NSW EPA

Our reference: DOC15/494417
Contact: Peter Morrall

Karen Jones
Director Transport Assessments
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Dear Ms Jones,

EPA response to public exhibition – WestConnex New M5 EIS (SI 6788)

I refer to your letter dated 25 November 2015, inviting the NSW Environment Protection Authority (EPA) to make a submission regarding the Environmental Impact Statement (EIS) for major civil construction works on the WestConnex project.

The EPA has reviewed the EIS and provided comments and recommendations in relation to the conditions of approval for the key issues of air quality, noise and vibration, surface water and groundwater (see attached).

The EPA would appreciate a copy of the submissions received by the Department of Planning and Environment (DP&E) in relation to the exhibition of the EIS. The EPA also requests the opportunity to comment on the draft conditions of approval proposed by DP&E and recommend additional conditions of approval if required based on the proponent's response to submissions.

If you wish to discuss any of the issues raised in this letter please contact me on 9995 6810 or peter.morrall@epa.nsw.gov.au.

Yours sincerely

1.2.16

PETER MORRALL
A/Unit Head Metropolitan Infrastructure
Environment Protection Authority

Encl: EPA's submission on the Environmental Impact Statement for the WestConnex New M5 project.

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EPA's submission on the Environmental Impact Statement for the WestConnex New M5 EIS (SI 6788)

ENVIRONMENT PROTECTION LICENCING

In accordance with Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act), this project will require an environment protection licence (EPL) for construction. The proponent will need to make a separate application to the EPA for this licence if project approval is granted.

WATER QUALITY

Groundwater Pollutants

The EIS identifies several sources of groundwater contamination from a range of current and former land uses surrounding the project site. Sampling of the local groundwater and data obtained from a nearby Water Treatment Plant for the M5 East Motorway has been used to predict the potential pollutants in wastewater discharges. While a number of pollutants have been identified and concentrations estimated for their discharge to the Cooks River, Wolli Creek and Alexandra Canal, it appears that some potential non-trivial pollutants have not been considered.

The EIS details how groundwater at Arncliffe has been impacted by contaminants associated with market gardens and dredged sediments from the Cooks River. However, pesticides and other associated organic toxicants are not listed in the water quality reference criteria (Appendix A) despite groundwater samples being analysed for these constituents. In addition, loads have been estimated for Total Petroleum Hydrocarbons (TPH), Phenols and Iron within groundwater influent however these pollutants are not included in the discharge criteria. Ammonia has been listed in the discharge criteria as a toxicant however Ammonium should also be listed as a stressor considering that the average load of Ammonia in contaminated groundwater influent has been estimated at 19.8kg/day.

Recommendation

The EPA recommends clarification is provided regarding an absence of these pollutants from the proposed discharge criteria, and consideration given to of expanding the list of pollutants to include Iron, Ammonium and the constituents listed in the draft groundwater monitoring program. Specifically these constituents are Total Hydrocarbons (TRH (C6-C40), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), Phenols, Organochlorine Pesticides, Organophosphorus Pesticides and Polychlorinated Biphenyls (PCBs).

NSW Water Quality Objectives

The EIS acknowledges most of the NSW Water Quality Objectives (WQO) of the Cooks River catchment (aquatic ecosystem health, visual amenity, primary and secondary contact recreation) however the WQO "aquatic foods (cooked)" has been omitted. The EIS does not provide a statement of the indicators and trigger values for the relevant environmental values or the practical measures that could be taken to restore or maintain those values. It should also be noted that following section 45(f1) of the POEO Act, the EPA is required to take the environmental values of receiving waters into consideration in its licensing decisions.

Recommendation

The EIS provide:

a) a statement of all relevant WQO and environmental values for the receiving waters relevant to the proposal
b) a statement of the indicators and associated trigger values or criteria for the identified environmental values
c) Demonstration of how the proposal will be designed and operated to:

a. protect the WQOs for receiving waters where they are currently being achieved; and
b. contribute towards achievement of the WQOs over time where they are not currently being achieved.

