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12 March 2020

Ms Naomi Moss
Senior Planner
Transport Assessments
Department of Planning, Industry and Environment
GPO Box 39
Sydney NSW 2001

Dear Ms Moss

Western Harbour Tunnel and Warringah Freeway Upgrade Project (SSI 8863)
Advice on the Environmental Impact Statement (EIS)

I am writing to you in reply to the invitation to the Environment Protection Authority (EPA) to provide advice on the Environmental Impact Statement (EIS), including recommendations for Conditions of Approval, for the above proposal.

The EPA has reviewed the EIS and notes that many of the technical assessments have been limited to high level desk top analyses that have not been fully underpinned by site investigations. The EPA believes this may increase a risk of unexpected impacts from the project potentially occurring during construction.

Issues identified by the EPA are set out in **Attachment A** which provides the EPA's review of noise and vibration, water quality, hydrogeology, contaminated lands, air quality, and waste. In addition, **Attachment B** provides EPA comments on the Air Quality Technical Paper.

If the project proceeds, a robust set of conditions is needed to ensure environmental protection and effective community engagement.

Should you require clarification about the EPA's input please contact Anna Timbrell on 9274 6345 or email anna.timbrell@epa.nsw.gov.au

Yours sincerely

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ATTACHMENT A

1. Noise and Vibration

The EPA reviewed the *Technical Working Paper: Noise and Vibration* (Appendix G), prepared by Renzo Tonin and Associates (dated January 2020) and is satisfied with the methodology used to determine noise and vibration impacts for construction and operation.

The assessment has adequately considered the noise and vibration risks associated with the project. This includes identifying the number of residential and non-residential receivers near the alignment that are predicted to experience impacts greater than the noise management levels identified in the noise assessment, the potential receivers that could be highly noise affected, and the duration of impact under different scenarios.

The greatest noise and vibration impacts are in the vicinity of the 20 temporary construction compounds located along the alignment between Rozelle and Cammeray, associated construction vehicle movements, and the requirement for night-time works particularly due to partial closure of the Warringah Freeway for upgrade works. The potential for blasting has also been considered as has the potential vibration impacts particularly to heritage buildings. The number of receivers that would potentially experience higher noise impacts as a result of operational traffic changes have also been considered.

As part of the SSI approval, the EPA supports the development of a robust community engagement plan so that the community is advised what construction activities will take place, where, when and for how long. Where construction activities are proposed outside of standard construction hours, the community should be engaged to identify feasible and reasonable mitigation, including periods of respite, guided by the *Interim Construction Noise Guidelines* (DECC, 2009), with details included in an Out-of-Hours Work Protocol.

While the EPA notes that the assessment has included significant detail on the reasonable and feasible mitigation options available to receivers that will experience adverse noise impacts from operation of the project, major design details that influence the overall noise levels at these receivers have been deferred to detailed design.

For operation mitigation, design factors such as road surface material, barrier construction, extension and height, and at-property treatment are yet to be determined in full. The EPA considers that the community is not yet fully aware of how changes to the noise levels and traffic in the area will be managed once the project is operational.

The EPA recommends the following conditions be included if approval is granted:

Land Use Survey

1. A detailed land use survey must be undertaken to confirm sensitive receivers (including critical working areas such as operating theatres and precision laboratories) potentially exposed to construction noise and vibration, construction ground-borne noise and operational noise. The survey may be undertaken on a progressive basis but must be undertaken in any one area prior to the commencement of works which generate construction or operational noise, vibration or ground-borne noise in that area. The results of the survey must be included in the Construction Noise and Vibration Management Plan.

Noise Assessments

2. All noise and vibration assessments regarding management and mitigation required by this approval must consider the cumulative noise impacts of approved SSD and SSI projects. This condition applies to all works and operation.

Works Hours

3. Works must be undertaken during the following hours:
    a. 7:00am to 6:00pm Mondays to Fridays, inclusive;
    b. 8:00am to 1:00pm Saturdays; and
    c. At no time on Sundays or public holidays.

4. Notwithstanding Condition 3, the identified 'Construction scenarios' within Table 5-2 of the *Noise and Vibration Assessment* (Appendix G of the EIS) are permitted to occur within the following hours:
    a. Day – 1:00 pm to 6:00 pm Saturday and 8.00am to 6.00 pm Sunday / Public holiday
    b. Evening – 6:00 pm to 10:00 pm Monday to Friday and 6:00 pm to 10:00 pm Saturday/Sunday/ Public holiday
    c. Night – 10:00 pm to 7:00 am Monday to Friday and 10:00 pm to 8:00 am Saturday / Sunday / Public holiday

5. Notwithstanding Condition 3 and Condition 4, construction activities identified in sections 6 and 7 of the *Noise and Vibration Assessment* (Appendix G of the EIS) as necessary outside of the standard hours of work are permitted to be undertaken 24 hours a day, seven days a week.

6. Surface works associated with tunnelling must only be undertaken in accordance with the *Noise and Vibration Assessment* (Appendix G of the EIS).

Highly Noise Intensive Works

7. Except as permitted by an environment protection licence (EPL), highly noise intensive works that result in an exceedance of the applicable Noise Management Level at the same receiver must only be undertaken as per the site-specific guidance listed in section 6 of the *Noise and Vibration Assessment* (Appendix G of the EIS).

8. The proponent must identify and consult with receivers identified as being subject to levels that exceed the Highly Noise Affected criteria with the objective of determining appropriate hours of respite unless an agreement is reached with those receivers. This condition does not apply to noise associated with the cutting surface of a road header.

