

Part

B

Response to key stakeholder submissions

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B Response to key stakeholder submissions

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B1 NSW Health

This chapter addresses issues raised by NSW Health.

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B1.1 Air quality

Refer to Chapter 9 (Air quality) and Appendix I (Technical working paper: Air quality) of the Environmental Impact Statement (EIS) for details of air quality.

B1.1.1 Models used to assess air quality impacts

The models used to assess air quality impacts are consistent with those used previously on Stage 1b and Stage 2 and were considered adequate.

Response

The comments received from NSW Health on the air quality modelling and assessment in the EIS are noted.

B1.1.2 Minimising exposure to traffic related air pollution

Exposure to traffic related air pollution has been shown in epidemiological and clinical studies to be associated with a range of cardiovascular and respiratory health outcomes. There is also little evidence of any threshold below which exposure to components of traffic related air pollution are not associated with adverse health effects. For these reasons, it is important that all reasonable measures are taken to minimise exposure to traffic related air pollution where feasible.

Consistent with this, the National Health and Medical Research Council (NHMRC) 2008 report *Air quality in and around traffic tunnels* concludes that it is good practice to limit, as far as possible, exposure to traffic related air pollution in and around tunnel portals and stacks. NSW Health supports this position and this is reflected in the comments provided in this submission.

Response

Environmental management measures, including those associated with air quality impacts during operation of the project, are provided in **Chapter E1** (Environmental management measures).

The transfer of traffic from surface roads to tunnels would minimise exposure to traffic emissions, as the practice of exhausting emissions from elevated ventilation outlets at appropriate velocities is a more effective dispersion mechanism than ground-level dispersion from surface roads. In addition, emissions from the portals of major Sydney road tunnels opened since 1998 is not permitted and so the air is drawn back from portals and is emitted through the nearest ventilation outlet. The outlets for the project have been subject to sensitivity testing to determine the height appropriate for effective dispersion while meeting the requirements for aviation safety.

The human health risk assessment undertaken for the project in relation to air quality (refer to Appendix K (Technical working paper: Human health risk assessment) of the EIS), followed national guidelines and addressed requirements of key government agencies, including NSW Health. The assessment determined that as the majority of the project footprint would be underground, the operation of the project is predicted to result in a decrease in total pollutant levels in the community, with a redistribution of vehicle emissions associated with redistribution of the traffic on surface roads. For much of the community this would result in no change or a small improvement (ie decreased concentrations of pollutants and associated health impacts), however for some areas located near key surface roads, a small increase in pollutant concentration may occur as a result of redistribution of traffic on surface roads. Refer to Chapter 6 of Appendix K (Technical working paper: Human health risk assessment) of the EIS for further details.

B1.1.3 Filtration of in-tunnel air

The EIS sets out reasons why filtration of in-tunnel air prior to ejection from ventilation stacks is not feasible or reasonable for this project (Appendix I, pages 232-240). The reasons relate to lack of effectiveness of the technology where it is in use in other countries, minimal impact on air quality, and cost. These conclusions are consistent with those in the *Initial Report on Tunnel Air Quality* of the Advisory Committee on Tunnel Air Quality, which has previously been established to provide the NSW Government with an understanding of the scientific and engineering issues informing road tunnel ventilation design and operation. It is important that the justification for not having filters in ventilation stacks is clearly communicated to community.

Response

NSW Health's comment regarding the non-filtration of the ventilation outlets and the need for clear communication with the community is noted. Filtration is discussed in section 9.2.2 of Appendix I (Technical working paper: Air Quality) of the EIS and in the responses to community submissions in **Chapter C09** (Air quality).

B1.1.4 Sensitivity tests

No sensitivity tests were conducted for the air quality modelling and assessment. The reason provided in the EIS for not doing sensitivity tests was that the parameters for the sensitivity tests conducted for previous WestConnex projects (M4 East and New MS [M5]) were very similar to that for the M4-M5 Link project, and therefore the outcomes for the previous sensitivity tests would also apply to the M4-M5 Link project. Outcomes of sensitivity tests for a parameter such as ventilation outlet temperature may be similar between projects. However, for parameters such as ventilation outlet height and the inclusion of buildings near ventilation heights, which will have site specific effects on air quality, the outcomes of sensitivity tests may differ between projects. Sensitivity tests related to these parameters resulted in changes to air pollutant concentrations by a factor of 1.3 to 1.5 for previous WestConnex projects. Changes of this magnitude could significantly change outcomes of the human health risk assessment. Sensitivity tests should be conducted for assessment of air quality related to the M4-M5 Link project.

Response

Sensitivity tests have been conducted in response to the comments received from NSW Health in its submission on the EIS to investigate the effects of varying important model parameters on the predicted concentrations around project ventilation outlets. For each parameter, the value used in the Graz Lagrangian Model (GRAL) was varied around a central estimate that was representative of the value used in the EIS.

The following model inputs were investigated:

- The influence of ventilation outlet temperature
- The influence of ventilation outlet height
- The inclusion of buildings near tunnel ventilation outlets.

The sensitivity tests were only conducted for the ventilation outlet contribution (ie background and surface road contributions were excluded), for maximum 24-hour $PM_{2.5}$ and annual mean $PM_{2.5}$, to assess the effects of the outlet parameters on dispersion of the emissions. $PM_{2.5}$ was used as an indicator of changes in response to the outlet parameters because of its importance to human health.

The tests were mainly conducted for a sub-area (the Rozelle domain) of the M4-M5 Link GRAL domain as presented in the EIS, of approximately three kilometres by three kilometres around the Rozelle ventilation facility (outlet H for the Western Harbour Tunnel, and outlets I and J for the M4-M5 Link/Iron Cove Link), as shown in **Figure B1-1**. Because there are few large buildings in this Rozelle domain, additional tests to examine the effects of buildings on pollution dispersion were undertaken for a similar domain around the northern outlet for the Iron Cove Link (outlet L) (see **Figure B1-2**). The building tests for the Rozelle and Iron Cove Link domains demonstrate the differences between the generally small and scattered buildings in the Rozelle domain and the higher density of buildings in the Iron Cove Link domain. Not all buildings in the Rozelle domain building test were included in the Iron Cove Link domain test as they were considered to be too far away to be significantly affected by the Iron Cove Link outlet. The effects of outlet temperature and height were not considered for the Iron Cove Link domain.

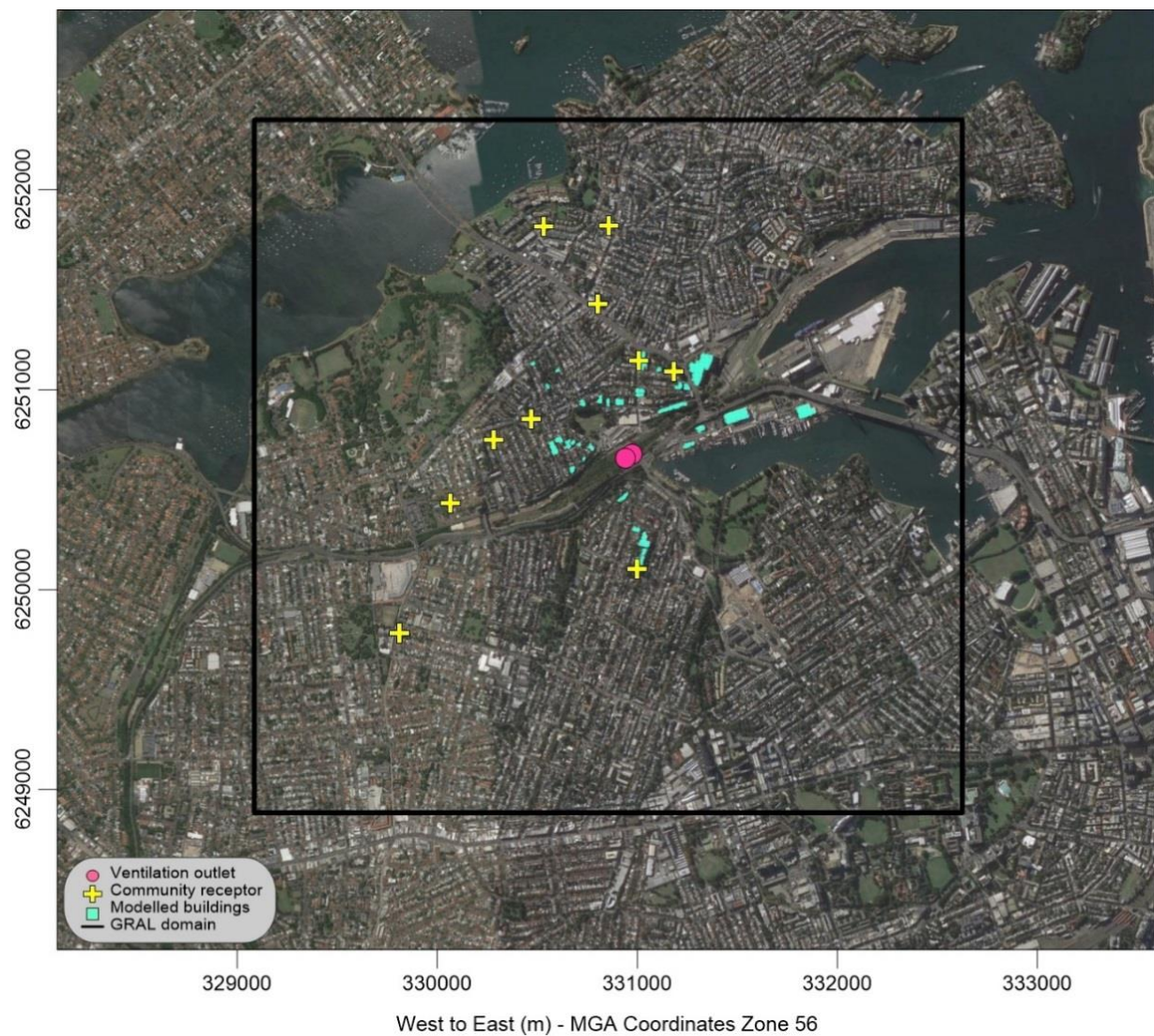


Figure B1-1 Domain and buildings for Rozelle sensitivity tests

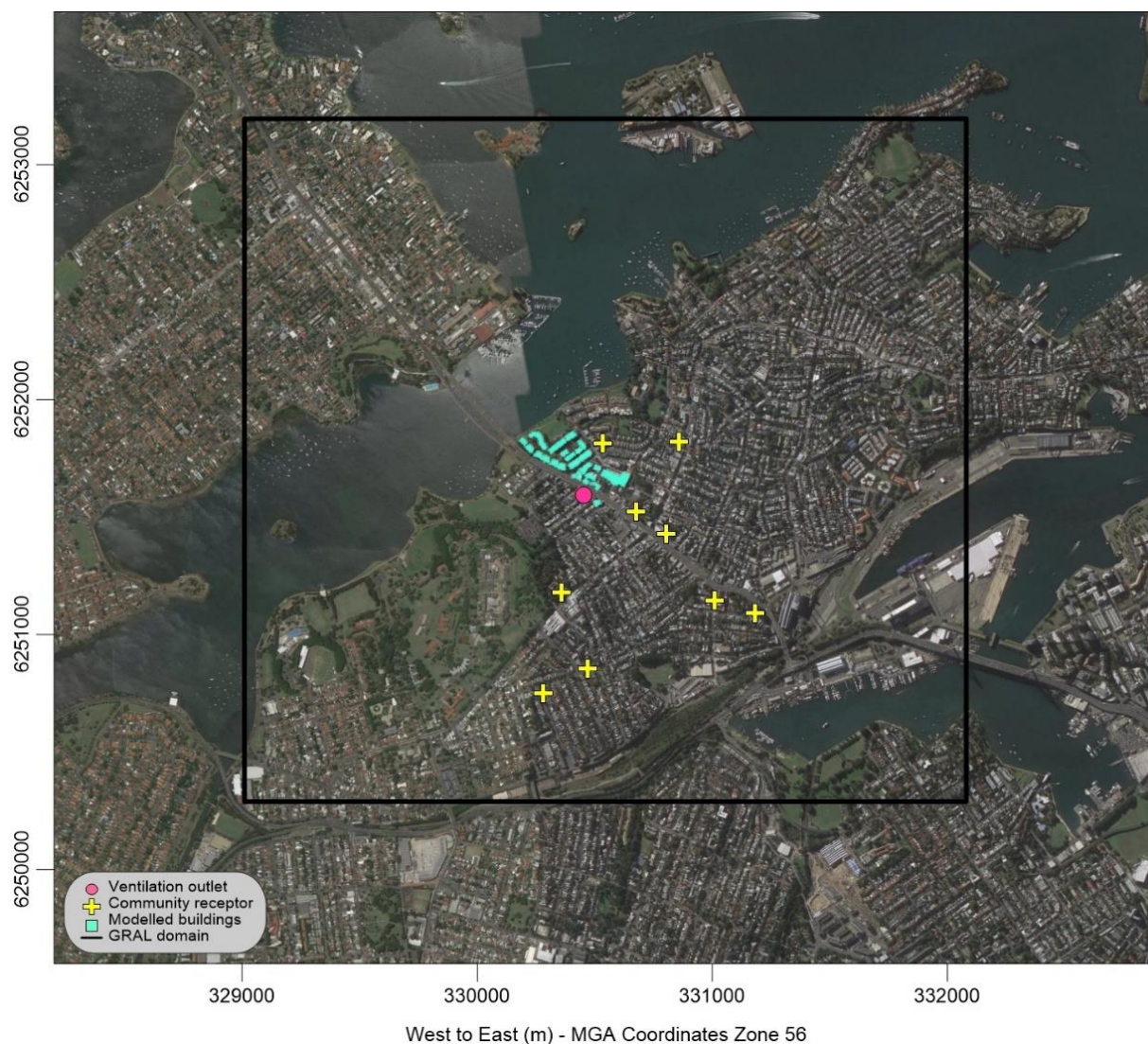


Figure B1-2 Domain and buildings for Iron Cove Link building sensitivity tests

Model predictions for these sensitivity tests were considered for 10 community receptors in the Rozelle domain and nine community receptors in the Iron Cove Link domain, as listed in **Table B1-1**. These community receptors were also used in the air quality assessment (refer to Chapter 9 (Air quality) of the EIS).

Table B1-1 Community receptors included in sensitivity tests

Rozelle domain		Iron Cove Link domain	
ID	Location	ID	Location
CR01	Lilyfield Community Centre	CR01	Lilyfield Community Centre
CR02	Balmain Cove Early Learning Centre	CR02	Balmain Cove Early Learning Centre
CR03	Rosebud Cottage Child Care Centre	CR03	Rosebud Cottage Child Care Centre
CR04	Sydney Community College	CR04	Sydney Community College
CR05	Rozelle Total Health	CR05	Rozelle Total Health
CR16	Sydney Secondary College Leichhardt Campus	CR15	Rozelle Child Care Centre
CR18	Inner Sydney Montessori - Lilyfield	CR22	St Thomas Child Care Centre
CR21	St Basil's Sister Dorothea Village	CR31	Rozelle Public School
CR22	St Thomas Child Care Centre	CR32	Lilyfield Early Learning Centre
CR32	Lilyfield Early Learning Centre		

Ventilation outlet temperature

In the air quality assessment, a single annual average temperature was used in GRAL for each tunnel ventilation outlet. For ventilation outlet temperature, the central estimate for Rozelle (test TT02) was taken to be 22°C. The effects of defining outlet temperatures 10°C below and above this value were then investigated. In temperature test TT01, the outlet temperature was set to 12°C, and in temperature test TT03, the outlet temperature was set to 32°C. This temperature range of 20°C is larger than the variation in temperature of the air from existing tunnels in Sydney. For example, for the Cross City, Lane Cove and M5 East tunnels, the difference between the minimum and maximum outlet temperatures during the course of a year is typically between around 12°C and 17°C respectively.

As expected, for the outlet temperature of 12°C, the predicted PM_{2.5} concentrations were systematically higher than those in the central estimate as a consequence of the reduced thermal buoyancy of the plume, which leads to poorer dispersion. However, predicted outlet contributions remain very low relative to the background and surface road traffic contributions.

For the outlet temperature of 32°C, the predicted PM_{2.5} concentrations were systematically lower than those in the central estimate because of increased thermal plume buoyancy which increases dispersion.

Table B1-2 shows the results of the sensitivity test for outlet temperatures for the Rozelle domain.

The tests for different outlet temperatures show that the changes as a result of differing outlet temperatures would not change the outcome of the air quality assessment presented in the EIS as the contributions of the ventilation outlets remain extremely low. For example, for the 12°C test, the highest predicted concentration to 24-hour PM_{2.5} is 3.4 per cent of the criterion and the highest predicted concentration to annual mean PM_{2.5} is 1.7 per cent of the criterion.