Clarification regarding reference criteria for the Cooks River and Wolli Creek

The water quality reference criteria for the Cooks River and Wolli Creek includes values for a range of ecosystem types as well as position within the catchment. From this it is unclear which of the trigger values tabulated in Appendix A (if any) are to be applied to each discharge point.

Recommendation

The EPA recommends that the EIS provide clarification on this issue by clearly defining the discharge criteria for each discharge point during construction and operation.

Water Treatment Plants

The EIS states that the water treatment plants would be designed to a minimum standard that would meet the water quality reference criteria provided in Appendix A.

Recommendation

The EIS provide a commitment to treat and discharge polluted groundwater for the operation phase of the project equivalent to or better than the discharge criteria used for the construction phase.

AIR QUALITY

General Comments

An air quality impact assessment for the proposed new M5 as part of the WestConnex project has been prepared (WestConnex Delivery Authority, 2015 *WestConnex New M5, Air Quality Assessment Report,* Prepared by: Pacific Environment, 20 November 2015).

An air quality impact assessment for a road project has a number of data and modelling inputs (e.g. traffic modelling, meteorological data and modelling, vehicle emission estimation, air dispersion model configuration). The EPA's review has focussed on compliance of the air quality impact assessment with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (the Approved Methods) and the vehicle emission estimation techniques. For the purposes of the review, the EPA has assumed all other data and modelling inputs are appropriate and accurate.

WDA (2015) has generally been conducted in accordance with the Approved Methods and indicates the following:

- For expected traffic scenarios, exceedances of EPA's impact assessment criteria were predicted for 1 hour average NO_2, 24 hour average PM_{10}, annual average $PM_{2.5}$ and 24 hour average $PM_{2.5}$. At some receptors exceedances were predicted with and without the project.
- For all pollutants, except air toxics, the predicted concentrations were usually dominated by the existing background contribution.
- For predicted NO_2 concentrations there was a significant contribution from the modelled surface road traffic.
- Under expected traffic conditions the contribution of tunnel ventilation outlets to pollutant concentrations was negligible for all receptors included in the assessment.
- For elevated receptors (10m and 30m), the highest predicted impacts are in the immediate vicinity of the ventilation outlets, particularly at 30m elevation.

The assessment predicts general improvements in air quality along the M5 motorway and General Holmes Drive as a result of the project. This is due to a reduction in traffic volumes and the improved dispersion of emissions through tunnel ventilation outlets. However, a deterioration in air quality is predicted along King

Georges Road to the south of the M5 East Motorway, Stoney Creek Road and Bexley Road to the south of the M5 East Motorway and around the St Peters area, amongst other roads.

The EPA has identified several issues with the air quality impact assessment which are detailed below in **Review of Air Dispersion Modelling** and **Review of Vehicle Estimation Techniques**.

The main issues with the dispersion modelling conducted for the project are outlined in **Review of Air Dispersion Modelling** and include:

- Justification for 1-hour average NO_x to NO_2 conversion methodology;
- Discrepancy between modelled NOx emission and the proposed NOx limit in the regulatory worst case scenario;
- Total NO_2 impacts are not presented for the regulatory worst case scenario;
- Results for the regulatory worst case scenario are not presented for air toxics;
- Analysis of monitoring data and model evaluation are not specific to the new M5 Project;
- Emissions for the Alexandria landfill are smeared throughout the entire year;
- Meteorological data is not fully justified; and
- Only annual average $PM_{2.5}$ is assessed at the elevated receptors.

Review of Vehicle Estimation Techniques includes an analysis of vehicle emission estimation techniques with issues that require addressing. These issues include:

- In tunnel fleet fuel mix;
- In tunnel fixed Light Duty Vehicles fuel mix;
- In tunnel fixed NO_x fraction; and
- In tunnel heavy goods vehicle exhaust particulate factor.

The issues with the in-tunnel NO_2 emissions estimation may be of more significance to the in-tunnel than ambient air quality. Resolution of the above issues is likely to increase predicted in-tunnel NO_2 concentrations. The in-tunnel average NO_2 concentration at capacity traffic is already predicted to be approximately two thirds of the likely in-tunnel limit. The highest maximum in-tunnel NO_2 concentration is predicted to be 0.66 ppm at capacity traffic (Table 9-9 in the Air Quality Assessment). This is approximately equal to 0.33 pm tunnel average assuming concentrations increase linearly along the tunnel. The in-tunnel average NO_2 limit along the length of the tunnel for NorthConnex is 0.5ppm.