Construction Noise and Vibration – General

9. **Construction Noise and Vibration Impact Statements** must be prepared for ancillary facilities before any works that result in noise and vibration impacts commence and include specific mitigation measures identified through consultation with affected sensitive receivers. The Statements must supplement the **Construction Noise and Vibration Management Plan** or **Site Establishment Management Plan(s)** and are to be implemented for the duration of the works.

10. Noise generating works in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the Noise Management Levels must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.

11. Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria:

    a. construction noise management levels of 'Noise affected' established using the *Interim Construction Noise Guideline* (DECC, 2009);

b. vibration criteria established using the *Assessing vibration: a technical guideline* (DEC, 2006) (for human exposure); or, as per the *Noise and Vibration Assessment* (Appendix G of the EIS);
c. Australian Standard AS 2187.2 - 2006 “Explosives - Storage and Use - Use of Explosives”;
d. BS 7385 Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2” as they are “applicable to Australian conditions”; and
e. the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage).

12. Any works identified as exceeding the noise management levels and / or vibration criteria must be managed in accordance with the Construction Noise and Vibration Management Sub-plan.

13. Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded:

    a. evening (6:00 pm to 10:00 pm) — internal $L_{Aeq(15\ minute)}$: 40 dB(A); and
    b. night (10:00 pm to 7:00 am) — internal $L_{Aeq(15\ minute)}$: 35 dB(A).

14. The mitigation measures must be outlined in the **Construction Noise and Vibration Management Sub-plan**, including in any **Out-of-Hours Work Protocols**.

15. The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.

16. The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring at heritage-listed structures.

Construction Noise Mitigation – Acoustic Sheds

17. All acoustic sheds must be erected as soon as site establishment works at the facilities are completed and before undertaking any works which are required to be conducted within the sheds.

2. Water Quality

The EPA reviewed the *Technical Working Paper: Surface Water Quality and Hydrology* (Appendix O), prepared by Jacobs (dated January 2020) and considers that further information is required to address the relevant environmental assessment requirements of the project and provide the information required to consider section 45 of the *Protection of Environment Operations Act 1997.*

The EIS proposes that intercepted groundwater and wastewater would be collected, treated and discharged to waterways. However, the EIS does not characterise the expected discharge quality or adequately assess the potential impact of those discharges on the environmental values of the receiving waterway. This information should be provided as part of the Response to Submissions.

The recommendations below aim to ensure that the applicant appropriately assesses water pollution risks and identifies practical and reasonable mitigation measures to address these risks.

Wastewater discharges

The environmental assessment requirements for the project include:

- identify and estimate the quality and quantity of all pollutants that may be introduced into the water cycle by source and discharge point(s), and describe the nature and degree of impact that any discharge(s) may have on the receiving environment, including consideration of all pollutants that pose a risk of non-trivial harm to human health and the environment
- demonstrate how construction and operation of the project (including mitigating effects of proposed stormwater and wastewater management) will, to the extent that the project can influence, ensure that:
    - where the NSW Water Quality Objectives (WQOs) for receiving waters are currently being met they will continue to be protected; and
    - where the NSW WQOs are not currently being met, activities will work toward their achievement over time
- demonstrate that all practical measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented.

Section 45 of the *Protection of Environment Operations Act 1997* (s45 POEO Act) sets out the matters the EPA must consider when making licensing decisions, including:

- the pollution caused or likely to be caused by the carrying out of the activity or work concerned and the likely impact of that pollution on the environment
- the practical measures that could be taken to prevent, control, abate or mitigate that pollution, and to protect the environment from harm as a result of that pollution
- in relation to an activity or work that causes, is likely to cause or has caused water pollution the environmental values of water affected by the activity or work, and the practical measures that could be taken to restore or maintain those environmental values.

The EIS states that wastewater and intercepted groundwater would be directed to one of five treatment plants prior to discharge, four of which would discharge to Sydney Harbour and one to Willoughby Creek. However, the EIS does not provide the information required to address the environmental assessment requirements and consider s.45 of the POEO Act matters in relation to these proposed discharges. These issues are discussed further below.

Discharges to Willoughby Creek

The EIS states that for discharges to Willoughby Creek, wastewater would be treated in accordance with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) for 95% protection levels and 99% protection levels for bioaccumulates. Clarification is required regarding whether this means that the pollutant levels of discharges would not exceed the guideline values. If so, then the discharges are unlikely to pose a risk to the receiving waterways and no further assessment is required. If discharges are to contain elevated concentrations of pollutants, then a water quality impact assessment consistent with the national Water Quality Guidelines and commensurate with the level of risk is required.

The EIS also states that site-specific trigger values (SSTVs) may be developed for physical and chemical stressors from an appropriate local reference site. Derivation of site-specific guideline values is discussed under 'Guideline values' below.

Discharges to Sydney Harbour

It is unclear if the impacts of the proposed discharges to Sydney Harbour would maintain or achieve the NSW Water Quality Objectives. Section 5.1.4 of Appendix Q states that ANZG (2018) guidelines would be applied to the receiving environment to ensure that the Project maintains or improves marine water quality however, the EIS does not characterise the expected discharge quality and states that the type, arrangement and performance of the construction wastewater treatment plants would be conducted at the detail design phase. A water quality impact assessment consistent with the national Water Quality Guidelines and commensurate with the level of risk is required.

