outcomes of further consultation with stakeholders (such as through inputs on the Urban Design and Landscape Plan for the project).

Implementation of environmental management measures

The environmental management measures for the project will form part of the conditions of approval for the project, should the project be approved. As the proponent for the project, Roads and Maritime will be obliged to meet these conditions and to pass these on to the construction contractor(s) appointed to design and construct the project, where relevant. Costing for the implementation of the measures will therefore form part of the written contract with the contractor. The Urban Design and Landscape Plan will consider visual and landscape impacts in the design of landscape treatment options.

Noise walls

As described in **section C12.5**, noise walls/barriers are currently not proposed as part of the design of the project.

Land bridge at President Avenue

At the President Avenue intersection, the entry and exit ramps would be uncovered and would extend from President Avenue towards the tunnel portals, which would be enclosed by a landscaped area above. Urban design and landscape treatments would be finalised during the preparation of the Urban Design and Landscape Plan (UDLP) for the project during detailed design. The UDLP will be developed in consultation with local councils, other key stakeholders and the community and made available to the public.

C Part C Response to community submissions

C13 Property and land use

This chapter addresses issues raised in community submissions associated with the property and land use assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 14 (Property and land use) of the EIS for further details on the property and land use assessment.

Contents

C13.1 Level and quality of property and land use assessment

55 submitters have raised issues regarding the quality of the property impact assessment. Refer to section 17.1 of the EIS for details of the geological and structural damage assessments.

The submitters raised concerns about the quality of the property impact assessment, stating that there is a lack of detail on the expected damage to properties as a result of settlement from tunnelling at shallow depths.

Response

The potential for ground movement resulting in damage to properties is discussed in section 17.3.9 of the EIS. A preliminary ground movement assessment was undertaken to identify areas on the surface that may be affected by ground movement and the potential impacts on properties during construction of the tunnels.

Some level of ground movement is expected during tunnelling projects as a result of groundwater drawdown or tunnel excavation. Areas most likely to be affected by ground movement are usually those where tunnelling is closest to the ground surface (such as around the tunnel portals and entry and exit ramps). The criteria relating to allowances for settlement have been specified in the conditions of approval for recent tunnelling projects in Sydney including the WestConnex and NorthConnex projects. These criteria are summarised in Table 17-3 of the EIS and it is expected similar criteria would be adopted for this project.

It is generally accepted that the risk of damage to surface features is negligible when subjected to total settlement of less than 10 millimetres[1]. Ground settlement is predicted to be less than 10 millimetres for the majority of the length of the tunnel because of the tunnel's average depth of 70 metres. **Table C13-1** details the indicative tunnel induced ground settlement estimates.

Table C13-1 Preliminary, indicative tunnel inducted ground settlement estimates

Tunnel Element	Depth below Ground Surface	Estimated Settlement
Cut and cover structure	5-10 metres	Nil
Twin Tunnels	<40 metres	10mm to 25mm
Twin Tunnels	40 metres to 60 metres	5mm to 10mm
Twin Tunnels	>60 metres	2mm to 5mm
Cavern	40 metres	10mm to 30mm

Figure 17-7 of the EIS displays the expected settlement for the areas around the tunnel portals and entry and exit ramps. Increased levels of settlement (up to around 30 millimetres) may be observed at the southern end of the project, where the tunnel is shallower (≤40 metres). The tunnel locations with depths associated with settlement greater than 10 millimetres are characterised by industrial and greenfield land uses as well as public open space. Where excavation depths are at the shallowest point (around the tunnel portals and exit and entry ramps) tunnel induced ground settlement is expected to be negligible due to the methods that will be used to construct the cut-and-cover structure. Construction methods would include installation of stabilisation and excavation support (retention systems) such as sheet pile walls (where required) and diaphragm walls.

As outlined in section 17.3 of the EIS, applicable structural damage criteria would not be exceeded by the tunnelling activities. While the EIS demonstrates this, a geotechnical model of representative geological and groundwater conditions will be prepared during the detailed design phase, once the tunnel alignment is confirmed by the appointed design and construction contractor(s). The model will be used to assess predicted settlement impacts and ground movement during the construction and operation of the project.

[1] R.J.Mair, R.N.Taylor, J.B. Burland (1996) Building Response to Tunnelling: Case Studies from Construction of the Jubilee Line Extension, London

The measures proposed to manage and mitigate settlement impacts during construction are provided in **Chapter D1** (Environmental management measures).

C13.2 Land use impacts during construction

One submitter raised concern about land use impacts during construction. Refer to section 14.5 of the EIS for details of property and land use impacts during construction.

The submitter raised concern about the loss of parkland as a result of construction, particularly at Rockdale Bicentennial Park.

Response

Part of Rockdale Bicentennial Park would be used for the President Avenue construction ancillary facility (C3). Sporting fields and recreational facilities within Rockdale Bicentennial Park would be directly impacted by the project, including a playground with equipment, a skate park, a recreation oval and up to three soccer playing fields. Some of these facilities would be offset with new facilities at nearby locations so as to ensure continuity for the community. New facilities would include new grass and/or synthetic playing fields and the upgrade of existing amenity blocks. The identified locations for these facilities are Ador Park/McCarthy Precinct and Brighton Memorial Playing Fields. Roads and Maritime are also committed to relocating the current skate park and other recreational facilities and are working with Bayside Council to identify a suitable location. The construction and installation of these facilities would be subject to separate planning approvals and are outside the scope of the EIS.

To better understand the potential impacts of the project on the community assets in the Rockdale Bicentennial Park precinct (during construction and operation), Roads and Maritime are completing a Recreation Needs Analysis with Bayside Council. Roads and Maritime will continue to work with Bayside Council to complete the Recreation Needs Analysis for the area, which will confirm current use and compare with future needs. Roads and Maritime will consult with key stakeholders through the Stakeholder Liaison Group during the development of offset facilities and permanent reconfiguration of the Rockdale Bicentennial Park facilities.

C13.3 Property impacts during construction

32 submitters have raised issues regarding damage to property during construction. Refer to section 11.1 of the EIS for details of the safe operating distances for construction plant and Appendix G (Noise and vibration technical report) of the EIS for details on vibration impact management measures.

C13.3.1 Damage to properties during construction

Submitters raised concerns about damage to residential properties during construction as a result of tunnelling activities or work generating increased vibration levels. Specific issues related to:

- Changes to the structural integrity of houses and social infrastructure
- Proximity of the construction zone to properties and suggestion that the distance should be extended from 50 metres to 100 metres
- Vibration impacts from tunnelling and constant spoil haulage movements causing damage to older homes.

Response

Subsurface construction

It is generally accepted that the risk of damage to surface features is negligible when subjected to total settlements of less than 10 millimetres[2]. For most of the tunnel length, the ground settlement is predicted to be less than 10 millimetres due to the depth of the tunnel. Where excavation depths are at the shallowest point (around the tunnel portals and exit and entry ramps) tunnel induced ground settlement is expected to be negligible due to the methods that will be used to construct the cut and cover.

Surface construction

The risk of cosmetic/structural damage is reduced where equipment and plant that cause vibration are operated at an appropriate working distance away from structures. The minimum working distances that would be used for construction plant are presented in Table 11-3 of the EIS. The safe working distance identified for vibration in the noise and vibration assessment was 25 metres to avoid cosmetic damage to structures, assessed against the maximum rating for plant such as a vibratory roller, hydraulic hammer, vibratory pile driver, pile borer and jack hammer. This assessment is described in section 5.5 of Appendix G (Noise and vibration technical report) of the EIS.

Where there is the potential that vibration intensive works may be required within these minimum working distances, alternative equipment would be identified and used as a substitute along with vibration monitoring at the most affected receptor. Vibration monitors are to provide real-time notification of exceedances of levels approaching cosmetic damage criteria. Further assessments would be completed during the detailed design process to avoid and mitigate potential impacts where possible. The detailed mitigation measures for each work site would be documented within the Construction Noise and Vibration Management Plan (CNVMP) developed for the project. Approaches to manage vibration intensive works within these minimum working distances are discussed in section 11.5 of the EIS.

Spoil haulage

Spoil haulage routes to and from construction ancillary facilities have been developed with the aim to minimise the use of local or residential streets and maximise the use of arterial roads. Potential spoil disposal sites have been identified in Table 21-6 of the EIS, all of which are around 40 – 70 kilometres from the project footprint. As per the NSW EPA Waste Proximity Principle[3], the transport of spoil waste would not be beyond 150 kilometres from the place of generation (the project footprint). Spoil haulage is not expected to result in property damage.

The CNVMP will include processes and responsibilities to assess monitor, minimise and mitigate noise and vibration impacts during construction. The CNVMP will:

- Identify relevant performance criteria in relation to noise and vibration
- Identify noise and vibration sensitive receptors and features in the vicinity of the project
- Include standard and additional mitigation measures from the Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime 2016) and details about when each will be applied
- Describe the process(es) that will be adopted for carrying out location and activity specific noise and vibration impact assessments to assist with the selection of appropriate mitigation measures
- Consider cumulative construction noise impacts and construction noise fatigue
- Include protocols that will be adopted to manage works required outside standard construction hours, in accordance with relevant guidelines
- Detail monitoring that will be carried out to confirm project performance in relation to noise and vibration performance criteria.

[2] R.J.Mair, R.N.Taylor, J.B. Burland (1996) Building Response to Tunnelling: Case Studies from Construction of the Jubilee Line Extension, London
[3] Refer to Clause 71 of the Protection of the Environment Operations (Waste) Regulation 2014 (NSW)

Further, vibration monitors may be used to measure vibration levels within private properties where and when required. Where vibration limits are exceeded, the circumstances would be assessed and vibration management and mitigation measures identified in the CNVMP will be implemented. Where members of the community are being impacted by spoil haulage or other vibration sources, they are able to lodge a complaint so that the matter can be investigated. A Complaints Management System will be implemented for the duration of construction. This system will be used to capture complaints including ongoing disturbance from vibration impacts.

C13.4 Property and land use impacts during operation

95 submitters raised issues regarding the impact of property and land use impacts during operation. Refer to section 14.4 and 14.5 of the EIS for details of property and land use impacts during operation.

C13.4.1 Future development of properties

Submitter is concerned the tunnels will impact on future property developments, such as basement works.

Response

As described in section 14.4.3 of the EIS, in most cases, subsurface acquisition for the tunnels would not affect the continued existing, or future use of property at the surface. Subject to council regulations and approvals, landowners would generally be able to:

- Carry out improvements, such as installing a swimming pool
- Dig foundations for a new building or second storey additions
- Undertake property development.

In circumstances where tunnel depths are at the shallowest point (around the tunnel portals and exit and entry ramps), the introduction of the subsurface stratum, and the tunnel itself, has the potential to limit development above the alignment.

C13.4.2 Impacts on property access

Submitter is concerned about the impact of increased operational traffic on safe property access, including along President Avenue.

Response

The traffic modelling for the project has shown that with the project, daily traffic on roads around the President Avenue intersection and surrounds is generally forecast to decrease. However, some changes in travel patterns and vehicle movements as people take up use of the project, will lead to small amounts of increased traffic on some roads, including along President Avenue (refer to section 8.7 of Appendix D (Traffic and transport technical report) of the EIS). However this is not expected to impact driveway access for properties along President Avenue.

There are a limited number of properties on President Avenue that may face difficulties making right turn movements out of driveways onto President Avenue. This would become more difficult with or without the project as traffic is forecast to increase on President Avenue in the future. For vehicles from properties located on the southern side of President Avenue, a left turn can be made from President Avenue onto Moorefield Avenue, Oakdale Avenue or Lachal Avenue and a right turn out of a signalised Civic Avenue intersection to head eastbound. For vehicles from properties located on the northern side of President Avenue, there are options available including making a left turn at Cross Street and subsequently a right turn out of West Botany Street or a right turn at signals at Lachal Avenue and subsequently a left turn out of Traynor Avenue to head westbound.

C13.4.3 Impact of the project on property values

Submitters are concerned that the project will negatively affect the valuation of non-acquired properties along the tunnel alignment.

Response

Future movements in property values are difficult to forecast as they are subject to many variables, including specific attributes of the property, local amenity and accessibility, demand and supply factors and other wider changes in the property market.

The long term impact of the project on property values would be influenced by the long term benefits of the project as perceived in the market, for example improved amenity and traffic movements, as well as new project elements. There is no evidence from previous road tunnel projects suggesting these projects result in a decrease in property values.

C13.4.4 Damage to ground conditions and impact to property foundations

Submitter raised concern that the project would result in significant sub-surface drainage, which would alter the soil moisture content upon which properties are built.

Response

Ground movement is an expected outcome of tunnelling projects and can affect the soil composition due to inflow of groundwater into the tunnel resulting in drawdown of the overlying soil layer (refer to section 17.1.7 of the EIS). This results in an increase in stress in the soil composition due to moisture loss which is only significant when it causes drainage of a thick layer of compressible water saturated soils. Ground movements are unlikely to occur as a result of groundwater drawdown given the tunnel has been located within competent bedrock with minimal impact to the groundwater profile. Varying waterproofing techniques will also be adopted to minimise water ingress into the tunnel. Ground movement (settlement) or subsidence due to the compression of the soil structure from groundwater drawdown is discussed in section 7.3.9 of the EIS.

A groundwater monitoring program will be implemented to continually assess groundwater inflows during construction and operation to ensure effectiveness of management measures (refer to environmental management measure GW7 of **Chapter D1** (Environmental management measures)). Ground settlement at buildings will be managed to comply with the criteria set out in table 17-3 of the EIS (refer to environmental management measure PL3). Where there is potential for construction activities to cause damage to properties, building condition surveys will be offered for the assurance of property owners (refer to environmental management measure PL4).

C13.4.5 Loss of open space

Submitters raised concern about the loss of open space and community infrastructure due to the project.

A submitter also raised concern that the reinstatement of the Brighton Memorial Playing Fields with a synthetic surface would transform it into a busy sports centre, which was inappropriate so close to nearby residences.

Response

The project has limited permanent infrastructure at the surface, with the majority of infrastructure comprising the underground tunnel. Despite the limited requirements for surface lands, the project would still acquire council owned land at Rockdale Bicentennial Park, Scarborough Park North and Kogarah Golf Course. Permanent infrastructure associated with the President Avenue intersection, shared cycle and pedestrian pathways and Arncliffe Motorway Operations Complex (MOC1) would be located on land owned by Roads and Maritime (refer to Table 14-4 of the EIS).

The permanent location of project infrastructure, including entry and exit ramps and other road infrastructure, would result in the permanent change of land use from what is primarily existing open space to transport infrastructure. After construction, land no longer required for the project would be returned to open space (refer to Figure 6-12 of the EIS).

Rockdale Bicentennial Park and the associated playing fields would be reinstated with a new car park to the north, a skate park and children's playground. The playing fields on the eastern side of the Rockdale Wetlands would also be reinstated to the existing condition following construction. New shared cycle and pedestrian pathways would be constructed which would include a new pedestrian bridge which would provide access to the Rockdale Wetlands.

Brighton Memorial Playing Fields would not be directly impacted by the project (refer to Figure 6-2 of the EIS for the labelling of playing fields in the vicinity of the project). The reinstatement of Rockdale Bicentennial Park would involve the reinstatement of the existing playing fields within Rockdale Bicentennial Park East. These facilities and playing fields would be comparable with existing facilities and therefore are not expected to significantly increase the use of these fields. Roads and Maritime is consulting with Bayside Council, as the facility owner, and the sporting groups that use the facilities, to develop a master plan for the reconfiguration of the Rockdale Bicentennial Park and associated facilities.

In addition, prior to construction commencing, some of the impacted facilities within Rockdale Bicentennial Park would be offset with new facilities at nearby locations. The construction and installation of these facilities would be subject to separate planning approvals.

Refer to **Chapter C14** (Social and economic) for further responses on social and economic impacts resulting from the loss of open space during operation.

C13.4.6 Management of residual land

Submitters are concerned with the management of residual land and open spaces, including the existing F6 reserved corridor, in locations not used by this project.

Response

As noted in section 14.4.2 of the EIS, the project has been designed to minimise the need to acquire privately owned property. Private property land acquisitions would largely be for permanent infrastructure. It is expected that there would be very little, if any, reusable land to support alternative use at the completion of construction.

Residual land remaining following construction of the project would be confirmed to identify appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses (refer to environmental management measure PL2 in **Chapter D1** (Environmental management measures)). Land leased temporarily for construction of the project (eg for the construction within Rockdale Bicentennial Park and Kogarah Golf Course) would be returned to its former use as open space. Consequently, there would be no residual land remaining in these circumstances.

Existing F6 reserved corridor

As a result of the preferred location and alignment of the project, the existing F6 reserved corridor would not be required for the project, aside from a small portion of land within Rockdale Bicentennial Park. The future use of the existing F6 reserved corridor between Arncliffe and Kogarah that would not be required for the project is being considered by Transport for NSW. Initially, a review of the corridor for possible alternative future public and active transport uses is being undertaken as part of a wider review of the integrated transport needs for the area. The review is being carried out in consultation with Bayside Council.

Any assessment or decision regarding the future of the corridor would be separate to the planning approval process for the project and would be developed in collaboration with the NSW Department of Planning and Environment, Transport for NSW and Bayside Council.

C13.4.7 Impact on urban sprawl

Submitters are concerned with the impact of the project on urban sprawl which would reduce the population's accessibility to employment, education and services and increase transport costs. One submitter expressed that providing faster travel along road networks enables urban sprawl. The new developments/suburbs have poor access to employment opportunities, education and services, so commuters are forced to travel by car to city centres which are already heavily congested.

Response

The project is located within the established urban areas of Arncliffe, Banksia, Rockdale, Kogarah and Brighton-Le-Sands, comprising established urban infrastructure including residential dwellings, transport infrastructure, community facilities and industry. The project would not extend beyond established urban areas in southern Sydney and therefore would not contribute to urban sprawl. The project objective is to support NSW's major sources of economic activity and provide one part of an integrated transport solution to address the current constraints of the road network. The *Greater Sydney Region Plan (Greater Sydney Commission 2018)* places a strong focus on the integration of land use and transport planning with the aim of delivering benefits such as improved access to transport and services, connectivity to jobs and homes and positive health and environmental outcomes.

C13.5 Property acquisition

17 submitters have raised issues regarding surface and subsurface property acquisition. Refer to section 14.4 of the EIS for details of the acquisition process and the Roads and Maritime Land Acquisition Information Guide.

C13.5.1 Property and subsurface acquisition

Submitters are concerned about the compulsory acquisition of properties from residents and businesses, specifically commenting on:

- The process of acquisition and fair compensation affecting residential properties and impacted businesses
- Requesting more information on subsurface acquisition.

Response

Surface acquisition

Private properties to be permanently acquired are detailed in Table 14-3 and Table 14-4 of the EIS. These properties include eight business premises comprising retail, commercial and industrial businesses which may serve local and district trade catchments. Where private land required for the project is not currently owned by Roads and Maritime, discussions are being held with the affected property owners concerning the purchase, lease or licence of the land.

All acquisitions required for the project will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the land acquisition reforms announced by the NSW Government in 2016[4], which can be viewed online[5].

Roads and Maritime have appointed a Personal Manager Acquisitions to assist each of the land owners, residents and commercial tenants affected by acquisition for the project. The Personal Manager Acquisitions will work with landowners, residents and commercial tenants to offer them assistance and support throughout the acquisition and relocation process. Further information about this process can be found online[6].

A toll-free Acquisition Assistance Line will also be established and maintained for a period of up to six months following completion of the final acquisition for the project. The Acquisition Assistance Line aims to provide ongoing dispute resolution, a counselling program and contact information for relevant services for relocated persons.

[4] https://www.finance.nsw.gov.au/land-property/land-acquisition-reform-2016
[5] NSW Government (2016) Review of the NSW *Land Acquisition (Just Terms) Compensation Act 1991*
[6] http://www.propertyacquisition.nsw.gov.au/

Subsurface acquisition

In addition to the properties affected by surface activities, land (or interests in land, such as easements) below the surface of the ground would be acquired to accommodate the tunnels and entry and exit ramps. This is called subsurface (or substratum) acquisition. The *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) rules that compensation is not payable for the majority of subsurface acquisition of land or easements, unless specific circumstances as detailed in the Act apply. Appendix C of the Roads and Maritime *Land Acquisition Information Guide*[7] sets out in detail the compensation provisions of the Act relating to subsurface acquisition and the land acquisition reforms announced by the NSW Government in 2016.

Where subsurface acquisition is confirmed during detailed design, Roads and Maritime would contact owners of directly affected properties. If private property is directly affected, Roads and Maritime has the authority to acquire the subsurface land, under the *Roads Act 1993* (NSW), by a compulsory acquisition process. A factsheet on property acquisition of subsurface land is available on Roads and Maritimes' website.[8]

C13.6 Cumulative property and land use impacts

Two submitters raised an issue regarding the cumulative impacts of the project relating to property damage and loss of open space.

C13.6.1 Cumulative property impacts

Submitters raised concern about the cumulative property impacts of the project with the WestConnex projects and future stages of the F6 Extension, specifically relating to:

- Temporary occupation of public recreation areas and open space
- Property damage.

Response

Cumulative impacts on open space

The project will extend the use of the Arncliffe construction ancillary facility that currently occupies a section of land located within Kogarah Golf Course. This land is currently being used for the construction of the WestConnex New M5 Motorway project. The construction ancillary facility would be partially demobilised before use by the project. The subsequent occupation of this land for the project will result in Kogarah Golf Course being required to operate as a nine hole golf course for a longer period of time (8 years in total).

There are no other anticipated cumulative impacts on public recreation areas and open space as a result of the project and other major projects. This project has also considered cumulative impacts of future stages of the F6 Extension, however, this would be considered in more detail within the separate environmental assessments for these future projects.

Cumulative property damage

Potential property damage impacts for motorway tunnel projects are generally associated with:

- Settlement as a result of tunnel excavation during construction or as a result of groundwater drawdown during operation
- Localised property impacts around surface construction activities from vibration intensive works or the movement of construction vehicles and equipment.

There is the potential for cumulative settlement impacts associated with the New M5 Motorway tunnels around the northern section of the project, where the tunnels connect. The preliminary ground movement assessment in section 14.4.6 of the EIS was undertaken for the project to identify areas on the surface that may be subject to ground movement. The assessment included consideration of potential settlement impacts associated with the New M5 Motorway tunnels.

[7] Roads and Maritime Services (2014) *Land Acquisition Information Guide*
[8] https://www.rms.nsw.gov.au/documents/projects/factsheet-property-acquisition-of-subsurface-lands.pdf

The preliminary ground movement assessment determined that the land around the northern connection of the project with the New M5 Motorway tunnels is expected to experience between around 2 - 5 millimetres of settlement during construction. It is generally accepted that the risk of damage to surface features is negligible when subjected to total settlement of less than 10 millimetres.

A geotechnical model of representative geological and groundwater conditions will be prepared by the construction contractor during the detailed design phase prior to the commencement of tunnelling. The model will be used to assess predicted settlement impacts and ground movement during the construction and operation of the project. The model will consider the cumulative settlement impacts associated with the New M5 Motorway tunnels.

As described in section 7.3.2 of the EIS, the construction ancillary facility for the New M5 Motorway project at the proposed Arncliffe construction ancillary facility (C1) would be demobilised prior to being made available for construction of the F6 Extension Stage 1 project. Given that construction activities for the project in this location would not overlap with the New M5 Motorway project, there would be no cumulative localised property damage impacts associated with surface construction activities.

Future stages of the F6 Extension are currently under investigation and would be subject to separate environmental assessment and planning approval. However, there is currently no formal commitment from the NSW Government regarding the development of a design or timeline for future stages of the F6 Extension.

C13.7 Property and land use environmental management measures

165 submitters have raised issues regarding compensation and property management measures. Refer to **Chapter D1** (Environmental management measures) for details of the proposed environmental management measures.

C13.7.1 Compensation to account for property impacts

Submitters are concerned about how compensation will be managed, specifically related to:

- Home owners may be liable for repair costs associated with property damage during construction
- Lack of compensation afforded for property damage and compensation should be fair and accurate
- Compensation for loss of property values
- Relocation costs for households who independently decide to move away from the project footprint to avoid being impacted.

Response

Property damage claims will be subject to assessment by the project contractors, on behalf of Roads and Maritime. Building condition surveys will be offered in writing to the owners of properties where there is a potential for construction activities to cause cosmetic or structural damage. If accepted, the surveys will be completed before and after construction works to identify pre-existing damage and damage that may be sustained due to the works. In the unlikely event of damage caused by construction, consultation will be undertaken with the affected landowner to determine rehabilitation requirements in order to restore the property to its pre-construction condition. Rectification works will be undertaken at no cost to the property owner.

In accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*, compensation to landowners is only payable when land is acquired for the particular project. Compensation for other perceived impacts is not proposed, based on the demonstration in the EIS that the potential impacts of the project are reasonable and justifiable. In the event that project settlement criteria are exceeded during construction for property and infrastructure, measures would be taken to 'make good' or to manage the impact. In consideration of this, compensation is not proposed for the relocation of residents whose households are not affected by compulsory acquisition.

Residential property values are driven by a range of factors including liveability and are subject to many variables, such as property attributes and changes in the wider property market. In consideration of this complexity, the project cannot be identified as the exclusive source of property value fluctuations. Generally, the long term improvements of the project in amenity, road safety, traffic connectivity and active transport options would likely be a positive influence on the property values of surrounding communities.

C13.7.2 Management measures for property impacts

Submitters commented on the limitations in the stated management measures, specifically relating to the following issues:

- Lack of mitigation measures to avoid property damage from tunnelling
- Uncertainty around implementation of measures by Roads and Maritime
- Uncertainty regarding the timing of pre-dilapidation assessments and damage claims
- Repair of properties at the government's expense is not an adequate mitigation measure
- Management measures do not confirm timeframes, methodology or responsibility for property rectification works, providing no assurance.

Response

Before construction commences, building condition surveys will be offered in writing, to the owners of properties where there is a potential for construction activities (for example, from the use of vibration intensive plant) to cause cosmetic or structural damage (refer to environmental management measure PL4). If accepted, a comprehensive written and photographic condition report will be produced by an appropriate professional prior to relevant works commencing. The survey will provide a clear record of the property's condition before and after construction. These surveys would not be conducted prior to the approval of the project.

In the unlikely event there is damage attributed to the project it would be repaired at no cost to the property owner. Each damage claim would be assessed on a case by case basis and rectification works carried out in consultation with the property owner. As each case is unique, there are no set timeframes or methods for property repairs specified in the EIS.

The depth of the tunnels and the predominant geology in the project footprint (Hawkesbury Sandstone) minimises the potential for settlement impacts. While groundwater drawdown would be managed during construction and operation, the risk of ground movement remains. The residual risk of ground movements resulting in damage was determined to be low, highlighting the effectiveness of the management measures proposed to avoid impacting properties.

C Part C Response to community submissions

C14 Social and economic

This chapter addresses issues raised in community submissions associated with the social and economic assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 15 (Social and economic) and Appendix I (Social and economic supporting information) of the EIS for further details on the social and economic assessment.

Contents

C14.1 Level and quality of social and economic assessment

138 submitters have raised issues regarding the adequacy of the social and economic assessment. Refer to section 15.1 of the EIS for details on the assessment approach for the social and economic assessment.

Submitters stated that the social and economic assessment did not adequately consider:

- The loss of community identity, social connection or public amenity
- Key public areas and their relationship to surrounding communities who use them
- Cumulative impacts with other projects in the vicinity
- Lessons learnt from other motorway projects (such as WestConnex).