Review of Air Dispersion Modelling

1 hour average conversion of NO_X to NO_2

An empirical method was used to convert 1 hour average NO_x to NO_2 concentrations rather than one of the methods listed in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (the Approved Methods). The empirical method is based on data collected at OEH background monitoring sites and RMS roadside sites.

Two different methods were used for community and other receptors:

- At the 'community receptors' (These were particularly sensitive locations within a zone (600 metres either side) along the project corridor, such as schools, child care centres and hospitals), predicted 1 hour NO_x concentrations from the ventilation outlets and surface road were added to a contemporaneous synthetic 1 hour NO_x background file. An upper bound function was then used to give the maximum likely 1 hour average NO_2 concentration for a given 1 hour average NO_X

concentration. Upper bound function for 2014 was determined from monitoring data. For 2021 and 2031, an NO_2/NO_x ratio of 0.16 was assumed and a corresponding function was determined.

- At the 'residential, workplace and recreational (RWR) receptors' (These were all discrete receptor locations along the project corridor, and mainly covered residential and commercial land uses) the 98th percentile background was combined with the maximum predicted concentration. The conversion of NO_x to NO_2 was then based on the upper bound functions used for the community receptors.

The data from all Sydney monitoring sites between 2004 and April 2015 were used to define the upper bound function. Approximately 16% of the data points were for roadside monitoring sites.
A comparison of the results of the 1 hour NO_2 impact assessment with other methods to convert NO_x to NO_2 concentrations was included in the air quality assessment (AQA). The results of the comparison concluded:

- ARM and OLM showed similar annual average impacts; and
- ARM and OLM predicted exceedances of the NO_2 criteria whilst the Project specific method predicted no exceedances.

Background NO_x and NO_2 concentrations are important factors to determine the conversion of NO_x to NO_2. The comparison between the statistical and contemporaneous approach to evaluate the use of 98^{th} percentile background in the statistical method shown in Figure 9-19 is exactly the same as for the M4 East Project. The predicted impacts should be project specific and therefore it is expected that the results for M4 East and the new M5 would look different.

It is also noted that the statistical and contemporaneous comparison for 24-hour average PM_{10} (Figure 9-20) and 24-hour average $PM_{2.5}$ (Figure 9-21) are also exactly the same as the ones presented in M4 East.

Recommendation

The EPA recommends that the justification for the use of 98^{th} percentile background data used in the conversion methodology for NO_2 is updated to be specific to the new M5 project. Additionally, all evaluation of methodology and modelling shown in the figures (e.g. Figures 9-20 and 9-21) and the report should be specific to the new M5 project.

Discrepancy between the modelled NOx emission rate for regulatory worst case scenario and the proposed emission limit

The proposed NOx limit for the regulatory worst case scenario is 20 mg/m^3 which is the same as the limit for NorthConnex. The modelled emission rate for the regulatory worst case scenario at St Peters and Arncliffe is 0.72 kg/h (0.2 g/s) at a flow rate of 100 m^3/s from each ventilation outlet. This equates to 2 mg/m^3 which is well below the proposed 20 mg/m^3.

Recommendation

The EPA recommends the proponent verify the modelled NOx emission rate in the regulatory worst case scenario is the same as the proposed emission limit.

Total NO_2 impacts are not presented for the Regulatory Worst Case scenario

The results for all pollutants for the Regulatory Worst Case scenario are presented as contribution from the ventilation outlets alone. The total impact for all pollutants must be presented so that it can be assessed against the EPA's impact assessment criteria.

It is understood there is difficulty in estimating total NO_2 impacts due to time series information not being available for all receptors. In the M4 East assessment, the total NO_2 impacts were estimated at the top 10 receptors around the ventilation stacks. A similar methodology may be adopted for the new M5 assessment.