Recommendation:

The EPA considers that the proponent must provide the following information to address the environmental assessment requirements and inform consideration of s.45 of the POEO Act matters with regard to wastewater discharges:

1. Clarification regarding the quality of the proposed discharges in terms of the concentrations of all pollutants present at non-trivial levels. If the levels of all pollutants in discharges meet the national Water Quality Guidelines (ANZG, 2018) - *guideline values for slightly to moderately disturbed ecosystems*, then the discharges are unlikely to pose a risk to the receiving waterways and no further assessment is required. Otherwise, the Response to Submissions should provide the information detailed at point 2 below.

2. A water quality impact assessment to determine the impact of each of the proposed discharges to waterways. The assessment should at a minimum:
   a. identify and estimate the quality and quantity of discharges including all pollutants that may be introduced into the water cycle by source and discharge point
      i where possible, discharge quality should be determined based on existing monitoring data that is available from the project site or similar sites
   b. assess the potential impact of discharges on the environmental values of the receiving waterway
      i using a dilution assessment to demonstrate how the relevant ANZG (2018) guideline values for slightly to moderately disturbed ecosystems would be met at the edge of the initial mixing zone of the discharge
      ii including average or typical through to worst-case scenarios
   c. where relevant, identify practical measures to mitigate identified impacts.

Guideline values

The following errors have been identified in the guideline values listed in Table 2-1 of Appendix O:

- The guideline value for electrical conductivity for NSW coastal rivers is 300 µS/cm and should be adopted for freshwater streams in the project area. (See Lowland rivers explanatory note under Table 3.3.3 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* volume 1 (ANZECC, 2000)).
- The ANZG (2018) interim working level for arsenic (III) in marine waters (2.3 µ/L) should be adopted for total arsenic in estuarine waterways.
- ANZECC (2000) does not recommend guideline values for TSS.

In addition, Appendix O states that site-specific physical and chemical stressor guideline values would be derived based on baseline water quality. If site-specific guideline values are developed, these should be derived consistent with the national Water Quality Guidelines, including being based on the 80th percentile of 24 months of data from an appropriate slightly disturbed reference site.

Recommendation:

1. The EPA recommends that the proponent adopt the appropriate Australian and New Zealand *Guidelines for Fresh and Marine Water* Quality guideline values for slightly to moderately disturbed ecosystems;

2. If site-specific guideline values are developed, these should be derived consistent with Australian and New Zealand *Guidelines for Fresh and Marine Water Quality*, including being based on the 80th percentile of 24 months of data from an appropriate slightly disturbed reference site.

Stormwater discharges

The EIS indicates that a sediment basin may be used at Cammeray Golf Course during construction and states that the contractor would make the final decision at the design stage.

Recommendation:

1. If sediment basin discharges are proposed, a discharge impact assessment commensurate with the potential risk and consistent with the national Water Quality Guidelines will be required to inform licensing consistent with s.45 of the *Protection of Environment Operations Act 1997*.

3. Hydrogeology

The EPA reviewed the *Technical Working Paper: Groundwater* (Appendix N), prepared by Jacobs, (dated January 2020) and considers there is a paucity of information regarding groundwater monitoring.

Samplings do not establish satisfactory baseline

The baseline data used to characterise the quality and quantity of available groundwater throughout the project area was established from using measurements and samples obtained over an eight-month timeframe from August 2017 to April 2018 (refer *Figure 5-8 Monitoring bore hydrographs* in Appendix N). Automatic loggers have been used to determine standing water level and hydraulic contours, but given the relatively short sampling duration, the results do not establish a satisfactory baseline to justify as a benchmark to evaluate changes to local and regional groundwater over time.

SEAR 5, under 9. *Water – Hydrology* requirements are not addressed satisfactorily

In addition, groundwater quality measurements are limited to sporadic sampling events in 2017 and 2018 with results showing variability in some water quality parameters – particularly from Bore B131A which has analyte concentration magnitudes higher than the other bores within the network. As such the proponent has not yet satisfactorily addressed the SEAR 5, under *9. Water – Hydrology*, requiring the establishment for baseline monitoring of hydrological attribute. Given that the Technical Working Paper is dated January 2020, this information should be updated.

SEAR 1j, under *10. Water – Quality* requirements are not addressed satisfactorily

SEAR 1j, under *10. Water – Quality*, requires the proponent to identify proposed monitoring locations, frequency and indicators of surface and groundwater quality. Eight groundwater monitoring bores near the proposed infrastructure alignment have been used to sample groundwater quality since November 2017 (these are identified in Table 5-10 and Figure 4-2). However, the full analytical results (monthly samples) provided in Appendix D to the Technical Working Paper show that monitoring has not been at regular intervals, with a maximum of six sampling rounds conducted since the bores were constructed in November 2017 (note this differs to the numbers shown in Table 5-10). To satisfactorily address the requirement of SEAR 1j *all* historic monthly data collected to date (sampling after April 2018 up until 2020) should be made available, updated, and reported on. All sites used for groundwater monitoring should be better presented and detailed for review.

Monthly baseline groundwater monitoring required to continue

The EPA requests the proponent to continue monthly baseline groundwater monitoring up to the commencement of construction. This information would need to be assessed in conjunction with data gathered to date and to inform the final design and construction progress.

Groundwater Management Sub-Plan

Should the project be approved, the EPA requests that Conditions of Approval include requirements for a *Groundwater Management Sub-Plan* as part of the *Construction Environmental Management Plan* (CEMP) and the *Operational Environmental Management Plan* (OEMP).