Table B1-2 Results of sensitivity tests for outlet temperature (Rozelle domain) – predicted concentrations

ID	Location	PM _{2.5} (µg/m ³)					
		TT01 (12°C)		TT02 (22°C)		TT03 (32°C)	
		Max 24h	Annual	Max 24h	Annual	Max 24h	Annual
		Impact assessment criteria					
		25	8	25	8	25	8
CR01	Lilyfield Community Centre	0.700	0.137	0.482	0.102	0.369	0.082
CR02	Balmain Cove Early Learning Centre	0.314	0.063	0.308	0.056	0.272	0.050
CR03	Rosebud Cottage Child Care Centre	0.465	0.068	0.309	0.049	0.261	0.039
CR04	Sydney Community College	0.629	0.117	0.473	0.086	0.359	0.066
CR05	Rozelle Total Health	0.362	0.061	0.343	0.053	0.287	0.047
CR16	Sydney Secondary College Leichhardt Campus	0.371	0.056	0.338	0.049	0.298	0.043
CR18	Inner Sydney Montessori, Lilyfield	0.596	0.097	0.496	0.084	0.452	0.072
CR21	St Basil's Sister Dorothea Village	0.495	0.065	0.349	0.043	0.249	0.031
CR22	St Thomas Child Care Centre	0.676	0.121	0.561	0.098	0.486	0.082
CR32	Lilyfield Early Learning Centre	0.839	0.096	0.551	0.075	0.455	0.061

Ventilation outlet height

For the ventilation outlet heights, the central estimate for Rozelle (HT02) was taken to be 35 metres above existing ground level (the outlet height used in the EIS). In height test HT01, the height was set to 30 metres above existing ground level, and in height test HT03, the height was set to 40 metres above existing ground level. This was considered to be a realistic potential range for the outlet height at this location.

For the outlet height of 30 metres, the predicted $PM_{2.5}$ concentrations were systematically higher than those for the 35 metre outlet. The largest increase in the concentration from a 30 metre ventilation outlet was 19 per cent, compared to the current proposed 35 metre outlet. However, the predicted outlet contributions remain small percentages of the air quality criteria for $PM_{2.5}$ and of the background air quality.

For the outlet height of 40 metres, the predicted $PM_{2.5}$ concentrations were in most cases lower than those for the 35 metre outlet. The largest decrease at any community receptor was 27 per cent and the average decrease was 11 per cent. However, these percentage changes are only percentages of around one per cent of the background air quality. Again, the contribution from the ventilation outlet is very small compared to the criteria and the background air quality.

The results for different outlet heights are shown in **Table B1-3**.

Table B1-3 Results of sensitivity tests for outlet height (Rozelle domain) – predicted concentrations

ID	Location	PM _{2.5} (µg/m ³)					
		HT01 (30m)		HT02 (35m)		HT03 (40m)	
		Max 24h	Annual	Max 24h	Annual	Max 24h	Annual
		Impact assessment criteria					
		25	8	25	8	25	8
CR01	Lilyfield Community Centre	0.549	0.115	0.507	0.104	0.411	0.096
CR02	Balmain Cove Early Learning Centre	0.311	0.058	0.291	0.056	0.276	0.054
CR03	Rosebud Cottage Child Care Centre	0.353	0.055	0.327	0.049	0.274	0.045
CR04	Sydney Community College	0.564	0.099	0.472	0.085	0.391	0.075
CR05	Rozelle Total Health	0.359	0.057	0.337	0.054	0.294	0.050
CR16	Sydney Secondary College Leichhardt Campus	0.344	0.051	0.323	0.048	0.304	0.048
CR18	Inner Sydney Montessori, Lilyfield	0.564	0.089	0.508	0.084	0.450	0.079
CR21	St Basil's Sister Dorothea Village	0.399	0.046	0.353	0.042	0.312	0.041
CR22	St Thomas Child Care Centre	0.653	0.106	0.580	0.099	0.485	0.089
CR32	Lilyfield Early Learning Centre	0.717	0.083	0.626	0.075	0.511	0.071

Buildings

Buildings can be included in dispersion modelling to account for building wake effects in the vicinity of ventilation outlets. However for the project assessment, buildings were excluded (the rationale for this was provided in section 8.4.6 of Appendix I of the EIS). The sensitivity of the inclusion of buildings to predicted concentrations was therefore assessed in response to NSW Health's submission on the EIS. As noted earlier, the effects of buildings were tested for both the Rozelle and Iron Cove Link domains. The buildings included in the tests are shown by light blue shading in **Figure B1-1** and **Figure B1-2**.

The results for the Rozelle domain are given in **Table B1-4**. These show that although there were increases in the concentrations associated with the ventilation outlets due to the inclusion of buildings in the sensitivity tests, the outlet contributions remained very small relative to the criteria.

The results for the Iron Cove Link domain are given in **Table B1-5**. This table also shows that there were increases in the concentrations associated with the ventilation outlets; however the outlet contributions remained very small relative to the criteria.

Although there are localised increases at some receptors with buildings included, the largest increases for a receptor with buildings included is 64 times less than the criterion for 24-hour $PM_{2.5}$ and 155 times less than the criterion for annual mean $PM_{2.5}$. The total predicted concentrations, and the conclusions of the assessment, would not change significantly with the inclusion of buildings.

Table B1-4 Results of sensitivity tests for buildings (Rozelle domain) – predicted concentrations

ID	Location	PM _{2.5} (µg/m ³)			
		BT01 (with buildings)		BT02 (without buildings)	
		Max 24h	Annual	Max 24h	Annual
		Impact assessment criteria			
		25	8	25	8
CR01	Lilyfield Community Centre	0.634	0.131	0.491	0.103
CR02	Balmain Cove Early Learning Centre	0.333	0.066	0.315	0.059
CR03	Rosebud Cottage Child Care Centre	0.482	0.081	0.369	0.059
CR04	Sydney Community College	0.871	0.138	0.481	0.086
CR05	Rozelle Total Health	0.357	0.061	0.341	0.054
CR16	Sydney Secondary College Leichhardt Campus	0.338	0.052	0.329	0.048
CR18	Inner Sydney Montessori, Lilyfield	0.539	0.089	0.500	0.081
CR21	St Basil's Sister Dorothea Village	0.456	0.056	0.343	0.042
CR22	St Thomas Child Care Centre	0.660	0.118	0.552	0.098
CR32	Lilyfield Early Learning Centre	0.752	0.082	0.645	0.076

Table B1-5 Results of sensitivity tests for buildings (Iron Cove Link domain) – predicted concentrations

ID	Location	PM _{2.5} (µg/m ³)			
		BT01 (with buildings)		BT02 (without buildings)	
		Max 24h	Annual	Max 24h	Annual
		Impact assessment criteria			
		25	8	25	8
CR01	Lilyfield Community Centre	0.056	0.007	0.050	0.006
CR02	Balmain Cove Early Learning Centre	0.200	0.027	0.122	0.018
CR03	Rosebud Cottage Child Care Centre	0.053	0.008	0.045	0.007
CR04	Sydney Community College	0.066	0.010	0.056	0.008
CR05	Rozelle Total Health	0.123	0.014	0.083	0.009
CR15	Rozelle CCC	0.105	0.014	0.084	0.011
CR22	St Thomas Child Care Centre	0.130	0.018	0.095	0.012
CR31	Rozelle Public School	0.191	0.024	0.122	0.015
CR32	Lilyfield Early Learning Centre	0.066	0.010	0.056	0.008

Summary of sensitivity tests

In the outlet temperature tests for the Rozelle domain, even with a significant change in temperature relative to the central estimate, the predicted outlet contributions to PM_{2.5} remained small in absolute terms. Consequently, the total predicted concentration (including the background, surface road and ventilation outlet contributions) is unlikely to be affected significantly. The assumption of a single annual average temperature in the GRAL dispersion model was therefore considered unlikely to represent a large source of uncertainty in the overall predictions.

The results for the ventilation outlet height tests for the Rozelle domain were broadly similar to those for the temperature sensitivity tests, and again a difference in height of the order tested is unlikely to represent a large source of uncertainty in the overall predictions.

The building tests for the Rozelle and Iron Cove Link domains indicated that the exclusion of buildings is also unlikely to represent a large source of uncertainty in the overall predictions in the assessment, given the small absolute contribution to PM_{2.5}. Although there are localised increases at some receptors with buildings included the largest increases for a receptor with buildings included is 64 times less than the criterion for 24-hour PM_{2.5} and 155 times less than the criterion for annual mean PM_{2.5}. The total predicted concentrations, and the conclusions of the assessment, would not change significantly with the inclusion of buildings.

The project has been designed for the central cases used in the sensitivity tests, not the high or low cases. The tests were conducted to demonstrate the influence of the separate factors of outlet height, temperature and the inclusion of buildings in the modelling domain. The tests demonstrate that the ventilation outlets have been designed to minimise air quality impacts, with consideration of the requirements for urban design and aviation safety, and secondly that the dispersion of pollutants is not significantly affected by the exclusion of buildings in the dispersion model.

B1.1.5 Air quality impacts from construction

Dust generated during construction activities can impact the health of nearby residents. It is important that dust emissions are mitigated according to best practice procedures and that dust management reduces exposure by residents near construction activities. The EIS refers to a *Construction Air Quality Management Plan*, however as the plan is not yet available NSW Health is unable to comment on its adequacy. The plan should be reviewed by the appropriate regulatory authority and NSW Health prior to the commencement of any construction related to the M4-M5 Link project. Dust mitigation measures should be subject to regular monitoring. Community members should be notified in advance of activities likely to generate substantial dust, and mitigation measures and options for reducing or avoiding exposure be made available and be accessible. This is especially important as some residents may be exposed for prolonged periods given the time periods of construction.

Response

A Construction Air Quality Management Plan will be prepared for the project in accordance with the conditions of approval imposed by the NSW Department of Planning and Environment (DP&E) and will include the relevant environmental management measures for the control of dust that are presented in **Chapter E1** (Environmental management measures). These include dust suppression techniques when undertaking activities likely to generate dust in close proximity to sensitive receivers, covering vehicle loads, tunnelling and spoil handling within acoustic sheds, as well as implementing controls such as wheel washes and rumble grids.

This plan will be prepared in consultation with relevant stakeholders as required by the conditions of approval for the project.

B1.2 Human health

Refer to Chapter 11 (Human health risk) and Appendix K (Technical working paper: Human health risk assessment) of the EIS for details of air quality.

B1.2.1 Approach used for the human health assessment

NSW Health is satisfied that for this particular project the HHRA has used a generally appropriate approach for the assessment of human health.

Response

NSW Health's comment on the human health risk assessment undertaken for the project are noted.

B1.2.2 Operational air quality impacts external to tunnels

The human health risk assessment (HHRA) of the environmental impact statement (EIS) has identified potential human health risks associated with air quality related to operation of the M4-M5 Link that it defines as unacceptable (greater than 1 in 10,000). The EIS does not describe in detail project design or mitigation options that were considered to reduce health risks at those locations where unacceptable health risks were identified. Consideration should be given to ways to mitigate these potential impacts as well as putting in place controls to prevent residential use of land within these areas or at these elevations.

Response

The specific locations of concern are addressed in the responses in **section B1.2.3** and **section B1.2.4**.

B1.2.3 Industrial location near Sydney Airport

Potential unacceptable health risks were identified in an industrial/workplace area. The EIS states that the health risks may be lower at this location because exposure may occur only during work hours. However, the amount of time that an individual could spend at a workplace or industrial site may not be as modelled. It is important that consideration be given to how to mitigate these effects through options such as improved traffic management as the impacts appear to be largely due to surface road congestion.

The EIS considered it 'not relevant to evaluate future residential exposures at this location' because it was considered unlikely that the location of concern near Sydney Airport would be rezoned for residential use. Given the recent substantial building of residential apartment blocks near to Sydney Airport, consideration should be given to implementing controls on future rezoning for residential purposes especially if mitigation of the air quality impacts is not feasible.

Response

The health risk calculated at this location for a single commercial receptor is a result of the forecast emissions from the surface road that is part of the indicative Sydney Gateway design (refer to Appendix K (Technical working paper: Human health risk assessment) of the EIS). Given the uncertainty of the design for the proposed future Sydney Gateway project, these results are likely to be unrealistic. In addition, it is not possible to provide an assessment of future residential exposure with any certainty in this location while the proposed future Sydney Gateway project is in development.

The Sydney Gateway project is under development by NSW Roads and Maritime Services (Roads and Maritime) and would be subject to a separate environmental assessment and planning approval in the future, subject to agency and community review and submissions in accordance with the *Environmental Planning and Assessment Act 1979* (NSW). As such, the location with unacceptable health risk would be reassessed as part of that project and the impacts and the health risks are likely to be different to those assessed as part of this project.

Consideration of planning controls for future rezoning and development within this area would be a matter for DP&E following the assessment of air quality carried out for the proposed future Sydney Gateway project.

B1.2.4 Elevated receptors near the St Peters interchange

The HHRA identified unacceptable health risks associated with air pollution 30 metres above ground-level adjacent to the tunnel ventilation stack at the St Peters interchange. This is a hypothetical risk because current buildings are less than 10 metres in height at that location. Consideration should be given to ensuring that planning controls are put in place so that building heights in the area are limited and exposure to these levels of PM_{2.5} are avoided.

The EIS determined that air quality at an elevation of 10 metres near the proposed St Peters interchange, which includes a 20 metre high ventilation stack, would be minimally impacted by the project. Air quality at heights between 10 and 30 metres were not modelled. Therefore the impact of the project on air quality at heights between 10 and 30 metres is unknown. On this basis, planning controls should be developed in the vicinity of the St Peters interchange to limit future building heights to no higher than 10 metres.

There is inconsistency within the EIS with regards to developing planning controls for the St Peters area. The air quality assessment states that planning controls in the vicinity of St Peters should 'ensure future developments at heights 30 metres or higher are not adversely impacted by the ventilation outlets' (page 9-106), while the HHRA states that planning controls should 'ensure future developments at heights above 10 metres are not adversely impacted by the ventilation outlets' (page 11-34). Unless air quality assessment of St Peters demonstrates acceptable impacts on air quality at heights between 10 and 30 metres, planning controls should limit building heights in that area to 10 metres.

Response

The appropriate recommended height for planning controls at St Peters is 10 metres as noted in section 11.5.1 of the EIS. The figure of 30 metres noted in section 9.7.5 of the EIS is a typographical error.

An assessment was undertaken to determine the air quality impacts of the project on elevated receivers. The calculation of elevation considered the height of buildings and terrain (refer to section 9.7.5 of the EIS). The terrain within the project footprint varies from an elevation of around 10 metres Australian Height Datum (AHD) at the western end at Haberfield to an elevation of around 14 metres AHD at the Rozelle interchange and 10 metres at St Peters, at the southern end of the project footprint.

Concentrations at two elevated receptor heights (10 metres and 30 metres) were considered for annual mean and 24-hour $PM_{2.5}$. At these two receptor heights, it was not necessarily the case that there were existing buildings at these heights at sensitive receptor locations.

The intent of the elevated receiver analysis was to:

- Determine potential adverse air quality impacts on existing elevated receivers
- Identify if there are potential constraints that should be taken into account for potential future residential developments, and which should be addressed through planning controls.

The ventilation outlets were predicted to not result in adverse air quality impacts at any existing elevated receptors as there are no existing buildings 10 metres or higher located close to the proposed ventilation facilities.

The implications of the results of the assessment of elevated receivers can be summarised as follows:

- For all receptor locations, the changes in $PM_{2.5}$ concentration at 10 metres are acceptable
- Future developments to the height of 10 metres should be possible at all locations in the area assessed. This assumes that the changes in $PM_{2.5}$ concentration for heights between ground level and 10 metres are also acceptable
- Planning controls should be developed in the vicinity of St Peters to ensure future developments at heights 10 metres or higher are not adversely impacted by the ventilation outlets.

The future development of land (including rezoning) in the vicinity of St Peters that may involve multi-story buildings at heights of 10 metres or higher would need to consider the air dispersion performance of the Campbell Road ventilation facility. Roads and Maritime would assist local councils in determining any relevant land use considerations applicable to future development for inclusion in local environmental plans or development control plans, where required.

B1.2.5 Traffic modelling

The WestConnex Road Traffic Model, in operational models of the M4-M5 Link, was unable to accommodate forecast growth in peak hour traffic to and from Sydney Airport without the proposed Sydney Gateway project which is presumably necessary to accommodate future traffic growth (Appendix H, page 53). It appears that peak hour traffic demand to and from Sydney Airport was therefore reduced by a factor of 0.7-0.75 so that the model could be applied to this area for scenarios without the Sydney Gateway (Table 4-1, Appendix H, page 53). This could mean that potential health risks associated with air pollution at St Peters, an area where the HHRA identified unacceptable health risks (see above), could be higher than the estimates provided in the EIS.

Response

The WestConnex Road Traffic Model (WRTM) is a strategic traffic model that forecasts future traffic demand. It is not constrained by the current capacity of the road network and is used to provide projected future traffic volumes that need to be accommodated on the road network for planning and design of future upgrades.

The forecast traffic demands used for the air quality assessment at Appendix I (Technical working paper: Air quality) of the EIS were also unaffected by this reduction factor as the air quality assessment used the WRTM traffic demand outputs. Consequently, the HHRA was not affected by scaling factors.

The peak hour reduction applied for Sydney Airport forecast traffic demand was only applied to the micro-simulation traffic models used for the more detailed modelling of the road network performance (as presented in Appendix H (Technical working paper: Traffic and transport) of the EIS).

B1.2.6 In-tunnel air quality

The modelled in-tunnel air quality should not result in air pollution exposures known to be associated with health effects if commuters have motor vehicle windows closed and ventilation on recirculate while traversing the WestConnex tunnel network. The predicted in tunnel air quality would appear to be consistent with the In-tunnel air quality (nitrogen dioxide) policy and I note the whole of government work in this space.

The EIS states that during extreme traffic congestion, for people with asthma who do not adopt advice to keep motor vehicle windows closed and ventilation on recirculate, or who are on a motor bike, there is the potential for those people 'to experience some minor change in respiratory response after using the tunnels' ((Appendix K), page 97). Signage and other messaging promoting motor vehicle drivers to close windows and set vehicle ventilation to recirculate while driving through tunnels should be adopted.