Response

The social and economic impact assessment (SEIA) has been prepared to assess the impacts of the project in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs) and the Roads and Maritime *Environmental Impact Assessment Practice Note – Social and economic assessment* (EIA-N05) (Practice Note). The Roads and Maritime Practice Note guides the assessment level and process for social and economic impact assessments and outlines the requirements for establishing the social and economic baseline.

In addition, the EIS addressed potential cumulative effects including road tolling and an increase in cumulative amenity impacts alongside those generated by the operational project such as traffic, air quality, noise and visual impacts.

Impacts upon community identity were assessed in section 15.3.8 of the EIS. This section drew upon specific community identity, values and aspirations as outlined in the *Rockdale City Council Community Strategy Plan 2013-2025* and the *Kogarah City Council Community Strategic Plan 2030* and considered the likely impact of the project accordingly.

While road and active transport connectivity was addressed in the EIS, the impact on social connectivity was not. This was due to the fact that the project included only discrete large infrastructure items at the surface which would not lead to noticeable changes to social connectivity. Further, the construction of the shared cycle and pedestrian pathway is likely to lead to benefits to the community through the facilitation of non-car based connectivity more generally along the alignment.

Public amenity was addressed in detail within the EIS for both construction and operation. This considered aspects such as noise and vibration, traffic and access, air quality and landscape and visual impacts. Impacts on key public areas and elements of social infrastructure, such as Rockdale Bicentennial Park has been considered in detail with reference to their relationship with the local community (refer to section 15.3.1 and section 15.3.3 of the EIS).

Impacts have been considered with reference to nearby development of a similar scale that is likely to lead to cumulative impacts alongside the project. This has included consideration of the ongoing construction of parts of the New M5 Motorway that overlap with the project, as well as ongoing urban development and intensification throughout the corridor. The community relations team would build a working relationship with the teams for other major projects to identify sensitive receptors who may be susceptible to construction fatigue, consultation fatigue and complaint fatigue and develop coordinated responses, where needed. Mitigation measures to address impacts of the project that may be experienced over longer durations are provided in the respective technical assessment chapters, including Chapter 8 (Traffic and transport), Chapter 9 (Air quality), Chapter 11 (Noise and vibration) and Chapter 13 (Landscape and visual).

The social and economic assessment for the project has taken account of key lessons learned from previous arterial road and motorway projects in Sydney. This has considered issues raised by communities as part of the development of the various stages of WestConnex. The assessment for the project included consideration of community views and values obtained through community and stakeholder consultation prior to the exhibition of the EIS. This has led to project changes and an indicative urban design and landscape plan (refer to Appendix C1 (Place making and urban design) of the EIS), to restore and improve community amenities in and around Bicentennial Park, as well as other initiatives during construction. Specifically, key elements of the project including the provision of

the shared cycle and pedestrian pathways, consideration of construction fatigue and the minimisation of property acquisition have been included in this project based on feedback from the community on previous motorway projects, such as WestConnex.

C14.2 Social and economic impacts during construction

17 submitters have raised issues regarding social and economic impacts during construction. Refer to section 15.3 of the EIS for details of the potential social and economic impacts during construction.

Submitters raised concerns over social and economic impacts during construction, including:

- Reduced quality of life due to reduced access to social infrastructure, amenity impacts and the duration of construction impacts
- Construction vehicle movements impacting local communities through amenity impacts and increased traffic
- Reduced accessibility to areas that benefit social wellbeing such as the beach and sporting facilities due to construction and loss of street parking.

Response

The SEIA considered the feedback received during project consultation including concerns from the local community and businesses on amenity, quality of life and wellbeing impacts during the four years of construction (an indicative construction program for the project is provided in Figure 7-2 of the EIS). The EIS provides an assessment of the amenity impacts associated with construction across all surface elements of the project. The impacts upon residents, businesses and social infrastructure are considered. **Chapter D1** (Environmental management measures) provides a detailed list of management measures which will be implemented for the project. A Site Establishment Management Plan will be prepared prior to construction and will have regard to the amenity of adjacent areas and minimising impacts on adjacent sensitive receptors, including potential noise, dust, traffic, visual, lighting and overshadowing and overlooking impacts.

The SEIA acknowledges that the presence of construction vehicles would affect local communities as a result of the proposed changes to the local road network. Impacts include an increase in air quality, noise, visual presence of more vehicles, trip durations, wait times at intersections, road safety and access to properties, businesses and social infrastructure. Construction haulage routes have been selected to minimise the use of local roads and for such movements to be concentrated outside peak periods where possible. In most instances, modifications to the local road network during construction would be temporary, with access off local roads reinstated upon completion of construction. In addition, construction works will be subject to careful traffic management to maintain the functionality of the surrounding roads. Such measures will be documented in a Construction Traffic and Access Management Plan (CTAMP).

During construction, the project would result in changes to local transport connectivity, which includes temporary road diversions or speed limiting and changes to the accessibility of some recreational spaces such as Bicentennial Park and a continuation of the occupation of parts of Kogarah Golf Course. The nature of the project, being largely underground with only discrete surface facilities, means that connectivity across and along the project would be largely maintained throughout construction. Accessibility of local places such as the beaches of Botany Bay would be largely unaffected by construction.

There would be a temporary loss of on-street parking during construction. However, this loss of parking would occur in stages and the spaces lost would not occur at the same time. Some on-street parking areas would be reinstated following completion of construction while other on-street parking areas removed during construction would be reinstated during non-peak periods following construction. A car parking strategy will be developed as part of the CTAMP to identify actions that will be implemented by the contractor to avoid or minimise the use of on-street parking in the vicinity of construction sites by the construction workforce.

Measures to reduce social infrastructure impacts during construction include the provision of temporary alternative sporting and recreational facilities in nearby locations, including a skate park, children's disability playground and sporting fields. This will be investigated during detailed design to account for the temporary and permanent loss of these facilities during construction of the project at the President Avenue construction ancillary facility (C3).

C14.3 Business and industry impacts during construction

Three submitters have raised issues regarding business and industry impacts during construction. Refer to section 15.3 of the EIS for details of the potential business and industry impacts during construction.

Submitters raised concern over the following impacts on business and industry during construction:

- Construction vehicle movements impeding deliveries to areas such as the industrial park located in Rockdale
- Reduced income and rent to businesses as a result of tenants no longer wishing to occupy businesses in the area.

Response

Potential construction related business impacts are assessed in detail in section 15.3.1 and section 15.3.6 of the EIS. These impacts include changes to the existing road network which would potentially affect servicing and deliveries of goods, as well as acquisition of business properties, requiring them to relocate.

The movement of project-related construction vehicles will constitute a very small proportion of the overall traffic in this area. Despite this, the project has committed to restricting construction vehicle movements to main roads, wherever practical. This includes movements throughout industrial areas within the study area, such as along West Botany Street.

Should businesses choose to terminate operations instead, this would result in the loss of income for employees and owners and a loss of economic input and output in the locality. Where these businesses cater to the specific needs of residents or industries in the local community, this may result in flow-on social or economic effects within the region.

A Business Management Plan will be prepared prior to construction to detail the process for identification and communication with businesses adversely affected by construction works. This plan will provide specific measures to reduce the impact of the project upon businesses. This may include mitigation to maintain access for passing trade such as additional signage, or commitments to manage construction activities to avoid or manage impacts at sensitive times for some businesses eg avoiding business delivery times. A car parking strategy will also be developed and implemented as part of the CTAMP to manage parking impacts in adjacent streets and subsequently impacts on businesses. Businesses may also benefit from the large number of project workers during construction.

C14.4 Social infrastructure impacts during construction

11 submitters have raised issues regarding social infrastructure impacts during construction. Refer to section 15.3 of the EIS for details of the potential impacts on social infrastructure during construction.

Submitters raised concern over social infrastructure impacts during construction. Specific concerns include impacts associated with:

- Access to sporting facilities for all members of the community
- Reduced recreational, open space and public open space for the community.

Response

Recreational facilities at Rockdale Bicentennial Park, including Rockdale skate park, Rockdale children's disability playground and the Bicentennial East soccer fields, would be affected by construction of the project and would be temporarily relocated to a nearby area, allowing the community to continue to benefit from use of these facilities during the construction period. Other sporting fields at this location, including the Brighton Memorial Playing Fields, may be reconfigured at their current location to allow the community to continue to benefit from their use during the construction period.

It is also acknowledged that the presence of construction activity in or around public open space and recreational areas has the potential to reduce the amenity and accessibility of the areas not being occupied during construction (eg Brighton Memorial Playing Fields and Ilinden Sports Centre). The impacts would affect the enjoyment or use of these areas for sporting and recreational uses and may deter people from using these areas for respite and relaxation. While some degree of impact on these facilities is unavoidable, the project would seek to manage impacts wherever possible through the implementation of construction environmental management plans such as the Construction Noise and Vibration Management Plan (CNVMP) and the CTAMP.

Access to some facilities would be affected in certain locations, including partial occupation of the Ilinden Sports Centre car park and more general temporary diversions and changes to footpaths and cycleways. Access during construction would be managed through the implementation of the CTAMP.

C14.5 Social and economic impacts during operation

205 submitters have raised issues regarding social and economic impacts during operation. Refer to section 15.4 for details of the social and economic impacts during operation.

Submitters raised concern over the following social and economic impacts during operation:

- Reduced quality of life due to amenity impacts and increased reliance on cars
- Pedestrian diversions and reduced access due to motorway infrastructure
- Division of the community
- Clearways impacting small businesses and local communities in locations such as:
  - President Avenue
  - St George
  - Ramsgate
  - Sans Souci
  - Rocky Point Road.

Response

Adverse amenity impacts during operation could be caused by changes to visual amenity due to the presence of new infrastructure, increased noise levels or changes in the distribution of air quality impacts. The majority of these impacts would be localised around the President Avenue intersection, the Arncliffe ventilation facility and the Rockdale ventilation facility.

It is acknowledged that the project would contribute to changes in the generally suburban nature of the area. In certain cases this may result in physical or psychological barriers between communities that discourage movement or interaction. The operation of the project has the potential to create or exacerbate this effect around areas of surface infrastructure such as widened roads, new intersections or in areas of increased traffic. In particular changes to the road layout on and around President Avenue, including the closure of some local roads, may affect this community severance effect. In this case though, the potential for impacts is considered to be low based upon the existing busy nature of President Avenue and the existing access restrictions to some side roads. This effect would however be offset by the improved community connectivity provided by the proposed shared cycle and pedestrian pathway, which has the potential to provide not only a transport linkage between communities, but an informal and impromptu social destination in its own right. Refer to **section C14.6** below for details on the improvements to active transport links proposed by the project.

The degree to which the community is reliant on private vehicles would generally not change for the operation of the project as the project would not prohibit the use of existing alternative transport modes (buses, cycling or walking) for local or regional trips. The shared cycle and pedestrian pathways would increase the attractiveness of cycling as an alternative to private vehicle travel for local north-south movements.

Adverse impacts on amenity and quality of life may be more acutely experienced by those living in proximity to surface elements of the project. However, the decision to place the motorway in tunnel through this region has prevented a much wider range of adverse quality of life impacts on a much greater number of people when compared to a surface motorway option. This, combined with the project's local benefits (such as improved active transport links, reduced surface traffic) suggests that the overall impact upon quality of life in the area is likely to be minor.

Refer to **section C14.4** for a description of the management of impacts on recreational and open spaces impacted by the project.

Clearways

The project would implement peak period clearways in both directions along President Avenue, west of O'Connell Street, which would reduce the number of parking opportunities in this area at these times. Businesses along President Avenue to the west of the West Botany Street intersection all have some form of customer and/or supplier access independent of on-street parking provisions on President Avenue. As such the impact of peak period clearways upon these businesses is not expected to be significant.

In regards to clearways impacting on areas such as St George, Ramsgate, Sans Souci and Rocky Point Road, these proposed clearway extensions are not part of the project.

Clearways along the Princes Highway and The Grand Parade are not expected to impact President Avenue and the project. These clearways would be subject to separate assessment which would address the impacts on parking and local business.

C14.6 Social infrastructure impacts during operation

138 submitters have raised issues regarding social infrastructure impacts during operation. Refer to section 15.4 for details of the social infrastructure impacts during operation.

Submitters raised concern over impacts associated with reduced recreational and public open space for the community and reduced access to public recreational/open space and social infrastructure.

Response

The project has been designed to minimise the need for land acquisition and to limit the potential for severance and/or sterilisation of public and private properties.

The permanent presence of project elements such as the President Avenue intersection will inevitably alter the existing access to sporting facilities such as Rockdale Bicentennial Park and Rockdale Skate Park. This would be offset by the provision of the shared cycle and pedestrian pathways. By doing so, this would provide improved and accessible connections to each of these facilities, as well as linking them to facilities to the north such as Rockdale Women's Sports Field, White Oak Reserve, C A Redmond Field, Greg Arkins mini field, Tony Baker Reserve, Ador Reserve and Rockdale Park.

This would provide valuable north-south connectivity along the majority of the project, as well as providing east-west connections to relevant social infrastructure such as schools and sporting fields. Importantly, the construction of the President Avenue bridge would dramatically improve safety and connectivity across President Avenue for pedestrians and cyclists – a major local and regional road corridor that would see an increase in traffic during operation. This would be expected to improve quality of life for a broad cross section of local residents, including children and the elderly, through the provision of a segregated, safe and accessible active transport option linked to several social infrastructure nodes within and near the Rockdale Wetlands and recreation corridor.

At the completion of project construction, land not comprising part of the permanent operation elements of the project will be rehabilitated with the intention that it be returned to its original or possibly reconfigured (within the project footprint) use. As discussed in Chapter 13 (Landscape and visual) of the EIS, there would be a permanent loss of vegetation and open spaces, around 1.1 hectares within the Rockdale Bicentennial and Scarborough parks, as a result of land being used for the tunnel portals and the shared cycle and pedestrian bridge over President Avenue. The project would however facilitate the upgrade of Rockdale Bicentennial Park East. This would provide for an enhanced quality and breadth of facilities for the community at this location.

A Community and Social Management Plan will be prepared which will detail the process for identification and implementation of measures to offset community and social impacts associated with the project. The plan will be prepared by a suitably qualified and experienced person(s) in consultation with the community and Bayside Council.

C14.7 General social and economic concerns

72 submitters have raised general social and economic concerns. Refer to Chapter 15 (Social and economic) for further details on the social and economic assessment.

Submitters raised concern over general social and economic impacts. Specific concerns included impacts associated with:

- Reduced social connectivity
- Physical barriers to access, reduced walkability and increased reliance on cars
- Reduced access to goods and services
- Opportunities for employment
- Mental health and wellbeing
- Community facilities such as hospitals and schools.

Response

Social connectivity

The project would provide connectivity improvements for pedestrians and cyclists through the shared cycle and pedestrian pathways. This would provide valuable north-south connectivity along the majority of the project, as well as providing east-west connections to relevant social infrastructure such as schools and sporting fields (refer to **section C14.6** for further details on connectivity benefits during operation of the project).

While adverse impacts on social connectivity may be more acutely experienced by those living in proximity to surface elements of the project, particularly during construction, it is noted that the decision to place the motorway in tunnel through this region has prevented the much more significant community severance that would have resulted from a surface motorway option.

The degree to which the community is reliant on private vehicles would generally not change for the operation of the project as the project would not prohibit the use of existing alternative transport modes (buses, cycling or walking) for local or regional trips. The shared cycle and pedestrian pathways would increase the attractiveness of cycling as an alternative to private vehicle travel for local north-south movements.

Access to goods and services

Impacts on the local road network during construction are discussed in **section C14.2**.In regards to access to goods and services via public transport during construction, movements on President Avenue, West Botany Street and Princes Highway would be maintained during peak periods, allowing bus services to continue. There would however be temporary relocation of some bus stops along President Avenue and some temporary closures of local streets that may require minor route diversions. In addition, the opportunity for the community to walk or cycle in the study area would be maintained, albeit that changes may increase pedestrian wait times and journey duration.

Refer to **section C14.3** for responses to access to goods and services (business and industry impacts) during construction.

Once operational, the project is forecast to reduce travel times between southern Sydney and the central business district, as well as facilitating faster journeys elsewhere through the broader Sydney motorway network. The reduction in traffic forecast on key roads with the project is expected to improve bus speed and reliability and access to public transport (ie train stations). The project would also provide additional connectivity improvements for pedestrians and cyclists through the shared cycle and pedestrian pathways. As such, during operation, the project would generally improve the community's ability to access goods and services locally and regionally.

For operational impacts for business and industries, it is expected that the local road, active transport and public transport network would generally improve as a result of the operation of the project. Increased accessibility and connectivity has the potential to reduce delivery times, increase delivery reliability and reduce transport costs for businesses. Access for customers travelling to business premises in the area would also be improved as a result of better links to other regions within Sydney and beyond.

Opportunities for employment

It is expected that construction of the project would significantly increase the employment opportunities across the study area, and is considered to have a significant positive benefit for the local economy.

In addition to those directly employed by the project, operational expenditures would generate around 120 full time equivalent positions off-site.

Mental health and wellbeing

Changes in the urban environment associated with the project have the potential to result in a range of impacts on health and wellbeing of the community.

The presence of construction activities and an influx of newcomers to the area as part of the construction workforce may affect local amenity and the community's perception of safety. However, it is unlikely that there would be substantial changes to the local demographic profile due to construction of the project.

An increase in construction activity in or around public open space and recreational areas has the potential to reduce the amenity and accessibility of these areas which can have an impact on the health of the community. However, recreational facilities affected by construction of the project would be temporarily relocated to a nearby area, allowing the community to continue to benefit from use of these facilities during the construction period.

Other wellbeing and health impacts could derive from visual amenity impacts during the construction of the project. Construction hoarding would be installed to limit visual impacts of construction of the project. The construction contractor would construct the project as outlined in the EIS, this report and the conditions of approval, including a code of conduct for the construction workforce to promote and encourage respect for local residents and businesses, and to maintain the community perception of a safe and welcoming community. Impacts on amenity and community wellbeing are assessed in section 15.3.3 of the EIS.

Adverse amenity impacts during the operation of the project could arise from increased noise levels, which could impact the ambience of a business, or changes in the distribution of air quality impacts. The majority of these impacts would be localised around the President Avenue intersection, the Arncliffe ventilation facility and the Rockdale ventilation facility. The project would however be expected to improve general amenity within the study area by reducing the volume of traffic on surface roads, which would be displaced into the mainline tunnels. This would subsequently reduce current levels of noise and vibration, air pollution from vehicle emissions, traffic movements and congestion.

Community facilities such as hospitals and schools

Social infrastructure including community facilities are identified in section 15.2.2 of the EIS and impacts are discussed throughout the chapter including in section 15.3.3, 15.3.8 and 15.4.5. Key impacts include potential property acquisition, access and connectivity and amenity impacts. No schools, hospitals or places of worship would be acquired or occupied for the construction of the project.

Mitigation measures include provisions for temporary alterative sporting and recreational facilities, consideration of noise attenuation and periods of respite for affected stakeholders, where reasonable and feasible, and a management plan to detail the process for identification and implementation of measures to offset community and social impacts associated with the project.

Amenity impacts

Management of operational amenity impacts are described in **section C14.5**, and management of construction amenity impacts is described in **section C14.2**.

C14.8 Cumulative social and economic impacts

30 submitters have raised issues regarding cumulative social and economic impacts. Refer to sections 15.3 and 15.4 of the EIS for details of the cumulative social and economic impacts of the project.

Submitters raised concern over cumulative social and economic impacts. Specific concerns include:

- Duration of construction impacts and construction fatigue as a result of other motorway projects in the vicinity (eg impacts at Arncliffe as a result of the New M5 Motorway)
- Cumulative impacts associated with the operation of tolled motorways throughout Sydney including:
  - Tolling costs
  - Health and wellbeing impacts of motorways
  - Amenity impacts, for example noise, air quality and traffic
  - Reduced social connectedness and increased car dependency
  - Loss of community identity.

Response

Construction fatigue

For this project, consideration of construction fatigue is most relevant to receptors surrounding the Arncliffe construction ancillary facility (C1), proposed to be undertaken at Kogarah Golf Course which is currently being used for construction of the New M5 Motorway. Coordination between the project and the New M5 Motorway project would consider potential overlap between the respective construction programs and allow for maximum respite time between intensive construction activities, where possible. Construction program coordination and potential construction fatigue implications would be identified early and mitigation developed, where necessary.

The extent and impacts of construction fatigue would be assessed by:

- Identifying where the project would have sustained impacts on stakeholders or community members
- Identifying whether the project would result in similar or overlapping impacts with other projects, to the same stakeholders or community members
- Analysing whether the project would increase the magnitude and intensity of overlapping impacts on stakeholders or community members
- Analysing the extension of duration of impacts for stakeholders or community members.

Ongoing community consultation will occur throughout the construction period, with consultation and complaints management coordinated with the New M5 Motorway project team, where possible, to reduce the potential for consultation fatigue and complaints fatigue.

A Construction Fatigue Protocol will be prepared and implemented as part of the CNVMP for the project to address potential construction fatigue impacts. The protocol will include consideration of noise attenuation and periods of respite for affected stakeholders, where reasonable and feasible, and restricting out of hours work where practicable.

Tolling

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 tax payers across NSW, not just those in Sydney that would benefit.

In recognition of the growing number of toll roads within Sydney, the NSW Government recently implemented the Toll Relief plan[1] designed to ease the financial burden on privately registered vehicle owners who regularly need to use toll roads. The Toll Relief plan provides free vehicle registration for NSW registered vehicle owners who spend on average more than $25 a week (ie at least $1,300 over a year) on NSW toll roads. Free registration is available to all owners of privately registered vehicles from 1 July 2018. It is anticipated that tolls paid for use of the F6 Extension Stage 1 tunnel would be counted towards the total spend for privately registered vehicles under the Toll Relief plan. This would assist in alleviating the cumulative economic impact of tolled roads on private vehicle users.

Other cumulative social and economic impacts

Potential operational impacts related to amenity, wellbeing, social connectedness and community identity are discussed at a project level in **section C14.1**, **section C14.5** and **section C14.7**. These impacts are generally considered to be minor and localised around project operational infrastructure. Given the localised nature of impacts, receivers are unlikely to experience cumulative impacts with other motorway operational infrastructure. The nearest operational motorway infrastructure for another motorway is the Bexley Road South motorway operations complex for the New M5 Motorway project, which is located over four kilometres from the President Avenue intersection for the project.

The co-location of operational infrastructure with the New M5 Motorway Arncliffe Motorway Operations Complex would minimise potential cumulative social and economic impacts that would be otherwise associated with two separate operational facilities.

The project would improve general amenity within the study area by reducing the volume of traffic on surface roads, which would be displaced into the mainline tunnels. This would subsequently reduce current levels of noise and vibration, air pollution from vehicle emissions, traffic movements and congestion.

When considered alongside other strategic transport projects in Sydney, the operation of the project is expected to result in a variety of socio-economic benefits. These include:

- Improved road connectivity between all parts of Sydney, including major road connections south (M31 Motorway), west (Great Western Highway) and north (M1 Motorway), as well as Sydney Airport and Port Botany. This would support Sydney's ongoing economic growth through the efficient connection of people, goods and services. Of particular importance is the contribution of the project to the efficiencies of the freight industry
- Improved connectivity between Sydney's key employment areas within the global economic corridor and largely residential suburbs adjacent to and to the south of the project
- Reductions in local and regional levels of congestion, particularly through the diversion of heavy vehicles off the existing surface road network. This carries with it benefits to road safety and efficiency and local amenity, particularly noise, and opens up the potential for urban renewal along major road corridors in the area.

C14.9 Social and economic environmental management measures

Seven submitters have raised issues regarding the environmental management measures for social and economic impacts. Refer to **Chapter D1** (Environmental management measures) for more details on the environmental management measures of the project.

Submitters raised concern over the social and economic impact environmental management measures. Specific concerns include:

- Temporary alternative sporting and recreational facilities proposed during construction of the project would:
  - Not be within walking distance of the impacted facilities eg Ador Reserve
  - Not provide the same features such a skate park or swing set

[1] NSW Government (2017) Toll Relief – free rego for drivers. *https://www.nsw.gov.au/your-government/the-premier/media-releases-from-the-premier/toll-relief-free-rego-for-drivers/*

- Would service different users for organised sports and would not provide provision for walking, cycling and picnics
- Do not provide the necessary infrastructure for club sports to continue.

Response

Sporting fields and recreational facilities within Rockdale Bicentennial Park would be directly impacted by the project, including a playground with equipment, a skate park, an open recreational oval and up to three soccer playing fields.

Some of these facilities will be offset with new facilities at nearby locations so as to allow for continuity of facilities for the community. The construction and installation of these facilities will be subject to separate planning approvals and are outside the scope of the EIS. Roads and Maritime will continue to work with Bayside Council to complete the Recreation Needs Analysis for the area, including the final relocation plan and permanent reconfiguration of the Rockdale Bicentennial Park facilities. Roads and Maritime will consult with key stakeholders through the Stakeholder Liaison Group during the development of offset facilities and permanent reconfiguration of the Rockdale Bicentennial Park facilities.

The assessment also provided measures to address amenity and social infrastructure impacts on manage the impacts on the loss of community identity, social connection and public amenity as well as key public areas and their relationship to surrounding communities. These measures include:

- A Site Establishment Management Plan will be prepared prior to construction and will have regard to the amenity of adjacent areas and minimising impacts on adjacent sensitive receptors, including potential noise, dust, traffic, visual, lighting and overshadowing and overlooking impacts
- Provision of temporary alternative sporting field and recreational facilities in nearby locations, including a skate park, children's disability playground and sporting fields, will be investigated during detailed design to account for the temporary and permanent loss of these facilities during construction of the project at the President Avenue construction ancillary facility (C3)
- A Community and Social Management Plan will be prepared. The plan will detail the process for identification and implementation of measures to offset community and social impacts associated with the project. The plan will be prepared by a suitably qualified and experienced person(s) in consultation with the community and relevant councils.

C Part C Response to community submissions

C15 Soils and contamination

This chapter addresses issues raised in community submissions associated with the soils and contamination assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 16 (Soils and contamination) and Appendix J (Contamination technical report) of the EIS for further details on the soils and contamination assessment.

Contents

C15.1 Level and quality of soils and contamination assessment

One submitter has raised issues regarding the soils and contamination assessment. Refer to section 16.1 and Appendix J (Contamination technical report) of the EIS for details of methodology of the soils and contamination assessment.

The submitter raised concern about the soil and contamination assessment, making judgement on its scope and adequacy. The submitter is concerned that soil and landfill contamination has not been adequately assessed and specifically that the potential impact on fish nurseries from soil and landfill contamination has not been adequately assessed.

Response

Soil and landfill contamination assessment

The soils and contamination assessment for the EIS was undertaken in accordance with the Secretary's Environmental Assessment Requirements (SEARs) and associated performance measures, as issued by the Planning Secretary. The assessment comprised both a desktop assessment and a field assessment. The analytical methods adopted during the investigation program of works are industry standard and considered appropriate for the purposes of the investigations completed (refer to section 3 of Appendix J (Contamination technical report) of the EIS).

The desktop assessment comprised a review of soil, groundwater and landfill gas data collected as part of targeted geotechnical investigations; an assessment of risk of acid sulfate soil exposure, erosion, soil sediment mobilisation and salinity; and a review of relevant background information and data of site contamination reports and records from the NSW Environment Protection Authority (NSW EPA).