Groundwater Monitoring Programs

The EPA also recommends a condition that the proponent prepare a *Groundwater Monitoring Program* for construction which would include mitigation measures where results of monitoring indicate adverse impacts or levels above relevant criteria, in addition to an *Operational Groundwater Monitoring Program*, with monitoring to continue for a minimum of five years following the completion of the tunnels.

4. Contaminated Lands

The EPA reviewed the *Technical Working Paper: Contamination* (Appendix M) and *Technical Working Paper: Groundwater* (Appendix N), both prepared by Jacobs (dated January 2020). The reports provide only a high-level desktop identification of areas of environmental interest. No site investigations have been conducted. Therefore, the risks to ecological and human health have not been properly determined. A detailed site assessment is required to investigate the nature and extent of contamination within the project footprint and to meet the requirements of the SEARs.

The desktop review identifies several areas of environmental interest, and it is considered that site remediation will be a likely outcome. However, site investigations are required to determine what remedial measures should be implemented. As such, the EPA recommends that the proponent be required to engage a NSW EPA-accredited Site Auditor for the duration of construction to ensure that any work required in relation to soil or groundwater contamination is appropriately managed.

It is recommended that as part of Response to Submissions, the proponent submit Interim Audit Advice from the engaged site auditor commenting on the nature and extent of the contamination and what further works are required.

The EPA recommends the following conditions of approval are included:

1. The proponent must conduct site investigations to determine the full nature and extent of the contamination at the project area. The site investigations must be undertaken, and the subsequent report(s), must be prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997*.

2. The proponent must ensure that all contaminated land reports, management plans and remediation action plans are either prepared, or reviewed and approved by the Contaminated Land Consultant certified under *either* the Environment Institute of Australia and New Zealand's 'Certified Environmental Practitioner' (Site Contamination) scheme (CEnvP(SC)) *or* the Soil Science Australia 'Certified Professional Soil Scientist Contaminated Site Assessment and Management' (CPSS CSAM) scheme.

3. At the completion of the site investigations, the applicant must prepare a Remediation Action Plan (RAP). The RAP must be prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997*.

   The RAP must include measures to remediate the contamination at the site to ensure the site will be suitable for the proposed use when the RAP is implemented.

   The RAP must include an unexpected finds protocol. The protocol must include a detailed procedure for identifying and dealing with unexpected contamination and other unexpected finds. The proponent must ensure the procedure includes details of who will be responsible for implementing the unexpected finds protocol and the roles and responsibilities of all parties involved.

4. The proponent must engage a NSW EPA-accredited Site Auditor throughout the duration of works to ensure that any work required in relation to soil or groundwater contamination is appropriately managed. If work is to be completed in stages, the site auditor must confirm satisfactory completion of each stage by the issuance of Interim Audit Advice(s).

Site Audit Statement

5. The proponent must obtain a 'Section A1 Site Audit Statement' or a 'Section A2 Site Audit Statement' (accompanied by an Environmental Management Plan) from an NSW EPA-accredited Site Auditor and submit it to the approval authority before commencing use of the infrastructure. The Site Audit Statement must certify the site is suitable for the proposed use.

5. Waste

The EPA reviewed Chapter 24 – Resource Use and Waste Management of the EIS main document prepared by Jacobs / Arcadis (dated January 2020) and finds that waste tracking and auditing protocols are not described, and that appropriate waste disposal facilities are not clearly defined.

The proposal describes large quantities of various types of waste that will be generated by the project. The generated waste includes demolition wastes, aggregates, hazardous wastes, vegetation wastes, general construction wastes, wastes from operation and maintenance of construction vehicles and equipment, and general wastes from site offices. The EIS also describes excavation and dredging of potentially contaminated soils that would require to be disposed of to appropriate waste facilities.

Waste that is generated by the project will need to be segregated, uniquely identified, classified using the NSW EPA Waste Classification Guidelines, and tracked to its destination.

The proponent will also be required to perform audits of the waste tracking process to ensure that waste is being delivered to the appropriate destination.

Some examples of Waste Tracking and Auditing Protocols include:

- Volumetric surveys;
- Reviewing of Waste Classification Reports prepared by Environmental Contractors for the waste;
- Tracking the transport of waste from the area of waste generation to disposal;
- Reviewing the receiving waste facility's Environment Protection Licence; and
- Storing and reviewing waste disposal dockets.

The EIS states that waste streams will be classified and disposed of at "appropriate licenced waste facilities". It is important however to note that waste facilities selected by RMS (or their construction contractors) during construction and operational activities must only deliver waste to facilities that can lawfully accept the waste. The Environment Protection Licence of a potential waste facility must be referred to ensure that the elected facility can lawfully accept that type of waste.

The EPA considers approval conditions reflect the following:

1. The proponent will need to identify and track all waste during generation, transfer, storage, processing and re-use or disposal.
2. All waste generated by the project and requiring disposal or recycling will need to be taken to a facility that can lawfully accept that type of waste.
3. The proponent will need to create and undertake a routine Waste Auditing Program that ensures compliance with relevant environmental legislation at all stages of waste processing during the project.

6. Air Quality

The EPA reviewed the *Technical Working Paper: Air Quality (TWPAQ)*, (Appendix H) prepared by ERM (dated January 2020). The paper adequately addresses all requirements of the SEARs and has been conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016).