Recommendation

For the regulatory worst case scenario, the EPA recommends the proponent provide the total impact (ventilation outlet, surface road and background) at receptors for all pollutants except air toxics.

Results for the regulatory worst case scenario are not presented for air toxics

Regulatory worst case modelling was completed to assess constant ventilation outlet concentrations (at the proposed discharge concentration limits) over a 24-hour period. Two scenarios were included in the regulatory worst case modelling: A) Project only and B) Project and M4-M5 link. The results of the regulatory worst case modelling were only presented at the RWR receptors.
The predicted concentration for speciated air toxics (benzene, polycyclic aromatic hydrocarbons, formaldehyde and 1,3-butadiene) are provided in Appendix K for scenarios not including the regulatory worst case scenario. For the regulatory worst case scenario, the only air toxic results presented were for total hydrocarbon without speciation.

It is not appropriate to compare the change in speciated air toxics to the assessment criteria. The EPA impact assessment criteria for air toxics are incremental, however, this is in recognition of the generally very low levels in 'background' air quality. For this project it is appropriate to compare predicted ventilation outlet plus surface road speciated air toxic concentrations to the assessment criteria.

Recommendation

The EPA recommends the proponent provide predicted impact (ventilation outlet and surface road) at receptors for speciated air toxics.

Analysis of monitoring data and model evaluation are not specific to the new M5

Seven new monitoring sites were established in the new M5 area including 3 monitoring stations at urban background and 4 monitoring stations to characterise roadside. The monitors were established in July/August 2015.

Monitoring data presented in the report was from 2004 to 2014 for OEH monitoring stations and existing M5 monitoring stations. Contemporary monitoring from the newly established monitoring stations for the M4 East and new M5 projects were not included in the background analysis.

Similarly, the assessment states that due to only two months of project-specific monitoring data being available, model evaluation based on the new M5 was not completed. The model evaluation in the M4 East assessment was discussed instead. The roadside data used in the M4 East evaluation was from existing M5 East tunnel monitors (F1 and M1). These sites were established to characterise air quality in the vicinity of the M5 East tunnel portals.

The analysis of background monitoring data is important in characterising and evaluating the new M5 area being assessed. Despite less than a complete year of data collected at the newly established monitoring stations for the M4 East and new M5 projects, the data should be included for discussion as they are most representative of the existing project site.

Recommendation

The EPA recommends the proponent include discussion on the contemporary monitoring data from the newly established sites for completeness and to evaluate model performance based on project specific data.

Emissions for assessment of Alexandria Landfill are smeared over the whole year

Potential impacts from the closure of the existing Alexandria Landfill are assessed as part of the new M5 project. The results indicate there is potential for exceedances of the criteria for annual average $PM_{2.5}$, 24-hour average PM_{10} and odour. Proposed dust mitigation measures include haul road watering, stockpile watering and keeping travel routes of dozers moist.

Emissions were estimated based on annual capacity based on the inventories provided in Tables 8-5 to 8-7. The assessment states that estimated contribution from closure works is based on activities occurring across the entire site continuously 24-hours per day every day of the year. It is noted from the landfill closure management plant (Appendix F of EIS) that landfill closure operations do not occur 24-hours per day.
If emissions were assumed to be operating 24-hours a day based on an annual inventory then there is potential for emissions to have been smeared across the year and underestimated compared to emissions from normal operations or potential worst case.

Recommendation

The EPA recommends the proponent verify the emissions used in the modelling for Alexandria landfill is representative of normal and/or worst case emissions and has not been smeared throughout the year.

Meteorological data used is not fully justified

There is insufficient justification and validation regarding the selection of meteorological station for Graz Mesoscale Model (GRAMM) meteorological modelling. Canterbury Racecourse was used as it was close to the centre of the WestConnex domain. This was stated to be beneficial for the modelling of the later stages of the project.

The validation of Canterbury Racecourse station influenced GRAMM showed poor correlation with the Sydney Olympic Park, Chullora and Rozelle stations. The rationale for not including Chullora and Rozelle stations in GRAMM is the stations are not compliant with Australian Standards. It is inappropriate to use Canterbury Racecourse in the statistical analysis as this is the data that was used to drive GRAMM. Earlwood station is located close to Canterbury Racecourse and has 100% data recovery in 2014 compared to 90% at Canterbury Racecourse. However, Earlwood station was excluded from the validation with no justification provided for the exclusion.