A preliminary qualitative risk assessment to assess the potential construction and operation impacts of contamination from the project was undertaken. The preliminary qualitative risk assessment involved development of a conceptual site model (CSM) for the project. A CSM identifies potential contamination sources, receptors and exposure pathways between the sources and receptors. The development of a CSM is a key component of contaminated site assessments and provides the framework for identifying how potential receptors may be exposed to contamination from previous or current site sources. The qualitative risk ranking identified and assessed the pollutant linkages in the CSM and assigned the following risks:

- Low risk: based on the available information, a complete pollutant linkage is considered to be unlikely
- Medium risk: based on the available information, a complete pollutant linkage may potentially be present, however the likelihood and consequence is considered to be medium
- High risk: based on the available information, a complete pollutant linkage is likely.

The areas identified as medium and high risk within the project footprint will be further investigated during detailed design and investigation sampling plans will be informed by existing data and project design. It is noted that that further investigations would not be required within the Arncliffe ancillary facility (C1), as these have been completed by the New M5 Motorway project.

All contamination investigations will be undertaken by a suitably qualified and experienced person in accordance with guidelines made or approved under the *Contaminated Land Management Act 1997*. Subject to the outcomes of the investigations, Remediation Action Plan (RAPs) may be required and implemented in the event that site remediation is warranted prior to construction. An independent NSW EPA Accredited Site Auditor would be engaged to review all contamination reports and evaluate the suitability of sites for a specified use as part of the project, where remediation is required.

With regards to landfill contamination, landfill gases and leachate were identified to be present within Rockdale Bicentennial Park, based on the results of preliminary investigations. The landfill gases and leachate may cause nuisance odours to the surrounding area during excavation of the cut-and-cover tunnel and associated works. Further detailed investigation and assessment will be undertaken to develop plans for leachate and landfill gas management (refer to **section C15.3**).

The results of the contamination assessment are summarised in section 16.3 and section 16.4 of the EIS. The results indicate that the contamination risks identified would unlikely impact surrounding receptors or the environment if adequately managed. . Environmental management measures outlined in **Chapter D1** (Environmental management measures), will be implemented during construction and operation of the project to reduce or minimise the potential impacts from contamination. Detailed site (contamination) investigations will be undertaken in accordance with the NSW EPA (1995) *Sampling Design Guidelines* within ancillary facilities and construction sites prior to commencement of construction.

Impacts on fish nurseries from soil and landfill contamination

Potential impacts on aquatic environments and species, including fish, are described in Appendix H (Biodiversity development assessment report) of the EIS.

There are no commercial fish nurseries within the project footprint. While key fish habitat was identified at three locations within the project footprint, surveys at the following locations identified no threatened aquatic species or populations, or valuable/specific habitats to support these species:

- Waterway through Rockdale Bicentennial Park
- Waterway through Scarborough Park North
- Muddy Creek
- Cooks River.

Where fish are present, they are unlikely to depend on habitat within the project footprint for their survival.

Notwithstanding, there are areas of key fish habitat located downstream of waterways within the project footprint (eg at Botany Bay). Potential impacts on water quality from contamination for waterways within the project footprint would therefore be associated with the potential for downstream water quality impacts on fish habitat outside of the project footprint.

A number of environmental management measures are proposed to manage potential contamination impacts on waterways within the project footprint which would also reduce the risk of potential downstream impacts on fish habitat. Relevant environmental management measures include:

- A Construction Soil and Water Management Plan (CSWMP) will be prepared which will detail the process and measures to manage and monitor soil and water impacts associated with the construction works, including contaminated land (refer to environmental management measure SC1 in **Chapter D1** (Environmental management measures))
- Construction water treatment plants will be established and operated at the Arncliffe Construction Ancillary Facility (C1), Rockdale Construction Ancillary Facility (C2) and President Avenue Construction Ancillary Facility (C3) to treat water from the tunnel works. Discharge from these plants will be managed to achieve the applicable Australian and New Zealand Environment and Conservation Council (ANZECC) criteria (refer to environmental management measure SC4 in **Chapter D1** (Environmental management measures)).

C15.2 Soil impacts during construction

One submitter raised concerns about soil impacts during construction. Refer to section 16.3 and section 5.1 of Appendix J (Contamination technical report) of the EIS for details of the potential soil impacts during construction.

The submitter raised concerns impacts on soil quality during construction.

Response

The EIS identified that surface disturbance and vegetation removal during construction would expose soils and may weaken surface soil structure. Soil salinity impacts may also occur as a result of earthworks and through changes in groundwater levels during tunnelling. However, these impacts can be managed satisfactorily with the implementation of environmental mitigation measures, as outlined in **Chapter D1** (Environmental management measures) and outlined below:

- A CSWMP will be prepared for the project that is consistent with the Blue Book[1] and relevant Roads and Maritime guidelines. The CSWMP will detail the process and measures to manage and monitor soil and water impacts associated with the construction works, including soil erosion and sedimentation
- Prior to ground disturbance in areas of very high potential soil salinity, testing will be carried out to confirm the presence of saline soils. If saline soils are encountered, they will be managed in accordance with *Site Investigations for Urban Salinity*[2]
- A soil conservation specialist will be engaged for the duration of construction to provide advice regarding erosion and sediment control.

C15.3 Contamination impacts during construction

Two submitters have raised issues regarding contamination impacts during construction. Refer to section 16.3 of the EIS and section 5.1 of Appendix J (Contamination technical report) for details of the potential contamination impacts during construction.

Submitters raised concerns regarding contamination impacts during construction. Specific issues include:

- Concerns about the unknown level of contamination currently located at the Rockdale Bicentennial Park landfill
- Concerns about the impact of contamination and increased salinity on the wetlands from construction including the potential release of toxic sediments from the former landfill.

Response

Section 4 of Appendix J (Contamination technical report) of the EIS identifies that Rockdale Bicentennial Park was used as a former landfill in the 1970s by Rockdale Municipal Council prior to redevelopment as a park in the 1980s.

Based on the intrusive investigation data, historical aerial imagery and maps reviewed, uncontrolled filling also occurred in areas around Rockdale Bicentennial Park within the Rockdale construction ancillary facility (C2) and President Avenue construction ancillary facility (C3). However, this is not clearly defined due to the nature of the filling that occurred, limited intrusive investigations and available council records.

Detailed site investigations will be undertaken during detailed design to identify the extent of landfilling within the project footprint. Remedial Action Plans (RAPs) for the Rockdale construction ancillary facility (C2), President Avenue construction ancillary facility (C3) and parts of the shared cycle and pedestrian pathways (where earths works are required) will be prepared, if required, following further investigations during the detailed design phase. The RAPs will include ongoing short and long-term monitoring requirements.

Further detailed investigation and assessment will be undertaken in Bicentennial Park in order to develop a Leachate and Landfill Gas Management Plan (refer to measure SC6 in **Chapter D1** (Environmental management measures)). The plan will be implemented to minimise nuisance odours to the surrounding area during excavation, and to contain and treat landfill gas emissions from excavations. The plan will include measures such as excavation staging, leachate and gas management, and gas and odour monitoring.

Prior to ground disturbance in areas of very high potential soil salinity, testing will be carried out to confirm the presence of saline soils. If saline soils are encountered, they will be managed in accordance with *Site Investigations for Urban Salinity*. With the proposed management measures in place potential impacts associated with disturbance of saline soils are considered to be negligible

[1] Landcom (2004) Soils and construction, *Managing Urban Stormwater*, Vol 1, 4th Edition

[2] Department of Land and Water Conservation (2012) *Site Investigations for Urban Salinity*

(refer to environmental management measure SC8 in **Chapter D1** (Environmental management measures)).

A Wetlands Management Plan will be prepared and implemented, in consultation with relevant stakeholders, to collectively manage waterbodies and riparian land within the project footprint that may be impacted by the project during construction. The objectives of the plan will be to:

- Maintain or improve the condition of the affected wetlands
- Reinstate any riparian land impacted by the project
- Provide positive ecological and amenity outcomes for the environment and local community.

The plan will include:

- Consideration of potential water quality, hydrology, amenity and flora and fauna impacts and mitigation
- A process for dewatering and restoration of the Rockdale Wetland, including measures developed by an ecologist to handle and relocate aquatic fauna
- A monitoring program to assess the effectiveness of the mitigation measures and to identify new measures that may be required.

The plan will be prepared by a suitably qualified ecologist with experience in wetlands management.

C15.4 Soils and contamination environmental management measures

Two submitters have raised issues regarding the environmental management measures for soil and contamination impacts. The environmental management measures are summarised in **Chapter D1** (Environmental management measures).

Submitters had queries regarding the soils and contamination environmental management measures in the EIS. Specific concerns included:

- Whether measures would be implemented to manage potential sedimentation, including at Patmore Swamp, Scarborough Ponds and Tonbridge Creek
- Requests for an Emergency Management Plan to respond to soil and chemical spillages.

Response

A range of environmental management measures are proposed to manage potential soil and contamination impacts. These will be documented in the CSWMP which will also include detailed Erosion and Sediment Control Plans.

A soil conservation specialist will also be engaged for the duration of construction to provide advice regarding erosion and sediment control. The specialist will undertake surveys and advise on land management strategies including management of acid sulfate soils, water quality, earthworks and rehabilitating degraded sites.

If the design identifies the risk of scour due to excessive velocities during construction and operation, the appropriate scour and erosion protection measures will be implemented at drainage outlets for both temporary and permanent works.

A Pollution Incident Response Management Plan (PIRMP) will be prepared for the project. The PIRMP will be prepared in accordance with legislative requirements and include measures to manage hazardous substances and dangerous goods including storage, handling and spill response.

As described in **section C15.3**, a Wetlands Management Plan will be prepared for the project that will address the collective impacts of the project on wetlands in the project footprint, including from sedimentation.

C Part C Response to community submissions

C16 Groundwater and geology

This chapter addresses issues raised in community submissions associated with the groundwater and geology assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 17 (Groundwater and geology) and Appendix K (Groundwater technical report) of the EIS for further details on the groundwater and geology assessment.

Contents

C16.1 Level and quality of groundwater and geology assessment

Six submitters have raised issues regarding the level and quality of the groundwater and geology assessment. Refer to section 17.1 and section 3 of Appendix K (Groundwater technical report) of the EIS for details of the groundwater and geology assessment.

C16.1.1 Issues regarding the adequacy of the groundwater and geology assessment

Submitters expressed concern about the adequacy of the groundwater and geology assessment. Specific concerns included:

- The potential for settlement impacts and property damage has not been adequately addressed
- Submitter disagrees that 'North Scarborough Pond' within Patmore Swamp is a highly modified wetland, as stated in the groundwater modelling report
- Direction of groundwater flow in the project footprint
- Groundwater impacts and restoration at Patmore Swamp, specifically changes in groundwater regimes and the amount of improvement and restoration works
- The limited data used to assess the impact on groundwater levels in Rockdale Bicentennial Park.

Response

Scope of the groundwater assessment

The groundwater assessment to support the EIS was undertaken in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs). Section 3.0 of Appendix K (Groundwater technical report) of the EIS provides a detailed description of the groundwater assessment methodology. In addition to meeting the SEARs, the groundwater impact assessment has also considered comments made by relevant government agencies. The groundwater assessment has been reviewed by an independent technical peer reviewer in accordance with the *Australian Groundwater Modelling Guidelines*.

Potential settlement impacts

Section 17.1.7 of the EIS provides background information and the criteria used for the ground movement and settlement assessment completed as part of the groundwater and geology assessment for the project.

Settlement criteria have been specified in the conditions of approval for recent tunnelling projects in Sydney including the WestConnex projects and NorthConnex. These criteria are summarised in Table 17-3 of the EIS and it is expected that they will be adopted for this project, should it be approved. Settlement criteria for individual utilities and infrastructure will be determined in consultation with the relevant authorities prior to the commencement of construction.

A geotechnical model of representative geological and groundwater conditions will be prepared by the construction contractor during the detailed design phase prior to the commencement of tunnelling. The model will be used to assess predicted settlement impacts and ground movement during the construction and operation of the project.

Monitoring of settlement throughout the construction phase will be included in the Construction Environmental Management Plan (CEMP) and may include the installation of settlement markers or inclinometers. Pre-construction condition surveys of property and infrastructure that have the potential to be impacted by settlement will be offered to property owners before the commencement of construction activities.

As outlined in **Chapter D1** (Environmental management measures), further assessment of potential settlement impacts, including numerical geotechnical modelling will be undertaken prior to excavation and tunnelling to assess the cumulative predicted settlement, ground movement, stress redistribution and horizontal strain profiles caused by excavation and tunnelling, including groundwater drawdown and associated impacts, on adjacent surface and sub-surface structures.

Criteria for surface and sub-surface structures at risk will be determined in consultation with the owner(s) of the structures.

Where modelling predicts exceedances of these criteria, an instrumentation and monitoring program will be implemented to measure settlement, distortion or strain as required. Appropriate mitigation measures will be identified and implemented in consultation with the owner(s) prior to excavation and tunnelling works to, where possible, not exceed the settlement criteria. Property damage that may occur due to settlement from the project will be rectified at no cost to property owners.

Scarborough Park North as a highly modified wetland

The Scarborough Ponds catchment covers an area of around 400 hectares and comprises a series of three pond systems including the Rockdale Wetland, the Northern Scarborough Pond and the Southern Scarborough Pond.

The western and eastern sides of the catchment predominantly comprise medium density residential development with some industrial development situated around the northern edges of the Rockdale Wetland. Stormwater runoff from urbanised areas is conveyed by a pit and pipe network into Scarborough Ponds via a series of piped outlets.

Water quality within the Scarborough Ponds does not currently meet the NSW Water Quality Objectives (NSW WQOs), which indicates a highly disturbed urban waterway. Scarborough Ponds is also adjacent to the historical landfill which occurred in Rockdale Bicentennial Park.

As explained in section 18.4.1 of the EIS, opportunities for the project to provide further stormwater quality improvements and to work towards achievement of the NSW WQOs for Scarborough Ponds will be considered during detailed design. Surface water modelling of the catchment indicates that by providing gross pollutant traps at two operational discharge points (ODP1 and ODP3 as shown in Figure 6-1 of Appendix L (Surface water technical report)), an overall reduction in pollutant loads could be achieved. However, as the operational surface infrastructure of the project is only a small portion of the overall catchment of the wetland, improvements to ambient water quality within Scarborough Ponds as a result of the project would still likely be negligible.

Direction of groundwater flow

Section 4.8 of Appendix K (Groundwater technical report) of the EIS describes the hydrogeological setting of the project footprint. The geology in a particular location will affect the direction of groundwater flows. Regionally, groundwater flow is eastward towards Botany Bay. The simulated water balance used in the groundwater assessment for the end of construction (Year 2024) is consistent with this regional flow.

Groundwater flow within the Botany Sands aquifer located east of the tunnel alignment is mainly eastward towards Botany Bay with minor components of flow to the Cooks and Georges Rivers[1].

In the shallow alluvium that characterises the Rockdale Wetlands, local groundwater flow is southwards, towards the Georges River.

The majority of the tunnel would be constructed in Hawksbury Sandstone. Regionally, groundwater within Hawksbury Sandstone flows eastwards towards the Tasman Sea.

Groundwater impacts and restoration at Patmore Swamp

The Scarborough Ponds (also known as Patmore Swamp) are located south of President Avenue and are hydraulically linked to the Rockdale Wetlands within Rockdale Bicentennial Park via a weir. **Figure A2-1** in **Chapter A2** (Clarifications) shows the location of these surface water features and how they are referred to in other chapters.

Scarborough Park North (in the northern part of Patmore Swamp) is a potential groundwater dependent ecosystem (GDE) fed by both surface flows (including stormwater from the wetland and associated water) and a weak tidal influence from Botany Bay.

Potential impacts on the GDE at Scarborough Park North during construction are discussed in **section C16.2** and potential impacts during operation are discussed in **section C16.3**.

[1] Hatley 2004 R.K. (2004) Hydrogeology of the Botany Basin. Australian Geomechanics Vol 39 No 3 pp73-91, dated September

With regards to improvement and restoration works, opportunities will be investigated to improve the water quality within Rockdale Bicentennial Park and Scarborough Park North during detailed design, in consultation with Bayside Council and other relevant stakeholders. As described in section 8.2.3 of the Appendix L (Surface water technical report) of the EIS, this may include investigation of:

- The incorporation of opportunistic macrophyte zones and appropriate treatments within the wetland zones disturbed by the project during construction
- Solar powered aeration devices to aerate the water column and maintain more consistent dissolved oxygen conditions within deeper zones to reduce algal bloom conditions
- Solar powered water circulation facilities to push water through macrophyte benches and eliminate stagnant areas and aquatic weed and algal growth
- Passive treatment of shallow groundwater within a sub-surface wetland system upstream of Rockdale Bicentennial Park Pond if groundwater and surface water level monitoring indicate groundwater inflows to be a significant contributor of pollutants to the pond.

Surface water and groundwater monitoring is ongoing within the area of the project and will continue to be undertaken prior to, during and following construction to inform the investigation. Roads and Maritime has also agreed to Bayside Council's request to prepare a Wetlands Management Plan (refer to environmental management measure B3 in **Chapter D1** (Environmental management measures)).

Data used for assessment of impacts on GDEs

While there is limited information available on the water levels within Rockdale Bicentennial Park, groundwater monitoring completed for the project was used to estimate water level fluctuations.

The Rockdale Bicentennial Park Pond is around 1.2 to 2 metres deep[2]. The Rockdale Bicentennial Park Pond is situated within a sandy aquifer and water levels are likely to be consistent with local groundwater levels during dry periods which groundwater monitoring indicates to be around 1 m AHD to 1.5 m AHD, suggesting the pond is fed by groundwater to some extent.

Groundwater modelling has predicted that long term groundwater drawdown at the Rockdale Bicentennial Park Pond would be between 0.02 and 0.19 metres at this location. However the wetlands are not classified as high priority groundwater dependent ecosystems and the predicted drawdown is likely to be mediated by the continual inflow of stormwater.

C16.1.2 Issues with the groundwater quality monitoring and baseline sampling

One submitter stated that the groundwater and geology assessment fails to characterise hydro-geochemistry in any of the described geological units (alluvial or sandstone aquifers). Specific concerns raised by the submitter included:

- The EIS fails to develop a groundwater quality baseline database and conclusions and obligations derived from the groundwater quality monitoring dataset should be re-assessed. The poor baseline dataset is due to failure to illustrate two aspects for all groundwater samples:
  - Basic field parameters were only taken (or reported) in 15 samples. Therefore, essential parameters like pH, temperature, dissolved oxygen (DO) and redox conditions are not provided for most of the reported groundwater samples (41 samples)
  - The groundwater report states that groundwater quality samples were tested for ionic balance however this information could not be located in the report
- Several data quality issues were identified with the groundwater sample analysis:
  - Only 11 of the 41 groundwater samples analysed met the usual criteria accepted by the scientific community for good quality major ion chemical analysis
  - About half the samples suggest there were issues with either analytical problems, sample handling errors, or missing ions

[2] Storm Consulting (2005) Scarborough and Bicentennial Park Ponds – Water Quality Study and Management Plan. Report prepared for Rockdale City Council, dated January

  - Given the large project footprint and diversity of potential hydrogeochemical compositions in the Alluvial and Hawkesbury sandstone aquifers as well as potential processes (mixing with seawater, interaction alluvial-sandstone, recharge and evaporation, interaction with intrusive etc.), the number of acceptable samples provided as a baseline are very limited

- Groundwater quality data for specific boreholes showed inconsistencies in the analytes analysed for some samples.

Response

The groundwater quality criteria have been developed in accordance with guidelines from the *Australian and New Zealand Environment Conservation Council* (ANZECC). For analytes not covered by the ANZECC guidelines, the amended *National Health and Medical Research Council Australian Drinking Water Guidelines* have been adopted.

Groundwater quality or hydrogeochemical data was initially collected from available monitoring wells constructed as part of the WestConnex New M5-Southlink monitoring program. This included a small data set of field parameters and inorganic analytes from laboratory analysis of samples collected in 2015. Additional data was collected later from monitoring wells constructed in 2016-2017 for the project.

The baseline data collected was based on numerous sampling events between March 2015 and December 2017 and included a series of parameters, including field parameters such as temperature, dissolved oxygen, electrical conductivity, pH and redox conditions. Laboratory analytes included calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, sulphate, resistivity, total nitrogen, nitrate, ammonia, phosphorous, metals, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc.

The SEARs require baseline monitoring to be outlined in the EIS - this was provided in sections 4.9, 4.10 and 4.11 of Appendix K (Groundwater technical report) of the EIS. In addition, groundwater quality monitoring will continue until the construction program commences and will continue throughout the construction program (should the project be approved). The ongoing baseline monitoring for the project will provide a more robust dataset and will include the collection of field parameters. The full suite of analytes to be included in the ongoing monitoring program is outlined in Summary Table B3 of Appendix K (Groundwater technical report) of the EIS.

It is agreed that the ionic balance is an important calculation used to validate the analytical results. The ionic balance is routinely undertaken by the analytical laboratory and is reported on in the laboratory report sheets. These analytical laboratory results were included in the routine groundwater monitoring reports that were prepared to support the EIS but were not provided as part of the EIS.

Regarding ionic balance errors or other minor inconsistencies in the analytical results, the laboratory QA/QC system requirements were met. The ionic balance errors could be due to not all ions being measured by the laboratory, as this was not a requirement of the monitoring program, which is consistent with previous groundwater monitoring for tunnel projects. Inconsistencies in the analytes analysed in each sample could be due to the purpose of the sample collection, for example, chloride and sulphate were only analysed in some samples as part of early groundwater aggressivity tests. Additional routine hydrogeochemical sampling that would continue up to the construction phase and beyond (should the project be approved), would increase the baseline dataset and improve the ratio of analytical results with an acceptable ionic balance. These errors or inconsistencies do not affect the outcomes of the groundwater assessment for the project.

C16.2 Groundwater and geology impacts during construction

Three submitters raised issues regarding the construction impacts on groundwater and geology. Refer to section 17.3 and section 5 of Appendix K (Groundwater technical report) of the EIS.

Submitters raised concern regarding groundwater impacts during construction. Specific concerns include:

- Excavation of the old landfill site in Bicentennial Park will contaminate the Botany Sands Aquifer
- Subsoil drainage and hydrological changes during construction at Patmore Swamp as the swamp filters stormwater and acts as a biodiversity refuge
- Construction of the tunnel will take place in unstable geology.

Response

Potential contamination of the Botany Sands Aquifer

Groundwater quality risks from construction activities include contaminated groundwater associated with previous industrial land use, including areas of historical landfilling, such as at Rockdale Bicentennial Park. As explained in section 5.5.2 of Appendix K (Groundwater technical report) of the EIS, limited groundwater contamination investigations have been conducted as part of EIS to identify existing potential contaminated groundwater within the project footprint.

Initial groundwater investigations adjacent to former landfill sites within the President Avenue construction ancillary facility (C3) did not identify significant groundwater contamination other than some elevated concentrations of ammonia and nitrogen which is indicative of typical landfill leachate. Some heavy metal concentrations were also slightly elevated. Due to these relatively low groundwater contaminant concentrations, additional groundwater contamination characterisation was not progressed for the EIS.

During construction, temporary dewatering of the shallow alluvial aquifer at C3 will be required to maintain dry working conditions. Extracted groundwater quality will be monitored and treated (if contamination is identified) as necessary by the construction water treatment plants prior to discharge into local waterways.

Potential impacts on Patmore Swamp

Scarborough Park North (in the northern part of Patmore Swamp), is a potential GDE fed by both surface flows (including stormwater from the wetland and associated water) and a weak tidal influence from Botany Bay. This potential GDE has a moderate reliance on subsurface water. A potential drawdown of between 0.11 and 0.12 metres is likely to be mediated by the inflow of water from stormwater.

Mitigation and management measures will be implemented during construction to reduce or eliminate the risks to the existing hydrology of wetlands, including Patmore Swamp. These measures are summarised in **Chapter D1** (Environmental management measures). Temporary measures to drain stormwater flows and maintain hydrologic flow between Rockdale Bicentennial Park Wetland and the Northern Scarborough Pond would be implemented, and disturbance within the wetlands would be minimised, for example locating stockpiles outside of riparian corridors where reasonable and feasible.

Construction of the tunnel in unstable geology

The alignment of the mainline tunnels and entry and exit ramps have been designed to be located within favourable geological conditions where possible (refer to section 5.4.4 of the EIS). The tunnel profile is primarily located within competent bedrock with minimal impact to the groundwater profile.

Where excavation depths are at the shallowest point and in softer ground conditions (around the tunnel portals and entry and exit ramps), construction methods would include installation of stabilisation and excavation support (retention systems) such as sheet pile walls (where required) and diaphragm walls.

C16.3 Groundwater and geology impacts during operation

One submitter has raised issues regarding the operational impacts on groundwater and geology. Refer to section 17.4 and section 6 of Appendix K (Groundwater technical report) of the EIS.

A submitter was concerned about the increased salinity in groundwater over time, as well as groundwater drawdown and the resultant impacts on GDEs as a result of the project during operation.

Response

Salinity

Section 17.4.3 of the EIS explains that saltwater intrusion would commence as soon as the hydraulic pressure within the aquifer declines, as groundwater drawdown via the tunnels would cause the displacement of fresher water along the shoreline with more saline tidal water.

There is potential for saline intrusion of tidal waters to impact the water quality of natural groundwater at Spring Street Drain and in the alluvial aquifer at Arncliffe, which may reduce the quality of groundwater being used to irrigate the Kogarah Golf Course. Salt water intrusion of the saline waters of Botany Bay is not predicted to be drawn towards the tunnels as the gradient near Botany Bay remains towards the coast.

Initial saline groundwater inflows represent extremely small inflow which would slowly become a larger proportion of flow over time. Groundwater quality in the tunnel catchment zones would slowly become more saline over thousands of years. There is the potential to increase the salinity in registered groundwater bores due to saltwater intrusion; however, the slow progress of saline groundwater is expected to have a minimal impact on these bores over a period of 100 years.

Groundwater quality and inflow will be routinely monitored and treated (groundwater inflows will be pumped to the surface and transferred to the operational water treatment plant within the Arncliffe Motorway Operations Complex (MOC1)), as required, prior to discharge in accordance with the Operational Environmental Management Plan for the project.

Long-term groundwater drawdown

Wetlands within the project footprint include the Landing Lights, Eve Street, Spring Street, King Street and Marsh Street Wetlands. The potential for long-term groundwater drawdown at these locations has been investigated for the project. Drawdown in excess of the seasonal variation of 0.05 metres is predicted at these wetlands with long term (Year 2100) drawdown predicted to vary from 0.28 metres at Landing Lights Wetland to 0.47 metres at the Marsh Street Wetland. These predicted drawdowns are not considered to be of concern because the wetlands are not dependent on groundwater.

For the Rockdale Wetlands (including Scarborough Park North/Patmore Swamp which are hydraulically linked to the pond within Rockdale Bicentennial Park), groundwater modelling predicts the long term surface water drawdown in as being in excess of 0.05 metres (between 0.02 and 0.19 metres). However, these wetlands are not classified as high priority and in fact are highly modified to act as flood mitigation basins. The predicted groundwater drawdown is expected to be less than predicted because of the continual inflow of stormwater and floodwaters.