Response

All long tunnels in Sydney have signage displaying this advice. Similar signage will be installed in all WestConnex tunnels, including the M4-M5 Link tunnels. This will include signage at the tunnel entrances.

B1.2.7 Impacts on active transport infrastructure

Significant health benefits are associated with active transport such as walking, cycling, and public transport. It is important that the M4-M5 Link project has minimal impact on the accessibility and availability of active transport. Incorporation of active transport infrastructure (walking and cycling paths) into the project are supported and encouraged.

Response

NSW Health's support of the incorporation of active transport infrastructure into the project is noted. Chapter 6 (Construction work), Chapter 8 (Traffic and transport) and Appendix H (Technical working paper: Traffic and transport) of the EIS provide details on expected changes to pedestrian and cycling infrastructure during construction. As part of construction planning, details about these changes, including diversion routes, durations and consultation with relevant stakeholders, will be further developed and documented in the Construction Traffic and Access Management Plan that will be prepared for the project. Roads and Maritime recognise the important role of walking and cycling for mobility in and around the project footprint and will ensure that impacts on active transport infrastructure are minimised and managed for the duration of the construction program.

Chapter 13 (Urban design and visual amenity) and Appendix N (Technical working paper: Active transport strategy) of the EIS provide details about the permanent walking and cycling connections that would be provided as part of the project, as well as the manner in which these will integrate with existing and planned active transport infrastructure around the project footprint.

B1.3 Noise and vibration

Refer to Chapter 10 (Noise and vibration) and Appendix J (Technical working paper: Noise and vibration) of the EIS for details of noise and vibration impacts.

B1.3.1 Potential impacts on the Royal Prince Alfred Hospital

Given the proximity of the Royal Prince Alfred Hospital (RPAH), Camperdown to proposed construction activities and the sensitivity of this facility to the effects of air quality, noise and vibration, it is important that RPAH management is consulted on the potential impacts of construction well in advance of any activity which may impact the site.

Response

Design refinements to the M4-M5 Link project during the development of the concept design included the following, which would avoid or minimise impacts on the Royal Prince Alfred Hospital:

- Removal of the proposed road interchange at Camperdown and associated requirements for construction ancillary facilities and areas in its vicinity
- Subsequent amendment of the alignment of the mainline tunnels further to the west (away from the Royal Prince Alfred Hospital), which also means that the closest construction ancillary facility to the Royal Prince Alfred Hospital is around 600 metres away (Pymont Bridge Road tunnel site (C9))
- Identification of spoil haulage routes that would avoid roads near the Royal Prince Alfred Hospital.

It is anticipated that the Royal Prince Alfred Hospital would be consulted during the detailed design in accordance with the Community Consultation Strategy (see environmental management measure SE2 in **Chapter E1** (Environmental management measures)), including consultation on non-vibration matters and to establish appropriate vibration levels taking into account the sensitive equipment that may be located within the hospital.

Further discussion on potential construction impacts on the Royal Prince Alfred Hospital at Camperdown associated with air quality and noise and vibration are described in the following sections.

Air quality impacts

The Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* (2014) identifies that an assessment of construction dust is normally required for human receptors that may experience the adverse effects of airborne dust, dust soiling or exposure to PM₁₀ over a time period that is relevant to air quality standards and goals. For human receptors, the assessment is required for those within 350 metres of the boundary of the site or 50 metres within the routes used by construction vehicles on public highways, up to 500 metres from the site entrances. Sites outside of these distances are typically not impacted by dust.

As the Royal Prince Alfred Hospital is around 600 metres from the Pymont Bridge Road tunnel site (C9) as noted in section 12.2.2 of the EIS and is not along proposed spoil haulage routes for the project (as described in Chapter 6 (Construction work) of the EIS), the risk of dust, soiling and exposure to PM₁₀ at the Royal Prince Alfred Hospital is expected to be low and further reduced as a result of the environmental management measures presented in **Chapter E1** (Environmental management measures) to control dust during construction.

Noise and vibration impacts

The realignment of the mainline tunnels described in the section above means that no tunnelling would be undertaken beneath the Royal Prince Alfred Hospital.

Notwithstanding this and as noted in section 10.3.7 of the EIS, the Royal Prince Albert Hospital has been identified as a vibration sensitive receiver and will be considered during the development of the Construction Noise and Vibration Management Plan (CNVMP) (see environmental management measure NV2 in **Chapter E1** (Environmental management measures)). No medical facilities, including the Royal Prince Albert hospital, were identified as noise sensitive receivers (refer to Table 10-23 of the EIS).

B1.3.2 Construction noise mitigation

The EIS discusses potential mitigation measures but does not provide details as to how or when mitigation measures will be applied, nor any assessment of residual noise impacts after mitigation. This will only be undertaken during the development of the Construction Noise and Vibration Management Plan (CNVMP) at the detailed design phase. It is therefore not possible for NSW Health to comment on the adequacy of mitigation measures or the acceptability of residual noise and associated health impacts. The proponent should provide further detail on mitigation measures where possible and give a clear commitment to mitigate noise levels in order to prevent exceedances of relevant management levels. The CNVMP should be reviewed by the appropriate regulatory authority and NSW Health prior to the commencement of any construction related to the M4-M5 Link project.

Response

Chapter 7 of Appendix J (Technical working paper: Noise and vibration) of the EIS includes a summary of potential noise and vibration impacts as a result of the project and details of proposed management and mitigation measures. Without additional mitigation, the EIS noise and vibration assessment stated that construction noise levels would exceed the relevant goals at most of the noise catchment areas for construction activities including earthworks, demolition of existing structures, site establishment, road tie-in works, road and intersection modifications and utility adjustments. The most affected receivers are those located around the surface works for the Iron Cove Link at Rozelle, Rozelle interchange, Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b) at Haberfield and Ashfield. For most construction activities, it is expected that the actual construction noise levels would generally be lower than the worst-case levels as predictions are representative of the highest noise level inclusive of all plant operating simultaneously at the closest location to each receiver.

Construction noise impacts would be managed using measures including scheduling of works, noise reduction measures for plant and equipment and provision of respite periods for sensitive receivers. Design and construction contractor(s) would be required to minimise time and duration of impacts to sensitive receivers and keep them proactively informed of likely timing and impacts of noisy activities. In addition, specific strategies to manage longer duration impacts are outlined in **section B1.3.3**. Further detail on construction noise and vibration management and mitigation measures is provided in the following sections and in **Chapter E1** (Environmental management measures).

Construction noise management and mitigation measures

Feasible and reasonable management and mitigation measures would be identified for the project as noted in the noise and vibration environmental management measures presented in **Chapter E1** (Environmental management measures). This includes the development of a CNVMP which will be prepared for the project (see environmental management measure NV2 in **Chapter E1** (Environmental management measures)). The plan will:

- Identify relevant performance criteria in relation to noise and vibration
- Identify noise and vibration sensitive receivers and features in the vicinity of the project
- Include standard and additional mitigation measures from the *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime 2016) and details about when each will be applied
- Describe the process(es) that will be adopted for carrying out location and activity specific noise and vibration impact assessments to assist with the selection of appropriate mitigation measures
- Include protocols that will be adopted to manage works required outside standard construction hours in accordance with relevant guidelines
- Detail monitoring that will be carried out to confirm project performance in relation to noise and vibration performance criteria.

The CNVMP will be implemented for the duration of construction of the project.

Review of the Construction Noise and Vibration Management Plan

The CNVMP will be prepared in accordance with the conditions of approval for the project and will include mechanisms for monitoring, review and amendment of the plan.

In addition, a suitably qualified Acoustics Advisor will be engaged during construction and will be responsible for:

- Reviewing management plans related to noise and vibration and endorsing that they address all relevant conditions of approval and requirements of all applicable guidelines
- Reviewing location and activity specific noise and vibration impact assessments prepared during the project and endorsing the assessments and proposed mitigation measures
- Reviewing proposals regarding works outside standard construction hours, confirming that the works are appropriate and endorsing the proposed mitigation measures
- Monitoring noise and vibration from construction generally and:
 - confirming that actual noise and vibration levels and impacts are consistent with predictions
 - confirming that reasonable and feasible noise and vibration mitigation measures are being implemented
 - suggesting additional reasonable measures to further reduce impacts
- Monitoring and providing advice in relation to compliance with conditions of approval and project commitments related to noise and vibration
- Providing advice in relation to complaints regarding noise and vibration impacts that cannot be resolved between the complaint and the project
- Reviewing and endorsing the proposed operational noise controls, the associated noise model and the proposed implementation program.

Residual noise and vibration impacts

Chapter 28 (Environmental risk analysis) of the EIS includes an environmental risk analysis of key issues that includes an assessment of residual risk following the implementation of management and mitigation measures. For key noise and vibration impacts, the residual risk was identified as being Medium.

Through the detailed design of the project there are further opportunities to:

- Resolve potential construction noise and vibration impacts as identified in section 10.3 of the EIS through design refinement, which could include revisions to the construction methodology and reconfiguration of the layout of construction ancillary facilities
- Develop effective construction methodologies and planning with the design and construction contractor(s) to ensure that management and mitigation measures are effectively implemented
- Implement a process of review, correction and audit for the Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP). This is a process of continuous improvement that will form part of the CEMP and OEMP and allow for management measures to be updated or improved during construction and operational phases where practical.

Specific construction noise and vibration management and mitigation measures that will be applied during construction include the development of location and activity specific noise and vibration impact assessments, which will be carried out prior to (as a minimum) activities where the impacts have the potential to exceed criteria:

- With the potential to result in noise levels above 75 dBA at any receiver
- Required outside standard construction hours likely to result in noise levels greater than the relevant noise management levels
- With the potential to exceed relevant performance criteria for vibration.

The assessments will clarify predicted impacts at relevant receivers in the vicinity of the activities to assist with the selection of appropriate management measures, consistent with the requirements of the *Interim Construction Noise Guideline* (ICNG) (NSW Environment Protection Authority 2009 (EPA))

and CNVG that will be implemented during the works. The Acoustics Advisor will be engaged during construction and will review the noise and vibration assessments, confirm that proposed mitigation measures proposed are appropriate and are implemented and suggest improvements that could be made to reduce noise and vibration impacts in accordance with environmental management measure NV1 in **Chapter E1** (Environmental management measures).

However, it is acknowledged that even with feasible and reasonable mitigation measures it may not always be possible to prevent exceedances of construction noise goals, particularly those associated with out-of-hours work which needs to be undertaken at specific times to minimise impacts on the road network. Management measures to mitigate these impacts will include notifying the community of noise impacts anticipated at specific times. Additional mitigation measures for affected receivers may include offering individual briefings on impacts and mitigation measures, respite periods and alternate accommodation.

Consultation with the affected receivers will occur in accordance with Community Communication Strategy (see environmental management measure SE2 in **Chapter E1** (Environmental management measures)) and conditions of approval for the project.

Timing of the implementation of management measures

Where reasonable and feasible, operational noise mitigation such as noise barriers and at-property treatments identified during detailed design would be installed early in the project so as to provide a benefit to receivers during the construction phase of the project (see environmental management measure NV10 in **Chapter E1** (Environmental management measures)).

In addition, receivers that qualify for assessment for at receiver treatment in relation to operational noise, that are also predicted to experience significant exceedances of noise management levels due to construction, will be given priority preference for assessment for treatment based on the severity and timing of impact. Where the building owner accepts the at receiver treatment proposal, the treatments will be installed as soon as possible (see environmental management measure NV9 in **Chapter E1** (Environmental management measures)).

Further detail about management and mitigation measures for receivers that may experience longer duration construction noise impacts is provided in **section B1.3.3**.

B1.3.3 Longer duration of construction noise impacts due to multiple WestConnex projects

Noise levels associated with construction are estimated to exceed management levels for some residences and at other sensitive locations such as child care centres and schools. Due to the on-going nature of the WestConnex development, some people could be exposed to noise from construction activities over a period of several years. NSW Health recommends that mitigation strategies are applied to minimise the risk of adverse health impacts to residents and other sensitive people from exposure to excessive noise.

Response

Longer duration construction impacts are expected where the project connects to the M4 East and New M5 projects at Haberfield/Ashfield and St Peters respectively. Chapter 26 (Cumulative impacts) of the EIS provides a detailed overview of the cumulative impact assessment of the project. Furthermore, respective technical working papers included in Appendix H (Technical working paper: Traffic and transport) Appendix J (Technical working paper: Noise and vibration) and Appendix I (Technical working paper: Air quality) of the EIS include consideration of consecutive and concurrent (cumulative) impacts during construction and operation of the project. The outcomes of the respective assessments of cumulative impacts were then used to inform the development of management and mitigation measures (see **Chapter E1** (Environmental management measures)).

Roads and Maritime acknowledge that the impacts from construction of the WestConnex program of works at Haberfield/Ashfield and St Peters are not short term, as the consecutive construction of components of the WestConnex projects would extend the duration of impacts to a period of up to seven years for some receivers in these areas. The range and intensity of impacts have and would continue to vary during these periods as construction progresses, with the majority of impacts occurring or expected to occur as a result of certain construction activities and during certain times of the day (for example outside standard daytime construction hours).

Key impacts resulting from longer duration construction in these areas may include noise and vibration, construction traffic, dust, visual impacts and impacts on parking on local streets around construction sites. Construction activities most likely to result in longer duration impacts include surface road works, utility works, tunnelling and tunnelling support (such as spoil handling and transport).

In many instances, M4 East and New M5 construction will transition to less intensive works as the respective construction programs progress towards their conclusion and tunnelling is completed. These less intensive activities include mechanical and electrical fitout, pavement and linemarking works and landscaping, which would occur prior to or at the same time as M4-M5 Link site establishment works commence.

This means that construction activities that overlap or occur consecutively from these projects and the M4-M5 Link would generally be less intensive and cause less disturbance to nearby communities. In addition, these works would typically be expected to require less road occupations (except for line marking and pavement works) and therefore would be more likely to occur during standard construction hours. In addition, at the completion of construction of the M4 East and New M5 projects, permanent noise treatments would be established and/or installed as required by the conditions of approval for these respective projects. This would include (where required by the conditions) the installation of at-receiver treatments and the establishment of permanent noise barriers. The noise modelling that has informed these at-receiver treatments has included the additional traffic forecast for the M4-M5 Link project. These treatments would assist in ameliorating construction noise impacts on these receivers.

Around Haberfield and Ashfield, the majority of the above ground infrastructure required for the M4-M5 Link project is currently being built by the M4 East project. The large civil construction works such as the construction of the Wattle Street and Parramatta Road entry and exit ramps and the Parramatta Road ventilation facility (including the outlet for the M4-M5 Link project) will be complete or nearing completion before construction of the M4-M5 Link commences. This includes the construction of the M4-M5 Link entry and exit ramps along Wattle Street, including the dive and cut-and-cover structure.

Around St Peters, clean-up of the Alexandria Landfill site, construction of the St Peters interchange as well as construction of a component of the above ground infrastructure required for the M4-M5 Link project is being carried out by the New M5 project. This includes construction of the M4-M5 Link entry and exit ramps, upgrades of the local roads (including Campbell Road) and the provision of a construction hardstand area and construction access driveway that will be reused for the Campbell Road civil and tunnel site (C10).

The M4-M5 Link project will need to carry out some civil construction works (including construction of the Campbell Road ventilation facility) and civil finishing works for infrastructure at Haberfield and St Peters. However, construction of surface infrastructure at both locations as part of the M4-M5 Link project has been minimised as much as practicable.

As described in section 6.4 of the EIS, site establishment activities associated with the M4-M5 Link project would include utility works, vegetation removal, the establishment of traffic management and environmental controls and demolition of buildings and structures to facilitate the establishment of construction ancillary facilities. Although these site establishment works are relatively intense in nature and thus are anticipated to generate amenity related impacts such as noise and vibration, they would typically occur during standard daytime construction hours, with scheduled respite periods that will be implemented in accordance with the conditions of approval and associated Environment Protection Licence.