Recommendation

The EPA recommends that the proponent provides justification for the choice of meteorological data used in the meteorological modelling. Similar justification was provided for the M4 East Project and the same level detail is expected for the new M5 as it is a standalone assessment.

Only annual average $PM_{2.5}$ is assessed at the elevated receptors

Potential impacts at elevated receptors are assessed at 10m and 30m. The focus is on annual average $PM_{2.5}$ concentrations in the 2031-DSC scenario. The assessment of elevated receptors did not include short term averages or other pollutants. To ensure adequate protection of human health the assessment of elevated receptors should include other pollutants and shorter averaging periods.

Recommendation

The EPA recommends that the assessment at elevated receptors should include other pollutants and shorter averaging periods.

Review of Vehicle Estimation Techniques

The surface road vehicle emission modelling adopted the EPA motor vehicle emissions inventory model and appears to have been conducted to a good standard and a good validation is provided.

The in-tunnel emissions modelling was conducted using the PIARC methodology which are said to provide emission estimates specifically developed for in-tunnel driving conditions. The methodology and Australian specific emission factors provided by PIARC are based on some key assumptions in terms of fleet fuel type composition and fleet turnover, and provides a projection to 2020 only. NO_2 emission factors are not provided by PIARC. Justification and validation of the base PIARC fleet fuel type composition, NO_2 and other key assumptions is not presented transparently in the EIS. (The traffic mix in terms of passenger vehicles/LDV/HDV is presented and justified adequately). To aid in the transparency and validity of the assessment, information deficiencies set out below should be addressed in the context of the overall assessment methodology, assumption and results.

Fleet fuel type mix

The fleet fuel type mix for passenger vehicles for both the 2021 and 2031 assessment is not stated. The EPA's calculations show that a fixed petrol/diesel fuel mix is used for passenger vehicles for 2021 and 2031. This does not account for the strong growth in diesel vehicle sales that could reasonably be expected to continue, and particularly for SUV vehicles where the diesel share is growing strongly, together with SUV's strong growth in the proportion of new passenger vehicle sales. Light duty diesel vehicles have both a much higher total NO_x emission rate, and the fraction of the NO_x that is NO_2 is also very much higher. The combination of these may result in NO_2 emissions from diesel light duty vehicles up to two orders of magnitude higher than comparable petrol light duty vehicles. Hence it is imperative to base emission calculations on the best possible estimation of the fleet fuel mix.

Recommendation

The proponent should present the disaggregated trends in fuel mix (i.e. passenger cars and SUV separately), the trend in SUV proportion and projections from these to 2031, and verify the in-tunnel NO_2 emissions arising from this fleet mix via a transparently documented sensitivity analysis for both 2021 and 2031.

Trends of new light diesel vehicle sales

The petrol/diesel mix for LDV adopts the PIARC default assumption of 50%/50% for both the 2021 and 2031 assessments. This is very likely to underestimate the proportion of light diesel vehicles in 2031, which the EPA estimates to be greater than 80% diesel in 2031 as compared to the base PIARC assumption of 50%. Given the higher NO_x and higher fNO_2 of light duty diesel vehicles relative to petrol vehicles, this may cause an underestimation of LDV NO_2 emissions.

Recommendation

The proponent should present the trends in fuel type of new LDV sales and a projection of this to 2031 and verify the in-tunnel NO_2 emissions arising from this fleet mix via a transparently documented sensitivity analysis for both 2021 and 2031.

Fleet fuel profile

The documentation of the NO_2 fraction (fNO_2) in section 9.3 of Appendix L to Appendix H indicates a fixed NO_2 fraction (fNO_2) is applied to the PIARC NO_x estimates for 2021 and 2031, based on a single reference. This approach is not considered best practice as it will not respond to changing fleet technology into the future, or to changing fuel mixes.