The assessment predicts the project will provide general improvements in air quality close to the Sydney Harbour Bridge, the Warringah Freeway near Cammeray, and in Rozelle. This is due to a reduction in traffic volumes accessing the Sydney Harbour Bridge or the Sydney Harbour tunnel, as well as improved dispersion of emissions through tunnel ventilation outlets. For the projected 2037 scenario, the project will contribute to a slight decrease in air quality on the Gore-Hill expressway in Artarmon and near the stack in Cammeray.

The assessment of potential air impacts from the project has a number of data and methodology inputs (eg. traffic modelling, vehicle emission modelling, meteorological data and modelling, dispersion model configuration). Given the air quality assessment has undergone detailed expert review by the Advisory Committee on Tunnel Air Quality (ACTAQ), and noting the conclusions of the ACTAQ review, the EPA has focused its review and offers comments on matters relevant to the EPA's particular expertise and the regulatory remit, ie:

- the identification of project related air quality risks associated with the construction phase of the project;
- the assessment of the operational phase including regulatory worst-case scenario, with a focus on assessment of emissions from ventilation outlets; and
- the methodology adopted for estimating motor vehicle emissions.

The EPA considers the construction phase of the project to be satisfactorily assessed, however, has identified several information deficiencies in the TWPAQ regarding operation.

To facilitate a robust and transparent assessment of operational impacts, the EPA recommends additional information be provided on the issues summarised below. (Further details are provided in the **Attachments B1** and **B2**).

Information deficiencies in *Technical Working Paper – Air Quality: Operational Impacts* (and detailed in **Attachment B1**) include:

- meteorological data is not fully justified;
- flowrates used in Regulatory Worst Case are not fully justified;
- evaluation of impacts at elevated receptors requires further analysis; and
- impacts of annual average $PM_{2.5}$ require clarification.

Information deficiencies in *Technical Working Paper – Air Quality: Vehicle Emission Estimation Techniques* (and detailed in **Attachment B2**) include:

- emission model verification;
- ventilation outlet temperatures;
- fleet profile – Euro 6; and
- THC and PM_{10} emissions.

The EPA recommends the proponent provide additional information to address the issues referred to above (and detailed further in **Attachments B1** and **B2**) by way of a Response to Submissions report. Specific recommendations with regards to information deficiencies are:

Meteorological data is not fully justified

The EPA recommends that the proponent provides justification for the choice of meteorological data and weightings used in the meteorological modelling. Further, the EPA recommends the proponent should validate Graz Mesoscale Model (GRAMM) using other meteorological stations (where possible) not included in the modelling, eg. BOM Wedding Cake West and DPIE Lindfield. If revised model validation does not demonstrate acceptable agreement, GRAMM modelling should be revised to more accurately simulate the meteorology.

Flowrates used in Regulatory Worst Case are not fully justified

The EPA recommends the proponent should provide additional supporting justification to robustly demonstrate that minimum discharge flowrate adequately simulates expected reasonable worst-case impacts for the regulatory worst-case scenario. In the absence of transparent and robust justification for using minimum flowrate, for the regulatory worst-case scenario, the EPA recommends the proponent provides additional regulatory worst-case predictions using the maximum ventilation flowrate for the expected traffic case (Table G-8), including:

- total impact (ventilation outlet, surface road and background) at receptors for all pollutants except air toxics;
- predicted impact (ventilation outlet and surface road) at receptors of speciated air toxics; and
- contour maps for the ventilation outlet alone for all pollutants and all averaging periods.

Evaluation of impacts at elevated receptors requires further analysis

The EPA considers that the proponent should provide further assessment of existing and approved elevated receptors located in proximity to proposed ventilation outlets. The additional assessment must:

- consider the regulatory worst-case scenario, as well as expected traffic scenarios;
- be conducted for existing and approved receptors at least 30 metres high and within 300 metres of the ventilation outlet;
- present incremental (Ventilation outlet), background (surface road and other non-surface road contributions) and cumulative concentrations for PM (24 hour and annual), and NO_2 (1 hour and annual);
- quantify the percentage of exceedances for the expected traffic scenario, both with and without the project; and
- present incremental (ventilation outlet) concentrations, for air toxics.

Impacts of annual average $PM_{2.5}$ require clarification

The EPA recommends the proponent should clarify whether the project contributes to additional exceedances in the annual average $PM_{2.5}$ criterion. Where the project contributes to additional exceedances, the proponent should provide the incremental contribution from the ventilation outlets of the project.

Emission model verification

The EPA recommends that the proponent should document a tabulated model verification presenting:

- traffic volumes
- tunnel lengths and gradients
- emission factors
- resulting total emissions

for one scenario (eg. 2027 DS) in order to transparently demonstrate that the sound and otherwise well documented methodology has been correctly implemented.

Ventilation outlet temperatures

The EPA recommends the proponent provide additional justification for the methodology adopted to calculate ventilation outlet temperature, including any potential impact on assessment results presented.

Fleet profile-Euro 6

The EPA recommends the proponent provide additional justification for the adopted assumption of Euro 6 introduction in 2019, including any potential impact on assessment results presented.

THC and PM_{10} emissions

The EPA recommends the proponent should provide additional justification for the adopted ratio THC:NOx, including any potential impact on assessment results presented.

ATTACHMENT B

BACKGROUND:

In early 2018, the NSW Government announced new procedures to inform evaluation of Environmental Impact Statements (EIS) for road tunnel projects. The changes include:

- A scientific review of the tunnel air emissions from ventilation outlets by the Advisory Committee on Tunnel Air Quality[1] (ACTAQ), managed by the Office of the NSW Chief Scientist and Engineer;
- A statement by the NSW Chief Health Officer[2]; and

ACTAQ review and Chief Health Officer statement have been completed and published concurrently with the Western Harbour Tunnel and Warringah Freeway Upgrade EIS.