To minimise the impacts associated with longer duration construction impacts from the concurrent construction of the WestConnex component projects in these areas and to respond to issues raised during the construction of other WestConnex projects and in submissions on the M4-M5 Link EIS, the following strategies are proposed:

- Provision of additional off-street car parking for the construction workforce at Rozelle, with the use of the White Bay civil site which would provide around 50 parking spaces. This site is further described in **Chapter D2** (White Bay civil site (C11))
- Using the Northcote Street civil site at Haberfield as a construction workforce car park and laydown area. Currently this site is used as the main tunnelling site for the eastern end of the M4 East project
- Reducing the surface construction footprint of the Wattle Street civil and tunnel site (C1a) to limit surface construction activities to the Wattle Street entry and exit ramps. Compared to the

indicative layout presented in Chapter 6 (Construction work) of the EIS for this site, this would reduce potential construction impacts such as noise and vibration and dust during construction of the M4-M5 Link project and would also allow for realisation of the M4 East urban design and landscaping outcome for this area at the completion of the M4 East project

- Provision of a heavy vehicle truck marshalling facility at the White Bay civil site at Rozelle, which would cater for around 40 heavy vehicles and stage the release of trucks to the tunnelling sites to manage the arrival of trucks to construction ancillary facilities (see **Part D** (Preferred infrastructure report)). Provision of a truck marshalling facility and additional construction workforce parking would result in several benefits for the community and the project, including:
 - Reducing potential queuing, idling, circling and congestion on local roads surrounding the project and associated construction ancillary facilities
 - Providing additional construction workforce parking spaces, which would minimise construction workers parking on local roads
 - Minimising disruptions to the road network around construction ancillary facilities and noise and other disturbance to the local community including residential, business and commercial properties
 - Improving safety for construction workers, motorists and the general public by providing a controlled area from which project traffic schedulers can manage trucks and direct truck drivers to the construction sites at an appropriate time
- Development of a car parking strategy that will quantify construction workforce parking demand, identify public transport options (and measures such as carpooling and shuttle-buses) and identify all locations that will be used for construction workforce parking (see environmental management measure TT04 in **Chapter E1** (Environmental management measures))
- Development and implementation of a truck management strategy that will identify potential truck marshalling areas that will be used for the project and describe management measures for project-related heavy vehicles to avoid queuing and site-circling in adjacent streets and other potential traffic and access disruptions (see environmental management measure TT16 in **Chapter E1** (Environmental management measures))
- Designing acoustic sheds with consideration of the activities that will occur within them and the relevant noise management levels in adjacent areas. Monitoring will be carried out to confirm that the actual acoustic performance of each shed is consistent with predicted acoustic performance (see environmental management measure NV7 in **Chapter E1** (Environmental management measures))
- The appointment of a suitably qualified and experienced Acoustics Advisor, who is independent of the design and construction contractor, and who will be engaged for the duration of construction of the project (see environmental management measure NV1 in **Chapter E1** (Environmental management measures))
- Use of the M4 East and New M5 tunnels for spoil haulage when they become available and where practicable, to minimise heavy vehicle movements on the surface road network
- Consideration of receivers that qualify for assessment for at-receiver treatment due to predicted operational road traffic noise, that are also predicted to experience exceedances of noise management levels during construction, for at-receiver treatments as a priority (see environmental management measure NV9 in **Chapter E1** (Environmental management measures)).

Specific management and mitigation will be documented in relevant construction environmental management sub-plans, the Ancillary Facilities Management Plan and the Construction Traffic and Access Management Plan. This will include detailed consideration of the types of activities that would be most likely to cause longer duration impacts during construction of the project, the types of impacts already experienced by these communities as a result of M4 East and New M5 construction, and subsequent development and implementation of location and activity specific mitigation that considers the consecutive nature of construction at these locations.

B1.3.4 Construction noise mitigation for vulnerable members of the community

The proponent should implement tailored mitigation and communication strategies for vulnerable members of the community and are likely to be more susceptible to adverse health effects of noise, especially those who are elderly, who do not speak English, are housebound, or who may be unwell. Vulnerable community members should be individually consulted to determine appropriate mitigation and management plans, and have ongoing two-way communication regarding noise impacts during construction. Consideration should be given to whether vulnerable community members are at home during the day and hence require additional mitigation to reduce noise impacts during standard construction hours.

Response

During construction of the project, the community engagement professionals representing the project would establish the specific needs of communities. These project representatives would ensure that the needs of specific at-risk (or more vulnerable) individuals are considered when developing and/or modifying construction staging and/or management plans, including the CNVMP.

In addition, a suitably qualified and experienced Acoustics Advisor, who is independent of the design and construction contractor, will be engaged for the duration of construction of the project. The Acoustics Advisor will be responsible for:

- Monitoring noise and vibration from construction generally
- Confirming that appropriate management measures are implemented
- Assisting with the resolution of complaints related to noise and vibration, as required.

Further details regarding the role and responsibility of the Acoustics Advisor is provided in **section B1.3.2**.

B1.3.5 Effect of lower noise level reduction than assumed in the EIS

Some noise management levels used in the EIS, including for sleep disturbance and for sensitive receptors such as schools, are based on the assumption that noise levels are reduced by 10 dBA from outside to inside with an open window. However, some dwellings may only provide a 5 dBA reduction with an open window. The EIS should consider how this may affect the numbers of receptors impacted and whether additional mitigation measures are required.

Response

As described in section 10.1.9 of the EIS, the 10 dBA assumption is considered conservative and is recommended by NSW EPA within the *Industrial Noise Policy* (INP) (NSW EPA 1999) and ICNG assessment guidelines. In practice there will be some variation in reduction due to the design of the existing building and other limitations such as building condition, however this assumption is appropriate for a typical building and therefore appropriate for the assessment presented in the EIS.

Further, construction noise management levels and road traffic noise criteria for residential receivers are applied externally to those properties. Therefore the reduction loss through an open window is of no consequence in determining the number of receptors impacted and/or if additional noise mitigation measures should be considered.

Management and mitigation measures include the preparation of location and activity specific noise and vibration impact assessments for noise sensitive receivers, which will be carried out prior to (as a minimum) activities:

- With the potential to result in noise levels above 75 dBA at any receiver
- Required outside standard construction hours likely to result in noise levels greater than the relevant noise management levels
- With the potential to exceed relevant performance criteria for vibration.

The assessments will clarify predicted impacts at relevant receivers in the vicinity of the activities to assist with the selection of appropriate management measures, consistent with the requirements of ICNG and CNVG that will be implemented during the works.

B1.3.6 Mitigation of operational noise impacts

Operation of the M4-M5 Link is expected to decrease the level of noise exposure for most people however there is expected to be a significant increase in noise exposure for some people.

Noise generated during construction is estimated to exceed management levels for exposure by some residents and other sensitive locations such as schools. It is important that all feasible measures to mitigate these expected or potential impacts from construction and operation of the M4-M5 Link be considered.

It is noted that the M4-M5 Link is expected to decrease exposure to traffic noise for most people, with more traffic moving underground. However there are expected to be significant increases in noise exposure for some residents as a result of changes in the location and movement of traffic.

All feasible and reasonable mitigation strategies should be implemented for all significant increases in noise exposure associated with changes in traffic resulting from the M4-M5 Link.

Response

Feasible and reasonable measures to manage and mitigate construction noise and vibration impacts are discussed in **section B1.3.2**.

With regards to managing and mitigating operational noise impacts, as detailed in Appendix J (Technical working paper: Noise and vibration) of the EIS, at-source noise controls such as road design, quiet road surfaces, followed by path controls such as noise barriers, are the first consideration where road traffic noise criteria are exceeded at noise sensitive receivers. Section 7.4.2 of Appendix J (Technical working paper: Noise and vibration) of the EIS provides a discussion of the 56 noise catchment areas and the operational impacts associated with each of those areas.

The environmental management measures also note potential operational noise performance of the project based on the detailed design will be assessed in accordance with NSW Road Noise Policy (Department of Environment and Climate Change and Water (DECCW) 2011) and appropriate management measures will be confirmed and implemented (see **Chapter E1** (Environmental management measures)).

Within 12 months of the commencement of the operation of the project, actual operational noise performance will be assessed and compared to predicted operational noise performance. The assessment will include identification of any further feasible and reasonable noise mitigation measures required to meet the relevant operational road traffic noise criteria, and identify timing and responsibilities for implementation, as identified in the environmental management measure NV14 (see **Chapter E1** (Environmental management measures)).

B1.3.7 Health impacts of environmental noise

There is also emerging evidence of the health impacts of environmental noise. The evidence is strongest for impacts on cardiovascular disease and sleep disturbance. Measures to limit the community exposure to noise are therefore important to protect public health.

Response

Section 8.5 and section 8.6 of Appendix K (Technical working paper: Human health risk assessment) of the EIS consider the impacts on human health relevant to noise predicted to be generated by the project during construction and operation.

Potential noise impacts have been assessed against noise criteria developed by the NSW EPA. These criteria have been established predominantly on the basis of attitudinal surveys linking the level of annoyance reaction to noise exposure with due consideration given to sleep disturbance and potential impairment to non-auditory tasks. Regular exposure to consistent elevated sound levels can adversely affect mental and physical health. Thus, the aim of these criteria is to protect majority of residences and other sensitive land uses from noise pollution most of the time.

The criteria developed for use in the assessment for control of noise come from policy documents developed by the NSW Government including the INP, Road Noise Policy and the ICNG (NSW Department of Environment and Climate Change (DECC) 2009, NSW DECCW 2011, NSW EPA 2000). All of these policies consider the potential health effects due to regular and excessive noise exposure outlined in the reviews published by the following organisations:

- World Health Organization (WHO) – *Guidelines on Community Noise – Health effects of noise* (WHO 1999)

- World Health Organization – *Night Noise Guidelines for Europe* (WHO 2009)
- International Institute of Noise Control Engineering – *Guidelines for Community Noise Impact Assessment and Mitigation* (I-INCE 2011)
- Environmental Health Council of Australia – The health effects of environmental noise – other than hearing loss (enHealth 2004).

The approach used to assess sleep disturbance and health and wellbeing impacts is discussed in section 4.7.3 of Appendix J (Technical working paper: Noise and vibration) of the EIS.

Construction noise

During standard construction hours, noise levels would exceed the relevant goals in most of the noise catchment areas for work activities including earthworks, demolition, site establishment and utility adjustments. The most affected receivers are located around the Iron Cove Link at Rozelle, the Rozelle interchange and around the Parramatta Road West civil and tunnel site and Parramatta Road East civil site at Haberfield and Ashfield. For most construction activities, it is expected that the actual construction noise levels would generally be lower than the worst-case levels as predictions are representative of the highest noise level inclusive of all plant operating simultaneously at the closest location to each receiver.

Construction noise impacts would be managed using measures including scheduling of works, noise reduction measures for plant and equipment and provision of respite periods for sensitive receivers. Design and construction contractor(s) would be required to minimise time and duration of impacts to sensitive receivers and keep them proactively informed of likely timing and impacts of noisy activities.

A review of the predicted $L_{A1(1\text{minute})}$ exceedances associated with construction noise at the nearest noise sensitive receivers provided in Annexure F of Appendix J (Technical working paper: Noise and vibration) of the EIS indicates that the sleep disturbance screening criterion is likely to be exceeded when night works are occurring adjacent to residential receivers. At this early stage in the project, the assessment has included predictions of maximum noise impacts for assessment of potential sleep disturbance, however, the ICNG requires the project to consider maximum noise levels where construction works are planned to extend over more than two consecutive nights.

The out-of-hours work protocol that will be developed as part of the project wide CNVMP will set parameters around how works outside standard daytime construction hours will be carried out, including timing and frequency, and the mitigation measures that will be implemented based on predicted impacts identified through location and activity specific assessments. The out-of-hours work protocol will be developed as part of the CNVMP as detailed in environmental management measure NV5 (see **Chapter E1** (Environmental management measures)).

However, it is acknowledged that even with feasible and reasonable mitigation measures it may be not always possible to prevent exceedances of construction noise goals, particularly those associated with out-of-hours work which needs to be undertaken at such time to minimise impacts on the road network.

Where reasonable and feasible, operational noise mitigation such as noise barriers and at-property treatments identified during detailed design should be installed early in the project so as to provide a benefit to receivers during the construction phase of the project. (see environmental management measures NV9 and NV10 in **Chapter E1** (Environmental management measures)).

In addition, receivers that qualify for assessment for at receiver treatment in relation to operational noise, that are also predicted to experience significant exceedances of noise management levels due to construction, will be given priority preference for assessment for treatment based on the severity and timing of impact. Where the building owner accepts the at receiver treatment proposal, the treatments will be installed as soon as possible (see environmental management measure NV9 in **Chapter E1** (Environmental management measures)).

Further detail about management and mitigation measures for receivers that may experience longer duration construction noise impacts is provided in **section B1.3.3**.

Operational noise

For over 60 per cent of the receptors evaluated as part of the operational noise assessment presented in Appendix J (Technical working paper: Noise and vibration) of the EIS, operational noise levels would be reduced as a consequence of the project. However, the worst case assessment also predicts that operational noise criteria would be exceeded at a number of properties adjacent to the project during operation.

The Road Noise Policy (NSW DECCW 2011) has been developed in consideration of noise related health impacts (as outlined above). As required by environmental management measure NV13, potential operational noise performance of the project based on the detailed design will be assessed in accordance with the Road Noise Policy (NSW DECCW 2011) and appropriate management measures will be confirmed and implemented. Environmental management measure NV14 also requires that within 12 months of the commencement of the operation of the project, actual operational noise performance will be assessed and compared to predicted operational noise performance. The assessment will include identification of any further feasible and reasonable noise mitigation measures required to meet the relevant operational road traffic noise criteria, and identify timing and responsibilities for implementation (see **Chapter E1** (Environmental management measures)).

The worst-case levels estimated are sufficiently high for some receptors that noise impacts are likely to occur. These properties are located south of Victoria Road adjacent to the Iron Cove Link tunnel portals, and to the west of Victoria Road near Lilyfield Road. These are primarily related to the new road alignment being closer to residential homes, and the removal of buildings closest to the road (that previously were a barrier to noise from the roadway). Mitigation measures considered for minimising operational noise impacts principally involve the use of Open Graded Asphalt or equivalent and noise barriers. Where these measures cannot be installed or do not provide sufficient mitigation, at-receiver treatments would be implemented where feasible and reasonable to minimise residual noise impact.

B2 NSW EPA

This chapter addresses issues raised by the NSW Environmental Protection Authority (NSW EPA).

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B2.1 Air quality

Refer to Chapter 9 (Air quality) and Appendix I (Technical working paper: Air quality) of the Environmental Impact Statement (EIS) for details of air quality.

B2.1.1 Assessment of air toxics

The assessment of air toxics (expected and regulatory worst case scenarios) involves comparing the change in the maximum predicted one hour average concentration of each compound to the corresponding impact assessment criterion in the Approved Methods. The justification for comparing the change and not predicted total concentration is that 'the criteria in the Approved Methods cannot be readily applied to complex road projects in urban areas, as they are based on the assumption that a project represents a new source, and not a modification to an existing source'. 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 a comparison of predicted ventilation outlet plus surface road speciated air toxic concentrations against the assessment criteria should be made. Further, the toxic assessment criteria have previously been applied to modifications of existing sources.

Recommendation: the proponent provide predicted impact (ventilation outlet and surface road) at receptors for speciated air toxics for both the expected traffic and regulatory worst case scenarios.

Response

Table 8-26 of Appendix I (Technical working paper: Air quality) of the EIS shows the results for air toxics at all residential, workplace and recreational (RWR) receptors in the regulatory worst case scenarios. Even if the maximum ventilation outlet contribution is added to the maximum increase in concentration with the project (including outlets and surface roads, which implies some double counting), the results are still below the impact assessment criteria.

B2.1.2 Regulatory worst case scenario

The results for the regulatory worst case scenario are presented at the following receptors:

- 1 hour NO₂ [nitrogen dioxide]: a regulatory worst case receptor at each ventilation facility
- Toxics: most affected RWR receptor
- CO [carbon monoxide] and PM [particulate matter]: maximum impacted residential and RWR receptor.

The impacts for the regulatory worst case scenario are all presented at different receptors. There is also lack of clarity regarding where the impacts are predicted and whether or not it includes the maximum impacted receptor in the domain, as the maximum impacted receptor in the domain may not necessarily be a RWR receptor.

Recommendation: For the regulatory worst case scenario, the EPA recommends that the proponent demonstrates for each pollutant, that the results include the maximum impacted receptor in the domain or provides the results for the maximum impacted receptor in the domain.

Response

Table B2-1 includes the results for air toxics at residential receptors (not included in Appendix I (Technical working paper: Air quality) of the EIS). These values are highlighted in **bold**, although they are the same as the values for all receptors.

Table B2-1 Results of regulatory worst case assessment (RWR receptors) – CO, PM and air toxics

Pollutant and period	Unit	Maximum ventilation outlet contribution at any receptor	
		Regulatory worst case (RWC)-2033-DSC ²	
		All receptors	Residential receptors
Criteria pollutants			
CO (1-h)	(mg/m ³)	0.50	0.50
PM ₁₀ (annual)	(µg/m ³)	1.01	1.01
PM ₁₀ (24-h)	(µg/m ³)	4.51	4.06
PM _{2.5} (annual) ¹	(µg/m ³)	1.01	1.01
PM _{2.5} (24-h) ¹	(µg/m ³)	4.51	4.06
Air toxics			
Benzene (1-h)	(µg/m ³)	2.20	2.20
PAH (BaP) (1-h)	(µg/m ³)	0.016	0.016
Formaldehyde (1-h)	(µg/m ³)	1.83	1.83
1,3-butadiene (1-h)	(µg/m ³)	0.59	0.59

Notes:

1 The same emission rates were used for PM₁₀ and PM_{2.5}.

2 DSC = Do something cumulative.

For simplicity of presentation, spatial information on the regulatory worst case (RWC) results has not been included in Appendix I (Technical working paper: Air quality) of the EIS.

Appendix I (Technical working paper: Air quality) of the EIS states that the maximum impacted receptor may not be a RWR receptor. Given the large number of closely-spaced RWR receptors (86,375) that are within the model domain and subject to the influence of surface road traffic from the project, it is very unlikely that other locations, further away from the project, would experience a larger impact. RWR receptors were all discrete receptor locations within the project footprint, and mainly covered residential and commercial land uses. For these receptors, a simpler¹ statistical approach was used to combine a concentration statistic for the modelled roads and outlets (eg maximum 24-hour mean PM₁₀) with an appropriate background statistic. The RWR receptors include 40 community receptors.

As described in the EIS, the RWR receptors are discrete points in space where people are likely to be present for some period of the day, classified according to the land use identified at that location. The RWR receptors do not identify the number of residential (or other) properties at the location. The residential land use at a RWR receptor location may range from a single-storey dwelling to a multi-storey, multi-dwelling building.