Some clarification presented in the submission report for the WestConnex M4 East EIS has confirmed that a fleet age profile was used to determine age specific fNO_2 based on the assumed emission certification of each model year vehicle. This information is also expected to be presented for the new M5 as it is a standalone assessment. However it is not clear what year the age profile was applied to in order to derive the fleet average fNO_2 presented in table 9.2.

Recommendation

The proponent should reassess the fNO_2 based on the reassessment of the fleet fuel profile per **Fleet fuel type mix** and **Trends of new light diesel vehicle sales** above for both 2021 and 2031, taking into account the age profile and consequent emission certification, noting that the diesel age profile is likely to be different to the petrol due to the rapid increase in the diesel vehicle sales.

Further the rigour of using one reference to source fNO_2 is debateable. The reference used draws its data from a remote sensing study that measured an instantaneous snapshot of vehicle emissions under a limited range of conditions. Other European data sources provide fNO_2 based on representative real world drive cycles and these should be referred to for comparison to the remote sensing data in order to ensure the most robust fNO_2 is applied.

It is noted that a more appropriate approach was taken for the surface road modelling which could have been adopted for the in-tunnel emission estimation.

Heavy goods vehicle exhaust emission factors

The heavy goods vehicle HGV exhaust emission factors used in the in-tunnel emissions estimation are 80% below that provided by PIARC for NO_2 and PM, and varying amounts below the PIARC figures for CO. No mention is made of an adjustment to the base PIARC emission factors in the text.

Recommendation

The EPA recommends that the reason for this variation should be provided and justified, along with a detailed description and reference to the methodology used.

Off Road Diesel Emissions

The environmental impacts associated with off road diesel equipment can be a major source of fine particles.

Recommendation

The EPA recommends that the proponent assess the environmental impacts associated with heavy vehicles including off road diesel equipment and plant used in the construction of the project. This should include but is not limited to:

- Compliance with relevant and current emission standards as prescribed in Australian design Rules for heavy duty engines and vehicles.
- Strategies for minimising air emissions from off road diesel equipment including but not limited to graders, bulldozers, loaders etc.
- Confirmation that all off road diesel equipment will meet best available diesel emissions standards or be fitted with an appropriate diesel exhaust treatment device where possible.

NOISE and VIBRATION

The EPA has the following comments on the Technical Working Paper that forms Appendix J of Volume 2D of the EIS:

Construction Noise and Vibration Management Plan

- The NVIA predicts noise and vibration impacts from construction works that are typical for this type of significant infrastructure project. An appreciable portion of the surrounding community is expected to be significantly impacted from time to time by many of the project's construction activities including demolition, clearing, earthworks, tunnelling, etc. Worst case exceedances of the construction noise management levels of greater than 25 decibels are flagged for some activities, with many receivers being highly noise affected, particularly when works are in close proximity. Impacts are also predicted from ground borne noise, vibration affecting human comfort, and disturbance to sleep.

- To address these impacts, the Technical Working Paper proposes mitigation and management measures in general terms, outlined in Section 7.2 and 7.3. The NVIA states in Section 7.1 that a Construction Noise and Vibration Management Plan (CNVMP) is to be developed, which will provide further detail on how a range of noise and vibration issues will be addressed in terms of impacts, mitigation and management. These issues include (but are not limited to):
    - Ground-borne noise from tunnelling;
    - Cumulative construction noise;
    - Out-of-hours works;
    - Sleep disturbance; and
    - General construction works.

  As the predicted impacts are significant, additional information on the impacts and mitigation measures should be provided at the EIS stage, and prior to any approval, rather than deferred to a post-approval management plan to enable appropriate consent conditions to be developed. The information to be provided should include, at a minimum, specific noise and vibration mitigation and management measures to be implemented for each activity and location together with an assessment of their mitigation performance at sensitive receivers. Details are required for an appropriate level of assessment of the likely impacts of the project to be made, the feasibility and reasonableness of any proposed mitigation and management measures, and their effectiveness in reducing impacts.

Notwithstanding the above, the EPA has provided recommended conditions of approval as below, which are consistent with conditions on project approvals for other similar transport infrastructure projects.