Long term dewatering caused by tunnel drainage is predicted to lower the water table and water pressure levels within the Hawkesbury Sandstone, reducing the amount of groundwater available for some shallow rooted plants. The minimum depth of the water table underlying the majority of the construction boundary is on average one metre below ground surface. Areas where the water table is shallow, such as along the Rockdale Wetlands corridor (including Scarborough Park North/Patmore Swamp), are typically subjected to flood inundation which would provide water periodically for shallow rooted plants that may have some groundwater dependence. At other more elevated topographic areas, such as parts of Arncliffe, the water table is much deeper below ground surface and consequently flora is unlikely to be dependent on groundwater.

Following the completion of tunnel construction, groundwater would be available for partially groundwater dependent flora, as the unsaturated soil zone would not be affected by the project and would continue to receive rain infiltration. Shallow perched water (water located at an elevation higher than the local water table) is expected to be present irregularly along the alignment and could partially sustain surface ecosystems. However, partially groundwater dependent flora would primarily be dependent upon rainfall recharge and moisture within the unsaturated soil zone. In low lying areas, the project is not expected to substantially change the availability of water for plants due to the low

permeability of fine soils in combination with frequent rainfall events and higher recharge compared to elevated sites.

C16.4 Groundwater and geology environmental management measures

Two submitters raised issues regarding the groundwater and geology environmental management measures. Refer to **Chapter D1** (Environmental management measures).

Submitters expressed concerns regarding the groundwater and geology environmental management measures. Specific concerns relate to:

- The management measures for changes in hydraulic conductivity of the Hawkesbury Sandstone from fractures, joints and dykes
- The protection and restoration of Patmore Swamp from the damages caused by the project
- The management of the Woolloomooloo Fault in Arncliffe
- The need to expand the groundwater modelling and the recovery plan to manage the wider groundwater basin due to the interlinkage with the groundwater system around President Avenue.

Response

Managing changes in hydraulic conductivity

The main source of groundwater inflows are via structural features within the Hawkesbury Sandstone which includes fractures, faults, joints and dykes. Where such structures are intersected, a combination of techniques will be used to reduce the bulk hydraulic conductivity. This will include pre-excavation pressure grouting, pressure grouting at the tunnel face, shotcrete and the installation of waterproof membranes. Post grouting may also be required to further reduce groundwater inflows. Such grouting methods are standard measures for similar tunnel infrastructure.

Protection and restoration of Patmore swamp and other wetlands

Opportunities will be investigated to improve the water quality within Rockdale Bicentennial Park and Scarborough Park North (in the northern part of Patmore Swamp) during detailed design, in consultation with Bayside Council and other relevant stakeholders. This may include investigation of:

- The incorporation of opportunistic macrophyte zones and appropriate treatments within the wetland zones disturbed by the project during construction
- Solar powered aeration devices to aerate the water column and maintain more consistent dissolved oxygen conditions within deeper zones to reduce algal bloom conditions
- Solar powered water circulation facilities to push water through macrophyte benches and eliminate stagnant areas and aquatic weed and algal growth
- Passive treatment of shallow groundwater within a sub-surface wetland system upstream of Rockdale Bicentennial Park Pond if groundwater and surface water level monitoring indicate groundwater inflows to be a significant contributor of pollutants to the pond.

A Water Quality Monitoring Program will be prepared and implemented to monitor, identify and mitigate impacts on surface water and groundwater quality during construction and operation.

A Wetlands Management Plan will be prepared and implemented, in consultation with relevant stakeholders, to collectively manage waterbodies and riparian land within the project footprint that may be impacted by the project during construction. The objectives of the plan will be to:

- Maintain or improve the condition of the affected wetlands
- Reinstate any riparian land impacted by the project
- Provide positive ecological and amenity outcomes for the environment and local community.

The plan will include:

- Consideration of potential water quality, hydrology, amenity and flora and fauna impacts and mitigation
- A process for dewatering and restoration of the Rockdale Wetland, including measures developed by an ecologist to handle and relocate aquatic fauna
- A monitoring program to assess the effectiveness of the mitigation measures and to identify new measures that may be required.

The plan will be prepared by a suitably qualified ecologist with experience in wetlands management.

Management of the Woolloomooloo Fault in Arncliffe

Groundwater inflows due to the Woolloomooloo Fault will be managed by advance grouting prior to tunnelling and grouting during tunnelling. It is recognised that the intersection of this fault during the tunnelling for the WestConnex New M5 project produced higher than expected inflows. However, tunnelling for the F6 Extension Stage 1 project will have the advantage of utilising lessons learnt from previous tunnelling in this area.

Management of wider groundwater basin

The groundwater model for the project was created over a wide footprint (7.5 x 12 kilometres) to enable predictions about cumulative impacts, including future stages of the F6 Extension. The model area includes President Avenue and extends to the Georges River in the south. The model has been used to predict future groundwater drawdown up to the Year 2100.

As explained in environmental management measure GW7, a groundwater monitoring program will be prepared and implemented to monitor groundwater levels, construction and operational groundwater inflows in the tunnels, and groundwater quality in the three main aquifers impacted by construction works.

The program will identify groundwater monitoring locations, performance criteria in relation to groundwater inflow and levels, and remedial action options that will be considered to address identified impacts. As a minimum, the program will include monthly manual groundwater level and quality monitoring and weekly monitoring of inflow volumes and quality.

C Part C Response to community submissions

C17 Surface water and flooding

This chapter addresses issues raised in community submissions associated with the surface water and flooding assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 18 (Surface water and flooding), Appendix L (Surface water technical report) and Appendix M (Flooding technical report) of the EIS for further details on the surface water and flooding assessment.

Contents

C17.1 Level and quality of surface water and flooding assessment

Six submitters have raised issues regarding the adequacy of the surface water and flooding assessment. Refer to section 3.0 of Appendix L (Surface water technical report) and section 3.0 of Appendix M (Flooding technical report) of the EIS for details on the methodology of the surface water and flooding assessment.

Submitters expressed concern that the level and quality of the surface water and flooding assessment is inadequate. Specific concerns include:

- The EIS leaves flood assessment and mitigation to be finalised post approval, for example, through a Flood Management Strategy and further hydraulic development during construction and operation
- The EIS does not address the impact on the water flow to the Scarborough Park North ponds
- A submitter does not understand the following statement from section 6.9.9 of the EIS: 'Lowering of ground levels along the eastern side of the tunnel portal extending to the Scarborough Ponds within Scarborough Park North to provide an overland flow path to control flow that approaches the tunnel portal from O'Neil Street for events up to the PMF'
- The surface water and flooding assessment does not take into account changes to the landform around President Avenue (eg from the raising of President Avenue) and does not identify associated changes to surface water levels in Rockdale Bicentennial Park Pond
- The Rockdale Wetlands during wet periods has not been properly assessed, as only yearly flooding events are assessed
- The assessment has not considered impacts on the natural filtration capacity of the wetland areas at Bicentennial Park and Patmore Swamp
- The potential flooding at the President Avenue construction ancillary facility (C3) during construction has been underestimated
- The assessment of the pollutants that could potentially be discharged to the Cooks River has not been considered
- The flooding assessment does not address flooding related damages to properties in low lying areas that will experience flood related damage as a result of changes in water flows.

Response

Post approval flood assessment

The flooding assessment undertaken for the project was prepared in accordance with the relevant Planning Secretary's Environmental Assessment Requirements (SEARs) and the associated desired performance outcomes that relate to flooding, as outlined in Table 1-1 of Appendix M (Flooding technical report) of the EIS.

The assessment of potential flooding impacts of the project on existing flood regimes has been conducted in accordance with the requirements of the *Floodplain Development Manual*[1]. The assessment also considers the NSW Government's *Flood Prone Land Policy*, the primary objectives of which are to reduce the impact of flooding and flood liability on owners and occupiers of flood prone property and to reduce public and private losses resulting from floods, while also recognising the benefits of use, occupation and development of flood prone land.

A number of models were developed to assess potential flooding impacts during the construction and operation of the project (a detailed description of these models is provided in section 3.4 of Appendix M (Flooding technical report) of the EIS).

[1] NSW Department of Infrastructure, Planning and Natural Resources (2005) *Floodplain Development Manual* – The management of flood liable land

Further hydraulic modelling and the preparation of a Flood Management Strategy (FMS) is required to be developed during the detailed design phase in order to ensure the appropriate flood mitigation is implemented based on the most recent design for the project. The detailed design will be prepared based on the approved project as described in the EIS and this submissions report. The design will be consistent with any conditions of approval and other requirements of DP&E, if approved.

The FMS will be prepared prior to construction to demonstrate how the risk of flooding on the project, as well as the impact the project would have on flood behaviour under present day conditions, will be mitigated during both the construction and operational phases. It will also address the potential impacts of future climate change on flood behaviour.

Impact of water flow on Scarborough Park North

The impact of changes in water flows to Scarborough Park North during construction of the project is assessed in section 18.3.1 of the EIS. A comparison between the discharge volumes and daily flows within the waterways is provided in Table 18-8 of the EIS.

As detailed in **Chapter D1** (Environmental management measures), site water quality management controls will be put in place and maintained through the construction phase. In addition, a program to monitor potential surface water quality impacts of the project, including at Scarborough Park North, will be developed and included in a Construction Soil and Water Management Plan (CSWMP).

Impacts on water flows at Scarborough Park North during operation are assessed in section 18.4.1 of the EIS. The impact to water flows during operation are assessed across a number of operational discharge points which are shown in Appendix L (Surface water technical report).

Lowering of ground levels

The statement referenced by the submitter is located in Chapter 6 (Project description) of the EIS. Some project features have been included in the design for flood mitigation purposes. This includes the feature mentioned by the submitter.

As outlined in **Chapter A2** (Clarifications), this statement should read that the project would require the lowering of ground levels along the eastern side of the tunnel portal within Rockdale Bicentennial Park, rather than Scarborough Park North.

The project would require the lowering of ground levels along the eastern side of the tunnel portal within Rockdale Bicentennial Park to provide an overland flow path to control flow that approaches the tunnel portal from O'Neill Street, for events up to the probable maximum flood (PMF). No works to lower ground levels are proposed within private properties (which are not being acquired for project) as they are not within the construction boundary.

Water level in Rockdale Bicentennial Park Pond

Impacts on the hydrological regime as a result of modifications to hydraulic controls and infilling to widen President Avenue are described in section 6.2.1 of the EIS. Around 550 square metres of Rockdale Bicentennial Park Pond would be filled in to widen the raised President Avenue, which is about three per cent of the existing pond footprint. Considering the minor loss of volume and given water levels are controlled by the existing weir, impacts on water levels within Rockdale Bicentennial Park Pond as a result of the loss in volume are predicted to be negligible. The minor reduction in the length (around 11 metres) of the estuarine open channel downstream of President Avenue as a result of the widening of President Avenue would result in a negligible loss in volume to the Scarborough Ponds system and is therefore considered to pose a negligible impact on its hydrologic function.

Rockdale Wetlands during wet periods

The assessment approach used for the flooding assessment is outlined in section 18.1 of the EIS. Flood behaviour was assessed under present day conditions for design floods with a range of Annual Exceedance Probability's (AEP), as well as the PMF. An AEP is the chance of a rainfall or a flood event exceeding a nominated level in any one year, rather than one year only, usually expressed as a percentage. For example, if a peak flood level has an AEP of five per cent, it means that there is a five per cent chance (that is one-in-20 chance) of being exceeded in any one year.

The impact of changes in flood behaviour and impact on the Rockdale Wetlands during construction and operation of the project is assessed in section 18.3.2 and 18.4.2 of the EIS. As outlined above and in **Chapter D1** (Environmental management measures), further hydraulic modelling and the preparation of a FMS will be developed during the detailed design phase in order to ensure the appropriate flood mitigation is implemented based on the most recent design for the project.

The loss of filtration capacity at Bicentennial Park and Patmore Swamp

As discussed in section 18.4.1 and section 8.2.1 of Appendix L (Surface water technical report) of the EIS, to achieve the pollutant load reduction targets for the project, the proposed stormwater management strategy that has been developed for the project will be implemented, which includes the following treatment measures:

- A biofiltration water quality basin to treat runoff from the tunnel portals at President Avenue
- Re-establishment of a grass swale adjacent and south of President Avenue
- New grass swales to convey runoff from batter slopes to Rockdale Bicentennial Park Pond
- New grass swale to convey diverted residential runoff to Rockdale Bicentennial Park Pond.

The water quality basin which incorporates biofiltration and swales are commonly used water sensitive urban design (WSUD) systems. They take into account WSUD principles by using vegetation and soil media to attenuate, filter and treat runoff prior to release to surface waters.

The final selection and design of the stormwater treatment measures will be undertaken during detailed design.

As outlined in section 8.2.2 of Appendix L (Surface water technical report), these treatments include retaining, protecting and maintaining the existing floating wetlands within the Rockdale Bicentennial Park Pond during construction.

Treatment measures would be implemented within the waterbodies of Scarborough Park North and Rockdale Bicentennial Park disturbed by the project during construction, to reduce algal bloom conditions and contribute to achieving the NSW WQOs over time. Treatments will be considered in consultation with Bayside Council and will include the establishment of macrophyte zones, bank reshaping of the wetland zones; and the use of solar powered devices to aerate the water column.

The investigation of measures will explore opportunities to treat the existing pavements and incorporate passive treatments within the Rockdale Bicentennial Park Pond.

The potential flooding at the C3 facility during construction has been underestimated

Section 18.3.2 of the EIS describes that construction of cut-and-cover structures to be carried out at the President Avenue construction ancillary facility (C3) has the potential for ingress of floodwater into the open excavations. This may result in potential impacts on flood behaviour including:

- Potential displacement of water due to blocking effects of the construction facility
- Potential increase in peak flood levels in 12 residential properties and one industrial property by a maximum of 20 millimetres
- Potential increase in above-floor inundation and flood damages in affected properties.

As described previously, a FMS will be prepared prior to construction to demonstrate how the risk of flooding, including at the C3 facility, will be mitigated during both the construction and operational phases. The FMS will be based on further design development and flood modelling that will be undertaken during the detailed design stage.

It will also include but not be limited to the identification of design and flood mitigation measures that will be implemented to manage the risk of flooding to proposed operations and not worsen existing flooding characteristics during construction and operation, including erosion and scour.

The FMS would be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, Sydney Water, OEH, SES and relevant councils.

Subject to the further hydraulic assessment during detailed design, floor level survey would confirm the extent to which the proposed works would increase above-floor inundation and seek to avoid the occurrence wherever possible.

The assessment of the pollutants that could potentially be discharged to the Cooks River

Table 18-10 and Table 18-14 of the EIS shows the potential construction impacts, including pollution on waterways, which includes the Cooks River. Once operational, as detailed in section 18.4.1, impacts on ambient water quality are likely to be negligible. The project is considered to have a negligible influence on stakeholder goals to achieve the NSW WQOs for the Cooks River over time.

Provided that the management measures outlined in **Chapter D1** (Environmental management measures) are implemented during construction and the discharge criteria are achieved, short term impacts are expected to be manageable. With the measures in place, the pollutant load being discharged from the project would be minor compared to the pollutant load being discharged to the receiving waterways from the wider catchment. This, together with the tidal flushing effect which would occur within the estuarine receiving environments, would result in negligible impacts on receiving water quality.

Flooding related damages to properties in low lying areas

Table 18-11 and Table 18-16 of the EIS describe the potential flooding impacts on a number of properties. The FMS will be prepared prior to construction to demonstrate how flooding risks and behaviours will be mitigated during both the construction and operational phases. The FMS will include floor level survey for identified affected properties.

The FMS will be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, Sydney Water, the NSW Office of Environment and Heritage (OEH), State Emergence Services (SES) and relevant councils.

C17.2 Surface water impacts during construction

Four submitters have raised issues regarding the surface water impacts during construction. Refer to section 18.3 and section 5.0 of Appendix L (Surface water technical report) of the EIS.

Submitters raised concern over surface water impacts during construction. Specific concerns included:

- The impact of surface water runoff during construction of the project on the environment, including impacts on surface water quality
- Wastewater would not meet the discharge criteria and that not all discharge criteria can be monitored in real time
- Using Scarborough Park North (Patmore Swamp) for working pads during construction.

Response

Surface water runoff

Section 18.3 and section 5 of Appendix L (Surface water technical report) of the EIS outline the potential impacts surface runoff may have on the environment, and Table 5-5 in Appendix L outlines the potential impacts on surface water quality during construction. Specific impacts caused by runoff includes erosion and mobilisation of exposed soils from stormwater runoff and wind, leading to sedimentation in receiving waterways and impacts on water quality (increased turbidity, lower dissolved oxygen levels and nutrients which could lead to algal blooms and aquatic weed growth, increases in toxicant concentration and reduced visual amenity).

Run off can also increase gross pollutants such as dust and litter which can reduce the areas visual amenity. The discharge of poorly treated construction wastewater could also potentially impact on the water quality of receiving waterways.

As discussed in **Chapter D1** (Environmental management measures), a Construction Soil and Water Management Plan (CSWMP) will be prepared for the project. The plan will include the measures that will be implemented to manage and monitor potential surface water quality impacts during construction. The CSWMP will be developed in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (the 'Blue Book')[2].

The CSWMP will include standard construction site mitigation measures such as stabilising disturbed ground and exposed soils, installation of sediment traps and basins, stormwater controls, dust suppression, implementing secure bunding for storage of chemicals and fuels and monitoring and managing surface water quality.

[2] Landcom (2004) Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition

Erosion and Sediment Control Plans (ESCPs) will be prepared for all work sites in accordance with the Blue Book. ESCPs will be implemented in advance of site disturbance and will be updated as required as the work progresses. A soil conservation specialist would also be engaged for the duration of construction to provide advice regarding erosion and sediment control.

Wastewater discharge criteria

A program to monitor potential surface water quality impacts of the project will be developed and included in the CSWMP. The program will include the water quality monitoring parameters (including pH, turbidity, dissolved oxygen, nitrogen and metals) and the monitoring locations (including Muddy Creek, Rockdale Bicentennial Park, North Scarborough Pond and Cooks River) identified in Annexure G of Appendix L (Surface water technical report) of the EIS.

Discharges from construction of the project will be directed to the construction water treatment plants located at the construction ancillary facilities for the project. This will ensure that construction wastewater is treated and tested prior to discharge.

The proposed discharge criteria for the pollutants of concern are summarised in Table 8-2 of Appendix L (Surface water technical report) of the EIS. Where feasible and reasonable, construction wastewater will be discharged to Muddy Creek or the Cooks River to protect the more sensitive environment of Scarborough Ponds. Construction wastewater will be treated such that discharge concentrations would be equal to or less than the discharge criteria set for the receiving waterways. The criteria have been developed in accordance with Australian and New Zealand Environment Conservation Council guidelines[3] and with consideration of the NSW Water Quality Objectives.

If treated construction wastewater (including extracted groundwater) originating from the President Avenue construction ancillary facility (C3) is found to be of a higher temperature than the adjacent surface water receiving bodies that would be discharged to, the potential risk of disrupting thermal stratification in Northern Scarborough Pond will be mitigated by storing and buffering this water in the treatment basin at C3 (until it reaches ambient water temperature) prior to release into Bicentennial Park Pond (at the surface).

Using Scarborough Park North for working pads

Section 18.3.2 of the EIS outlines that in order to construct the shared cycle and pedestrian bridge over President Avenue, it would be necessary to provide a temporary access road, as well as a series of working pads within Scarborough Park North. This area is inundated by floodwater that surcharges to Scarborough Ponds during storms. The inundation of the access road and working pads by floodwater has the potential to cause the transport of sediment and construction materials into the receiving waterways. Conversely, raising the access road and working pads to reduce the potential for flooding to the work areas would have the potential to displace floodwaters and exacerbate flood behaviour in adjacent development.

As described in section 8.2 of Appendix M (Flooding technical report) of the EIS, the impact of the bridge construction on flood behaviour could be managed by staging the construction of the bridge to minimise the extent of the access road and working pads within the floodplain at any one time. Measures are subject to further hydraulic assessment, which will be undertaken during the detailed design phase.

C17.3 Surface water impacts during operation

Nine submitters raised issues regarding the surface water impacts during operation. Refer to section 18.4 and section 6.0 of Appendix L (Surface water technical report) of the EIS.

Submitters raised concern about impacts on water quality and ecosystems resulting from the operation of the project such as untreated storm water runoff flowing into Patmore Swamp and other local waterways. Other specific concerns include:

[3] Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) National Water Quality Management Strategy, Paper No. 4, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines*

- More roads would increase the amount of contaminants (brake and clutch dust and hydrocarbons) deposited into waterways
- The surface water impacts associated with changing waterways from being natural to concrete lined built drains.

Response

The project includes sections of aboveground roadway, intersections with existing surface roads, and subsurface road tunnels. As outlined in section 18.4.1 of the EIS, new surface roadway exposed to direct rainfall is proposed at the intersection of President Avenue and the Princes Highway. The tunnel ramps at President Avenue would also generate a minor amount of surface runoff which would be captured and pumped to the surface for treatment.

Increases in impervious area (such as road pavement) exposed to direct rainfall would contribute to an increase in runoff volume and potential pollutant mobilisation. Runoff from road pavement would typically contain pollutants such as sediments, nutrients, oils and greases and heavy metals, from atmospheric deposition, vehicle leaks, operational wear, road wear or spills. These pollutants could potentially impact on water quality when discharged to receiving waterways.

A preliminary stormwater drainage strategy, including treatment measures, has been developed for the project, which would be finalised during the detailed design phase. MUSIC modelling was undertaken for the project to assess the performance of the proposed preliminary stormwater drainage strategy and to identify further opportunities for water quality improvement. The MUSIC modelling indicated that by providing gross pollutant traps at two operational discharge points, an overall reduction in pollutant loads could be achieved, which would assist in achieving the NSW Water Quality Objectives. The MUSIC modelling also demonstrated that the preliminary stormwater drainage strategy exceeds the stormwater pollutant load reduction targets when taking into account the treatment of the diverted residential external catchment. Stormwater is therefore manageable in line with current industry practice.

The final selection and design of the stormwater treatment measures will be undertaken during detailed design, supported by additional MUSIC modelling as the design progresses.

The strategy (which includes the water quality basin proposed at Rockdale Bicentennial Park) and implementation of the proposed management measures outlined in **Chapter D1** (Environmental management measures) will minimise impacts on ambient water quality within Scarborough Park North (Patmore Swamp) and other local waterways such that impacts on waterways are expected to be negligible.

Figure 18-6 of the EIS also outlines the likely approach to operational water management, including for Scarborough Park North.

Increase in contaminants in waterways

Section 6.3.2 of Appendix L (Surface water technical report) of the EIS explains that the Operational Motorway Control Centre and ventilation facility at West Botany Street, Rockdale and the new water treatment facility at Arncliffe would incorporate treatment facilities to manage potential impacts associated with stormwater runoff. The treatment facilities would capture pollutants such as sediments and hydrocarbons. With consideration to the size of the catchments and associated pollutant load of the waterways downstream of these facilities, including Muddy Creek, Rockdale Bicentennial Park Pond and the Cooks River, the residual impact of stormwater discharge is considered to be negligible.

As detailed in **Chapter D1** (Environmental management measures), treatment measures will be implemented within the waterbodies of Scarborough Park North and Rockdale Bicentennial Park disturbed by the project during construction, to reduce algal bloom conditions and contribute to achieving the NSW Water Quality Objectives over time. Treatments will be considered in consultation with Bayside Council and could include the establishment of macrophyte zones, bank reshaping of the wetland zones; and the use of solar powered devices to aerate the water column.

The surface water impacts from changing waterways

No concrete lined drains within waterways are proposed as part of the project.

C17.4 Flooding and drainage impacts during operation

Six submitters have raised issues regarding the flooding and drainage impacts during operation. Refer to section 18.4 and section 6.0 of Appendix M (Flooding technical report) of the EIS.

Submitters raised concern regarding flooding impacts during operation of the project. Specifically these were in regards to the following:

- Flooding impacts in the vicinity of Patmore Swamp
- Flooding that would impact on local properties
- Changes to water flows and the potential impacts on biodiversity
- The impacts from dividing the Bicentennial Ponds sub-catchment into two by the raising of the tunnel exits and ground level of President Avenue.

Response

Flooding impacts during operation

The flooding assessment found that once constructed, the project would generally have only a minor impact on flood behaviour in adjacent development for storms with Annual Exceedance Probability's (AEP) up to 1 per cent in intensity. Table 18-16 and Table 6-2 of Appendix M (Flooding technical report) of the EIS provides a summary of impacts of the project on flood behaviour once operational.

While it will be necessary to undertake further design development during detailed design which is aimed at further reducing the residual impacts of the project on flood behaviour, the nature of the changes in flooding patterns attributable to the project would not have a significant impact on the future development potential of land located outside the project footprint.

There would also be an increase in peak PMF levels at the tunnel ancillary facilities (Arncliffe motorway operations complex and Rockdale motorway operations complex (north) and (south)) and the President Avenue tunnel portal of between 0.06 metres and 0.4 metres due to a 0.9 metre rise in future sea levels based on future climate change estimates. In order to manage the risk of flooding over the design life of the project, the impact of future sea level rise would need to be taken into consideration when setting the minimum level of entries to the tunnel ancillary facilities and tunnel portal. Based on this finding, the road level at the entry to the President Avenue tunnel portal has been designed to be above the PMF level including allowance for an increase in peak flood levels due to future sea level rise.

As outlined in **Chapter D1** (Environmental management measures), a FMS will be prepared prior to construction to demonstrate how flooding risks and behaviours will be mitigated during both the construction and operational phases.

Flooding impacts in the vicinity of Patmore Swamp

The project has been designed to minimise the risk of flooding and the risk of exacerbating flooding risks in the vicinity of the project. There would be negligible change in PMF flood levels along the reach of Scarborough Ponds to the south of President Avenue. There would also be no change in the duration of flooding within the Scarborough Ponds catchment as a result of the project.

As summarised in table 18-16 of the EIS, a shared cycle and pedestrian bridge would be provided where the shared cycle and pedestrian pathway crosses President Avenue and a section of Scarborough Park North (Patmore Swamp). A waterway crossing would also be required where the shared cycle and pedestrian pathway crosses an existing drainage line that discharges into Scarborough Ponds from Civic Avenue. Subject to detailed design, this waterway crossing may be incorporated into an extension to the length of the bridge.

No potential impacts on flood behaviour are anticipated during the operation of the shared cycle and pedestrian pathway within this area. For further reference, see figure 19-5 which outlines the project features within Scarborough Park North (Patmore Swamp).

There would also be further hydraulic modelling undertaken during the detailed design phase of the project.

Flooding impacts on local properties

As outlined above, the project has been designed to minimise the risk of flooding and the risk of exacerbating flooding risks in the vicinity of the project. A summary of the potential operational impacts on flooding to local properties are identified in Table 18-16 of the EIS.

As outlined in **section C17.1**, a FMS will be prepared prior to construction to demonstrate how flooding risks and behaviours will be mitigated during both the construction and operational phases. The FMS will include a floor level survey for identified affected properties.

Changes to water flows and the potential impacts on biodiversity

Table 12-13 of the EIS outlines the potential impacts on aquatic biodiversity as a result of water source changes. Overall, impacts on aquatic habitat would be relatively minor, considering existing conditions, scale and recovery potential. A Wetlands Management Plan will be prepared to provide a holistic management approach to impacts on wetlands in the project footprint, including impacts on fauna and flora.

Once operational, residual impacts on water levels during dry conditions and after frequent rainfall events in Scarborough Ponds, Muddy Creek and the Cooks River are considered to be negligible during the operation of the project (refer to section 12.4.3 of the EIS). Monitoring will be undertaken after the restoration of the Bicentennial Park Pond to certify that Bicentennial Park Pond restoration works have been undertaken appropriately. Continuous surface water level and groundwater level monitoring will be undertaken within Rockdale wetland and surrounding area for at least 12 months prior to the commencement of construction.