The main reason for the distinction between RWR and community receptors was to permit a more detailed analysis of short-term metrics for representative community receptors. The number of such receptors that could be included was dictated by the limit on the number of time series for individual receptors that could be extracted from the Graz Lagrangian Model (GRAL). Due to the computational requirements of the GRAL model, it was not possible to include a larger number of time series for receptors over such a large project footprint.

Figure B2-1 shows the locations of the various discrete community receptors.

¹ The simplification only related to short-term metrics. Annual mean concentrations were equally valid for both types of receptor.

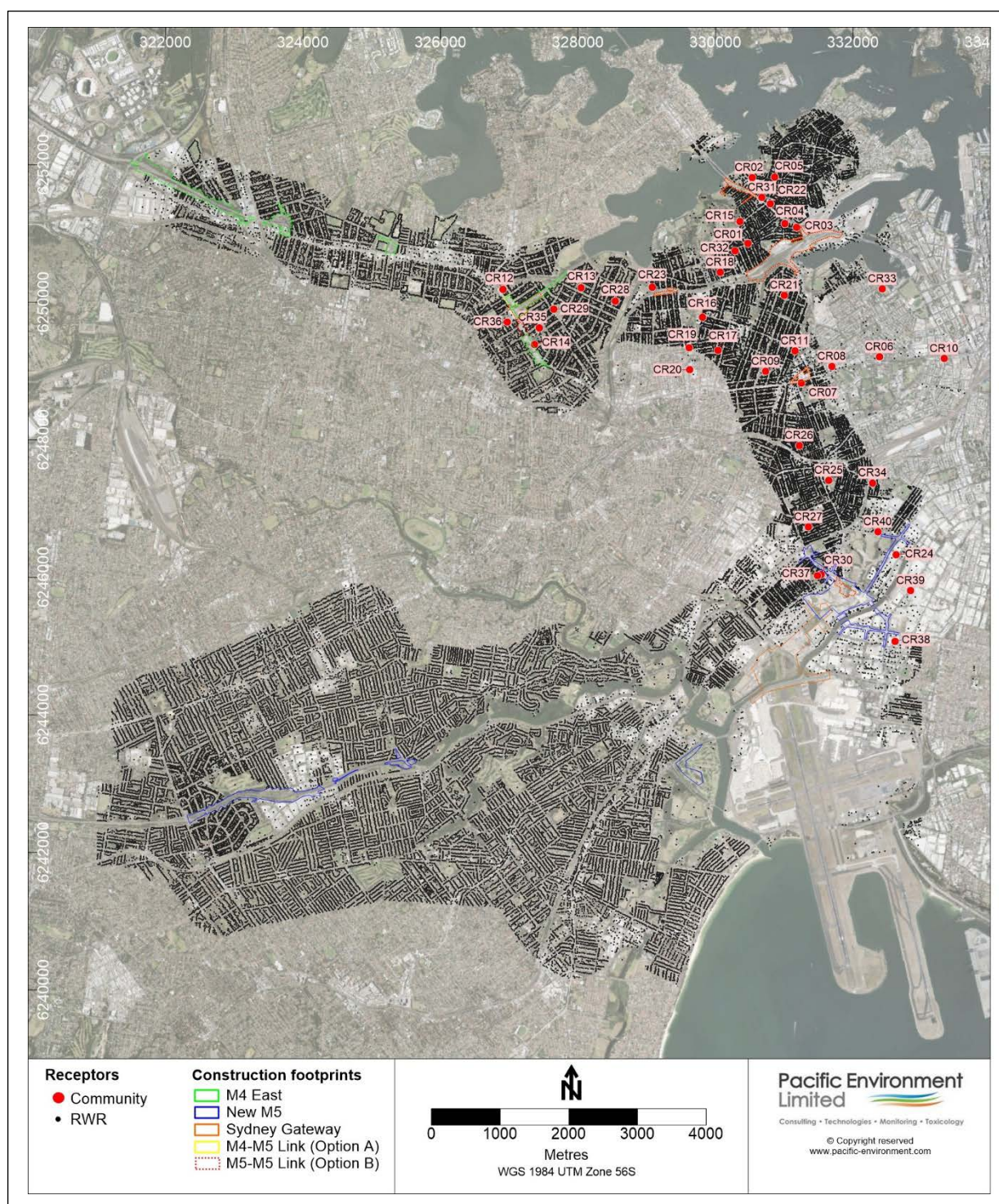


Figure B2-1 Modelled discrete receptor locations and project footprint

B2.1.3 Vehicle emissions estimation techniques

Annexure L of Appendix I was reviewed to assess the in-tunnel motor vehicle emission modelling. It is noted that this M4-M5 Link EIS assesses the entire WestConnex network including the M4 East and the New M5, and it is stated that this M4-M5 Link EIS will effectively supersede the ventilation reports in these previous EIS. Hence issues raised in the EPA's responses to the M4 East and New M5 EIS will also be superseded by those made here.

The motor vehicle emissions have been estimated using the detailed PIARC [Permanent International Association of Road Congress] method which specifically considers the fuel type mix, age profile and emission certification standards of the NSW fleet. This is a significant improvement relative to the simple PIARC approach applied in the two previous WestConnex project EIS.

Notwithstanding the improved methodology, some issues were noted and are listed below. Importantly, the validation of the emission model should be presented in full to demonstrate the level of conservatism of the in-tunnel emissions modelling.

Fleet model

a) The proportion of total diesel passenger vehicle and total light duty vehicle (light commercial vehicle) predicted in tables 6.12 and 6.13 are a little higher than predicted by the EPA fleet model. However, the higher diesel fuel type estimates in the EIS will generally lead to more conservative (ie. higher) emission estimations.

b) The assignment of the passenger vehicle fleet to Euro emission standards has assumed the introduction of Euro 6 for light vehicles, however this standard has not been promulgated as an Australian Design Rule as at October 2017. The Commonwealth government emission standard review draft RIS published in December 2016 proposes introduction dates of 2019-2020 for those options that consider Euro 6 for light vehicles and Euro VI for heavy vehicles. Given that nearly 12 months have passed and no announcement has been made, a full implementation of Euro 6 should not be expected until 2020 at the very earliest.

c) The assignment of passenger cars and light duty vehicles to Euro standards is presented in table 6.15, and shows an assumed implementation of Euro 5 in 2014 and Euro 6 in 2019. These dates are considered too early; ADR79/03 phased in Euro 5 from November 2013 for new model vehicles, but ADR79/04 did not require Euro 5 for all new vehicles until November 2016. As noted in b) above, it is unlikely that Euro 6 will be implemented for all new vehicles until 2020 at the very earliest.

It is noted that the adoption of Euro VI for heavy duty diesel vehicles has not been assumed. This provides for a level of conservatism in the emission estimates if it is assumed that Australia will adopt Euro VI at some time in the future.

d) The percentages of the light vehicle fleet that are assumed to be Euro 6 presented in table 6.12 for the year 2023 are considered too high for a Euro 6 implementation of 2019. EPA estimates that in 2023, petrol vehicles with year of first registration between 2019 and 2023 will comprise only 18% of the car fleet and 6% for diesel vehicles, versus the 32% and 12% in table 6.12. This will have minimal impact for petrol vehicles but will result in lower emission estimations for diesel vehicles, particularly for NO_x, as the PIARC emission factors assume a very significant decrease in NO_x for Euro 6 vehicles.

It is suspected that the data in table 6.12 and 6.13 are the percentage of VKT [vehicle kilometres travelled] by emission standard class, which would give higher values for the newer emissions classes. However even if this is the case, the petrol Euro 5 and Euro 6 VKT percentages, in particular, appear too high. Overestimation of the proportion of VKT by newer emission certification vehicles will result in lower emission estimates.

Emission Model Validation

Section 6.6.9 of the Ventilation Report states that a validation was performed on the emission model using tunnel measurements from the existing M5 East tunnel. It is stated that this validation found the emissions estimated in the ventilation report are 'consistent with in-tunnel measurements'. No detail is presented to support this statement, and the report referenced is not appended to the E18, and does not appear to be publicly accessible.

Recommendations:

- The proponent should perform a sensitivity analysis to assess the impact on the fleet aggregate emission factors of full implementation of Euro 5 in 2017 rather than 2014, and full implementation of Euro 6 in 2021. The analysis should disaggregate the emission contributions by vehicle type (PC, LDV and HGV) and assess the level of conservatism in the model based on the relative assumptions for light and heavy vehicles
- The proponent should clarify the data in table 6.12 and 6.13 including its derivation; ie. fleet numbers and assumed VKT as a function of vehicle age
- The proponent should present full details of the validation to substantiate the claim made in section 6.6.9. The validation report should be made publicly available. Note that this validation conducted in 2015 will only validate the emission model for vehicles conforming with emission standards up to Euro 4 for petrol and diesel light duty vehicles and Euro V for heavy duty vehicles, and will not address the fleet model issues raised above.

Response

Fleet assumptions for the EIS ventilation analysis

In September 2016, NSW Roads and Maritime Services (Roads and Maritime) prepared a forecast of the on-road NSW vehicle fleet, taking into account trends in vehicle registrations, vehicle age and vehicle kilometres travelled for each vehicle category (see **Figure B2-2**). This forecast enables accurate estimates of vehicle emissions for future road tunnel projects up to the year 2040, by supplementing the PIARC (2012) methodology. This work is presented in the Draft NSW Fleet Forecast for Tunnel Ventilation Design: 2016 to 2040².

Some of the key assumptions within the vehicle emissions estimation provided in the EIS are outlined below:

- Vehicles compliant with Australian Design Rule (ADR)79/03 (Euro 5a) and ADR79/04 (Euro 5b) were assumed to be equivalent to Euro 5 emissions standard
- Euro 6 emissions standard assumed to be mandated for all vehicles from 2019 onwards
- Alternative fuelled vehicles (low emission, zero emission) are excluded from the emissions estimation and ventilation analysis. All vehicles are assumed to be either petrol or diesel powered.

Year	- 1995	1996-1998	1999-2002	2003	2004-2005	2006	2007	2008 - 2009	2010	2011-2013	2014-2016	2017-2018	2019-
Petrol PCs	Euro 0	Euro 1 (ADR 37/01)			Euro 2	Euro 3 (ADR79/01)			Euro 4 (ADR79/02)		Euro 5a	Euro 5b	Euro 6
Diesel PCs	Euro 0	Euro 1		Euro 2 (ADR 79/00)			Euro 4 (ADR 79/02)			Euro 5a	Euro 5b	Euro 6	Euro 6
Petrol LDVs	Euro 0	Euro 1 (ADR 37/01)			Euro 2	Euro 3 (ADR79/01)			Euro 4 (ADR79/02)		Euro 5a	Euro 5b	Euro 6
Diesel LDVs	Euro 0	Euro 1		Euro 2 (ADR 79/00)			Euro 4 (ADR 79/02)			Euro 5a	Euro 5b	Euro 6	Euro 6
Diesel HGVs	Euro 0	Euro I (ADR 70/00)		Euro III (ADR 80/00)			Euro IV (ADR 80/02)		Euro V (ADR 80/03)				

Notes:

PC = passenger car

LDV = light-duty vehicle

HGV = heavy goods vehicle (the same emission rates were used for PM₁₀ and PM_{2.5})

DSC = Do something cumulative.

Figure B2-2 Fleet forecast vehicle emissions standard assumed years of implementation

² https://www.westconnex.com.au/local-updates?default_view=2&project=14&updates=9

Table B2-2 EIS fleet composition - opening year (2023)

Emission Standard		PC Petrol	PC Diesel	LDV Petrol	PDV Diesel	HGV Diesel
Pre Euro	Pre-ADR37/01	0.10%	0.00%	1.12%	0.19%	5.19%
Euro 1	ADR37/01	0.78%	0.01%	1.45%	0.18%	2.78%
Euro 2	ADR79/00	1.15%	0.21%	1.01%	0.92%	-
Euro 3	ADR79/01	5.44%	-	3.29%	-	6.08%
Euro 4	ADR79/02	13.25%	2.98%	5.00%	12.02%	13.99%
Euro 5	ADR79/03	26.43%	6.48%	5.46%	25.37%	71.96%
Euro 6		31.63%	11.53%	4.58%	39.39%	-
Total		100%		100%		100%
Estimated Qty of Vehicles		4,818,517		876,342		145,232

Assessment of sensitivity of the fleet emissions standards used in the EIS ventilation design

As suggested by the NSW EPA, a sensitivity assessment has been carried out to compare the emissions estimation was based on the alternative assumptions for implementation of vehicle emissions standard as set out in **Figure B2-3**. The fleet composition for this sensitivity check for the year 2023 is shown in **Table B2-3**.

For this sensitivity assessment, it was assumed that:

- Vehicles complaint with ADR79/03 (Euro 5a) assumed to be equivalent to Euro 4 emissions standard
- Vehicles compliant with ADR79/04 (Euro 5b) assumed to be equivalent to Euro 5 emissions standard
- Euro 6 emissions standard assumed to be mandated for all vehicles from 2021 onwards
- Alternative fuelled vehicles are excluded from the emissions estimation and ventilation analysis. All vehicles are assumed to be either petrol or diesel powered.

Year	- 1995	1996-1998	1999-2002	2003	2004-2005	2006	2007	2008 - 2009	2010	2011-2016	2017-2020	2021-
Petrol PCs	Euro 0	Euro 1 (ADR 37/01)			Euro 2	Euro 3 (ADR79/01)			Euro 4 (ADR79/02 & ADR79/03)		Euro 5	Euro 6
Diesel PCs	Euro 0	Euro 1		Euro 2 (ADR 79/00)			Euro 4 (ADR 79/02 (ADR79/02 & ADR79/03)			Euro 5	Euro 6	
Petrol LDVs	Euro 0	Euro 1 (ADR 37/01)			Euro 2	Euro 3 (ADR79/01)			Euro 4 (ADR79/02 (ADR79/02 & ADR79/03)		Euro 5	Euro 6
Diesel LDVs	Euro 0	Euro 1		Euro 2 (ADR 79/00)			Euro 4 (ADR 79/02 (ADR79/02 & ADR79/03)			Euro 5	Euro 6	
Diesel HGVs	Euro 0	Euro I (ADR 70/00)		Euro III (ADR 80/00)			Euro IV (ADR 80/02)		Euro V (ADR 80/03)			

Figure B2-3 Sensitivity check - fleet forecast vehicle emissions standard assumed years of implementation

Table B2-3 Sensitivity assessment - fleet composition - opening year (2023)

Emission Standard		PC Petrol	PC Diesel	LDV Petrol	PDV Diesel	HGV Diesel
Pre Euro	Pre-ADR37/01	0.10%	0.00%	1.12%	0.19%	5.19%
Euro 1	ADR37/01	0.78%	0.01%	1.45%	0.18%	2.78%
Euro 2	ADR79/00	1.15%	0.21%	1.01%	0.92%	-
Euro 3	ADR79/01	5.44%	-	3.29%	-	6.08%
Euro 4	ADR79/02	27.79%	6.04%	8.24%	25.62%	13.99%
Euro 5	ADR79/03	25.81%	8.11%	4.35%	26.85%	71.96%
Euro 6		17.71%	6.84%	2.46%	24.30%	-
Total		100%		100%		100%
Estimated Qty of Vehicles		4,818,517		876,342		145,232

Table B2-4 shows the sensitivity comparison for the 2023 fleet composition with 14 per cent heavy vehicles. In addition to the change in composition of the fleet, the different implementation of Euro years for calculating age degradation is also included. The values provided are the emissions from a fleet average vehicle traversing the route from the M4 East entry portal to the New M5 exit portal and return, so provide a nominal average comparison for the mix of mainline tunnel section lengths and gradients in WestConnex.

These increases in in-tunnel concentrations are within the margins allowed for the ventilation design.

Although it is possible that the inclusion of Euro 6 emission factors in the NSW EPA model could have meant that NO_x emissions from diesel light vehicles were underestimated in the assessment, overall it is likely that the approach used would, in itself, have tended to give a conservative estimate of emissions. For example, all diesel light duty vehicles in Australia are imported, and hence Euro 6 vehicles will enter the fleet irrespective of promulgating ADR79/05, and they will probably reflect the enhanced standards incorporating real driving emissions (RDE).

The change in ambient air quality as a result of delayed implementation of Euro 6 would be negligible and within the conservatism of the model predictions. The analysis of postponed implementation of the standards confirms that the effects on both in-tunnel and ambient air quality would be marginal.

Table B2-4 Sensitivity analysis – M4 portal to M5 portal total mass of emissions for typical fleet vehicle (14% HGV)

	NO ₂ emissions (g)/"fleet avg vehicle"				NO _x emissions (g)/"fleet avg vehicle"				CO emissions (g)/"fleet avg vehicle"				PM emissions m ² "fleet avg vehicle"			
Speed (kilometres per hour)	80	60	40	20	80	60	40	20	80	60	40	20	80	60	40	20
EIS at 2023	3.38	3.69	4.90	7.83	20.44	22.95	30.74	49.23	29.85	24.79	28.32	46.29	9.91	10.06	10.63	12.03
Fleet composition sensitivity check at 2023	3.75	3.99	5.23	8.29	21.26	23.62	31.47	50.27	29.98	24.85	28.40	46.50	10.11	10.23	10.82	12.27
Percentage increase from EIS	11%	8%	7%	6%	4%	3%	2%	2%	0%	0%	0%	0%	2%	2%	2%	2%

Emission model validation

The validation of the emissions model used for the ventilation design is described in the report; *Comparison of PIARC based pollution estimates with measurements in the M5 East tunnel* (Stacey Agnew 2017) which is available on the WestConnex website³.