Recommendation

The EPA recommends that the Department of Planning and Environment includes in any approval given for the project:
- the recommended conditions provided below
- compliance assessment conditions which require additional noise mitigation measures to be implemented if predicted noise or vibration levels are exceeded.

Recommended Conditions of Approval

Noise

Recommended construction noise conditions

1. Any blasting associated with construction works shall comply with the Australian and New Zealand Environment Council (ANZEC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (1990).*

Construction Noise & Vibration Levels

2. Construction Noise Management Levels (CNML) shall be established using the *Interim Construction Noise Guideline* (DECCW, 2009). Vibration criteria shall be established using *Assessing Vibration: a technical guideline* (DEC, 2006). Any construction activities identified as exceeding the CNML and/or vibration criteria shall be managed in accordance with the Construction Noise and Vibration Management Plan (CNVMP) required by this approval. The Proponent shall implement all reasonable and feasible noise mitigation measures with the aim of achieving the CNMLs and vibration criteria.
   NOTE: The ICNG (DECCW, 2009) identifies 'particularly annoying' activities that require the addition of 5dB(A) to the predicted level before comparing to the CNML.

2. Prior to commencement of works, the proponent shall undertake a detailed land use survey to identify potentially critical working areas (e.g. hospital operating theatres, precision laboratories etc.) that are sensitive to vibration and ground-borne noise impacts. A specific plan of management, where relevant, shall be submitted to, and approved by, the Secretary outlining the proposed mitigation for both construction and operational impacts. The outcomes of specific consultation with affected receivers shall be reported.

3. The proponent shall undertake noise monitoring during high noise generating activities (such as piling, rock hammering, jack hammering) to accurately establish the L_{Aeq} to $L_{A1(1minute)}$ differential and number of potentially affected residences, and adapt management and mitigation measures as necessary to ensure sleep disturbance impacts are minimised.

4 Wherever feasible and reasonable, piling activities shall be undertaken using quieter alternative methods than impact or percussion piling, such as bored piles or vibrated piles.

5. During construction, affected educational institutions shall be consulted and feasible and reasonable steps taken to ensure that noise generating construction works in the vicinity of affected buildings are not timetabled during examination periods where practicable, unless other reasonable arrangements to the affected institutions are made at no cost to the affected institution.

6. The proponent is to ensure that construction vehicle contractors operate so as to minimise any potential sleep disturbance impacts. Measures that could be used include toolbox talks, contracts that include provision for dealing with unsatisfactory noise performance for the vehicle and/or operator, and specifying non-tonal movement alarms in place of traditional reversing beepers or other alternatives such as reversing cameras or proximity alarms, or a combination of these, where tonal alarms are not mandated by legislation.

Construction Noise and Vibration Management Plan

7. Prior to commencement of construction, the Proponent shall submit to, and have approved by, the Secretary, a Construction Noise and Vibration Management Plan (CNVMP) consistent with the guidelines contained in the *Interim Construction Noise Guidelines* (DECCW, 2009) to detail how construction noise and vibration impacts would be minimised and managed across the project. The CNVMP will provide further specific detail on how a range of noise and vibration issues will be addressed, including (but not limited to):

   - Ground-borne noise from tunnelling;
   - Cumulative construction noise and 'construction fatigue';
   - Out-of-hours works;

- Construction traffic;
- Sleep disturbance; and
- General construction works.

The CNVMP shall include, but not be necessarily limited to:

a) identification of sensitive noise receivers likely to be impacted by construction noise and vibration;
b) identification of applicable CNMLs, vibration criteria and ground-borne noise levels, as relevant;
c) details of construction activities and a schedule for construction works for each work site;
d) identification of construction activities that have the potential to generate noise and/or vibration levels exceeding the relevant criteria;
e) a detailed description of what feasible and reasonable actions and measures would be implemented to ensure, to the greatest extent practicable, that these works would comply with the relevant noise and vibration criteria/ guidelines or impacts mitigated by other means;
f) procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity, as well as procedures for dealing with and responding to noise complaints; and
g) a description of how the effectiveness of these actions and measures would be monitored during the proposed works, clearly indicating how often this monitoring would be conducted, how the results of this monitoring would be recorded; and, corrective preventative actions if any non-compliance is detected.