The surface water monitoring program will continue for a minimum of three years following the completion of construction, or until the affected waterways are certified by a suitably qualified and experienced independent expert as being of an equal or better condition than pre-construction conditions (or as otherwise required by any project conditions of approval).

Dividing the Bicentennial Ponds sub-catchment and raising President Avenue

The Bicentennial Ponds sub-catchment forms part of the larger Cooks River and Botany Bay catchments. Table 18-16 of the EIS describes the potential impacts on the areas most likely to be impacted by flooding including Rockdale Bicentennial Wetland (the sub-catchment). As shown in Table 18-16 of the EIS, there would be no change to the duration of flooding within the Scarborough Ponds catchment as a result of the project, which includes the raising of President Avenue. The existing box culvert structure that crosses President Avenue at Scarborough Ponds would be upgraded which would also improve the conveyance of water and the level of flood immunity within the area.

A FMS will be prepared prior to construction to demonstrate how flooding risks and behaviours will be mitigated during both the construction and operational phases. The FMS will be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, Sydney Water, OEH, SES and relevant councils.

A Wetlands Management Plan will also be prepared to provide a holistic management approach to impacts on wetlands in the project footprint (refer to environmental management measure B3 in **Chapter D1** (Environmental management measures)).

C17.5 Cumulative surface water and flooding impacts

Two submitters have raised issues regarding cumulative flooding impacts during operation of the project. Refer to section 18.5 of the EIS for details of the cumulative surface water and flooding impacts of the project.

Submitters raised concern about the increased impacts of waterway contamination associated with runoff from multiple motorway projects.

Response

Potential cumulative surface water impacts are described in section 18.5.1 of the EIS. There is the potential for cumulative water quality impacts from runoff associated with the F6 Extension Stage 1 project and other motorway projects over an increased area of impervious surfaces. This has the potential to impact common surface water receptors. As described in section 18.5.1 of the EIS, approved motorway projects with the potential for cumulative water quality impacts (associated with runoff) are primarily limited to the New M5 Motorway and M4-M5 Link.

The Cooks River is a common receptor for the New M5 Motorway and the F6 Extension Stage 1 project, with Botany Bay being a common sensitive downstream receptor. While there are no common direct surface water receptors for the M4-M5 Link and F6 Extension Stage 1 projects during construction or operation, the Cooks River is a downstream receptor for the M4-M5 Link project.

The New M5 Motorway EIS indicates that the proposed New M5 Motorway stormwater treatment systems would provide a net benefit to the Cooks River in terms of stormwater pollutant loading during its operation. Potential opportunities to reduce stormwater pollutant loading to Scarborough Ponds as part of the project have also been identified. Therefore the cumulative impact of the two projects in terms of stormwater pollutant loading to the downstream sensitive environment of Botany Bay could be beneficial but negligible in the context of the larger Botany Bay catchment.

Potential cumulative water quality impacts associated with future planned motorway projects (such as Sydney Gateway) would be assessed as part of the respective environmental assessments for those projects and would be managed in accordance with relevant legislation and guidelines.

C17.6 Surface water and flooding environmental management measures

13 submitters have raised issues regarding the surface water and flooding environmental management measures. Refer to **Chapter D1** (Environmental management measures) for further details on the surface water and flooding environmental management measures).

Submitters raised concerns in regards to the surface water and flooding environmental management measures recommended in the EIS. Specific concerns include:

- How water quality will be measured and how the water levels within Rockdale Bicentennial Park will be managed during the diversion of the waterway
- Queries regarding how a negligible impact on receiving water quality will be achieved
- How waterways would be protected from sediment and contamination runoff during construction in areas including Patmore Swamp/Scarborough Ponds, Tonbridge Creek and Cooks River
- If flood immunity would be provided for the potential high risk of major flooding in the area of Scarborough Park during operation
- Clarification on the compensation that would be offered for property impacts from damage caused by flooding
- Requests for stormwater runoff from the impervious surfaces created by the project to be treated prior to discharge
- Clarification about the plans that would be in place to manage the total discharge volume of construction surface water at the President Avenue construction ancillary facility (C3)
- How discharges from the construction water treatment plant at the C3 facility would be directed to Muddy Creek, as it is separated by higher ground
- Suggestion that Muddy Creek should be modernised similar to the Shell Cove and The Ponds.

Response

Water quality monitoring

A program to monitor potential surface water quality impacts of the project will be developed and included in a CSWMP. The program will include the water quality monitoring parameters (including pH, turbidity, dissolved oxygen, nitrogen and metals) and the monitoring locations (including Muddy Creek, Rockdale Bicentennial Park, North Scarborough Pond and Cooks River) identified in Annexure G of Appendix L (Surface water technical report) of the EIS.

Continuous surface water level and groundwater level monitoring will be undertaken within Bicentennial Park Pond for at least 12 months prior to the commencement of construction. Monthly groundwater quality monitoring will also be undertaken in the surrounding area. The data would be used as a baseline to monitor impacts on surface and groundwater levels and groundwater quality within the pond during construction.

Once operational, the surface water monitoring program will continue for a minimum of three years following the completion of construction, or until the affected waterways are certified by a suitably qualified and experienced independent expert as being appropriately rehabilitated (or otherwise required by any project conditions of approval).

Diversion of waterway within Rockdale Bicentennial Park

The waterway within Rockdale Bicentennial Park would be dewatered and excavated during construction of the cut-and-cover structures within the President Avenue construction ancillary facility (C3). The waterway would require complete restoration following construction. A temporary diversion channel would be provided within the Rockdale wetland to divert water flows around the project footprint during construction.

The cut-and-cover tunnel excavation works would not commence within the pond until management measures such as a coffer dam and the water tight diaphragm wall had been installed. Therefore, with the proposed diversion channel providing hydrologic connectivity within the pond and a continuous groundwater inflow, the cut-and-cover tunnel construction and associated dewatering is considered to pose a negligible impact to flows through the Rockdale wetland. Impacts on water levels within areas of the waterway outside the project footprint are also likely to be negligible.

Management of erosion and sedimentation impacts

The following management measures are proposed to manage potential sedimentation and runoff impacts throughout the project footprint:

- A CSWMP will be prepared for the project that will detail the process and measures to manage and monitor soil and water impacts associated with the construction works, including contaminated land. The CSWMP will describe measures to minimise and/or manage sediment and erosion within the project footprint, including overland flow and requirements for site-specific ESCPs. The CSWMP measures will be consistent with the Blue Book and relevant Roads and Maritime guidelines. As discussed in **section C17.2**, the CSWMP will also include the measures that will be implemented to manage and monitor potential surface water quality impacts during construction
- ESCPs will also be prepared for all work sites in accordance with the Blue Book. ESCPs will be implemented in advance of site disturbance and will be updated as required as the work progresses. A soil conservation specialist will also be engaged for the duration of construction to provide advice regarding erosion and sediment control.

The measures outlined above will be implemented at Patmore Swamp/Scarborough Ponds as well as at the Arncliffe construction ancillary facility, in close proximity to the Cooks River. While Tonbridge Creek is not within the project footprint, implementation of these measures within the project footprint would prevent any sedimentation from occurring off-site.

Flood management at Scarborough Park North

The project has been designed to minimise the risk of flooding and the risk of exacerbating flooding risks in the vicinity of the project. The flooding assessment found that there would be a negligible change in PMF flood levels within Scarborough Park North (Patmore Swamp) to the south of President Avenue. There would also be no change in the duration of flooding within the Scarborough Ponds catchment as a result of the project.

Further hydraulic modelling will be undertaken and a FMS would be developed during the detailed design phase of the project.

Compensation for flooding impacts on properties

Subject to further hydraulic assessment during detailed design, floor level survey may be required to confirm the extent to which the proposed works would increase above-floor inundation and seek to avoid the occurrence wherever possible.

Treatment of runoff during operation

A preliminary stormwater drainage strategy, including treatment measures, has been developed for the project, which will be finalised during the detailed design phase. The final selection and design of treatments will consider the sensitivity of the environment, changes in imperviousness as a result of the project, environmental, operational and hydraulic constraints and the Botany Bay Water Quality Improvement Plan objectives, which set targets for pollutant load reductions (discussed further in Appendix L (Surface water technical report) of the EIS).

The stormwater drainage strategy would include the water quality basin to treat runoff from the tunnel portal at President Avenue. The water quality basin, which will incorporate biofiltration and swales, are commonly used water sensitive urban design (WSUD) systems. These systems take into account WSUD principles by using vegetation and soil media to attenuate, filter and treat runoff prior to release to surface waters. Other opportunities to implement stormwater treatments (including passive treatments) for existing pavements and non-road pavement project elements would be investigated during detailed design.

Stormwater treatment of project elements will include:

- Landscaped areas will be suitably profiled, vegetated and stabilised to control erosion
- Passive treatment of stormwater from the shared cycle and pedestrian pathway pavement. This would include diverting stormwater to a grass or vegetated buffer adjacent to the pavement or through use of a permeable pavement system
- Incorporation of rainwater harvesting and proprietary devices to treat runoff from ancillary buildings and pavement.

The above passive treatment and rainwater harvesting measures consider WSUD principles by replicating a natural system through infiltration and reuse respectively to reduce runoff volumes.

Discharge to Muddy Creek

A combination of an above ground pumped connection between the President Avenue construction ancillary facility (C3) and use of the existing stormwater drainage system, would allow construction water flows to be discharged to Muddy Creek.

Construction wastewater flows

Water quality and discharge volumes from the tunnels are likely to be highly variable due to the program of activities during construction. The volumes of wastewater generated will vary depending on the construction activity, tunnel groundwater infiltration rate and excavated tunnel length. For example, tunnel construction would result in relatively higher volumes of groundwater inflow than operation, which would require collection, treatment and disposal. Other sources of wastewater during construction include dust suppression, washdown areas and stormwater runoff from construction ancillary facilities.

Chapter 18 (Surface water and flooding) of the EIS provides further details on water treatment methods, proposed discharge locations, the existing water quality of potential receiving waterways and proposed discharge criteria and volumes. Provided that the treatment measures outlined in **Chapter D1** (Environmental management measures) achieve the recommended discharge criteria, tunnel wastewater discharges during construction are likely to have a negligible impact on receiving water quality.

Estimates of construction discharge volumes are provided within section 5.2.2 Appendix L (Surface water technical report) of the EIS, with average discharge rates likely to be less than 10 litres per second. Hydraulic assessment of the stormwater system to assess its capacity to accept construction wastewater flows will be undertaken during detailed design. Given the estimated average flow rates are relatively minor compared to typical flows which would be conveyed within the stormwater system, impacts are likely to negligible. Where the hydraulic assessments indicate impacts may occur, additional controls will include providing additional storage capacity at the treatment facilities to limit construction wastewater discharges during rainfall events. The treatment system will be designed during detailed design to achieve the discharge criteria set out in section 8.1.6 of Appendix L (Surface water technical report) of the EIS and/or any approval conditions in relation to discharge requirements.

The management of construction wastewater flows is discussed further in **section C20.4.1**.

Naturalisation of Muddy Creek

Sydney Water is looking into opportunities to naturalise Muddy Creek in Brighton-Le-Sands which would involve replacing concrete walls with natural looking banks made of rocks and native plants. Roads and Maritime would work with Sydney Water to ensure the design of the shared cycle and pedestrian pathways is consistent with naturalisation plans for Muddy Creek.

C Part C Response to community submissions

C18 Non-Aboriginal heritage

This chapter addresses issues raised in community submissions associated with the non-Aboriginal heritage assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 19 (Non-Aboriginal heritage) and Appendix N (Statement of heritage impact) of the EIS for further details on the non-Aboriginal heritage assessment.

Contents

C18.1 Level and quality of non-Aboriginal heritage assessment

Two submitters have raised issues regarding the adequacy of the non-Aboriginal heritage assessment. Refer to section 19.1 and section 3 of Appendix N (Statement of heritage impact) of the EIS for further details on the methodology for the non-Aboriginal heritage assessment.

Submitters were concerned with the level and quality of the non-Aboriginal heritage assessment and the heritage impact statement. Specific concerns include:

- The heritage significance of Patmore Swamp was not accurately presented in the EIS
- The property at 136 President Avenue has not been identified as being of heritage significance
- The non-Aboriginal heritage assessment does not identify the significant connection between the former Moorefield racecourse and Patmore Swamp.

Response

The EIS, including the non-Aboriginal heritage assessment provided in Appendix N (Statement of heritage impact), was prepared by a team of qualified professionals, in accordance with the relevant Planning Secretary's Environmental Assessment Requirements (SEARs) for the project.

The EIS, including all technical studies, was reviewed by the NSW Department of Planning and Environment (DP&E) to confirm that it adequately responded to the SEARs prior to being placed on public exhibition. DP&E also commissioned independent technical peer reviews of key technical studies presented in the EIS to inform it's assessment of the EIS. Feedback received from DP&E and agencies was considered and addressed in the EIS, where relevant, prior to public exhibition.

Heritage significance of Patmore Swamp

The historical context of Patmore Swamp is detailed in section 4 and 5 of Appendix N (Statement of heritage impact) of the EIS. Patmore Swamp is listed as a local heritage item (I202) under the Rockdale Local Environmental Plan 2011. The assessment of historical significance was informed by the NSW Office of Environment and Heritage (OEH) statement of significance for Patmore Swamp[1],. Patmore Swamp is recognised as being technically significant for its contribution to the Central Scarborough wetland area which is an integral part of the wetlands corridor. The place also has historical value for its role in the 1930s depression era program of public works. The wetland reserve contributes to amenity and character of the area.

Heritage significance of 136 President Avenue, Brighton-Le-Sands

The house located at 136 President Avenue, Brighton-Le-Sands, has not previously been identified as a heritage item on any statutory register, including the Rockdale Local Environmental Plan (LEP), or by any previous heritage assessment.

Based on a review of archaeological and historical literature and data relevant to the study area including searches of the Register of the National Estate, relevant Local Environmental Plans, the Register of the National Trust of Australia and a review of historical documents such as parish maps and plans, archives from the National Library of Australia and the State Library of NSW, the property at 136 President Avenue has not been identified to be of potential heritage value.

Following further review of available historical aerial photographs (since 1943) it is considered likely that the current house at 136 President Avenue contains elements of the house shown in the 1943 aerial. However, the house appears to have been subject to modification over time, including extensive modifications along the western and northern (rear) sides. These modifications are also likely to have resulted in internal changes to the house. Based on the data review and field visit undertaken during the assessment for the EIS, the structure does not demonstrate local heritage significance. The property is unlikely to retain archaeological potential as a local level of significance. No further investigation is proposed by the heritage specialist.

[1] NSW Office of Environment and Heritage (2018) http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330166)

Moorefield Racecourse

Section 4.2 and 4.4 of Appendix N (Statement of heritage impact) of the EIS considers the historic presence of Moore's Racecourse track south of President Avenue within Patmore Swamp. A section of Moore's Racecourse track was built in this area, however by 1906, pressure for more land for residential needs was increasing. Larger plots of land, including the existing private racecourses and pleasure grounds were being subdivided from 1910 onwards.

The area has been disturbed by subsequent landscaping works post 1943, as well as more recent residential and commercial development. No archaeological remains associated with the track are expected to be within the project footprint.

C18.2 Non-Aboriginal heritage impacts during construction

Four submitters have raised issues regarding the non-Aboriginal heritage impacts during construction. Refer to section 19.3 of the EIS for details of non-Aboriginal heritage impacts during construction.

A submitter was concerned with impacts on non-Aboriginal heritage items during construction. Specific concerns include:

- The proposed shared cycle way and pedestrian pathways and their impact on the heritage values of Patmore Swamp and Kings Wetland
- The potential damage to heritage properties during the construction of the tunnel. Specific locations include properties on Farr Street and Gibbes Street
- The removal of a coco palm on President Avenue as it has heritage significance.

Response

Impacts from the shared cycle and pedestrian pathways

Patmore Swamp

There would be direct impacts on Patmore Swamp from the acquisition of a 30 metre wide portion of the area along the President Avenue frontage and from the construction of the shared cycle and pedestrian pathway. The project would therefore result in around four percent of the Patmore Swamp listed area being directly impacted. This would have a minor impact on the heritage significance of Patmore Swamp. Landscaping works associated with the construction of the shared cycle and pedestrian pathway would promote the aesthetic significance of the swamp and have a positive heritage outcome.

A protection area will be established as a no-go area during construction along either side of the proposed shared cycle and pedestrian pathways and along the new boundary of President Avenue and Patmore Swamp, to preserve as much of the existing vegetation as is practical within the boundaries of the heritage listing. The delineation of the protection area will be maintained throughout the construction period. A heritage interpretation strategy will be prepared to outline opportunities for heritage interpretation being integrated into the design of the shared cycle and pedestrian pathway through Patmore Swamp (refer to environmental management measure NAH6 in **Chapter D1** (Environmental management measures)).

Kings Wetland

The remnant section of Kings Wetland, specifically relating to the section of the heritage listing to the north of Kings Road is considered to be representative of a native wetland in the previously prepared heritage listing[2]. Removal of some vegetation in this area for the construction of the project (specifically, the impact of an internal haulage road) would result in a moderate impact to the heritage significance associated with Kings Wetland under this criterion.

Impacts on the southern portion of this heritage listing would only result in a minor impact to the significance of the Kings Wetland under this criterion as the landscape reflects the post 1940s reclamation works and is not an example of the native vegetation prior to 1788.

[2] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=3490033

The shared cycle and pedestrian pathways would also be constructed through the heritage curtilage of the Kings Wetland. The construction of the pathways is not expected to require the removal of additional vegetation. Creating a formal access into the wetland via the inclusion of an active transport network would have a positive heritage outcome as it would highlight the aesthetic significance of the wetland, and would also link with the active transport network to the south, through Patmore Swamp.

In accordance with environmental management measure NAH6, a protection area will be established as a no-go area during construction along either side of the proposed shared cycle and pedestrian pathways to preserve as much of the existing vegetation as is practical within the boundaries of the heritage listing. The delineation of the protection area will be maintained throughout the construction period.

Settlement impacts on heritage properties

The areas that are most likely to be affected by ground settlement are where tunnelling is closest to the ground surface and around the tunnel portals and entry and exit ramps.

It is generally accepted that the risk of damage to surface features is negligible when subjected to total settlements of less than 10 millimetres[3]. For the majority of the tunnel length, the ground settlement is predicted to be less than 10 millimetres due to the depth of the tunnel. Increased levels of settlement (up to around 30 millimetres) may be observed at the southern end of the project, where the tunnel is shallower.

Seven heritage items (including 11 Gibbes Street, Banksia) and heritage conservation areas that directly intersect with the tunnel alignment were assessed in the EIS for potential settlement impacts. As the tunnel is expected to be greater than 60 metres below these items/areas, impacts from ground settlement are considered unlikely. Other heritage properties located along Gibbes Street and Farr Street include 18 Gibbes Street (around 20 metres west of the tunnel alignment) and 105 Farr Street (around 90 metres west of the tunnel alignment). Both properties are located in areas where the tunnel is expected to be greater than 40 metres below ground level and are considered unlikely to be impacted by ground settlement.

Heritage listed trees on President Avenue

The non-Aboriginal heritage assessment did not identify any coco palm trees along President Avenue as being of heritage significance.

There is no information in the *Rockdale Local Environmental Plan 2010* that suggests there was a former streetscape or landscape setting which included trees of historical significance along President Avenue. The 1943 historical aerial maps do not indicate coco palm trees along President Avenue.

C18.3 Non-Aboriginal heritage impacts during operation

One submitter raised issues regarding the non-Aboriginal heritage impacts during operation. Refer to section 19.4 of the EIS for details of non-Aboriginal heritage impacts during operation.

The submitter raised concern about non-Aboriginal heritage impacts during operation, including:

- How the project will impact Patmore Swamp during operation
- The alteration of view corridors to heritage values including Patmore Swamp.

Response

Impacts on Patmore Swamp

Potential impacts on non-Aboriginal heritage (either direct or indirect) during the operation of the project largely relate to impacts on urban design landscape character and visual amenity.

[3] [3] R.J.Mair, R.N.Taylor, J.B. Burland (1996) Building Response to Tunnelling: Case Studies from Construction of the Jubilee Line Extension, London

Landscaping works along the boundary of Patmore Swamp with President Avenue would aim to be consistent with the surrounding landscape character and existing vegetation where possible. The use of the shared cycle and pedestrian pathway would create a formal access into the swamp via the inclusion of a shared pedestrian and cycle pathway would also have a positive heritage outcome as it would highlight the aesthetic significance of the swamp.

Impacts on heritage values

Through the preparation of an urban design and landscape strategy, the project aims to blend new infrastructure such as bridges associated with the shared cycle and pedestrian pathways, portals and other facilities into the existing visual surrounds where reasonable and feasible to do so. Furthermore, existing vistas from heritage items will be considered during future design phases and any rehabilitation strategies (for items such as Kings Wetland and Patmore Swamp) will be undertaken in a manner sympathetic to the heritage significance of the item. Specific impacts on each item are as follows:

- **Kings Wetland** - There would be moderate-low visual impacts from Kings Wetland due to the reinstatement of parkland and introduction of new vegetation, which would in time soften the appearance of views to the tunnel entry and exit lanes, ramps and portal
- **Patmore Swamp** - There would be a high-moderate visual impact from Patmore Swamp of the project entry and exit ramps due to the extensive changes to these views which would be transformed from open space to an intersection and tunnel entrance
- **Brighton-Le-Sands Public School** - There would be a moderate-low visual impact on views from the Brighton-Le-Sands school (one heritage listed building) due to intervening existing and new vegetation.

C18.4 Cumulative non-Aboriginal heritage impacts

Two submitters have raised issues regarding cumulative non-Aboriginal heritage impacts. Refer to section 19.5 of the EIS for details of cumulative non-Aboriginal heritage impacts.

Submitters were concerned about the cumulative impacts of motorway projects on heritage areas and buildings in the study area.

Response

Overall, the project is assessed as having a minor heritage impact. This is due to the project characteristics including deep tunnels, limited surface infrastructure and placement of infrastructure in areas of low heritage value/already disturbed areas.

The WestConnex projects and future stages of the F6 Extension were considered in the assessment of cumulative heritage impacts.

The WestConnex New M5 and M4-M5 Link motorway projects are considered to have a moderate adverse impact on non-Aboriginal heritage. The additional impact of the project would be relatively minor.

The future stages of the F6 Extension propose an additional motorway connection from President Avenue south towards Loftus. As these future works would potentially combine controlled surface infrastructure with underground tunnels, and listed heritage items to the south of President Avenue are known, it should be possible to complete a design that is sensitive to these items and that avoids major impacts on heritage values.

Cumulative impacts can be mitigated primarily through impact avoidance ie by designing projects so they avoid heritage items and areas wherever possible.

C18.5 Non-Aboriginal heritage environmental management measures

One submitter raised concerns about non-Aboriginal heritage environmental management measures. Refer to **Chapter D1** (Environmental management measures) for details of the non-Aboriginal heritage environmental management measures.

A submitter was concerned with the non-Aboriginal heritage environmental management measures. Specifically, the submitter does not agree with the proposed environmental management measures.

Response

Environmental management measures will be implemented to avoid, reduce and manage potential impacts on non-Aboriginal heritage items.

Prior to construction, a Heritage Management Plan will be prepared for the project. The plan will provide further detail on the measures to minimise impacts on identified heritage features within the study area and will also detail procedures to manage unexpected heritage finds.

C Part C Response to community submissions

C19 Aboriginal cultural heritage

This chapter addresses issues raised in community submissions associated with the Aboriginal cultural heritage assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 20 (Aboriginal heritage) and Appendix N (Statement of heritage impact) of the EIS for further details on the Aboriginal cultural heritage assessment.

Contents

C19.1 Impacts on the Aboriginal cultural heritage significance of Patmore Swamp

One submitter has raised issues regarding the impacts on Aboriginal cultural heritage items. Refer to section 20.3 and Appendix N (Statement of heritage impact) of the EIS for details of the potential impacts on Aboriginal cultural heritage items.

A submitter raised concern about the project impact on the Aboriginal cultural heritage significance of Patmore Swamp, specifically that the project would have a direct impact on the cultural heritage significance of Patmore Swamp as a result of visual impacts.

Response

Based on the assessment of the project footprint and proposed works in relation to Aboriginal cultural heritage, construction of the project is not likely to result in any impacts upon Aboriginal cultural heritage, including within Patmore Swamp.

Public park areas within the project footprint including Patmore Swamp were assessed by researching available background information and conducting a field inspection accompanied by a Metropolitan Local Aboriginal Land Council (MLALC) representative. The work was conducted by a suitably qualified heritage consultant in accordance with the relevant NSW guidelines and requirements. The MLALC noted that there were no objects of Aboriginal cultural significance identified during the assessment and the MLALC have no objection to the proposed development of the site (refer to Annexure A of Appendix N (Statement of heritage impact) of the EIS).

The areas within the project footprint were found to be unlikely to contain in situ cultural deposits due to the areas being highly disturbed. Impacts noted during the survey included earthworks associated with swamp reclamation and artificial channel construction, dating to the 1930s depression relief program that drained Patmore Swamp and created artificial lakes[1].

If an Aboriginal object(s) is discovered during construction it would be managed in accordance with the *Standard Management Procedure: Unexpected Heritage Items*[2].

To recognise the prior presence of Aboriginal people, the Urban Design and Landscape Plan (UDLP) will include an Aboriginal interpretative signage strategy developed in consultation with the MLALC (refer to **Chapter D1** (Environmental management measures)).

Visual impacts to Patmore Swamp

Section 20.2.3 of the EIS recognises that while there is unlikely to be any Aboriginal objects impacted by the project, the southern area of the project represents the character of wetland environments commonly used by Aboriginal people.

Through consideration in design, the project has minimised the surface works to more closely integrate with the existing surrounding infrastructure and to be sympathetic to the surrounding landscape context. This is a prudent measure for the avoidance of Aboriginal cultural heritage sites and values, although in this case the assessment has shown there were no known sites or values in the vicinity that require avoidance.

The project aims to blend new infrastructure such as bridges associated with the shared cycle and pedestrian pathways, portals and other facilities into the existing visual surrounds where reasonable and feasible to do so. Furthermore, maintaining or enhancing existing vistas from heritage items will be considered during future design phases and any rehabilitation strategies (for heritage items/places such as Kings Wetland and Patmore Swamp) in a manner sympathetic with the heritage significance of the item.

Construction of the project entry and exit ramps would have a high-moderate impact on current views from Patmore Swamp. The view of open space would be replaced with motorway infrastructure. However, landscaping works and creation of the shared cycle and pedestrian pathways through Patmore Swamp would have a positive outcome on visual amenity.

[1] NSW Office of Environment and Heritage. (2017) NSW State Heritage Register. Accessed at https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330166
[2] Roads and Maritime Services (2015) *Standard Management Procedure: Unexpected Heritage Items*

C Part C Response to community submissions

C20 Waste management

This chapter addresses issues raised in community submissions associated with waste management for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 21 (Waste management) of the EIS for further details on the waste management approach, including spoil handling and disposal.

Contents

C20.1 Level and quality of the waste assessment

One submitter raised issues regarding the level and quality of the waste assessment. Refer to Chapter 21 (Waste management) of the EIS for details of the waste assessment.