B2.1.4 Construction dust controls

Dust controls will be documented and implemented during construction activities to ensure the potential for off-site impacts are minimised. Additional control measures that will be implemented as necessary, and the process for determining whether or not additional control measures are necessary, will also be detailed.

Response

Dust management measures are outlined in **Chapter E1** (Environmental management measures). Dust management during construction will be documented in a Construction Air Quality Management Plan that will be developed and implemented to monitor and manage potential air quality impacts associated with the construction for the project. The Plan will be implemented for the duration of construction (see **Chapter E1** (Environmental management measures)).

B2.2 Social and economic

Refer to Chapter 14 (Social and economic) and Appendix P (Technical working paper: Social and economic) of the EIS for details of social and economic impacts.

B2.2.1 Ongoing construction impacts at Haberfield and St Peters

The EPA is concerned about the significant and ongoing nature of construction impacts experienced by the communities at Haberfield and St Peters, particularly in relation to noise and vibration. Whilst the EIS acknowledges that certain communities along the alignment will be subject to consecutive construction impacts from the stages of the WestConnex project, there is minimal evidence to suggest that this has shaped the approach to mitigation in the assessment; the EIS makes repeated references to 'short-term' impacts from the construction work. The EPA considers that the ongoing impacts on the communities at Haberfield and St Peters need to be quantified and assessed in detail in the EIS, rather than being addressed under a post-approval management plan, if the project is approved as proposed.

Response

Longer duration construction impacts are expected where the project connects to the M4 East and New M5 projects at Haberfield/Ashfield and St Peters respectively. Chapter 26 (Cumulative impacts) of the EIS comprises a detailed cumulative impact assessment. Furthermore, respective technical working papers including traffic and transport (Appendix H (Technical working paper: Traffic and transport) of the EIS), noise and vibration (Appendix J (Technical working paper: Noise and vibration) of the EIS) and air quality (Appendix I (Technical working paper: Air quality) of the EIS) include consideration of consecutive and concurrent (cumulative) impacts during construction and operation of the project. The outcomes of the respective assessments of cumulative impacts were then used to inform the development of management and mitigation measures (see **Chapter E1** (Environmental management measures)).

Roads and Maritime acknowledge that the impacts from construction of the WestConnex program of works at Haberfield/Ashfield and St Peters are not short-term, as the consecutive construction of components of the WestConnex projects would extend the duration of impacts to a period of up to seven years for some receivers in these areas. The range and intensity of impacts have and would continue to vary during these periods as construction progresses, with the majority of impacts occurring, or expected to occur, as a result of certain construction activities and during certain times of the day (for example outside standard construction hours).

³ https://www.westconnex.com.au/local-updates?default_view=2&project=14&updates=9

Key impacts resulting from longer duration construction in these areas may include noise and vibration, including ground-borne noise from tunnelling, construction traffic including spoil haulage, dust, visual impacts and impacts on parking on local streets around construction sites. Construction activities most likely to result in longer duration impacts include surface road works, utility works, tunnelling and tunnelling support (such as spoil handling and transport).

The majority of intensive utility and civil construction works (including surface road works) around Haberfield/Ashfield and St Peters will be completed as part of the M4 East and New M5 projects respectively. In addition, in many instances, M4 East and New M5 construction will transition to less intensive works as the respective construction programs progress towards their conclusion and tunnelling is completed. These less intensive activities include mechanical and electrical fit-out, pavement and line-marking works and landscaping, which would occur prior to or at the same time as M4-M5 Link site establishment works commence. Areas where longer duration impacts are likely to be experienced around Haberfield/Ashfield and St Peters are shown in **Figure B2-4** to **Figure B2-6**.

This means that construction activities that overlap or occur consecutively from these projects and the M4-M5 Link would generally be less intensive and cause less disturbance to nearby communities. In addition, these works would typically be expected to require less road occupations (except for line marking and pavement works) and therefore would be more likely to occur during standard construction hours. In addition, at the completion of construction of the M4 East and New M5 projects, permanent noise treatments would be established and/or installed as required by the conditions of approval for these respective projects. This would include (where required by the conditions) the installation of at-receiver treatments and the establishment of permanent noise barriers. The noise modelling that has informed these at-receiver treatments is based on a cumulative scenario that includes the additional traffic forecast for the M4-M5 Link project. These treatments would assist in ameliorating construction noise impacts on these receivers.

Around Haberfield and Ashfield, the majority of the above-ground infrastructure required for the M4-M5 Link project is currently being built by the M4 East project. The large civil construction works such as the construction of the Wattle Street and Parramatta Road entry and exit ramps and associated civil construction works on Wattle Street and Parramatta Road, as well as the Parramatta Road ventilation facility (including the outlet for the M4-M5 Link project) will be complete or nearing completion before construction of the M4-M5 Link commences. This includes the construction of the M4-M5 Link entry and exit ramps along Wattle Street, including the dive and cut-and-cover structure.

Around St Peters, clean-up of the Alexandria Landfill site, construction of the St Peters interchange as well as construction of a component of the above ground infrastructure required for the M4-M5 Link project is being carried out by the New M5 project. This includes construction of the M4-M5 Link entry and exit ramps, upgrades of the local roads (including Campbell Road) and the provision of a construction hardstand area and construction access driveway that will be reused for the Campbell Road civil and tunnel site (C10).

The M4-M5 Link project will need to carry out some civil construction works (including construction of the Campbell Road ventilation facility) and civil finishing works for infrastructure at Haberfield and St Peters. However, construction of surface infrastructure at both locations as part of the M4-M5 Link project has been minimised as much as practicable.

As described in section 6.4 of Chapter 6 (Construction work) of the EIS, site establishment activities associated with the M4-M5 Link project would include utility works, vegetation removal, the establishment of traffic management and environmental controls and demolition of buildings and structures to facilitate the establishment of construction ancillary facilities. Although these site establishment works are relatively intense in nature and thus are anticipated to generate amenity related impacts such as noise and vibration and dust, they would typically occur during standard day time construction hours, with scheduled respite periods that will be implemented in accordance with the conditions of approval and associated environment protection licence. The majority of site establishment activities would also be relatively short in duration, with the exception of some activities such as utility works.

To further manage the impacts associated with longer duration construction impacts from the concurrent construction of the WestConnex component projects in these areas and to respond to issues raised during the construction of other WestConnex projects and in submissions on the M4-M5 Link EIS, the following strategies are proposed:

- Provision of additional off-street car parking for the construction workforce at Rozelle, with the use of the White Bay civil site which would provide around 50 parking spaces. This site is further described in **Chapter D2** (White Bay civil site (C11))

- Using the Northcote Street civil site for construction workforce car parking and laydown. Currently this site is used as the main tunnelling site for the eastern end of the M4 East project
- Reducing the surface construction footprint of the Wattle Street civil and tunnel site (C1a) to limit surface construction activities to the Wattle Street entry and exit ramps. Compared to the indicative layout presented in Chapter 6 (Construction work) of the EIS for this site, this would reduce potential construction impacts such as noise and vibration and dust during construction of the M4-M5 Link project and would also allow for realisation of the M4 East urban design and landscaping outcome for this area at the completion of the M4 East project
- Provision of a heavy vehicle truck marshalling facility at the White Bay civil site at Rozelle, which would cater for around 40 heavy vehicles and stage the release of trucks to the tunnelling sites to manage the arrival of trucks to construction ancillary facilities (see **Part D** (Preferred infrastructure report)). Provision of a truck marshalling facility and additional construction workforce parking would result in several benefits for the community and the project, including:
 - Reducing potential queuing, idling, circling and congestion on local roads surrounding the project and associated construction ancillary facilities
 - Providing additional construction workforce parking spaces, which would minimise construction workers parking on local roads
 - Minimising disruptions to the road network around construction ancillary facilities and noise and other disturbance to the local community including residential, business and commercial properties
 - Improving safety for construction workers, motorists and the general public by providing a controlled area from which project traffic schedulers can manage trucks and direct truck drivers to the construction sites at an appropriate time
- Development of a car parking strategy that will quantify construction workforce parking demand, identify public transport options (and measures such as carpooling and shuttle-buses) and identify all locations that will be used for construction workforce parking (see environmental management measure TT04 in **Chapter E1** (Environmental management measures))
- Development and implementation of a truck management strategy that will identify potential truck marshalling areas that will be used by project-related heavy vehicles and describe management measures for project-related heavy vehicles to avoid queuing and site-circling in adjacent streets and other potential traffic and access disruptions (see environmental management measure TT16 in **Chapter E1** (Environmental management measures))
- Designing acoustic sheds with consideration of the activities that will occur within them and the relevant noise management levels in adjacent areas. Monitoring will be carried out to confirm that the actual acoustic performance of each shed is consistent with predicted acoustic performance (see environmental management measure NV7 in **Chapter E1** (Environmental management measures))
- The appointment of a suitably qualified and experienced Acoustics Advisor, who is independent of the design and construction personnel, and who will be engaged for the duration of construction of the project (see environmental management measure NV1 in **Chapter E1** (Environmental management measures))
- Use of the M4 East and New M5 tunnels for spoil haulage when they become available and where practicable, to minimise heavy vehicle movements on the surface road network
- Receivers that qualify for assessment for at receiver treatment in relation to operational noise, that are also predicted to experience significant exceedances of noise management levels due to construction, will be given priority preference for assessment for treatment based on the severity and timing of impact. Where the building owner accepts the at receiver treatment proposal, the treatments will be installed as soon as possible (see environmental management measure NV9 in **Chapter E1** (Environmental management measures)).

Specific management and mitigation will be documented in relevant construction environmental management sub-plans including the Ancillary Facilities Management Plan and the Construction Traffic and Access Management Plan. This will include detailed consideration of the types of activities that would be most likely to cause longer duration impacts during construction of the project, the types of impacts already experienced by these communities as a result of M4 East and New M5 construction, and subsequent development and implementation of location and activity specific mitigation that considers the consecutive nature of construction at these locations.

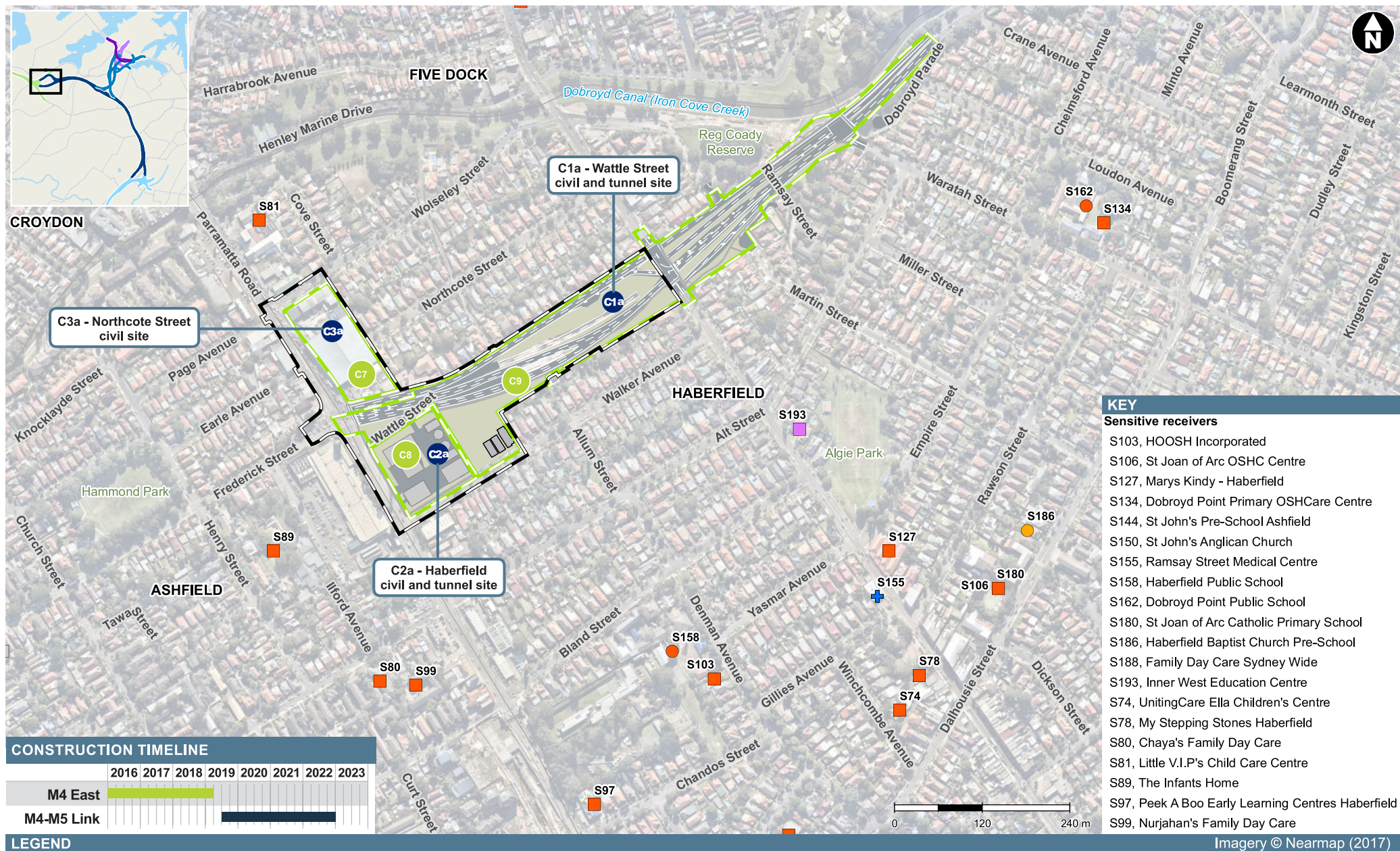


Figure B2-4 Cumulative construction impacts – Haberfield (Option A)

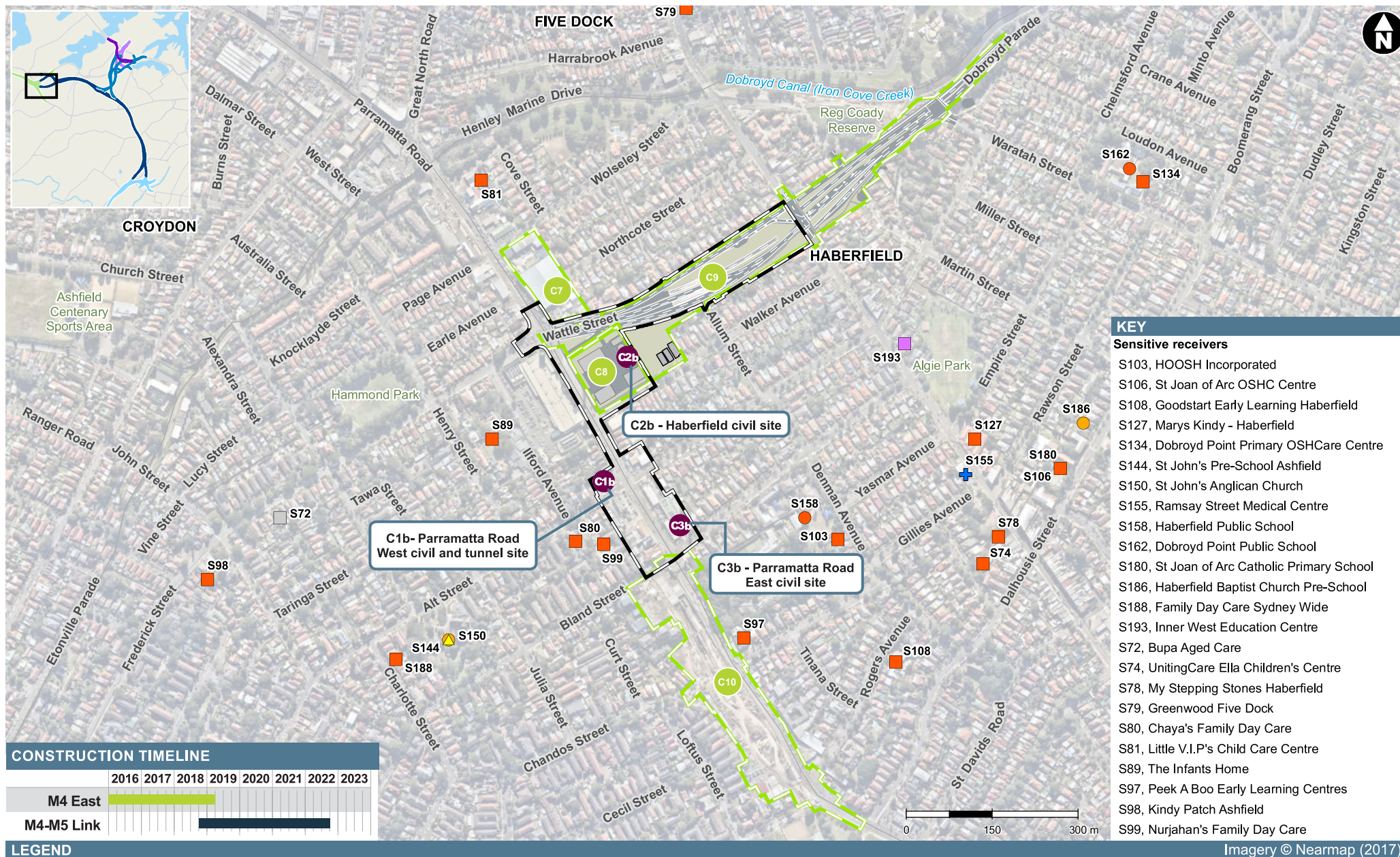


Figure B2-5 Cumulative construction impacts – Haberfield (Option B)