The review conducted by the ACTAQ for the proposed Western Harbour Tunnel project concluded:

- The Western Harbour Tunnel EIS constitutes a thorough review of high quality;
- The choices made regarding data used and methods followed have been logical and reasonable;
- The emission modelling has been improved from other projects due to the application of the new PIARC approach for calculating vehicle emissions in tunnels;
- Tunnel emissions assume Euro 6 being adopted, and therefore may be under predicted. However, tunnel concentrations at discharge are subject to regulatory limits and so ambient impacts are protected even with the increase.

The NSW Chief Health Officer Statement advises that:

- The primary source of community exposure to air pollution is from pre-existing regional air pollution, followed by pollution from surface road traffic; and
- 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;
- The project should provide an overall improvement in air quality.

ATTACHMENT B1

EPA comments on Technical Working Paper – Air Quality: Operational Impacts

The EPA has reviewed the *Western Harbour Tunnel and Warringah Freeway Upgrade Technical Working Paper: Air Quality* (ERM, January 2020) (the TWPAQ). The TWPAQ addresses all requirements of the SEARs and has been conducted in general accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2007).

The EPA has identified several information deficiencies in the TWPAQ. To facilitate a robust and transparent assessment of operational impacts, the EPA recommends additional information be provided on the issues detailed below.

a) Meteorological data used is not fully justified

[1] Review of the Western Harbour Tunnel and Beaches Link EIS – Tunnel Ventilation, Advisory Committee on Tunnel Air Quality, 25 September 2019.

1. [2] Western Harbour Tunnel and Beaches Link and Gore Hill Freeway Connection: Statement on potential health impacts of emissions from road tunnel ventilation stacks, 8 November 2019, Letter to DPIE from Dr Kerry Chant PSM, Chief Health Officer and Deputy Secretary, Population and Public Health.

Annexure F to the TWPAQ provides an analysis of meteorological data and an evaluation of the Graz Mesoscale Model (GRAMM). There is insufficient justification and validation regarding the selection of the meteorological stations and weightings used in the GRAMM meteorological modelling. The four stations used within the GRAMM modelling were DPIE Randwick, DPIE Rozelle, BOM Fort Denison and BOM Manly.

BOM Wedding Cake, despite being in the GRAM domain was considered to be too coastal and could cause an overestimate of higher windspeeds. DPIE Lindfield lies on the north western edge of the GRAL domain and could therefore provide a good estimation of winds near the Warringah freeway upgrade and Beaches Link. However, despite siting conforming to AS/NZS siting criteria, it was not used in the analysis since it was considered too far inland and would not be representative of weather patterns in the project domain.

DPIE Randwick does not lie in the GRAL domain and lies approximately 2 km from the coast. However, this station was considered to be the most representative of winds in the project corridor, and thus had the highest weighting. Rozelle, despite being very close to the western end of the project, does not conform to AS/NZS for siting, and so was given a small weighting. Manly and Fort Dennison were considered too coastal and were assigned similarly small weightings.

The validation of the meteorology in the project domain compared GRAMM data at the four stations (Randwick, Rozelle, Fort Denison and Manly) with the measured data from these stations. Not surprisingly, GRAMM results at Randwick compared well to observation data from the Randwick station (R^2=0.84). The agreement between GRAMM and observations was not so good for Manly and Fort Dennison (R^2=0.58 and 0.54 respectively). The performance of GRAMM at Rozelle was considered weak/moderate with R^2=0.17, however it is unclear how much of this is due to the poor siting of the met station, and how much is due to the low weighting assigned in GRAMM.

The EPA considers it is suboptimal to validate GRAMM using the four stations that were used to derive the GRAMM meteorology data set, and it is unclear why BOM Wedding Cake or other available data was not used instead. It is also unclear why DPIE Lindfield was not used in the generation of the GRAMM data set since it is likely to more closely represent wind patterns in Artarmon than the Randwick data used. At the very least it could have been used to validate GRAMM.

Recommendation: The EPA recommends that the proponent provides justification for the choice of meteorological data and weightings used in the meteorological modelling. Further, the EPA recommends the proponent should validate GRAMM using other meteorological stations (where possible) not included in the modelling, e.g. BOM Wedding Cake West and DPIE Lindfield. If revised model validation does not demonstrate acceptable agreement, GRAMM modelling should be revised to more accurately simulate the meteorology.

b) Ventilation flowrates used in Regulatory Worst Case not fully justified

An assessment of regulatory worst case was undertaken for all pollutants for the 2037-DSC scenario. The discharge flowrate for all outlets, given in Table G-166, was the minimum ventilation flow rate used in the expected traffic model (Table G-8). The EPA does not consider that using the minimum discharge flowrate (velocity) necessarily constitutes regulatory worst case.

The EPA agrees that dispersion is decreased when the discharge velocity (hence discharge flowrate) decreases, via a reduction in the effective plume height, leading to potentially higher impacts. However, a decrease in discharge flowrate also contributes to an equivalent lower mass emission rate, and hence potentially lower impacts. Thus, the EPA considers that the use of the minimum discharge flowrate to simulate reasonable worst case impacts requires additional supporting justification.