C20.1.1 Level and quality of the waste assessment

A submitter expressed concern about the level and quality of the waste assessment, including that the Spoil Management Plan has not been made available to the public.

Response

Level and quality of the waste assessment

The waste assessment has been prepared to assess the impacts of the project in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs). The SEARs include requirements of key government agencies as well as reference to undertaking the assessment in accordance with relevant industry standards and guidelines (refer to Table 21-1 of the EIS).

Spoil Management Plan

Prior to construction, a Spoil Management Plan will be prepared for the project in consultation with the relevant councils and other stakeholders (refer to environmental management measure W2 in **Chapter D1** (Environmental management measures)). The plan will detail spoil management measures including spoil haulage routes and spoil disposal sites.

C20.2 Waste management

One submitter raised concerns about the management of waste materials. Refer to **Chapter D1** (Environmental management measures) for details of the waste management measures.

C20.2.1 Waste management

A submitter expressed concern about the management of dangerous materials, such as asbestos, and the poor management practices for waste on other projects being repeated.

Response

Management of asbestos

Asbestos has been identified within the fill material at the Arncliffe construction ancillary facility (C1) and President Avenue construction ancillary facility (C3) and is likely to be present at other locations within the project footprint. The houses to be acquired along the northern side of President Avenue would be demolished as part of the works. These buildings may contain hazardous materials (asbestos and lead). Potential contamination pathways that have been identified include inhalation of asbestos by construction workers and off-site transport via dust.

The excavation, handling, storage, movement and disposal of asbestos containing material would be undertaken in accordance with the relevant NSW guidelines. Examples of measures to be taken include spraying asbestos waste with water to reduce the risk of asbestos being inhaled as dust and migrating off site, and ensuring all equipment is washed thoroughly before being transported off-site. Construction workers will also be required to wear the required personal protective equipment.

A number of waste facilities in Sydney are licenced to accept asbestos. Specific facilities and collection contractors for the disposal of asbestos waste would be selected prior to the commencement of construction and documented in a Construction Waste Management Plan.

The Construction Soils and Water Management Plan (CWSMP) for the project will also describe stockpile management measures for asbestos containing materials, including stabilisation and sediment controls and preventing overland flow.

Waste management

All wastes generated during construction of the project would be managed in accordance with the waste provisions contained within the *Protection of the Environment Operations Act 1997* and, where reused off site, would comply with relevant NSW Environment Protection Authority resource recovery exemptions. Disposal methods would be selected for waste if it is found unsuitable for reuse or recycling. Section 21.3.1 of the EIS provides a summary of the anticipated waste types and the waste management strategy for each waste type.

All waste generated during operation of the project will be managed in accordance with relevant legislation and policies. Waste streams during operation would include maintenance waste and wastewater. During operation, maintenance and repair activities would be subject to separate assessment processes which would include the assessment of waste impacts associated with these activities. With the implementation of standard work practices during routine maintenance and repair activities, the overall impact of operational waste would be minimal.

Refer to **Chapter D1** (Environmental management measures) for details on management measures to avoid, minimise or manage waste.

C20.3 Spoil handling and management

Two submitters have raised issues regarding spoil handling and management. Refer to section 21.3 of the EIS for details of the spoil management strategy for the project.

C20.3.1 Disposal and reuse of construction spoil

Submitters expressed concern disposal and reuse of construction spoil. Specific concerns include the following:

- Locations and names of spoil disposal sites
- Amount of spoil to be reused and where the spoil reuse would take place (on-site or off-site)
- Traffic impacts associated with off-site spoil haulage
- Restrictions that would be placed on vehicles for spoil haulage in and outside the project footprint.

Response

Spoil disposal sites

Roads and Maritime aims to reuse spoil within the project wherever possible. Excess spoil that cannot be reused would require off-site reuse/disposal. Spoil would be delivered to the spoil management sites in accordance with the conditions of approval and environment protection licences governing those sites.

Eight potential spoil disposal locations have been identified for the project (refer to section 21.3.3 of the EIS). The identified spoil reuse and disposal sites are based on the current existing availability of spoil receiving locations (including projects with a fill deficit) across the Sydney area. Negotiations for the final destinations for excess spoil would be carried out during detailed design. Consultation with Bayside Council would be undertaken to identify potential local spoil disposal sites to minimise traffic impacts on the local road network.

Refer to Table 21-6 of the EIS for additional information on the locations and capacities of these spoil disposal sites.

Spoil haulage impacts

Spoil stockpiles would be required at the Arncliffe construction ancillary facility (C1), Rockdale construction ancillary facility (C2), President Avenue construction ancillary facility (C3) and the shared cycle and pedestrian pathways construction ancillary facilities (C4/C5). Stockpile management for the project is outlined in section 21.1 of the EIS. The Princes Highway construction ancillary facility (C6) would not be used for the stockpiling of spoil material.

Spoil would be hauled using heavy vehicles to spoil reuse and disposal sites. The construction traffic and transport and noise and vibration assessments undertaken for the project took into account heavy vehicle movements associated with spoil management (refer to section 8.4 and section 11.3 of the EIS).

Spoil haulage routes to and from construction ancillary facilities have been developed and would be confirmed through detailed design 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 will be coordinated to minimise potential queuing and traffic access and disruptions in the local area.

Spoil would be removed during the day and outside of peak periods where possible. The majority of spoil haulage would occur during 7am-6pm on weekdays and between 8am-1pm on Saturday. Some night-time spoil haulage would be required at the Arncliffe construction ancillary facility (C1) and Rockdale construction ancillary facility (C2). However, feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements at night.

Prior to construction, a Spoil Management Plan will be prepared for the project in consultation with the relevant councils and other stakeholders (refer to **Chapter D1** (Environmental management measures)).

In addition, a Construction Traffic and Access Management Plan (CTAMP) will be prepared and will detail processes to minimise delays and disruptions and identify and respond to changes in road safety as a result of project construction works. The CTAMP will identify measures to manage the movements of construction related traffic to minimise traffic and access disruptions on the public road network. Refer to Chapter 8 (Traffic and transport) of the EIS for further details on traffic and transport during construction.

Spoil reuse options

The project design has considered the principles of the resource management hierarchy as defined in the *Waste Avoidance and Resource Recovery Act 2001*, including minimising excess spoil generation as far as practical. Where possible and fit for purpose, spoil would be beneficially reused as part of the project before alternative spoil disposal options are pursued. Excess spoil which cannot be reused or recycled would be disposed of at a suitably licensed waste management facility.

The project will target a 95 per cent beneficial re-use of usable spoil, either within the project footprint or at other locations. This target is one of the project environmental management measures (refer to environmental management measure W3 in **Chapter D1** (Environmental management measures)). Roads and Maritime will be required to take all feasible and reasonable measures to achieve this target.

C20.4 Waste environmental management measures

One submitter raised issues regarding the management of waste materials. Refer to **Chapter D1** (Environmental management measures) for details of the waste management measures.

C20.4.1 Waste environmental management measures

A submitter expressed concern about the plan for the disposal of construction wastewater should the stormwater system be incapable of accepting the expected water volumes.

Response

Construction wastewater

Construction water treatment plants would be located at each of the construction ancillary facilities that would support tunnelling (C1, C2, C3 and C6). Wastewater treatment plants would receive water pumped from the low point of each tunnel and surface water runoff which may be contaminated (for example from concrete washout). At these treatment plants, construction wastewater would be treated so that it is suitable for reuse during tunnelling and construction generally, or for appropriate discharge or disposal.

Construction wastewater will be reused on site wherever feasible. Where treated water is not required for use on site, it would be discharged into the local stormwater system or the Cooks River in accordance with the *Protection of the Environment Operations Act 1997.* Where treated water does not meet discharge criteria or the stormwater system cannot cope with the amount of wastewater to be disposed of, wastewater would be disposed of off-site at a suitably licensed facility as necessary. Each of the construction ancillary facilities would also include a sediment retention basin to temporarily store the wastewater from surface run-off before it is treated and discharged into the stormwater network. The sediment basins will be designed in accordance with the Blue Book[1] to ensure the structures meet the appropriate water quality standards for the protection of surrounding waterways.

Chapter 18 (Surface water and flooding) of the EIS provides further details on water treatment methods, proposed discharge locations, the existing water quality of potential receiving waterways and proposed discharge criteria and volumes. Provided that the treatment measures discussed in section 18.6 of the EIS achieve recommended discharge criteria, tunnel wastewater discharges during construction are likely to have a negligible impact on receiving water quality.

Estimates of construction discharge volumes are provided within section 5.2.2 of Appendix L (Surface water technical report) of the EIS, with average discharge rates likely to be less than 10 L/s. However, water quality and discharge volumes from the tunnels are likely to be highly variable due to the program of activities during construction. The volumes of wastewater generated will vary depending on the construction activity, tunnel groundwater infiltration rate and excavated tunnel length. For example, tunnel construction would result in significant volumes of groundwater inflow which would require collection, treatment and disposal. Other sources of wastewater during construction include dust suppression, washdown areas and stormwater runoff from construction ancillary facilities.

Further hydraulic assessment of the stormwater system's capacity to accept construction wastewater flows will be undertaken during detailed design. Given the estimated average flow rates are relatively minor compared to typical flows which would be conveyed within the stormwater system, impacts are likely to be negligible and it is expected that the system has capacity to accept the water flows.

Where further hydraulic assessments indicate impacts may occur, additional controls may be implemented, such as, for example, providing additional storage capacity at the treatment facilities to limit construction wastewater discharges during rainfall events, if required.

Wastewater management will be outlined in the Construction Soil and Water Management Plan to be developed for the project prior to construction commencing (refer to environmental management measure SC1 in **Chapter D1** (Environmental management measures)).

[1] Landcom (2004) Managing Urban Stormwater: Soils and Construction Volume 1

C Part C Response to community submissions

C21 Climate change and greenhouse gas

This chapter addresses issues raised in community submissions associated with the climate change and greenhouse gas assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 22 (Climate change and greenhouse gas) of the EIS for further details on the climate change and greenhouse gas assessment.

Contents

C21.1 Level and quality of the climate change and greenhouse gas assessment

55 submitters have raised issues regarding the level and quality of the climate change and greenhouse gas assessment. Refer to section 22.1 of the EIS and section 3.0 of Appendix O (Methodologies) for details of the climate change risk and greenhouse gas assessment methodology.

Submitters raised concern over the adequacy of the climate change and greenhouse gas (GHG) assessment. Specifics concerns included:

- Concern that the EIS addressed the impact of climate change on the project, but not the contribution of the project to climate change (ie greenhouse gas emissions)
- Submitters questioned why the EIS claims the project will reduce emissions, when building a motorway is not the solution to cutting greenhouse gas emissions
- Submitters raised concern over a method of analysis which does not look at alternatives but instead compares the F6 project against a 'do nothing' scenario to claim a reduction in greenhouse gas emissions.

Response

Project's contribution to climate change

Climate change occurs due to a global increase in GHG emissions in the atmosphere. Chapter 22 (Climate change and greenhouse gas) and Appendix O (Methodologies) of the EIS provide an estimate of the project's contribution to climate change through an assessment of GHG emissions attributed to the project's construction and operation.

Section 3.0 of Appendix O (Methodologies) of the EIS provides a detailed description of the GHG assessment completed for the project, including the emissions factors used for all emission sources, and detailed calculation methods used to estimate the GHG emissions from fuel combustion, electricity consumption, vegetation removed, materials use and waste.

Section C21.2 provides further responses about the project's GHG contribution during construction.

Motorway alternative/'do nothing'

As outlined in Chapter 4 (Strategic context and project need) of the EIS, the project is needed to address traffic growth forecast across NSW, which would include around one million extra road users in Sydney within the next decade and nearly twice the freight movements by 2031. Chapter 5 (Project development and alternatives) of the EIS considers alternatives to the project such as rail infrastructure and bus service improvements as well as the 'do nothing' option ie not developing the F6 Extension Stage 1 motorway. The project is complementary to these other modes of transport and would, by redirecting surface traffic into the tunnel, provide opportunities for improved public transport on surface roads.

Consideration of traffic scenarios both with ('do something') and without the project ('do minimum') demonstrate that the project would not lead to a cumulative increase in GHG emissions, but would, however, together with other tunnel projects, lead to an overall reduction (refer to Table 22-7 of the EIS). This is due to the benefits of road tunnel usage in urban areas, where travel along a more direct route at higher average speeds results in fewer GHG emissions being generated by road users, as reduced congestion and stop-start driving reduces the fuel used by vehicles.

C21.2 Greenhouse gas emissions during construction

133 submitters raised concerns about greenhouse gas emissions during construction. Refer to section 22.3 of the EIS for details of the potential greenhouse gas emissions during construction.

Submitters raised concern about greenhouse gas emissions associated with the construction phase, including the carbon footprint of building concrete tunnels.

Response

Key GHG emission sources during construction of the project are summarised in Table 22-4 and Figure 22-3 and Figure 22-3 of the EIS.

The results of the GHG assessment demonstrate that the majority of GHG emissions associated with the construction of the project are attributed to upstream/downstream emissions generated in the wider economy due to third party supply chains and road users as a consequence of activity within the boundary of the project footprint, such as the embodied life cycle emissions for concrete used to construct the project. As expected on large construction projects, the decomposition of waste including spoil and the production and transport of concrete and steel would contribute the highest proportion of GHG emissions. The high proportions of emissions associated with these materials are attributed not only to the quantity required for the construction of the project, but also the emissions-intensive processes involved in the extraction and production of these materials. This therefore encapsulates the carbon footprint of building the tunnels.

The project has been optimised to reduce energy and resource requirements. Environmental management measures to be implemented prior to or during construction, such as consideration of green power/renewable energy sources, use of lower emission construction materials and equipment, maintenance of plant and equipment to reduce the GHG emissions of the project, procuring local goods and services where feasible, will be investigated further (refer to **Chapter D1** (Environmental management measures)).

A Sustainability Management Plan will also be developed for the project during detailed design that will identify initiatives to be implemented during design and construction of the project to reduce carbon emissions, resource use and embodied life cycle impacts.

C21.3 Climate change and greenhouse gases during operation

Seven submitters raised concerns about the impact of climate change on the project during operation. Refer to section 22.4 of the EIS and section 2.0 of Appendix O for details of the climate change risk assessment.

Submitters raised concerns that the project will be impacted by climate change, for example, flooding of the tunnels.

Response

The nature of the project, primarily comprising underground tunnel infrastructure, is likely to offer protection from a number of climate impacts, however the project's surface infrastructure including tunnel interchanges and project buildings are likely to be susceptible to these impacts.

Section 22.4.1 of the EIS assessed climate change risks to the project. Climate change risks identified as 'high' for the project are associated with an increase in the intensity of extreme rainfall events and sea level rise, which are likely to exacerbate localised flood risk to project surface infrastructure and tunnel portals at President Avenue.

In order to assess the impact of climate change on flood behaviour, sensitivity analyses were undertaken for increases in extreme rainfall and sea level rise, with design refinements made to manage potential flood risks exacerbated by climate change. As discussed in Chapter 18 (Surface water and flooding) and Appendix M (Flooding technical report) of the EIS, tunnel portals have been designed to ensure immunity from the greater of the Probable Maximum Flood (PMF) or 100 year Average Recurrence Interval (ARI) event plus 0.5 metre freeboard. Where the portals lie within the PMF extent, flood immunity would be achieved by appropriate flood protection measures such as elevating the tunnel entrances. Therefore, it is expected that the tunnels would be protected from flooding and changes in flood behaviour resulting from climate change.

C21.4 Cumulative climate change and greenhouse gas impacts

12 submitters raised issues regarding the impact from cumulative climate change and greenhouse gas impacts. Refer to section 22.3 and 22.4 of the EIS for details of the potential cumulative climate change and greenhouse gas impacts during the project.

Submitters raised concern about the cumulative impacts of motorway projects (including WestConnex) on climate change and greenhouse gas emissions, including:

- Higher per-capita greenhouse gas emissions
- Contribution to the urban heat island effect.

Response

Higher per-capita GHG emissions

Private vehicle use is acknowledged as the highest mode of transport for per capita GHG emissions. However, while the project would result in the generation of GHG emissions during construction and operation, the assessment found that in the 2026 and 2036 assessment scenarios, the total operational project emissions for the study area would be less than those generated from existing roads under the 'do minimum' (ie without project) scenario. In other words, the project would contribute to a reduction in GHG emissions for the study area. This demonstrates the benefits of road tunnel usage in urban areas, where travel along a more direct route at higher average speeds results in fewer GHG emissions being generated by road users, as reduced congestion and stop-start driving reduces the fuel used by vehicles.

In addition, the project would facilitate improvements in alternative modes of transport, such as improvements to bus services, which have lower per capita GHG emissions.

Contribution to the urban heat island effect

Introduction of additional infrastructure as part of the project may contribute to the urban heat island effect, as hard surfaces absorb and retain heat resulting in an increase in local average temperatures. While the project primarily comprises underground tunnel infrastructure, associated surface infrastructure such as tunnel interchanges and project buildings, potentially contribute to this effect.

While the project would remove around 4.45 hectares of vegetation (primarily at Rockdale Bicentennial Park), this is the total removal across the project footprint, and would not be concentrated in a single area. Vegetation would be replanted following project construction, with proposed landscaping and replacement trees resulting in a net increase in the number of trees, which would help to offset this impact. Options are being considered in the development of the project design as to where tree replanting can occur on President Avenue and other areas.

Section 22.5 of the EIS identifies additional measures to mitigate the impacts of heat, including consideration of increased extreme heat events incorporated into the urban design of project surface infrastructure and areas of open space created by the project, such as provision of areas of respite and drinking fountains, where possible. Landscaping will be designed to include consideration of users of the shared cycle and pedestrian pathways and the increasing need for shading and areas of respite during extreme heat events.

C Part C Response to community submissions

C22 Sustainability

This chapter addresses issues raised in community submissions associated with the sustainability assessment for the F6 Extension Stage 1 Environmental Impact Statement (EIS). Refer to Chapter 23 (Sustainability) of the EIS for further details on the sustainability assessment.

Contents

C22.1 Sustainability of the project

Three submitters have raised issues regarding the sustainability of the project.

The submitters raised the following specific concerns:

- Concerns that the project is not sustainable, and will eventually lead to social, environmental and economic problems
- Concerns about the cost of productivity loss related to unhealthy and unsustainable development
- Concerns that motorway projects are not sustainable and they reduce the liveability of local communities
- Concerns that the project would increase NSW's dependence on oil. Failure to address transport pricing and improve rail will leave NSW with increasing road congestion and dependence on oil.

Response

A sustainable motorway solution

The strategic importance of the project is that it is one part of a wide range of transport infrastructure projects including public transport. The project would contribute to a more sustainable road network by providing improved and more reliable travel times between southern Sydney and the Sydney central business district.

Chapter 5 (Project development and alternatives) of the EIS considers alternatives such as rail infrastructure and bus service improvements as well as the 'do nothing' option. While the project would not preclude public transport improvements from occurring, these improvements would address different objectives, therefore the need for the project remains.

The assessment of strategic transport alternatives demonstrated that the project provides the best complete response to the objective of addressing congestion in southern Sydney, relative to the alternatives.

As described below, the project has considered how it can contribute to more liveable and sustainable communities.

Sustainability of the project

Section 23.1.1 of the EIS outlines the sustainability policy framework for the project, including NSW Government targets and strategies to improve efficiency in the use of water, energy, transport and waste.

Section 23.1.6 of the EIS describes how sustainability initiatives will be integrated into the design, construction and operation of the project. Some of the key sustainability focus areas for the project include:

- Energy and carbon management: The project's Sustainability Management Plan identifies initiatives to be implemented during design and construction of the project to reduce carbon emissions, energy use and embodied life cycle impacts. These include minimising travel distances between ancillary facilities and minimising transport of materials and staff around the site, as well as optimising plant operation and efficiency
- Liveable communities: The project would contribute to the liveability of communities and facilitate urban revitalisation by easing congestion on the existing road network, connecting communities and integrating land use and transport planning. The project would provide and facilitate improvements in pedestrian and cyclist connections, creating new shared cycle and pedestrian pathways and linking existing active transport networks with new connections. The project would also improve the amenity of streetscapes, and would investigate a 'net improvement in public recreation' policy whereby the project results in an overall improvement in terms of public recreation facilities

- Sustainable procurement. The Sustainability Management Plan guides the implementation of sustainability throughout the project's design and construction phases and facilitates the achievement of the project's Infrastructure Sustainability 'Design' and 'As Built' target rating of 'Excellent'. A detailed Sustainability Management Plan to be developed for the project will detail protocols for sustainable procurement, including the consideration of whole of life environmental, social and economic factors and will maximise equitable/fair training and employment opportunities.

Overall, the project would contribute to building the resilience of metropolitan Sydney by addressing some of the key chronic stresses facing the city, including the need for improved connectivity and reduced congestion. The project would improve connectivity by spreading out traffic on alternative routes and improve network redundancy.

Dependence on oil

Refer to **section C7.5** for responses to road congestion increases in NSW.

Although consideration of dependence on oil, or peak oil, is not a requirement of the Planning Secretary's Environmental Assessment Requirements (SEARs) for this project, Roads and Maritime acknowledges that it is prudent to consider peak oil.

Roads and Maritime recognise that the project will involve consumption of fuel resources during construction and operation. Until alternative technologies for passenger and freight transport are developed and readily available, Roads and Maritime can help reduce the dependence on peak oil by improving the energy efficiency of the current vehicles moving through the road network. This would enable the economic benefits provided by road transport to continue to be delivered with a reduced need for fossil fuels.

In accordance with the project objectives to improve travel times between southern Sydney and strategic centres in the metropolitan area, increases in average speeds as a result of the operational efficiency of the project tunnels, which would reduce the number of intersections and the frequency of stopping, would result in improved vehicle fuel efficiency.

This project is one component of the strategic transport planning blueprint for the city which considers planning for road, rail and freight, which together would provide for the transport needs of Sydney and reduce dependence on automobiles.

C Part C Response to community submissions

C23 Other Roads and Maritime projects and issues outside the scope of the project

This chapter addresses issues raised in community submissions associated with other Roads and Maritime projects, such as the WestConnex program of works, and issues outside the scope of the project.

Contents

C23.1 WestConnex program of works

73 submitters raised issues regarding the WestConnex program of works.

Submitters raised concern over the WestConnex program of works. Specific concerns included:

- Concern over the environmental and social impacts of the WestConnex program of works, including the management of these impacts, such as:
  - Property impacts, including acquisition
  - Human health and social and economic impacts
  - Loss of public open space
- Concern over the availability of information for WestConnex
- Concern that the WestConnex program of works are not justified and is an inefficient transport solution
- Concerned about the approval process for WestConnex due to:
  - The modelled projections and predictions being contradicted by the outcomes
  - Proposals were pursued despite expert advice
  - Approvals process was problematic
  - Integrated transport and land use development factors in the north and south sectors of Sydney have not been strategically considered
  - Traffic volumes are projected to only reach one third of capacity after 10 years of operation
- Little confidence in Roads and Maritime Services due to previous decisions and management in the area (e.g. due to the management of the New M5 Motorway)
- The approvals process should take the findings of the NSW Parliamentary Inquiry into the impacts of the WestConnex project into account when deciding whether to approve the project.

Response

Specific impacts associated with the construction and operation of the WestConnex program of works are beyond the scope of the F6 Extension Stage 1 project. The WestConnex program of works has been developed as three separate projects, each having achieved development consent following separate environmental assessments.

The WestConnex program of works has been considered as part of the F6 Extension Stage 1 EIS only to the extent that it relates to the broader strategic objectives of the project and in relation to cumulative impacts. Traffic analysis for the project has included the completed WestConnex motorway as part of the 'Do minimum' scenarios (ie it assumes that WestConnex is fully operational by 2026). The WestConnex motorway therefore also forms part of the operational impact assessment for noise and vibration and air quality, which are informed by the traffic analysis.

Parliamentary inquiry into WestConnex

The request for the planning approval process to consider the findings of the parliamentary inquiry into WestConnex is noted, and is a matter for the Planning Secretary to consider.

C23.2 Other Roads and Maritime projects

Seven submitters have raised issues regarding other Roads and Maritime projects.

Submitters raised concerns regarding other Roads and Maritime projects which are outside the scope of the F6 Extension Stage 1 project. Specific issues include:

- The Western Harbour Tunnel and Beaches Link is only being proposed because it benefits the owners of WestConnex
- Strategic alternatives to the Western Harbour Tunnel and Beaches Link projects (e.g. Metro rail projects)
- The Sydney Gateway project has access only from the St Peters interchange, with no direct connections that would otherwise provide Port Botany freight to access the F6 and bypass Brighton-Le-Sands
- Concern about the Southern Gateway project (Gateway to the South) being progressed instead of the Southern Sydney freight rail line
- The traffic modelling and air quality impacts of other existing motorways across Sydney, including the Eastern Distributor, M5 East, Cross City Tunnel, Sydney Harbour Tunnel and the Lane Cove Tunnel.

Response

Other Roads and Maritime projects are beyond the scope of the F6 Extension project and are subject to separate assessment and approval. Impacts associated with the construction and operation of other Roads and Maritime projects and the F6 Extension have been considered and addressed within the cumulative impacts section of each assessment chapter of the EIS, where applicable.

C23.3 Issues outside the scope of the project

85 submitters raised issues that were outside the scope of the project.

Submitters were concerned about issues unrelated to the project. Specific concerns included transport and non-transport relates issues.

Transport related issues

Transport related issues which were raised by submitters and are unrelated to the project included:

- Concern that it is too dangerous for children to cross over the Princes Highway to Carlton South Primary School and St Patricks Primary School
- Submitter questioned how NSW Infrastructure were allowed to retrospectively rewrite the NSW Transport Master Plan 2012
- Concern about the poor judgement of the Baird government to privatise Port Botany in 2013
- Concern that Transurban's contracts are not made available to the public and that for example, Transurban's aggressive negotiations on WestConnex are not transparent
- Concern regarding the governance and management of roads in general, suggesting that:
  - The road classifications/categorisations scheme (under the *Roads Act 1993*) should be overhauled
  - Local roads management should be shifted from Roads and Maritime to local government, with funding support provided
- Concern about the Australian Labour and Liberal National Party's decisions to implement a cash back scheme or waive registration fees for toll road users as it is a drain on public funds
- Concern about the impacts of the Sydney Metro projects by forcing commuters onto the road
- Submitter supports replacement of the Bankstown and Epping heavy rail lines with Metro

- Submitters queried what provisions would be made for more parking that is required in the Sydney central business district
- Concern about traffic impacts from high density developments in general and the nature of 'concrete jungles'
- Concern that trains used in Sydney are bought from South Korea rather than Australia
- Concern about the traffic modelling carried out for the Brisbane Airport Link
- DP&E should conduct a full investigation into the EIS process
- Concern that Roads and Maritime are able to influence the Department of Planning
- The NSW Government cannot be trusted to appropriately plan Sydney's Transport infrastructure
- A royal commission should be called to investigate Transport Planning, including the role of DP&E in approving WestConnex and considering the F6 and other projects.