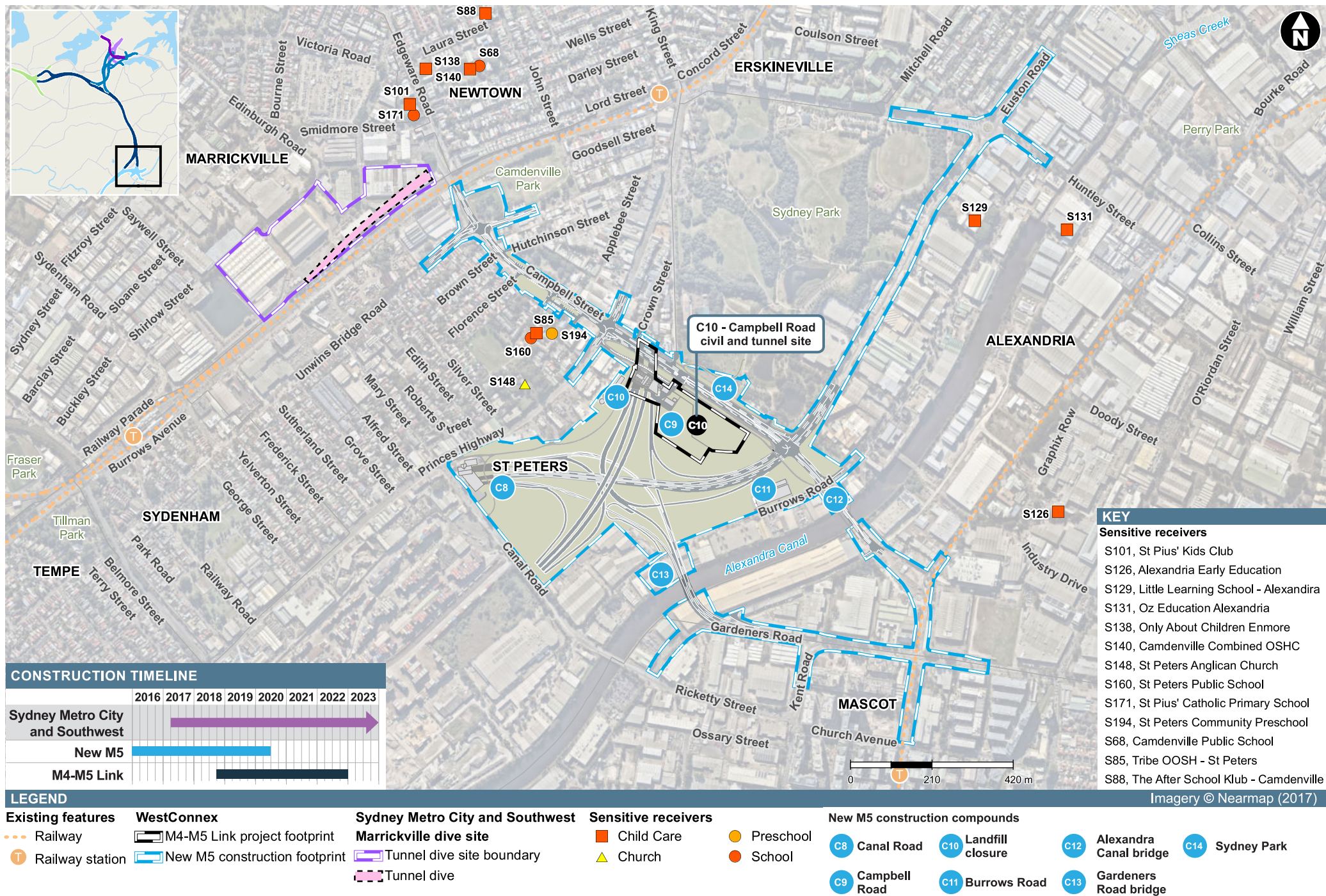


Figure B2-6 Cumulative construction impacts – St Peters

B2.3 Noise and vibration

Refer to Chapter 10 (Noise and vibration) and Appendix J (Technical working paper: Noise and vibration) of the EIS for details of noise and vibration impacts.

B2.3.1 Construction works outside of standard construction hours

In relation to noise and vibration impacts, the proponent has incorporated an assessment for works that will occur outside of standard construction hours. Justification for this scenario has not been provided. For works subject to an EPL [Environment Protection Licence], strong justification (other than scheduling) is necessary to support any application to work outside of standard construction hours. It should not be assumed that there will be provisions made within an EPL for works to occur outside standard construction hours; the justifications are essential for the EPA to make this assessment.

Response

The timely construction and delivery of the project is an essential part of the NSW Government's multi-faceted approach to planning for future growth in Sydney, along with other State significant projects such as other WestConnex projects as well as the Sydney Metro City and Southwest, NorthConnex and the Central Business District (CBD) and South East Light Rail.

In developing construction methodologies and a construction program for the project, the aim has been to minimise the duration of the construction period, while maintaining an acceptable and manageable amenity outcome for surrounding receivers. This has required a balance between the speed of construction activities and the ability to reasonably and feasibly manage potential impacts within acceptable limits.

Tunnelling and associated tunnelling support construction activities (including spoil haulage) would occur 24 hours per day, seven days per week. The exception to this would be at the Darley Road civil and tunnel site (C4), where tunnelling, along with spoil management within an acoustic shed, would occur 24 hours per day, seven days per week, but spoil haulage would occur during standard construction hours only.

The majority of surface construction would be undertaken during standard working hours. However, some construction activities would need to be undertaken outside standard construction hours (ie at night). When works outside of standard construction hours are required, these will need to be justified in accordance with the *Interim Construction Noise Guidelines* (NSW Department of Environment and Climate Change 2009). Construction works that might be undertaken outside the recommended standard hours are:

- Utility works
- Surface works to arterial roads, such as Wattle Street, City West Link, The Crescent, Anzac Bridge, Victoria Road, to minimise impacts on peak traffic flows
- The delivery of oversized plant or structures which are determined by authorities and police to be transported at a time which minimises disruption and safety concerns
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- Emergency work required to avoid the loss of life, damage to property or to prevent environmental harm
- Public infrastructure works that shorten the length of the project and are supported by the affected community
- Works where a justification of the need to operate outside the recommended standard hours is accepted.

Where required, the proponent will provide the relevant authority with a clear justification for the need for out-of-hours works, such as to sustain operational integrity of the road networks.

An out-of-hours works protocol will be developed for the construction of the project (see NV5 in **Chapter E1** (Environmental management measures)). The protocol will include:

- Details of works required outside standard construction hours, including justification of why the activities are required outside standard construction hours
- Measures that will be implemented to manage potential impacts associated with works outside standard construction hours
- Location and activity specific noise and vibration impact assessment process(es) that will be followed to identify potentially affected receivers, clarify potential impacts and select appropriate management measures
- Details of the approval process (internal and external) for works proposed outside standard construction hours.

The protocol will be included in the Construction Noise and Vibration Management Plan (CNVMP).

B2.3.2 Noise and vibration mitigation

The EIS includes discussion of options A and B for tunnelling and support works at Haberfield. This indicates that noise and vibration mitigation is conceptual at this point and that further review of feasible and reasonable mitigation will need to be undertaken once the contractor has been appointed and during detailed design.

Recommendation: Further assessment of actual impacts and reasonable and feasible mitigation measures is undertaken.

Response

The construction methodologies described in this EIS are based on the concept design for the project and are therefore indicative only with detailed design to be carried out by the design and construction contractor(s).

As described in section 6.1 of the EIS, the EIS has been prepared prior to the appointment of a design and construction contractor and as such the construction strategy presented in the EIS aims to provide an assessment of probable construction methodologies, while retaining flexibility for the design and construction contractor to refine the construction methodology following their appointment. The design and construction methodology presented by the contractor(s) would be consistent with the environmental performance outcomes and environmental management measures described in **Chapter E1** (Environmental management measures) and the conditions of approval for the project. This approach has been used by several recent large infrastructure projects in Sydney including Sydney Metro City and South West and CBD and South East Light Rail.

The noise and vibration assessment undertaken to inform the EIS was prepared in response to the Secretary's Environmental Assessment Requirements (SEARs) as issued by the Department of Planning and Environment (DP&E). The assessment was undertaken in accordance with the following guidelines/policies:

- *Noise Criteria Guideline* (Roads and Maritime 2015)
- *Noise Mitigation Guideline* (Roads and Maritime 2015)
- *NSW Road Noise Policy* (NSW EPA 2011)
- *NSW Industrial Noise Policy* (NSW EPA 1999)
- *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime 2016)
- *Interim Construction Noise Guideline* (ICNG) (NSW EPA 2009).

Twelve construction ancillary facilities are described and assessed in this EIS. This included the assessment of two potential combinations of construction ancillary facilities at Haberfield and Ashfield (Option A and Option B) as representative scenarios, the purpose of which was to inform the development of a construction methodology that would manage constructability constraints and the need for construction to occur in a safe and efficient manner, while minimising impacts on local communities, the environment and users of the surrounding road and other transport networks.

As described in section 6.5.1 of the EIS, the layout and access arrangements for the construction ancillary facilities are based on the concept design only and would be confirmed and refined during detailed design. The construction ancillary facilities as described in the EIS provide a good representation of what may be present during construction. Consequently, detailed assessments presented in the EIS therefore provide a robust representation of the likely impacts during the establishment and use of construction ancillary facilities.

The final construction site layouts and access arrangements would be consistent with the EIS and the Submissions and preferred infrastructure report (including the environmental management measures outlined in **Chapter E1** (Environmental management measures)) and satisfy criteria identified in any relevant conditions of approval. They would also have regard to the following amenity criteria:

- Where practicable, temporary buildings and structures (such as offices and amenities) would be used to provide a noise barrier between the construction site and adjacent sensitive receivers
- Vehicle access points and internal circulation roads would be located away from adjacent sensitive receivers
- Vehicle access points would have ready access to the arterial road network and would minimise the need for heavy vehicles to travel on local roads through residential areas
- Construction sites would provide sufficient area for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard construction hours.

Management and mitigation measures have been developed to avoid or minimise the impacts from construction noise and vibration on nearby receivers. These are outlined in **Chapter E1** (Environmental management measures) and include the preparation of a CNVMP that will be prepared for the project. The plan will:

- Identify relevant performance criteria in relation to noise and vibration
- Identify noise and vibration sensitive receivers and features in the vicinity of the project
- Include standard and additional mitigation measures from the *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime 2016) and details about when each will be applied
- Describe the process(es) that will be adopted for carrying out location and activity specific noise and vibration impact assessments to assist with the selection of appropriate mitigation measures
- Include protocols that will be adopted to manage works required outside standard construction hours in accordance with relevant guidelines
- Detail monitoring that will be carried out to confirm project performance in relation to noise and vibration performance criteria.

The CNVMP will be implemented for the duration of construction of the project.

In addition, location and activity specific noise and vibration impact assessments will be carried out prior to (as a minimum) activities:

- With the potential to result in noise levels above 75 dBA at any receiver
- Required outside standard construction hours likely to result in noise levels greater than the relevant noise management levels
- With the potential to exceed relevant performance criteria for vibration.

The assessments will clarify predicted impacts at relevant receivers in the vicinity of the activities to assist with the selection of appropriate management measures, consistent with the requirements of ICNG and CNVG that will be implemented during the works.

Environmental management measure NV1 (see **Chapter E1** (Environmental management measures)) also requires that an Acoustics Advisor be engaged for the duration of the construction of the project. The Acoustics Advisor will be responsible for:

- Reviewing management plans related to noise and vibration and endorsing that they address all relevant conditions of approval and requirements of all applicable guidelines
- Reviewing location and activity specific noise and vibration impact assessments prepared during the project and endorsing the assessments and proposed mitigation measures

- Reviewing proposals regarding works outside standard construction hours, confirming that the works are appropriate and endorsing the proposed mitigation measures
- Monitoring noise and vibration from construction generally and:
 - Confirming that actual noise and vibration levels and impacts are consistent with predictions
 - Confirming that reasonable and feasible noise and vibration mitigation measures are being implemented
 - Suggesting additional reasonable measures to further reduce impacts
- Monitoring and providing advice in relation to compliance with conditions of approval and project commitments related to noise and vibration
- Providing advice in relation to complaints regarding noise and vibration impacts that cannot be resolved between the complaint and the project
- Reviewing and endorsing the proposed operational noise controls, the associated noise model and the proposed implementation program.

B2.3.3 Noise and vibration mitigation

With regard to construction noise and vibration, the EPA considers that the proponent has not adequately provided clear justification for out-of-hours works, even though this has been assumed and assessed as part of the proposal.

Recommendation: Construction work be limited to standard construction hours as per the *Interim Construction Noise Guideline* unless the proponent can demonstrate strong justification for out of hours works (other than scheduling).

Response

See the response in **section B2.3.1** for justification of works proposed outside of standard construction hours.

B2.3.4 Conditions of approval (noise and vibration)

NSW EPA recommends that the Department of Planning and Environment includes in any approval given for the project the recommended conditions provided as part of the NSW EPA submission.

Response

Noted. Conditions of approval are a matter for the DP&E to consider during its assessment of the project.

B2.4 Soil and water quality

Refer to Chapter 15 (Soil and water quality) and Appendix Q (Technical working paper: Surface water and Flooding) of the EIS for details of impacts on soil and water quality.

B2.4.1 Water quality impact assessment

The EIS states the relevant Water Quality Objectives (protection of aquatic ecosystems, visual amenity, secondary contact recreation, primary contact recreation and aquatic foods cooked) and most of the indicators and trigger values for the receiving waters' environmental values, listing both the lowland rivers and estuarine values. The EIS anticipates that the discharge water quality requirements for the construction phase would be consistent with the 90% species protection level for toxicants in accordance with the ANZECC [Australian and New Zealand Environment Conservation Council] Guidelines (2000).

While the EPA accepts that the proposed works are in proximity to highly disturbed waterways, the ANZECC Guidelines recommend that 'guideline trigger values for slightly to moderately disturbed systems also be applied to highly disturbed ecosystems wherever possible'. The Guidelines also state: 'the aim is to eventually restore highly disturbed systems to a slightly to moderately disturbed condition', and that: 'It is not acceptable to allow poor environmental performance or water pollution, simply because a water way is degraded'.

Consistent with this, the policy in NSW is that the level of protection applied to most waterways is the one suggested for 'slightly to moderately disturbed' ecosystems. In a highly disturbed waterway, a reduced level of protection may be appropriate as a pragmatic short-term goal, with the aim of eventually restoring it to the status of 'slightly to moderately disturbed'. The construction phase however is projected to be close to 4 years (for each stage), which the EPA does not consider to be 'short-term, particularly given the consecutive nature of the WestConnex Project at certain areas along the alignment.

Recommendation: The receiving waterways require an appropriate protection level relevant to the duration of the project. The proponent should demonstrate that any discharge water quality is consistent with at least the 95% protection level for the appropriate receiving environment ie freshwater and/or marine ecosystems.

Response

Section 8.2.1 of Appendix Q (Technical working paper: Surface water and flooding) of the EIS discusses that temporary construction water treatment facilities would be designed to treat wastewater from the tunnelling works which includes groundwater ingress, rainfall runoff in tunnel portals and ventilation shafts, heat and dust suppression water and wash down runoff.

An ANZECC (2000) species protection level of 90 per cent for toxicants was considered appropriate for adoption as a discharge criterion during construction where practical and feasible. The 90 per cent species protection level is considered to be acceptable for the construction phase because:

- As described in section 2.2.1.9 of ANZECC (2000) and in the *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (NSW Department of Environment and Conservation 2005) the guidelines and objectives are not intended to be applied directly as discharge criteria. They have been derived to apply to the ambient waters that receive effluent or stormwater discharges and protect the environmental values they support. Therefore a less stringent criteria for an end of pipe discharge is considered appropriate when other factors are considered, as described below
- While a quantitative assessment has not been undertaken for the construction phase discharges, when considering the results of the box modelling conducted to inform this response for the operational water treatment plant discharges (see **section B2.4.4**), it is considered that aiming to achieve guideline trigger levels for slightly to moderately disturbed systems as discharge criteria for groundwater treatment is unlikely to result in a material improvement to ambient water quality.

Additional treatment processes such as reverse osmosis or ion exchange would be required to achieve a discharge criteria equivalent to the more stringent 95 per cent species protection level and 99 per cent for contaminants that bioaccumulate, with limited benefit to ambient water quality. Reverse osmosis and ion exchange also have negative environmental impacts including the additional energy usage and chemical waste requiring disposal. Additional footprint would also be required at each location where a construction water treatment plant is proposed to accommodate these more advanced facilities which would result in loss of viable construction area and potentially the need for additional property acquisition.

The discharge criteria for the treatment facilities will be finalised during the preparation of the Construction Soil and Water Management Plan in consultation with relevant stakeholders.

See **section B2.4.4** for details on operational water treatment plant discharges.

B2.4.2 Water quality objectives

An assessment of the potential impacts on the relevant Water Quality Objectives is not provided. The EIS has not provided any predicted water quality discharge concentrations for the duration of the construction and operational phases. The EIS also does not assess the nature and degree of impact that discharges 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.

Recommendation: The 99% protection level should be applied for contaminants that bio-accumulate.

Response

Appendix Q (Technical working paper: Surface water and flooding) of the EIS has been prepared in accordance with the SEARs for the project and with consideration of relevant legislation, guidelines and policy. Further details on the assessment methodology is included in Chapter 3 of Appendix Q (Technical working paper: Surface water and flooding) of the EIS.