Construction ground-borne noise and vibration limits

8. Reasonable and feasible noise mitigation measures shall be applied to construction activities when the following residential ground-borne noise levels are exceeded;
   - Evening (6pm to 10pm – Internal $L_{Aeq(15min)}$ 40dB(A)
   - Night-time (10pm to 7am) – Internal $L_{Aeq(15min)}$ 35dB(A)

   The mitigation measures shall be included in the CNVMP required under condition 11.

9. Any work generating high noise impact must only be undertaken:
   (a) between the hours of 8:00am and 6:00pm Monday to Friday;
   (b) between the hours of 8:00am and 1:00pm Saturday; and
   (c) in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers;

   For the purposes of this condition 'continuous' includes any period during which there is less than a 1 hour respite between ceasing and recommencing any of the work the subject of this condition

Recommended operational noise conditions

10. The project shall be designed and operated with the objective of not exceeding the road noise criteria outlined in the *NSW Road Noise Policy* (DECCW, 2011).

11. Where feasible and reasonable, operational noise mitigation measures shall be implemented at the start of construction (or at other times during construction) to minimise construction noise impacts.

Operational noise mitigation review

12. Unless otherwise agreed by the Secretary, within 6 months of commencing construction, the Proponent shall, in consultation with the EPA, prepare and submit for the approval of the Secretary, a review of the operational noise mitigation measures proposed to be implemented for the project. The review shall:
    (a) confirm the operational noise predictions of the project based on detailed design. This operational noise assessment shall be based on an appropriately calibrated noise model (which has incorporated additional noise monitoring, where necessary for calibration purposes);
    (b) review the suitability of the operational noise mitigation measures identified in the Preferred Infrastructure Report to achieve the criteria outlined in the Road Noise Policy (DECCW, 2011), based on the operational noise performance of the project predicted under (a) above; and
    (c) where necessary, investigate additional feasible and reasonable noise mitigation measures to achieve the criteria outlined in the *NSW Road Noise Policy* (DECCW, 2011).

Operational noise report

13. Within 12 months of the commencement of operation of the project, or as otherwise agreed by the Secretary, the Proponent shall undertake operational noise monitoring to compare actual noise performance of the project against noise performance predicted in the review of noise mitigation measures required by condition 14, and prepare an Operational Noise Report to document this monitoring. The Report shall include, but not necessarily be limited to:

    (a) noise monitoring to assess compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under condition 14;
    (b) a review of the operational noise levels in terms of criteria and noise goals established in the *NSW Road Noise Policy* (EPA, 2011);
    (c) methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which project noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers;
    (d) details of any complaints and enquiries received in relation to operational noise generated by the project between the date of commencement of operation and the date the report was prepared;
    (e) any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and proportions;
    (f) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures; and
    (g) identification of additional feasible and reasonable measures to those identified in the review of noise mitigation measures required by condition C14, that would be implemented with the objective of meeting the criteria outlined in the *NSW Road Noise Policy* (EPA, 2011), when these measures would be implemented and how their effectiveness would be measured and reported to the Secretary and the EPA.

    The Proponent shall provide the Secretary and the EPA with a copy of the Operational Noise Report within 60 days of completing the operational noise monitoring referred to in (a) above or as otherwise agreed by the Secretary.

Fixed operational facilities

14. All fixed facilities associated with the project shall be designed and operated, where feasible and reasonable, to satisfy project specific noise levels (PSNL) derived from the *New South Wales Industrial Noise Policy* (INP, DECCW, 2000) and acceptable vibration levels presented in *Assessing Vibration: a technical guideline* (DECCW, 2006).

Prior to operational commissioning of the above facilities, the proponent shall submit an Operational Noise and Vibration Review based on detailed design to, and have approved by, the Secretary. The Review shall identify the PSNL and acceptable vibration levels applicable to each facility and the means by which the noise and vibration levels will be satisfied. Where the noise and vibration levels cannot be achieved, the assessment shall present an analysis of feasible and reasonable noise and vibration mitigation measures, and the 'best practice' achievable noise and vibration outcome for each facility.