Non-transport related issues

Non-transport related issues which were raised by submitters and are unrelated to the project included:

- Concern that the NSW Government's regulatory response to air quality, namely that current air quality standards are not meeting recommended safe levels, and that there is no requirement for routine, independent monitoring of air quality at key pollutant sources
- A different approach to assessment by NSW Health is required due to the evidence of past health impacts
- Concern with the approvals process for State Significant Infrastructure, stating that it is not transparent, that the normal 'rule book' for regulations for development is disregarded, and that the public does not have input into how the NSW transport system is developed
- Concern about the appointment of Nick Greiner as head of NSW Infrastructure
- Concern about certain councillors at Bayside Council who are not considered to be good managers
- The Biodiversity Conservation Act 2016 is a blueprint for environmental disaster
- Concern about the
- Concern about Roe 8's environmental report for a project in Western Sydney
- Concern about the conduct of the Victorian Government in relation to the Melbourne East-West Link project
- Concern about the recent whistle-blowers at the Department of Planning
- Submitter suggests decentralisation is necessary in Australia to address future population growth and sustain transport networks.

Response

The issues raised are outside the scope of the F6 Extension Stage 1 project and the environmental impact statement prepared for the project therefore Roads and Maritime are not in a position to comment on them.

NSW GOVERNMENT

Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Submissions report

Part D
Environmental management measures

D Part D Environmental management measures and conclusion

Contents

D1 Environmental management measures

The Environmental Impact Statement (EIS) for the F6 Extension Stage 1 project (the project) identified the environmental management measures that would be adopted to avoid or reduce environmental impacts. These measures were summarised in section 24.6 of the EIS.

After consideration of the issues raised in the stakeholder and community submissions on the EIS, the environmental management measures for the project have been updated (refer to **Table D-1**). The adjustments to the measures were made to:

- Make additional commitments based on the submissions on the EIS
- Make additional commitments based on design refinements and the findings of further assessment (refer to the preferred infrastructure report)
- Make additional commitments based on the additional consultation carried out during the preparation of this report
- Modify the wording so that the outcome of the commitment is clearer to implement.

The measures are set out under each environmental aspect.

Where new commitments have been added or new text has been added to an existing measure, it appears as bold text. Where a commitment has been deleted or text from the commitment deleted, it appears as strikethrough text.

Table D-1 Updated environmental management measures

Impact	EIS ID	New ID	Measure	Timing
Traffic and transport				
Construction traffic and access	TT1		A Construction Traffic and Access Management Plan (CTAMP) will be prepared as part of the Construction Environmental Management Plan. The CTAMP will detail processes to minimise delays and disruptions and identify and respond to changes in road safety as a result of project construction works. The CTAMP will be prepared in accordance with applicable guidelines and relevant standards, guides and manuals. The CTAMP will: • Ensure all relevant stakeholders are considered during all stages of the project • Provide safe routes for pedestrians and cyclists during construction • Develop project staging plans in consultation with relevant traffic and transport stakeholders, which would include measures to manage impacts during special events (such as sporting events) • Plan and stage works to minimise the need for road occupancy, where possible • Minimise the number of changes to the road users' travel paths and, where changes are required, implement a high standard of traffic controls which effectively warn, inform and guide • Comprehensively communicate changes in traffic conditions on roads or paths to emergency services, public transport operators, other road user groups and other affected stakeholders • Identify measures to manage the movements of construction-related traffic to minimise traffic and access disruptions in the public road network • Minimise the use of local roads by the project's heavy vehicles and identify haulage routes • Propose a car parking strategy for construction staff at the various worksites, **prepared** in consultation with ~~local councils and~~ stakeholders associated with any facilities adjacent to the project site • Minimise the loss of on-road parking for local residents • Stage the construction works on key parts of the network – such as Princes Highway, President Avenue and West Botany Street – to enable these key roads to continue to function with as minimal impact as possible.	Prior to construction
	TT2		Where required, changes ~~in~~ **to** bus stops will be undertaken in consultation with Transport **for** NSW and bus operators, with the community ~~to be informed~~ **notified** of any potential changes in advance. Wayfinding signage will be provided directing commuters to ~~adjacent or~~ relocated bus stops. Footpaths will be provided to any relocated bus stops such that accessibility standards are met.	Construction

Impact	EIS ID	New ID	Measure	Timing
	TT3		During construction, work with the TMC to observe traffic flows and incidents from CCTV footage and where reasonable and feasible, modify sites and activities to address issues identified by TMC.	Construction
	TT4		Spoil haulage vehicles will be managed to minimise movements in the AM and PM peak periods.	Construction
	TT5		Minimise local road closures and maintain adequate property access to the road network. Property owners would be consulted and agree to any changes to access.	Construction
	TT6		The movements of haulage vehicles accessing ancillary construction sites will be coordinated to minimise potential queuing and traffic and access disruptions in the local area.	Construction
Damage or impacts to road infrastructure resulting from construction works	TT7		Prior to impacting roads, a road dilapidation report will be prepared, ~~in consultation with relevant council(s) and road owners,~~ identifying existing conditions of local roads and mechanisms to repair damage to the road network caused by heavy vehicle movements associated with the project.	Prior to construction Construction
Operational road network performance impacts ~~including potential increased traffic on some parts of the network, particularly President Avenue, West Botany Street and Bestic Street as a result of the project.~~	TT8		~~A review of~~**An o**Operational **Road N**~~n~~etwork **P**~~p~~erformance **Review** will be undertaken **within** 12 months and five years from commencement of operation to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. The review ~~would~~**will** identify relevant mitigation measures, if required**,** to address impacts on road network performance. The results of the review will be considered in future operational network performance planning carried out by Roads and Maritime. **The Review will be undertaken in consultation with Transport for NSW and relevant councils.**	Operation
Managing traffic on local roads	**N/A**	**TT9**	**Roads and Maritime will, in conjunction with the local council, implement Local Area Traffic Management (LATM) measures, such as heavy vehicle load limits, raised pedestrian crossings and speed humps, to reduce traffic demand on O'Connell Street/Chuter Avenue and Civic Avenue/Marshall Street.**	**Operation**

Impact	EIS ID	New ID	Measure	Timing
Air quality				
Impacts from ambient air quality from dust generation and deposition during construction	AQ1		A Construction Air Quality Management Plan will be developed and implemented to monitor and manage potential air quality impacts associated with the construction of the project and activities at construction ancillary facilities. The management plan will identify project construction activities with the potential to have air quality impacts and the controls required to avoid, minimise and mitigate these impacts. The plan will include measures to: • Minimise project ~~and cumulative~~ dust generation from stockpiles, haulage routes, work activities, exposed ground surfaces and ~~acoustic~~ **spoil** sheds • **Manage the transport, storage and handling of sand, aggregate and fine materials** • Minimise generator and vehicle emissions during construction of the tunnel • Inspect and address corrective actions • Modify or cease dust generating works during unfavourable weather conditions. The Plan will be implemented for the duration of construction **and will include appropriate dust monitoring procedures.**	Prior to construction
	AQ2		Demolition activities, including removal of hazardous building materials will be planned and carried out in a manner that minimises the potential for dust generation. Removal of hazardous building materials will be completed prior to the commencement of general demolition works.	Construction
Odour impacts	AQ3		Odorous material would be treated immediately on-site, and removed from site where necessary. Areas of odorous materials would be excavated in a staged process to allow for treatment and handling. Exposed areas of odorous material would be kept to a minimum to reduce the total emissions from the site. On-site odour measurements would be carried out during excavation works to determine odour emission rates. Results from the monitoring would be used to inform future excavation and treatment activities on site.	Construction
Impacts on air quality within project tunnels and from the ventilation outlets during operation	AQ4		Tunnel infrastructure will be designed in such a way that the generation of pollutant emissions by the traffic using the tunnel is minimised. In-tunnel air quality will be managed through monitoring and management of the ventilation systems and, where necessary, traffic management.	Detailed design
	AQ5		An in-tunnel air quality monitoring system will be included in the detailed design to monitor and assess ambient and in-tunnel air quality against relevant criteria. This will require sufficient, appropriately placed monitors to calculate a journey average.	Construction and operation
~~Ambient air quality monitoring~~	~~N/A~~	~~AQ6~~	~~The number and locations of ambient air quality monitoring stations during the operation of the project will be developed in consultation with stakeholders, including council representatives, as part of the ongoing consultation process to be developed in~~	~~Construction and operation~~

Impact	EIS ID	New ID	Measure	Timing
			~~the Community Communication Strategy.~~	
Health, safety and hazards				
Hazardous substances and dangerous goods spill	HS1		A Pollution Incident Response Management Plan (PIRMP) will be prepared for the project. The PIRMP will be prepared in accordance with legislative requirements and include measures to manage hazardous substances and dangerous goods including storage, handling and spill response.	Construction
Improper handling and transport of hazardous substances and dangerous goods	HS2		A Work Health and Safety Plan will be implemented during construction of the project, supplemented by site and activity specific Safe Work Method Statements.	Construction
	HS3		Transport of dangerous goods and hazardous substances will be conducted in accordance with relevant legislation and codes.	Construction Operation
	HS4		An Incident Response Protocol will be developed as part of the Emergency Response Plan for the project and implemented in the event of an accident or incident. The protocol is to detail operational management measures associated with the storage, handling and transport of hazardous substances and dangerous goods, including spill response.	Prior to operation
	HS5		The transport of dangerous goods and hazardous substances will be prohibited through the mainline tunnels and entry and exit ramps during operation.	Operation
Impact of lighting on airport operations	HS6		The project will be constructed and operated in accordance with the design requirements of CASA and the Sydney Airport Master Plan 2033, with respect to lighting.	Construction
	HS7		Should the exhaust plumes or structures at any of the F6 Extension Stage 1 ventilation outlets be assessed as a 'controlled activity' under the Airports Act and the Airspace Regulations, then the project will be operated in accordance with conditions of approval from the Secretary of DIRDC.	Operation
Impact of electric and magnetic fields	HS8		The project substations will be designed to ensure that the exposure limits for the general public detailed in by the Draft Radiation Standard (Australian Radiation Protection and Nuclear Safety Agency 2006) will not be exceeded at the boundary of the substation sites.	Detailed design

Impact	EIS ID	New ID	Measure	Timing
Noise and vibration				
Construction noise	NV1		A Construction Noise and Vibration Management Plan (CNVMP) will be prepared. The CNVMP will include processes and responsibilities to assess, monitor, minimise and mitigate noise and vibration impacts during construction. The plan will: • Identify relevant performance criteria in relation to noise and vibration • Identify noise and vibration sensitive receptors and features in the vicinity of the project • Include standard and additional mitigation measures from the Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime 2016) and details about when each will be applied • Describe the process(es) that will be adopted for carrying out location and activity specific noise and vibration impact assessments to assist with the selection of appropriate mitigation measures • Consider cumulative construction noise impacts and construction noise fatigue • Include protocols that will be adopted to manage works required outside standard construction hours, in accordance with relevant guidelines including for management of respite periods • **Include a Blast Management Strategy (where blasting is required)** • Detail monitoring that will be carried out to confirm project performance in relation to noise and vibration performance criteria. The CNVMP will be implemented for the duration of the construction of the project.	Prior to construction
	NV2		Detailed noise assessments will be carried out for all ancillary facilities required for construction of the project. The requirement for temporary noise walls within ancillary facilities and adjacent to construction works, and the requirement for other appropriate noise management measures, is to be assessed and implemented prior to the commencement of activities which have the potential to cause noise or vibration impacts.	Prior to construction

Impact	EIS ID	New ID	Measure	Timing
	NV3		All residents affected by noise from the construction of the project which are expected to experience an exceedance of the construction ~~NMLs~~**noise management levels** will be ~~consulted~~ **notified** about **potential noise impacts** ~~the project~~ prior to the commencement of construction works. Roads and Maritime ~~would~~ **will** consult with vulnerable members of the community who are likely to be more susceptible to adverse health effects of noise (especially those who are elderly, who do not speak English, are housebound, or who may be unwell) to accommodate their preferences for noise mitigation, as far as practicable. Consultation ~~would~~**will** also be undertaken with all schools likely to be affected, and in particular Cairnsfoot Special School, to determine suitable mitigation measures where necessary. The information provided to the residents will include: • General sequencing and locations of construction work • The hours of the project works • Construction noise and vibration impact predictions for the works • Construction noise and vibration mitigation measures likely to be implemented on site. Community consultation regarding construction noise and vibration will be detailed in the Community ~~Involvement~~ **Communication Strategy** ~~Plan~~ for the construction of the project and will include a complaints handling process. The community will be able to provide feedback via a 24 hour, toll-free project information and complaints line, a dedicated email address and postal address for the project. For out of hours works, consultation with affected residents will take place with consideration to Practice note vii of the ENMM and Strategy 2 of the ICNG.	Prior to construction
	NV4		Noisy work (as defined in the EPL) and vibration intensive activities (those activities that exceed the vibration criteria) will be scheduled to be undertaken during standard construction hours as far as possible. Works or activities that cannot be undertaken during standard construction hours will be scheduled as early as possible during the evening and/or night-time periods. Respite measures are to be implemented for noisy work and vibration intensive activities in a manner consistent with EPL and Roads and Maritime guideline requirements.	Construction
	NV5		**Receptors identified as requiring at-property noise mitigation because of an exceedance of operational traffic noise goals** ~~noise management levels when the project is operating,~~ **will be offered treatment prior to construction commencing. The receptors which are predicted to trigger consideration of noise mitigation will be confirmed during** ~~the detailed~~ **future design phases of the project and any additional eligible receptors will be contacted and noise mitigation options discussed with them.** ~~Receptors identified as requiring at-property operational noise mitigation will be identified and offered treatment prior to commencement of construction works that affects them.~~	~~Prior to c~~ **C**onstruction
	NV6		Construction vehicle movements (on and off site) will be managed to avoid or minimise noise impacts. Where reasonable and feasible, spoil will only be removed from site during the day. Mitigation measures for vehicle movements	Construction

Impact	EIS ID	New ID	Measure	Timing
			outside of standard construction hours are to be included in the CNVMP.	
	NV7		Vibration generating activities will be managed to minimise the potential for impacts on structures and sensitive receptor(s), including maximising safe working distances where practicable, or use of alternate methods to minimise vibration where safe working distances cannot be achieved. Where alternatives cannot be implemented, vibration monitoring is to be undertaken and receptors notified in advance of works. Vibration monitors are to provide real-time notification of exceedances of levels approaching cosmetic damage criteria.	Construction
Operational noise	NV8		Operational noise and vibration mitigation measures are to be identified in an Operational Noise and Vibration Review (ONVR). Requirements for at-property noise treatments in properties identified as 'eligible' in the EIS will be reviewed as part of the ONVR and progress of the detailed design. The implementation of treatments will be undertaken in accordance with Roads and Maritime Guidelines.	Detailed design
	NV9		Within 12 months of the commencement of the operation of the project, actual operational noise performance will be compared to predicted operational noise performance. The need for additional mitigation or management measures to address identified operational performance issues and meet relevant operational noise criteria would be assessed and implemented where reasonable and feasible.	Operation
Biodiversity				
Removal of native vegetation and habitat, including threatened plants	B1		Detailed design will avoid or minimise the need for native vegetation and habitat removal for the construction of the project, where feasible. A plan for the rehabilitation of all areas directly affected by construction, including water bodies, would be included as part of the CFFMP (refer B4 below).	Detailed design
Indirect impacts on native vegetation and habitat	B2		Detailed design of the project will avoid or minimise artificial light impacts on biodiversity within and immediately adjacent to the operational project (**e**g downward-facing lighting along the shared cycle and pedestrian pathways)	Detailed design
~~Impacts to wetlands and riparian land~~	~~B3~~		~~Detailed design of the project will avoid or minimise disturbance to wetlands and riparian land during both construction and operation, as far as practical. This will include location of stockpiles outside of riparian corridors where reasonable and feasible.~~	~~Detailed design~~
Impacts to wetlands and riparian land	**N/A**	**B3**	**A Wetlands Management Plan will be prepared and implemented, in consultation with relevant stakeholders, to manage waterbodies and riparian land within the project footprint that may be impacted by the project during construction. The objectives of the plan will be to:** • **Maintain and improve the condition of the affected wetlands** • **Reinstate and rehabilitate any riparian land impacted by the project** • **Provide positive ecological and amenity outcomes for the environment and local community.** **The plan will include:**	**Prior to construction**

Impact	EIS ID	New ID	Measure	Timing
			• **Consideration of potential water quality, hydrology, amenity and flora and fauna impacts and mitigation** • **A process for dewatering and restoration of the Rockdale Wetland, including measures developed by an ecologist to handle and relocate aquatic fauna** • **A monitoring program to assess the effectiveness of the mitigation measures and to identify new measures that may be required.** **The plan will be prepared by a suitably qualified ecologist with experience in wetlands management.**	
Impacts to flora and fauna	B4		A Construction Flora and Fauna Management Plan (CFFMP) will be prepared. The CFFMP would outline processes and responsibilities with regard to avoiding, managing and/or mitigating biodiversity impacts during construction. The plan will include: • A process for pre-clearance surveys prior to vegetation clearing • A process for vegetation clearing including the establishment of exclusion zones at the limit of clearing to protect sensitive areas. Exclusion zones will be established in accordance with Guide 2 Exclusion Zones of Roads and Maritime's Biodiversity Guidelines[1] • An unexpected finds procedure for both flora and fauna • A procedure for managing inadvertent impacts to both flora and fauna • A process for identifying and managing priority and environmental weeds and other pests prior to, during, and after construction (including within vegetation exclusion zones) • A protocol to minimise the potential for the spread of pathogens such as Chytrid or Phytophthora fungus into and out of the site during construction ~~A process for dewatering and restoration of the Rockdale Wetland, including measures developed by an aquatic ecologist to handle and relocate aquatic fauna~~ The processes and procedures will be prepared in accordance with relevant Roads and Maritime guidelines.	Prior to construction
Impacts to Green and Golden Bell Frogs	B6	**B5**	All construction site inductions will contain a relevant section on identifying and managing potential risks to the Green and Golden Bell Frog. This will include identification of the frog and its habitat, a clear outline of the location of no-go zones for construction personnel, equipment and materials (including herbicides and pesticides), hygiene protocols and what to do in the event of an unexpected find. Frog exclusion fencing and sediment controls will be installed. Any Green and Golden Bell Frogs encountered within the construction boundary during construction are to be collected by a qualified and experienced herpetologist and relocated within the adjacent golf course by the herpetologist.	Construction, and post-construction

[1] Roads and Traffic Authority (2011) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*

Impact	EIS ID	New ID	Measure	Timing
			Impacts to Green and Golden Bell Frog due to light spill will be mitigated with lighting directed to minimise construction night time light spill outside of all construction areas, particularly onto the RTA ponds and Kogarah Golf Course. The ground surface within the Arncliffe construction ancillary facility (excluding the operational footprint) will be reinstated to a condition the same or better than prior to the commencement of construction of the New M5 Motorway project in consultation with relevant stakeholders.	
Detailed review of the power supply route	**N/A**	**B6**	**A detailed review of the permanent power supply route will be undertaken, in accordance with the Biodiversity Assessment Method (BAM), once the route is confirmed. This will include consideration of any Coastal Management SEPP wetlands areas and an update of the BAM Calculation for the project, which will be provided to the NSW Office of Environment and Heritage.**	**Detailed design**
Landscape and visual				
Impacts to views from the construction of surface infrastructure for the project including construction ancillary facilities, particularly within the vicinity of President Avenue interchange	LVIA1		An Urban Design and Landscape Plan **(UDLP)** will be prepared **and implemented**. The ~~plan~~ **UDLP** will detail built and landscape features ~~and architectural treatments~~ to be implemented prior to operation of the project. **The UDLP will be developed in consultation with local councils, other key stakeholders and the community and made available to the public.** ~~The plan is to be developed in consultation with local council.~~	Prior to construction
	LVIA2		Where reasonable and feasible, existing trees will be retained and protected within construction areas.	Construction
	LVIA3		Construction and operational lighting will be oriented to minimise glare and light spill impacts on adjacent receptors.	Construction Operation
	LVIA4		The design and maintenance of construction compound hoardings will aim to minimise visual impacts and landscape character impact, including the prompt removal of graffiti.	Construction
	LVIA5		Where trees are removed to facilitate construction of the project, replacement trees would be selected and planted in accordance with the tree management strategy developed for the project. The strategy would provide for the following: • Consideration of all options to minimise the need for tree removal and to retain as many trees as possible • Preparation of comprehensive tree reports (by a qualified arborist) for trees requiring protection, pruning, or removal, to guide the approach to managing trees • Measures to minimise damage to, and ensure the health and stability of, trees to be retained, in accordance with AS4970-2009 Protection of trees on development sites	Construction

<table>
<tr><th>Impact</th><th>EIS ID</th><th>New ID</th><th>Measure</th><th>Timing</th></tr>
<tr><td></td><td></td><td></td><td>• Replacement of trees where removal cannot be avoided, in accordance with the following general principles:
- net increase in the number of replacement trees
- provision of replacement trees to achieve similar outcomes as those removed where possible, such as screening, amenity, etc.
- replacement trees are to have a minimum pot size of 75 litres, except where the plantings are consistent with the pot sizes specified in a relevant authority's plans for vegetation management, or as agreed by the relevant authority(s) (such as Bayside Council)
- trees to be planted within 500 metres of the project area wherever practicable, or in another location determined in consultation with the relevant council
• Consideration of plant species that would benefit Grey-headed Flying-fox foraging
• Targets to be achieved such as established vegetation cover and water quality parameters.</td><td></td></tr>
<tr><td colspan="5">Property and land use</td></tr>
<tr><td>Property acquisition</td><td>PL1</td><td></td><td>Prior to the commencement of works, a toll-free Acquisition Assistance Line will be established and maintained for a period of up to six months following completion of the final acquisition for the project. The Acquisition Assistance Line is to provide ongoing dispute resolution, a counselling program and contact information for relevant services for relocated persons.</td><td>Prior to construction</td></tr>
<tr><td>Creation of residual land</td><td>PL2</td><td></td><td>Residual land remaining following construction of the project would be confirmed to identify appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses.</td><td>Construction</td></tr>
<tr><td>Ground settlement</td><td>PL3</td><td></td><td>Ground settlement at buildings, roads, parking areas and parks as a result of the project will be managed to comply with the following criteria unless more stringent criteria are subsequently determined by the project:
<table>
<tr><th>Surface and sub surface structures</th><th>Maximum settlement</th><th>Maximum angular distortion</th><th>Limiting tensile strain* (percent)</th></tr>
<tr><td>Buildings – Low or non-sensitive properties
(i.e. ≤up to 2 levels and carparks)</td><td>30 mm</td><td>1 in 350</td><td>0.1</td></tr>
<tr><td>Buildings – High or sensitive properties (i.e. ≥ 3 levels and heritage items)</td><td>20 mm</td><td>1 in 500</td><td>0.1</td></tr>
<tr><td>Roads and parking areas</td><td>40 mm</td><td>1 in 250</td><td>N/A</td></tr>
<tr><td>Parks</td><td>50 mm</td><td>1 in 250</td><td>N/A</td></tr>
</table>
* As defined in Burland et al. 'Building response to tunnelling – Case Studies from construction of the Jubilee Link Extension',</td><td>Detailed design
Construction</td></tr>
</table>

Impact	EIS ID	New ID	Measure	Timing
			London, Thomas Telford (2001).	
	PL4		Prior to the commencement of construction, pre-construction Building Condition Surveys will be offered in writing, to the owners of properties where there is a potential for construction activities to cause cosmetic or structural damage. If accepted, a comprehensive written and photographic condition report would be produced by an appropriate professional prior to relevant works commencing.	Prior to construction
Utility impacts	PL5		Interface agreements will be entered into with relevant owners of infrastructure and utility services likely to be impacted by construction of the project. The agreements will likely identify: • Minimum separation distances and appropriate settlement criteria for utility infrastructure • Settlement monitoring requirements during construction • Contingency actions in the event that settlement limits are exceeded.	Prior to construction
Impacts to the Bardwell Valley Golf Club	PL6		Work with the Bardwell Valley Golf Club to determine staging of construction works and construction method to minimise impact on the activities and operation of the Golf Club.	Construction
Temporary access to public land	**N/A**	**PL7**	**Roads and Maritime will enter into access agreements with relevant councils and other agency stakeholders for temporary access to public land to enable the construction of the project.**	**Prior to construction**
Social and economic				
Amenity	SE1		A Site Establishment Management Plan will be prepared prior to construction and will have regard to the amenity of adjacent areas and minimising impacts to adjacent sensitive receivers, including potential noise, dust, traffic, visual, lighting and overshadowing and overlooking impacts **during the establishment phase**.	Prior to construction
Social infrastructure	SE2		Provision of ~~temporary~~ alternative sporting and recreational facilities in nearby locations, including a skate park, children's disability playground and sporting fields, will be investigated during detailed design to account for the temporary loss of these facilities during construction of the project at the President Avenue construction ancillary facility (C3).	Detailed design Prior to construction
Impacts to businesses	SE3		A Business Management Plan will be prepared prior to construction to detail the process for identification and communication with businesses adversely affected by construction works.	Prior to construction
Construction fatigue	SE4		Prepare and implement a Construction Fatigue Protocol as part of the CNVMP to address potential construction fatigue impacts. The Protocol will include consideration of noise attenuation and periods of respite for affected stakeholders, where reasonable and feasible, and restricting out of hours work where practicable.	Prior to construction
Community consultation	SE5		A Community Communication Strategy ~~would~~ **will** be prepared prior to construction to detail the processes to facilitate communication between the project team and the community.	Prior to construction

Impact	EIS ID	New ID	Measure	Timing
Social infrastructure	SE6		A Community and Social Management Plan will be prepared. The plan will detail the process for identification and implementation of measures to offset community and social impacts associated with the project. The plan ~~is to~~ **will** be prepared by a suitably qualified and experienced person(s) in consultation with ~~the community and~~ relevant councils.	Operation
Power supply route	**N/A**	**SE7**	**Alternative route options for the permanent power supply suggested by Canterbury-Bankstown Council will be assessed during design development. Council will be consulted on the outcomes of the route options assessment.**	**Detailed design**
Soils and contamination				
Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material	SC1		A Construction Soil and Water Management Plan (CSWMP) will be prepared for the project. The plan will detail the process and measures to manage and monitor soil and water impacts associated with the construction works, including contaminated land. The CSWMP will: • Describe measures to minimise and /or manage sediment and erosion within the project footprint, including overland flow, including requirements for Erosion and Sediment Control Plans (ESCP). • Describe stockpile management measures, including location restrictions, separation of waste types, stabilisation and sediment controls • Describe measures for managing waste, including spoil classification and handling • Describe procedures for managing unexpected contamination finds • Describe procedures for managing groundwater impacts including treatment requirements • Describe procedures for dewatering accumulated water on site and within sediment basins, including discharge criteria and sign off • Describe spill management procedures including requirements for locating and maintaining spill response materials such as spill kits • Detail surface water and groundwater monitoring requirements, including discharge criteria. Measures are to be consistent with the Blue Book (Landcom 2004) and relevant Roads and Maritime guidelines.	Prior to construction
	SC2		A Hazardous Building Materials Management Plan will be prepared detailing measures to manage the removal of known and unexpected hazardous building materials, including asbestos within buildings and soil. The plan is to be prepared in accordance with relevant guidelines.	Construction