Recommendation: The proponent should provide additional supporting justification to robustly demonstrate that minimum discharge flowrate adequately simulates expected

reasonable worst-case impacts for the regulatory worst-case scenario. In the absence of transparent and robust justification for using minimum flowrate, for the regulatory worst-case scenario, the EPA recommends the proponent provides additional regulatory worst-case predictions using the maximum ventilation flowrate for the expected traffic case (Table G-8), including:

- **Total impact (ventilation outlet, surface road and background) at receptors for all pollutants except air toxics;**
- **Predicted impact (ventilation outlet and surface road) at receptors of speciated air toxics; and**
- **Contour maps for the ventilation outlet alone for all pollutants and all averaging periods.**

c) Incomplete evaluation of impacts at elevated receptors

Section 8.4.13 of the TWPAQ provides the results of the assessment undertaken for elevated receptors. Assessment of impacts at elevated receptors has only been undertaken for annual and 24 hour average $PM_{2.5}$ for the 2037-DSC scenario. Impacts were not assessed in the RWC scenario, and impacts due to other pollutants were not analysed.

Further, the assessment was undertaken using the change in 24 hour $PM_{2.5}$ concentrations as a metric, and therefore does not consider background concentrations nor presents the actual predicted impact/pollutant exposure at these receptor locations.

The EPA impact assessment criteria do not apply on a predicted concentration change. If background concentrations do not exist at height, then the assessment should adopt a suitably robust methodology to enable prediction of pollutant exposure and comparison with the adopted impact assessment criteria.

The assessment results presented indicate that there are predicted impacts for potential future buildings above 20 m in height within 300 m of the ventilation outlets. Table 8-23 indicates that the potential for adverse impacts increases significantly for building heights greater than 30 m. Figure 8-12 shows there is at least one building of height greater than 30 m within 300 m of the ventilation outlets. The EPA considers there should be a more comprehensive assessment of impacts at existing and approved buildings of height greater than 30 m and within 300 m of a ventilation outlet.

Recommendation: The EPA considers that the proponent should provide further assessment of existing and approved elevated receptors located in proximity to proposed ventilation outlets. The additional assessment must:

- **Consider the regulatory worst-case scenario, as well as expected traffic scenarios;**
- **Be conducted for existing and approved receptors at least 30 m high and within 300 m of the ventilation outlet;**
- **Present incremental (Ventilation outlet), background (surface road and other non-surface road contributions) and cumulative concentrations for PM (24 hr and annual), and NO_2 (1 hour and annual);**
- **Quantify the percentage of exceedances for the expected traffic scenario, both with and without the project; and**
- **Present incremental (Ventilation outlet) concentrations, for air toxics.**

d) Model results suggest increased exceedances of annual average $PM_{2.5}$ impacts

Figure I-43 indicates that annual average $PM_{2.5}$ concentrations decrease with the project along the Sydney Harbour Bridge, the Anzac bridge, and near the Sydney Harbour and Eastern Distributor tunnel portals. Conversely, annual average $PM_{2.5}$ concentrations increase in Rozelle and along the Gore-Hill expressway, in Artarmon. The project does not cause any additional exceedances in annual average $PM_{2.5}$ at community receptors. Annual average $PM_{2.5}$ concentrations at RWR

receptors increase up to 0.6 µg/m^3 at 41% to 77% of receptors, depending on the scenario. It suggests that the project may contribute to additional exceedances in the annual average $PM_{2.5}$ criterion, however this should be clarified.

Recommendation: The proponent should clarify whether the project contributes to additional exceedances in the annual average $PM_{2.5}$ criterion. Where the project contributes to additional exceedances, the proponent should provide the incremental contribution from the ventilation outlets of the project.

ATTACHMENT B2

EPP comments on Technical Working Paper: Air Quality – Vehicle Emission Estimation Techniques

Overview

The motor vehicle emission estimation techniques detailed in Annexure C to Appendix H (surface roads) and Annexure K to Appendix H (in-tunnel) have been reviewed and comments are presented below.

1. Surface Road Emissions

The surface road motor vehicle emission estimation used emission factors from the NSW EPA motor vehicle emission model developed for the 2008 EPA GMR Air Emission Inventory. The emission modelling appears to have been conducted to a good standard and is well documented. A detailed description and validation of the NSW EPA motor vehicle emission model is presented in Annexure C to Appendix H.

Annexure C presents a validation of the EPA model using air quality data from the Lane Cove tunnel and this indicates the model is likely to conservatively overestimate emissions.

The NSW EPA conducted a high-level check of the total surface road emissions estimated by the EIS within the WestConnex GRAL modelling domain. The total domain emissions reported in the EIS are in close agreement to those estimated by the EPA indicating the NSW EPA motor vehicle emission model has been applied correctly.

2. In-tunnel Emissions

The in-tunnel emission estimation used the detailed methodology from the 2019 update of the PIARC methodology and is relatively well documented in Annexure K to Appendix H.

The PIARC detailed methodology applies emission factors for each Euro level in the fleet profile projected by the RMS fleet model. The emission factors published in the 2019 PIARC report are derived from a 2017 update of the *European Handbook of Emission Factors for Road Transport*. These are appropriate and up to date and represent real-world vehicle emission performance including widely reported real-world NO_x levels of modern light duty diesel vehicles.

The EIS estimates NO_2 fractions using the 2017 issue of the European EEA/EMPA guidebook which are similarly considered to be the most up to date data.

While overall the emission estimation methodology is sound, some issues are noted below:

a) Emission model verification

A validation of the in-tunnel emissions model is not presented, and insufficient data is provided to allow transparent demonstration that the stated methodology was correctly implemented.