Impact	EIS ID	New ID	Measure	Timing
	SC3		Detailed site (contamination) investigations will be undertaken in accordance with the NSW EPA (1995) *Sampling Design Guidelines* within the following ancillary facilities and construction sites prior to commencement of construction at these sites: • Rockdale construction ancillary facility (C2) • President Avenue construction ancillary facility (C3), specifically Bicentennial Park and 427 to 441 West Botany Street • Parts of the **s**~~S~~hared cycle and pedestrian pathways where earth works are required within **Scarborough Park North**, Civic Avenue, Bicentennial Park, Rockdale Women's Sports Field, Greg Atkins Mini Field, CA Redmond Field and White Oak Reserve • Princes Highway construction ancillary facility (C6), the 7-Eleven service station at 734 Princes Highway, Kogarah • The substation within St George TAFE. Where required, based on the results of the additional investigations, a Remedial Action Plan (RAP) will be prepared prior to construction.	Prior to construction Construction
Impacts on soil and water quality through incorrect handling of contaminated material	SC4		Construction water treatment plants will be established and operated at the Arncliffe Construction Ancillary Facility (C1), Rockdale Construction Ancillary Facility (C2) and President Avenue Construction Ancillary Facility (C3) to treat water from the tunnel works. Discharge from these plants will be managed to achieve the applicable ANZECC criteria. Where feasible, water from the water treatment plants will be reused for construction activities.	Construction
Acid sulfate soils	SC5		An Acid Sulfate Management Plan will be prepared detailing processes to manage actual and potential acid sulfate soils disturbed during construction.	Construction
Landfill gas and leachate	SC6		Further detailed investigation and assessment will be undertaken in Bicentennial Park in order to develop **a** ~~management plans for~~ **L**~~l~~eachate and **L**~~l~~andfill **G**~~g~~as **M**~~m~~anagement **Plan**. The ~~purpose of the management~~ plan~~s~~ will be **implemented** to minimise nuisance odours to the surrounding area during excavation and to **contain and treat landfill gas emissions from excavations.** ~~prevent the accumulation of landfill gases in buildings, basins and subsurface service trenches and pits associated with the project~~ The ~~management~~ plan~~s may~~ **will** include measures such as excavation staging, leachate and gas management, and gas and odour monitoring.	Construction
Erosion and sedimentation	SC7		A soil conservation specialist will be engaged for the duration of construction to provide advice regarding erosion and sediment control.	Construction
Salinity	SC8		Prior to ground disturbance in areas of very high potential soil salinity, testing will be carried out to confirm the presence of saline soils. If saline soils are encountered, they will be managed in accordance with Site Investigations for Urban Salinity (DLWC 2002).	Construction

Impact	EIS ID	New ID	Measure	Timing
Groundwater and geology				
Operational tunnel inflows higher than expected which may exceed the inflow criteria of 1 L/sec/km for any kilometre length of tunnel.	GW1		Where fractured Hawkesbury Sandstone is intersected, a combination of techniques will be investigated to reduce the bulk hydraulic conductivity	Construction
	GW2		Appropriate waterproofing measures will be identified and included in the detailed design to reduce the inflow into the tunnels. A target of one litre per second per kilometre for any kilometre length of the tunnel during operation will be adopted.	Detailed design
Groundwater drawdown impacting a water supply well water level by more than two metres	GW3		Impacts on water supply bores will be 'made good' as soon as practicable. Where water supply bores cannot be made good, alternate measures are to be implemented to replace supply.	Construction and Operation
Alteration of groundwater flows and levels due to the installation of subsurface project components	GW4		Measures to reduce potential impacts to groundwater flows due to subsurface components of the project will be identified and included in the detailed construction methodology and the detailed design as relevant.	Detailed design
Actual groundwater inflows and drawdown in adjacent areas exceed predictions	GW5		A detailed groundwater model will be developed by the construction contractor. The model will be used to predict groundwater inflow rates and volumes within the tunnels and groundwater levels (including drawdown) in adjacent areas during construction and operation of the project.	Detailed design
	GW6		Groundwater inflow and groundwater levels in the vicinity of the tunnels will be monitored during construction and compared to model predictions and groundwater performance criteria applied to the project. The detailed groundwater model will be updated based on the results of the monitoring as required and proposed management measures to minimise potential groundwater impacts adjusted accordingly to ensure that groundwater inflow performance targets are met.	Construction
Impacts to groundwater quality, groundwater levels or groundwater flows	GW7		Prior to construction, a groundwater monitoring program will be prepared and implemented to monitor groundwater levels, construction and operational groundwater inflows in the tunnels, and groundwater quality in the three main aquifers impacted by construction works. The program will identify groundwater monitoring locations, performance criteria in relation to groundwater inflow and levels, and	Prior to construction

Impact	EIS ID	New ID	Measure	Timing
			potential remedial actions that will be considered to address potential impacts. As a minimum, the program will include monthly manual groundwater level and quality monitoring and weekly monitoring of inflow volumes and quality.	
Adverse impacts on the local hydrogeological regime due to groundwater discharge	GW8		An operational water treatment plant will be constructed at the Arncliffe Motorway Operations Complex (MOC1) to manage and treat groundwater from the tunnel prior to discharge. Discharge will be undertaken in accordance with the approval conditions and agreed discharge criteria.	Operation
Treated groundwater may be discharged to stormwater without consideration to a suitable sustainable use.	GW9		Sustainable water re-use options will be reviewed for treated groundwater during operations.	Construction
Risks of bore water contamination impacting local bore users	**N/A**	**GW10**	**Potential risks of the project contaminating bore water during construction will be identified. Affected bore users will be notified that the bore water is not suitable for use and the corrective actions being taken by the project. Bore users will be notified again once the bore water is safe for use.**	**Construction**
Geology (ground movement)				
Ground movements may cause impacts to structures on the surface.	GM01		A geotechnical model of representative geological and groundwater conditions will be prepared by the construction contractor during the detailed design phase prior to the commencement of tunnelling. The model will be used to assess predicted settlement impacts and ground movement during the construction and operation of the project	Detailed design
	GM02		Further assessment of potential settlement impacts, including numerical geotechnical modelling will be undertaken prior to excavation and tunnelling to assess the cumulative predicted settlement, ground movement, stress redistribution and horizontal strain profiles caused by excavation and tunnelling, including groundwater drawdown and associated impacts, on adjacent surface and sub-surface structures. Criteria for surface and sub-surface structures at risk will be determined in consultation with the owner(s) of the structures. Where modelling predicts exceedances of these criteria, an instrumentation and monitoring program will be implemented to measure settlement, distortion or strain as required. Appropriate mitigation measures will be identified and implemented in consultation with the owner(s) prior to excavation and tunnelling works to where possible not exceed the settlement criteria.	Detailed design

Impact	EIS ID	New ID	Measure	Timing
Surface water and flooding				
Impacts on surface water quality	SWF1	SWF1	A program to monitor potential surface water quality impacts of the project will be developed and included in a Construction Soil and Water Management Plan (CSWMP). The program will include the water quality monitoring parameters (including pH, turbidity, dissolved oxygen, nitrogen and metals) and the monitoring locations (including Muddy Creek, Rockdale Bicentennial Park, North Scarborough Ponds and Cooks River) identified in Annexure G of Appendix L (Surface water technical report) Continuous surface water level and groundwater level monitoring will be undertaken within Bicentennial Park Pond and surrounding area for at least 12 months prior to the commencement of construction. Monthly groundwater quality would also be undertaken in the surrounding area. The data would be used as a baseline to monitor impacts on surface and groundwater levels and groundwater quality within the Pond during construction. In the instance that during detailed design it cannot be demonstrated that treated construction wastewater would meet the discharge criteria for Scarborough Ponds, in particular nutrient concentrations, treated construction wastewater from C2 and C3 will be discharged to the Muddy Creek stormwater catchment.	Prior to construction Construction
	N/A	**SWF2**	**If treated construction wastewater (including extracted groundwater) originating from the President Avenue construction ancillary facility (C3) is found to be of a higher temperature than the adjacent surface water receiving bodies that would be discharged to, the potential risk of disrupting thermal stratification in Northern Scarborough Pond will be mitigated by storing and buffering this water in the treatment basin at the C3 facility (until it reaches ambient water temperature) prior to release into Bicentennial Park Pond (at the surface).**	Construction
	SWF7	**SWF3**	Treatment measures will be implemented within the waterbodies of Scarborough Park North and Rockdale Bicentennial Park disturbed by the project during construction, to reduce algal bloom conditions and contribute to achieving the NSW **Water Quality Objectives** over time. Treatments **will**~~would~~ be considered in consultation with Bayside Council and **will**~~shall~~ include **the establishment**~~gross pollutant traps in drainage lines; inclusion~~ of macrophyte zones, ~~and~~ bank reshaping of the wetland zones; and the use of solar powered devices to aerate the water column.	**Detailed design**
	SWF8	**SWF4**	The surface water monitoring program will continue for a minimum of three years following the completion of construction, or until the affected waterways are certified by a suitably qualified and experienced independent expert as being appropriately rehabilitated (or otherwise required by any project conditions of approval).	**Operation**
	SWF9	**SWF5**	The project will be designed to manage the potential impacts of future climate change on flooding behaviour in accordance with the procedures set out in *Practical Considerations of Climate Change – Floodplain Risk Management Guideline* (DECC, 2007) and in *Australian Rainfall and Runoff* (GA 2016).	**Detailed design**

Impact	EIS ID	New ID	Measure	Timing
Impacts on water bodies	SWF2	**SWF6**	All works within watercourses or on waterfront land will be managed in accordance with the *Controlled Activities on Waterfront Land* guidelines (DPI 2012). The following specific measures are required to manage impacts within Bicentennial Park Pond: • Installation of a temporary barrier to isolate the excavation works from the rest of the pond and prevent mobilisation of sediment and pollutants into adjacent areas. Water within the construction zone will be treated by the construction water treatment plant. Sediment mobilised during installation of the barrier will also be managed • Retention of hydrologic connectivity through Bicentennial Park Pond throughout construction.	Construction
	SWF3	**SWF7**	A Water Reuse Strategy for the construction and operational phases of the project will be developed prior to construction. This will outline the construction and operational water requirements and potential water sources to supply the water demand.	Prior to construction
	N/A	**SWF8**	**If the design identifies the risk of scour due to excessive velocities during construction and operation, the appropriate scour and erosion protection measures will be implemented at drainage outlets for both temporary and permanent works.**	**Prior to construction**
	N/A	**SWF9**	**The shared cycle and pedestrian bridge over the channel within Scarborough Park will be designed in accordance with the *Controlled activities on waterfront land – guidelines for watercourse crossings on waterfront land* and where feasible and reasonable, the bridge structure will fully span the waterway channel.**	**Detailed design**
Impacts on flood behaviour	SWF4	**SWF10**	A Flood Management Strategy (FMS) will be prepared prior to construction to demonstrate how flooding risks and behaviours will be mitigated during both the construction and operational phases. The FMS will include floor level survey for identified affected properties. The FMS would be prepared prior to commencement of construction by a suitably qualified and experienced person in consultation with directly affected landowners, Sydney Water, OEH, SES and relevant councils.	Prior to construction
~~Impacts on flood behaviour~~	SWF5	**SWF11**	Entries to tunnel excavations, including cut and cover sections of tunnel will be protected against flooding, to an appropriate flood standard. The same hydrologic standard will be applied to tunnel ancillary facilities such as tunnel ventilation buildings, operational water treatment plants, emergency facilities and electrical substations. A minimum level of flood immunity of one exceedance per year would be provided to shared user paths within the project footprint.	Detailed design Construction
	SWF6	**SWF12**	As a minimum, site facilities are to be located outside high flood hazard areas based on a one per cent AEP flood. For site facilities located within the floodplain, the FMS is to identify how risks to personal safety and damage to construction facilities and equipment will be managed.	Construction

Impact	EIS ID	New ID	Measure	Timing
Non-Aboriginal heritage				
General	NAH1		A ~~Construction~~ Heritage Management Plan will be prepared for the project. The plan will detail measures to minimise impacts on identified heritage features within the project boundary and will also detail procedures to manage unexpected heritage finds.	Prior to construction
	NAH2		Impacts to non-Aboriginal heritage items will ~~to the greatest extent practicable,~~ be avoided and minimised. Where impacts are unavoidable, works will be undertaken in accordance with the relevant management strategy as defined for the non-Aboriginal heritage item.	Prior to construction Construction
Kings Wetland	NAH3		Consultation will be undertaken with Bayside Council regarding the impacts that would occur to the Kings Wetland (heritage item listed on the Rockdale LEP 2011). Roads and Maritime will provide a copy of the proposed landscape rehabilitation plan to Council to facilitate comment on the proposed impacts and mitigation measures.	Prior to construction
Patmore Swamp	NAH4		Notification and consultation will be undertaken with Bayside Council outlining the impacts that would occur to the Patmore Swamp (heritage items listed on the Rockdale LEP 2011).	Prior to construction
Kings Wetland	NAH5		A protection area will be established either side of the proposed haul road to reduce impacts within the boundaries of the heritage listing. The delineation of the protection area will be maintained throughout the construction period. As part of the detailed design phase, the haul road through the boundaries of the heritage listing will be further optimised with a view to reducing the requirement for the removal of vegetation, as far as is practical. At the conclusion of construction, parts of the area within the boundaries of the heritage listing will be rehabilitated.	Detailed design Construction
Patmore Swamp	NAH6		A protection area will be established as a no-go area during construction along either side of the proposed shared cycle and pedestrian pathways and along the new boundary of President Avenue and Patmore Swamp, to preserve as much of the existing vegetation as is practical within the boundaries of the heritage listing. The delineation of the protection area will be maintained throughout the construction period. A heritage interpretation strategy will be prepared to outline opportunities for heritage interpretation being integrated into the design of the shared cycle and pedestrian pathway through Patmore Swamp.	Construction
Bardwell Park Railway Station group	NAH7		The installation of the permanent power supply across the Bardwell Park Railway Station group overbridge would be undertaken to avoid permanent changes to the fabric and visual appearance of the bridge. Should this be unavoidable, further assessment will be undertaken during detailed design.	Prior to construction
Shop and residence, **Princes Highway**	NAH8		~~Use of machinery should be limited within a seven metre distance to avoid cosmetic damage to existing structures.~~ ~~A visual inspection and assessment should be undertaken by a heritage specialist before works commence to ensure no additional mitigation measures are required.~~ **Vibration monitoring of the heritage item will be undertaken during vibration intensive construction works to ensure vibration limits are not exceeded. The monitoring system will include real time notification to the Site Foreman of any exceedances of the applicable limits so that appropriate corrective action can be taken.**	Pre-Construction and Construction

Impact	EIS ID	New ID	Measure	Timing
Aboriginal cultural heritage				
Unexpected discovery of Aboriginal objects	AH1		If an Aboriginal object(s) is discovered during construction it would be managed in accordance with the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services 2015).	Construction
Unexpected discovery of human remains	AH2		If human remains are discovered during construction, they would be managed in accordance with the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services, 2015).	Construction
Recognising the prior presence of Aboriginal people	AH3		The **UDLP will include an Aboriginal interpretative signage strategy developed in consultation with the Metropolitan** ~~project would recognise the prior presence of Aboriginal people by highlighting resource zones they may have used. This could be undertaken through the implementation of interpretive signage and incorporated in to the Place making and Urban Design Strategy. Should this be pursued, it will be undertaken in consultation with the M~~LALC.	Construction
Waste management				
Waste generation and disposal	W1		A Construction Waste Management Plan will be prepared for the project prior to construction and will detail appropriate waste management procedures. The CWMP will: • Document expected waste types and volumes for the project • Describe procedures for managing office and project waste materials including separation, treatment and disposal in accordance with relevant guidelines • Detail waste reporting requirements including the implementation of a waste register • Detail the process for identifying waste re-use sites including approval requirements.	Prior to construction
	W2		A Spoil Management Plan will be prepared for the project. The plan will detail spoil management measures including spoil haulage routes and spoil disposal sites.	Prior to construction
Large volumes of spoil directed to landfill due to inadequate recycling and reuse	W3		The project will target the reuse or recycling of 95 percent of uncontaminated spoil generated for beneficial purposes in accordance with the project spoil management hierarchy.	Construction
Unexpected waste volumes and types during construction	W4		Suitable areas **within project sites** will be identified to allow for contingency management of unexpected waste materials, including contaminated materials. Suitable areas will be required to be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage.	Construction

Impact	EIS ID	New ID	Measure	Timing
Climate change				
Climate change adaptation	CC1		A review of the climate change risk assessment will be undertaken during detailed design, with adaptation actions implemented to address extreme and high risks. Adaptation measures for medium risks will be considered and implemented where reasonable and feasible.	Detailed design
	CC2		The increased potential for heat stress among construction personnel will be considered when refining construction Work Health and Safety Management Plans. Measures will be implemented to create greater awareness and education of personnel around health and wellbeing during periods of extreme heat.	Construction
	CC4		The projected increase in the intensity and frequency of extreme rainfall, which may lead to exacerbated risk of road incidents, will be considered during detailed design.	Detailed design
	CC5		Implementation of operational procedures will be considered for surface connections to increase safety during extreme rainfall events, including the potential use of variable speed signs and reduced speed limits.	Detailed design
	CC6		Emergency management planning will include consultation and collaboration with other key agencies to enable a coordinated response.	Detailed design
	CC7		Emergency management procedures will consider worst case scenarios with multiple events (e.g. evacuation of the tunnel required during a storm/ flash flood event).	Detailed design
	CC8		The upgrade of bus stop facilities on President Avenue in proximity to the tunnel portals to incorporate shading/ areas of respite for commuters will be considered during detailed design.	Detailed design
	CC9		Roads and Maritime will consider the possibility of using treated water, normally discharged to waterways to irrigate green space (if feasible) in proximity to the project to provide cooling, particularly during periods of extreme heat. This approach will depend on suitability and salinity of water and potential for reuse.	Detailed design
Greenhouse gas				
Generation of greenhouse gas emissions	GG1		Targets to reduce GHG emissions, including the use of green power and/or other renewable energy sources, will be included as part of the project's Sustainability Management Plan to assist in achieving 'Design' and 'As Built' ratings of Excellent under the Infrastructure Sustainability Council of Australia infrastructure rating tool.	Detailed design
	GG2		An updated GHG assessment based on detailed design will be undertaken for ongoing monitoring and review of emissions during construction.	Detailed design
	GG3		Energy efficiency will be considered during the design of mechanical and electrical systems such as the tunnel ventilation system, tunnel lighting, water treatment systems and electronic toll and surveillance systems. Energy efficient systems will be installed where reasonable and practicable. The installation and use of solar power on operational infrastructure will be considered as part of detailed design, in order to ~~improve the operational energy efficiency~~ **reduce the GHG emissions** of the project.	Detailed design

Impact	EIS ID	New ID	Measure	Timing
	GG4		Opportunities to use low emission construction materials, such as recycled aggregates in road pavement and surfacing, and cement replacement materials will be investigated and incorporated where feasible and cost-effective.	Construction
	GG5		Construction site layouts will be designed to reduce travel distances and double handling of materials so as to reduce fuel usage and emission generation.	Construction
	GG6		Construction plant and equipment will be well maintained to allow for optimal fuel efficiency.	Construction
	GG7		Raw materials will be managed to reduce energy requirements for their processing. For example, stockpiled materials will be covered or provided undercover storage where possible to reduce moisture content of materials, and therefore the process and handling requirements.	Construction
	GG8		Locally produced goods and services will be procured where feasible and cost effective to reduce transport fuel emissions.	Construction

D Part D Environmental management measures and conclusion

Contents

D2 Conclusion and next steps

The NSW Department of Planning and Environment (DP&E) will, on behalf of the NSW Minister for Planning, review the Environmental Impact Statement (EIS), this submissions report and the preferred infrastructure report for the F6 Extension Stage 1 project (the project). Once DP&E has completed its assessment, a draft Environmental Assessment Report will be prepared for the Planning Secretary of DP&E, which may include recommended conditions of approval.

The Environmental Assessment Report will be provided to the NSW Minister for Planning, who will then approve the project (with any conditions considered appropriate) or refuse to give approval to the project.

A copy of the final submissions report and preferred infrastructure report will be made publicly available. The NSW Minister for Planning's determination, including any conditions of approval and the Planning Secretary's Environmental Assessment Report, will be published on the DP&E Major Projects website following determination.

D Part D Environmental management measures and conclusion

D3 References

ACTAQ (2016) 'In-tunnel air quality (nitrogen dioxide) policy', *Advisory Committee on Tunnel Air Quality*, http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/81778/In-Tunnel-Air-Quality-Policy-FINAL.pdf

ANZECC Guidelines (2006) 'Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration', AS 2187.2-2006 Explosives - Storage and Use Part 2: Use of Explosives – Appendix J

Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) 'National Water Quality Management Strategy, Paper No. 4', *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Vol 1, The Guidelines*

Australian Bureau of Statistics (2016) *Travel to work data*

Barnett, B, Townley, LR, Post, V, Evans, RE, Hunt, RJ, Peeters, L, Richardson, S, Werner, AD, Knapton, A & Boronkay, A (2012) 'Australian Groundwater Modelling Guidelines', *Waterlines Report Series No 82, National Water Commission,* Canberra, pp.191, June

Commonwealth Department of Environment and Energy (2017) *EPBC Act Protected Matters Search Tool*

Commonwealth of Australia (2009) 'Significant impact guidelines for the vulnerable green and golden bell frog (*Litoria aurea*)', *Nationally threatened species and ecological communities EPBC Act policy statement 3.19*

Commonwealth of Australia (2013) *Matter of National Environmental Significance Significant Impact Guidelines*

Carslaw, D (2017) *Comments on Optimisation of the application of GRAL in the Australian context*, http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0008/138158/Comments-on-Optimisation-of-the-application-of-GRAL-in-the-Australian-context.pdf

Fairfull, S & Witheridge, G (2003) *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*, NSW Fisheries, Cronulla

Greater Sydney Commission (2018) *Eastern City District Plan*

Greater Sydney Commission (2018) *Greater Sydney Region Plan – a metropolis of three cities*

Hansson, E, Mattisson, K, Björk, J, Östergren, P-O & Jakobsson, K (2011) *'Relationship between commuting and health outcomes in a cross-sectional population survey in southern Sweden*', BMC Public Health, vol. 11, no. 1, p. 834

Hatley, R.K., (2004) 'Hydrogeology of the Botany Basin', *Australian Geomechanics* vol. 39, no. 3, pp. 73-91, September

IACA (2010) 'IACA Significance of a Tree, Assessment Rating System (STARS)', *Institute of Australian Consulting Arboriculturalists*, Australia, www.iaca.org.au

IAQM (2014) 'Guidance on the assessment of dust from demolition and construction', *Institute of Air Quality Management*, London

Infrastructure NSW (2018) *Final Business Case Summary: F6 Extension – Stage 1*, http://www.infrastructure.nsw.gov.au/media/1664/f6-extenstion-stage-1_fbc-summary_final.pdf

Infrastructure NSW (2018) *First things first - The State Infrastructure Strategy 2012 – 2032*

Landcom (2004) 'Soils and construction', *Managing Urban Stormwater*, Vol 1, 4th Edition

Mair R.J, Taylor, R.N & Burland, J.B (1996) *Building Response to Tunnelling: Case Studies from Construction of the Jubilee Line Extension*, London

Manansala, F, Boulter, P, Barnett, J & Kurz, C (2017*) Optimisation of the application of GRAL in the Australian context*

NSW Department of Environment and Climate Change (2009) *Interim Construction Noise Guideline*

NSW Department of Infrastructure, Planning and Natural Resources (2005) *Floodplain Development Manual – The management of flood liable land*

NSW Department of Land and Water Conservation (2012) *Site Investigations for Urban Salinity*

NSW Department of Planning and Environment (2018) *Bayside West Precincts 2036 Plan – Arncliffe, Banksia and Cooks Cove*

NSW Department of Planning and Environment (2018) F6 Extension Stage 1 New M5 Arncliffe to President Avenue, Kogarah, http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8931

NSW Department of Planning and Environment (2018) *Privacy Statement*, https://www.planning.nsw.gov.au/privacy

NSW Department of Primary Industries (2012) *Controlled Activities on Waterfront Land guidelines*

NSW Department of Primary Industries (2013) *Policy and Guidelines for Fish Habitat Conservation and Management* (update 2013)

NSW Environment Protection Authority (1995) *Sampling Design Guidelines*

NSW Environment Protection Authority (2012) '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: Result*, NSW Environment Protection Authority, Sydney South.

NSW Government (2014) *NSW State Infrastructure Strategy*

NSW Government (2016) *Review of the NSW Land Acquisition (Just Terms) Compensation Act 1991*

NSW Government (2017) *Property Acquisition*, http://www.propertyacquisition.nsw.gov.au/

NSW Government (2017) *Toll Relief – free rego for drivers*, *https://www.nsw.gov.au/your-government/the-premier/media-releases-from-the-premier/toll-relief-free-rego-for-drivers/*

NSW Government (2018) 2018-2019 Budget Papers, https://www.budget.nsw.gov.au/nsw-budget-2018-19-budget-papers

NSW Government (2018) *Future Transport Strategy 2056*

NSW Government Architect New South Wales (2017) *PLACED an integrated design policy for the built environment of New South Wales*, http://www.governmentarchitect.nsw.gov.au/thinking/integrated-design-policy/introducing-better-placed

NSW Office of Environment and Heritage (2012) *National Recovery Plan Magenta Lilly Pilly Syzygium paniculatum*

NSW Office of Environment and Heritage (2015) 'New South Wales Air Quality Statement 2014', *NSW and Office of Environment and Heritage*, Sydney, January 2015

NSW Office of Environment and Heritage (2015) *Kings Wetland*, http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=3490033

NSW Office of Environment and Heritage (2016) Sydney Metropolitan Catchment Management Authority Vegetation Mapping v. 3.0

NSW Office of Environment and Heritage (2017) Visual information system online Vegetation Classification database

NSW Office of Environment and Heritage (2017) NSW State Heritage Register, https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330166

NSW Office of Environment and Heritage (2018) http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330166)

NSW Office of Environment and Heritage (2018) *Technical Paper TP: 02 Air Quality Trends in Sydney* http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0008/192491/TP02_Air-Quality-Trends-in-Sydney.pdf

NSW Government Roads and Maritime Services (2015) *Fact Sheet Property acquisition of subsurface lands*, https://www.rms.nsw.gov.au/documents/projects/factsheet-property-acquisition-of-subsurface-lands.pdf

Roads and Maritime Services (2014) *Beyond the Pavement – Urban design policy, procedures and design principles*

Roads and Maritime Services (2014) *Land Acquisition Information Guide*

Roads and Maritime Services (2016) *Construction Noise and Vibration Guideline*

Roads and Maritime Services (2018) Bus Priority Infrastructure Program (BPIP), https://www.rms.nsw.gov.au/projects/easing-sydneys-congestion/bus-priority-program.html

Roads and Maritime Services (2018) Improving bus services in Arncliffe, Rockdale and Wolli Creek - Bus Priority Infrastructure Program, http://www.rms.nsw.gov.au/projects/sydney-south/arncliffe-rockdale-wolli-creek-bus-priority/index.html

Roads and Maritime Services (2018) Outside air quality monitoring, https://www.rms.nsw.gov.au/projects/sydney-south/m5-east/outside-air-quality-monitoring/index.html

Roads and Traffic Authority (2011) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*

Storm Consulting (2005) Scarborough and Bicentennial Park Ponds – Water Quality Study and Management Plan. Report prepared for Rockdale City Council, dated January

Sydney Metropolitan Catchment Management Authority (2011) *Botany Bay and Catchment Water Quality Improvement Plan*

Transport for NSW (2013) *NSW Freight and Ports Strategy*

Transport for NSW (2013) *Sydney's Bus Future*

Transport for NSW (2013b) *NSW Freight and Ports Strategy*

Transport for NSW (2018) *Tomorrow's Sydney Travel Choices*, https://www.mysydney.nsw.gov.au/travel-choices

Transport for NSW (2018) *Greater Sydney Services and Infrastructure Plan*