The EPA conducted an evaluation of the 2027 Do Something total emission flows presented in Figure 7.1 using the fleet profile presented in Table 6.13, the PIARC emission factor workbook available on-line, traffic volumes estimated from Figure 6.5 and from Appendix F of the EIS, and WHT gradients estimated from Figure 6.1. Based on the statement in 6.1.3.1 of the EIS, the EPA assumed a constant speed of 80 km/h.

A comparison of the emissions estimated by the EPA to those scaled off Figure 7.1 are presented in the table below.

Time period	NOx (g/hr)			$PM_{2.5}$ (g/hr)			CO (g/hr)		
	EIS	**EPA**	**Diff.**	**EIS**	**EPA**	**Diff.**	**EIS**	**EPA**	**Diff.**
7:00-9:00	12,950	11,082	17%	495	590	-16%	14,590	7,032	107%
9:00-15:00	12,140	10,415	17%	547	529	3%	13,420	5,893	128%
15:00-18:00	9,920	8,623	15%	-	-	-	12,920	5,749	125%
18:00-7:00	4,010	2,809	43%	-	-	-	7,010	1,906	268%

The emissions estimated by the EPA were of similar order to those presented in the EIS for NO_x and $PM_{2.5}$, noting that the resolution to scale $PM_{2.5}$ off Figure 7.1 is poor. For CO, the emissions estimated in the EIS were consistently significantly higher by more than 100%. This is of concern as while it is expected that the necessarily simplified approach taken by the EPA in estimating the emissions would result in small to moderate differences to the EIS, the differences should be of a similar order for all pollutants.

Recommendation: The proponent should document a tabulated model verification presenting:

- **Traffic volumes**
- **Tunnel lengths and gradients**
- **Emission factors**
- **Resulting total emissions**

for one scenario (e.g. 2027 DS) in order to transparently demonstrate that the sound and otherwise well documented methodology has been correctly implemented.

b) Ventilation outlet temperatures (section 5.2.6 of Annexure K)

The EIS estimates ventilation outlet temperatures by applying the same ambient to ventilation outlet temperatures differential measured on the Lane Cove tunnel to the WHT ventilation outlets. The justification of this approach is stated to be that the Lane Cove Tunnel is in close geographical proximity to the WHT. While the small temperature difference of the ventilation outlet to ambient temperature is likely to have a minor impact of ventilation outlet dispersion and the ventilation outlet contribution to the ambient pollutant concentrations is very small, the assumption underlying this approach is inappropriate. The temperature difference will be determined by the heat rejection of the vehicles passing through the tunnel, which primarily a function of traffic volumes, and the tunnel ventilation rates.

It is noted that the previous WestConnex EIS used the same IDA tunnel software as was used for this WHT project. However, unlike the Westconnex EIS, WHT EIS did not model tunnel air temperature using the IDA tunnel software. It is recommended that the IDA modelling approach is taken in future.

Recommendation: The proponent should provide additional justification for the methodology adopted to calculate ventilation outlet temperature, including any potential impact on assessment results presented.

c) Fleet profile- Euro 6

The EIS assumed the introduction of Euro 6 for light duty petrol and diesel vehicles in 2019. The EIS performed a sensitivity analysis which found that NO_x and NO_2 increased by 12-26% in 2027 if Euro 6 were not implemented. The EPA found a similar impact.

The EPA considers that no Euro 6 is the likely scenario as no progress has been made towards the promulgation of Euro 6 as of February 2020, and that the Petrol Fuel Quality Standard to require Euro 5/6 levels of sulfur will not take effect until 2027.

Therefore, it is likely that in-tunnel levels of NO_2 will be of order 20% higher than estimated in the EIS. This should not be an issue for in-tunnel concentrations provided the ventilation system has sufficient design capacity. However, the impact of the adopted assumption on ambient air quality impacts should be further evaluated by the proponent.

Recommendation: The proponent should provide additional justification for the adopted assumption of Euro 6 introduction in 2019, including any potential impact on assessment results presented.

d) THC and PM_{10} emissions

Table 8-1 of Appendix H presents ratios of PM_{10} to $PM_{2.5}$, and Total Hydrocarbons (THC) to NO_x that were used to estimate PM_{10} and THC from the WHT ventilation outlet mass emission rates of $PM_{2.5}$ and NO_x predicted by the PIARC modelling. It is stated that these are taken from the EPA emission model.

However, the EPA model predicts a PM_{10} to $PM_{2.5}$ ratio of 1.65 versus the EIS value of 1.45. This is not likely to have a significant impact as the in-tunnel $PM_{2.5}$ is overestimated as noted in 3 above.

The EPA model predicts a GMR fleet wide THC:NO_x ratio of approximately 0.2 for 2026 (excluding evaporative emissions) versus the EIS figure of 0.068 for 2027. This will result in underestimation of VOC and air toxics from the ventilation outlet emissions.

Recommendation: The proponent should provide additional justification for the adopted THC:NOx ratio, including any potential impact on assessment results presented.

e) Non-exhaust PM

The non-exhaust PM emission factors taken from PIARC are tabulated in section 6.2.4.3. These are stated to be $PM_{2.5}$, however the PIARC workbook states the emission factors to be PM_{10}. This will result in an overestimation of the $PM_{2.5}$ and PM_{10} in the tunnel and ventilation outlet emissions. (In the emission comparison conducted above the EPA took the PIARC non-exhaust PM emission factors to be $PM_{2.5}$ in order to allow a direct comparison with the EIS).