The EIS has qualitatively assessed impacts to relevant water quality objectives. This level of assessment is consistent with assessments undertaken for the M4 East and New M5 projects. Residual impacts to ambient water quality will generally be negligible with impacts localised to the zone near the outlet where discharges mix with receiving waters. In the context of the entire catchment draining to Sydney Harbour, the project is likely to have a negligible influence on achieving the water quality objectives. Further assessment including the development of a box model has been undertaken to demonstrate that this is the case. See response in **section B2.4.4** for further details.

The EIS outlines stormwater pollutants and groundwater pollutants of concern for tunnel discharges from the Darley Road and Rozelle water treatment facilities during operation and discusses the nature and degree of impacts. Pollutants from other drainage streams in the tunnel would be captured and tested, and tanked offsite for treatment elsewhere if not suitable for treatment at the project's water treatment facilities and subsequent discharge; therefore they have not been considered further.

Due to the mixing and dilution affect which would occur at the outlet to the receiving waters, impacts to ambient water quality are likely to be negligible where iron and manganese are treated by the water treatment plants. Any minor impacts are likely to be localised and near to the outlet. The constructed wetland would also provide polishing treatment at Rozelle interchange, which would likely remove a portion of the nutrient and metal load (see **section B2.4.4** for further details about operational water treatment including the specific requirement for treatment of iron and manganese).

The recommendation of a 99 per cent protection level is acknowledged as an appropriate level of protection for contaminants that bioaccumulate in slightly to moderately disturbed systems. However, based on a review of the mean groundwater quality for contaminants that bioaccumulate, only nickel (0.008 mg/L) in the mainline tunnel groundwater inflows exceeds the marine water 99 per cent protection level (0.007 mg/L). With consideration of the negligible magnitude of the exceedance and negligible benefit to ambient water quality that would be achieved by a 0.001 mg/L improvement in discharge quality, further investigation of the need for treatment of nickel is not considered necessary.

B2.4.3 Construction state water treatment plants

Temporary construction water treatment plants are proposed and would be designed to treat wastewater including tunnel groundwater ingress, rainfall runoff in tunnel portals and ventilation outlets, heat and dust suppression water and wash down runoff and then discharge into receiving waters (stormwater and local waterways). The EIS has identified that the water treatment would typically involve: primary settling tanks, pH balance, flocculation. The EIS does not confirm that all identified pollutants of concern will be treated (ie no commitment has been made to treat nutrients (including ammonia), heavy metals, hydrocarbons and salinity). The EIS states that type, arrangement and performance of construction water treatment facilities will be developed and finalised during detailed design.

Recommendation: Confirmation that all identified pollutants of concern will be treated by the proposed methods during construction, and where these methods are not suitable, an assessment of additional treatment measures is undertaken.

Response

Section 5.3.1 of Appendix Q (Technical working paper: Surface water and flooding) of the EIS states that iron, manganese, suspended solids, hydrocarbons and other settleable compounds and pH would likely be treated at construction water treatment plants and provides some details around the type of treatment processes. It is considered that there is no need to treat salinity as discharges are to tidal water bodies.

Based on review of the most recent groundwater quality data undertaken since the EIS was prepared, phosphorus, nitrogen, chromium, copper, nickel and zinc are also potential pollutants of concern. Chromium, copper, nickel and zinc only slightly exceeded ANZECC slightly to moderately disturbed criteria with only copper (Rozelle tunnel wells) and zinc (mainline tunnel wells) exceeding 90 per cent species protection levels (see **Table B2-5** and **Table B2-6**). Given the low concentrations of these metals, impacts of untreated discharges would likely result in negligible impacts to water quality when considering the mixing and dilution which would occur within the receiving waters. Treatment of nickel and chromium is therefore not considered to be required. Opportunities to incorporate copper treatment processes at the Rozelle construction water treatment facilities, and zinc treatment processes at the mainline construction water treatment facilities, would be considered further during detailed design.

Phosphorus and nitrogen concentrations in groundwater were elevated in relation to the 90 per cent species protection level. The groundwater concentrations for both nitrogen and phosphorus are sufficiently low such that when considering dilution and mixing affects, discharges during construction are likely to result in negligible impacts to ambient water quality. Opportunities to treat phosphorus would be incorporated where feasible and reasonable, but nitrogen is not proposed to be treated during construction due to the need for advanced treatment methods.

Temporary construction water treatment plants will be designed and managed so that treated water will be of suitable quality for discharge to the receiving environment (see SW10 in **Chapter E1** (Environmental management measures)). An ANZECC (2000) species protection level of 90 per cent is considered appropriate for adoption as discharge criteria for toxicants where practical and feasible. The discharge criteria for the treatment facilities will be included in the Construction Soil and Water Management Plan (CSWMP).

B2.4.4 Operational state water treatment plants

Operational water treatment plants would be provided for the mainline tunnels at Darley Road, Leichhardt and for the Rozelle interchange and Iron Cove Link tunnels at the Rozelle interchange. The EIS states that the preferred option for treated water discharge from the Darley Road water treatment plant would be confirmed during detailed design. Options include direct discharges to either Hawthorne Canal, existing stormwater networks or to the sewer system. Treated flows from the Rozelle plant would drain via a constructed wetland to Rozelle Bay. The EIS provides limited information on the pollutants to be treated and the proposed treatment methods except for Iron and Manganese.

Recommendation: Further assessment of all pollutants is required as well as confirmation that the level of treatment proposed will produce effluent of a suitable quality for discharge to the receiving environment and that this has been developed in accordance with the ANZECC (2000) and relevant NSW WQOs.

The EIS states that the proposed constructed wetland will provide 'polishing' treatment to treated groundwater flows from Rozelle which would likely remove a portion of the nutrient and metal load. No details or modelling has been provided for the proposed constructed wetlands to demonstrate any treatment efficiencies. There is also potential for the constructed wetlands to be impacted by any remaining contaminated soil and/or groundwater onsite.

Recommendation:

- Detailed modelling should be provided to justify the claim that the constructed wetlands will treat groundwater inflows from Rozelle and will not be impacted by residual contaminated material
- Further investigation as part of the EIS should be provided into any opportunities to incorporate nutrient treatment (eg. ion exchange or reverse osmosis) within the water treatment plant at Darley Road
- It is not appropriate for the above assessment to be deferred to the detailed stage (as stated in the EIS) given that there could be impacts to the receiving water body - this should be quantified as part of the impact assessment.

Response

At the time of preparation of the EIS, groundwater monitoring results showed that iron and manganese had a high percentage of samples exceeding guideline level and therefore are the pollutants of most concern.

As identified in section 6.3.3 of Appendix Q (Technical working paper: Surface water and flooding) of the EIS, metal, nutrient and ammonia loading to Hawthorne Canal and Rozelle Bay is likely to increase as a result of the continuous treated groundwater discharges.

The operational water treatment facilities will be designed and managed such that effluent will be of suitable quality for discharge to the receiving environment. Opportunities to incorporate nutrient treatment within the plant at Darley Road will be investigated during detailed design. Discharge criteria will be developed in accordance with ANZECC (2000) and relevant NSW water quality objectives (WQOs), and will also include the following discharge criteria:

- 0.3 milligrams per litre for iron
- 1.9 milligrams per litre for manganese.

The discharge criteria for the treatment facilities will be nominated during detailed design in consultation with relevant stakeholders and included in the OEMP (see environmental management measure OSW16 in **Chapter E1** (Environmental management measures)).

The latest available groundwater monitoring results (July 2016 to August 2017) were reviewed after the preparation of the EIS to inform this response. Monitoring results were separated and assessed based on their location and assumed relevance to the mainline tunnel and Rozelle tunnels respectively. The monitoring results were reviewed against the various species protection levels (estuarine physical and chemical stressors and marine water for toxicants). Recreational water quality criteria were also considered. A summary of the analysis is provided in **Table B2-5** and **Table B2-6**.

Table B2-5 M4-M5 Link mainline tunnel groundwater monitoring results

Parameter	Units	Mainline Mean GW Concentration	99% SPL	95% SPL	90% SPL	80% SPL	Recreational Criteria	Groundwater Quality Assessment	Comments
pH	pH units	8.72	NA	6.5-8.5	7.6 to 8.0	NA	6.5-8.5	Outside range for SMD and 80%ile reference criteria	Proposed treatment suitable
Iron	mg/L	35.78	NA	NA	NA	NA	0.3	> Recreational Criteria.	Proposed treatment suitable
Nitrite (as N)	mg/L	0.06	NA	NA	NA	NA	1	< Recreational Criteria.	Pollutant not of concern
Nitrate (as N)	mg/L	0.09	0.017	0.7	3.4	17	10	<SMD PL.	Pollutant not of concern
Ammonia as N	mg/L	0.66	0.5	0.91	1.2	1.7	0.01	<SMD PL but > Recreational criteria	No treatment proposed
Nitrogen (Total)	mg/L	1.87	NA	0.3	0.9	NA	NA	>SMD PL and 80%ile reference criteria	No treatment proposed
Total Phosphorus	mg/L	1.16	NA	0.03	0.12	NA	NA	>SMD PL and 80%ile reference criteria	No treatment proposed
Reactive Phosphorus	mg/L	0.011	NA	0.005	0.04	NA	NA	>SMD PL but less than 80%ile reference criteria	No treatment proposed
Arsenic	mg/L	0.0008	0.0008	0.013	0.042	0.14	0.05	<SMD PL.	Pollutant not of concern
Cadmium	mg/L	0.00006	0.0007	0.0274	0.0486	0.0906	0.005	<SMD PL.	Pollutant not of concern
Chromium (III+VI)	mg/L	0.006	0.00014	0.0044	0.02	0.085	0.05	>SMD PL but <90% SPL	No treatment proposed
Copper	mg/L	0.003	0.0003	0.0013	0.003	0.008	1	>SMD PL. but equal to 90% SPL	No treatment proposed
Lead	mg/L	0.0006	0.0022	0.0044	0.0066	0.012	0.05	<SMD PL.	Pollutant not of concern
Manganese	mg/L	0.97	1.2	1.9	2.5	3.6	0.1	> Recreational Criteria.	Proposed treatment suitable
Mercury	mg/L		0.0001	0.0004	0.0007	0.0014	0.001	<SMD PL	Pollutant not of concern

Parameter	Units	Mainline Mean GW Concentration	99% SPL	95% SPL	90% SPL	80% SPL	Recreational Criteria	Groundwater Quality Assessment	Comments
Nickel	mg/L	0.008	0.007	0.07	0.2	0.56	0.1	> SMD PL but <90% SPL	No treatment proposed
Zinc	mg/L	0.07	0.007	0.015	0.023	0.043	5	> SMD PL. Exceeds 80% SPL.	No treatment proposed

Notes:

Bold values indicates slightly to moderately disturbed (SMD) protection level

Highlighted grey values indicates toxicants that bioaccumulate

In the absence of Marine Water criteria, the Freshwater criteria were adopted for arsenic, nitrate and manganese

Arsenic (V) and Chromium (VI) criteria were used

80 percentile Iron Cove reference criteria adopted as 80% SPL for pH, nitrogen, phosphorus and reactive phosphorus

Table B2-6 M4-M5 Link Rozelle and Iron Cove Link groundwater monitoring results

Parameter	Units	Rozelle Mean GW Concentration	99% SPL	95% SPL	90% SPL	80% SPL	Recreational Criteria	Groundwater Quality Assessment	Comments
pH	pH units	7.643	NA	6.5-8.5	7.4 to 8.0	NA	6.5-8.5	Outside range for SMD and 80%ile reference criteria	Pollutant not of concern
Iron	mg/L	34.8	NA	NA	NA	NA	0.3	> Recreational Criteria.	Proposed treatment suitable
Nitrite (as N)	mg/L	0.018	NA	NA	NA	NA	1	< Recreational Criteria.	Pollutant not of concern
Nitrate (as N)	mg/L	0.151	0.017	0.7	3.4	17	10	<SMD PL.	Pollutant not of concern
Ammonia as N	mg/L	0.38	0.5	0.91	1.2	1.7	0.01	<SMD PL but > Recreational criteria	Wetland proposed
Nitrogen (Total)	mg/L	1.47	NA	0.3	1.05	NA	NA	>SMD PL and 80%ile reference criteria	Wetland proposed
Total Phosphorus	mg/L	0.22	NA	0.03	0.1	NA	NA	>SMD PL and 80%ile reference criteria	Wetland proposed

Parameter	Units	Rozelle Mean GW Concentration	99% SPL	95% SPL	90% SPL	80% SPL	Recreational Criteria	Groundwater Quality Assessment	Comments
Reactive Phosphorus	mg/L	0.009	NA	0.005	0.03	NA	NA	>SMD PL but less than 80%ile reference criteria	Wetland proposed
Arsenic	mg/L	0.002	0.0008	0.013	0.042	0.14	0.05	<SMD PL.	Pollutant not of concern
Cadmium	mg/L	0.00006	0.0007	0.0274	0.0486	0.0906	0.005	<SMD PL.	Pollutant not of concern
Chromium (III+VI)	mg/L	0.003	0.00014	0.0044	0.02	0.085	0.05	>SMD PL but <90% SPL	Pollutant not of concern
Copper	mg/L	0.010	0.0003	0.0013	0.003	0.008	1	>SMD PL. but equal to 90% SPL	No treatment proposed
Lead	mg/L	0.002	0.0022	0.0044	0.0066	0.012	0.05	<SMD PL.	Pollutant not of concern
Manganese	mg/L	0.59	1.2	1.9	2.5	3.6	0.1	> Recreational Criteria.	Proposed treatment suitable
Mercury	mg/L	0.000051	0.0001	0.0004	0.0007	0.0014	0.001	<SMD PL	Pollutant not of concern
Nickel	mg/L	0.007	0.007	0.07	0.2	0.56	0.1	> SMD PL but <90% SPL	Pollutant not of concern
Zinc	mg/L	0.019	0.007	0.015	0.023	0.043	5	> SMD PL. Exceeds 80% SPL.	No treatment proposed

Notes:

Bold values indicates slightly to moderately disturbed (SMD) protection level

Highlighted grey values indicates toxicants that bioaccumulate

In the absence of Marine Water criteria, the Freshwater criteria were adopted for arsenic, nitrate and manganese

Arsenic (V) and Chromium (VI) criteria were used

80 percentile Iron Cove reference criteria adopted as 80% SPL for pH, nitrogen, phosphorus and reactive phosphorus

For Rozelle interchange monitoring wells average groundwater concentrations exceeded water quality criteria as follows:

- Total nitrogen, total phosphorus, reactive phosphorus, copper and zinc exceeded slightly to moderately disturbed trigger levels
- Iron, manganese and ammonia exceeded recreational water quality trigger levels.

For mainline tunnel monitoring wells average groundwater concentrations exceeded criteria as follows:

- pH, total nitrogen, total phosphorus, reactive phosphorus, copper, chromium, nickel and zinc exceeded slightly to moderately disturbed trigger levels
- Iron, manganese and ammonia exceeded recreational water quality trigger levels.

The proposed operational water treatment plants at Darley Road (MOC1) and Rozelle (MOC3) would treat suspended solids, pH, iron and manganese. The proposed constructed wetland at the Rozelle Rail Yards would provide 'polishing' treatment to the treated groundwater flows, removing a proportion of the nutrient (forms of nitrogen and phosphorus) and metal load.

As the wetland at Rozelle Rail Yards is considered to be a 'polishing' wetland it would not be designed to perform to achieve a certain discharge criteria. The discharge criteria would be set as the discharge from the treatment plant upstream of the construction wetland. With this in mind, the box model assessment (as discussed below) did not take into account any potential water quality benefits from the wetland. However, the wetland would provide some water quality benefit by reducing nutrient and metal loading to Rozelle Bay.

MUSIC modelling of the constructed wetland was undertaken to gain an appreciation of what benefit the wetland might provide to inform the concept design and EIS. The modelling indicated that the wetland would reduce nutrient concentrations close to the assumed background concentrations within a wetland (MUSIC assumes background concentrations to be 1 mg/L for nitrogen and 0.06 mg/L for phosphorus) with an increasing removal rate as groundwater nutrient concentration increased. MUSIC is unable to model metal treatment. Further investigation would be undertaken at detailed design to confirm the effectiveness of the wetland. Notwithstanding this, the water treatment facility at the Rozelle East motorway operations complex (MOC3) would provide the necessary treatment to achieve the discharge criteria.

The wetland would be lined, eliminating the risk of direct groundwater inflows. A contamination investigation would be undertaken during detailed design, the findings of which would inform the need for site remediation and/or management measures. Potential contamination impacts to the wetland and other surface water systems (drainage channels) would be considered and appropriately managed as part of this investigation.

As no constructed wetland is proposed at the Darley Road motorway operations complex (MOC2), opportunities to incorporate other forms of nutrient treatment (for example ion exchange or reverse osmosis) within the plant at Darley Road will be investigated during detailed design. Other metals with mean concentrations which exceeded the slightly to moderately disturbed criteria, including zinc and copper (Rozelle and mainline tunnel) and chromium and nickel (mainline tunnel only) would also require similar forms of treatment to reduce their already low concentrations to slightly to moderately disturbed levels. Appropriate treatment methods, such as reverse osmosis and ion exchange, have negative environmental impacts including the additional energy usage and chemical waste requiring disposal. Additional footprint would also be required to accommodate these more advanced facilities which would result in a greater operational footprint and less land available for future non-road uses. With consideration of these factors, further assessment has been undertaken on the need for more advanced treatment as described below.

To inform this response, a box model was developed to quantify the impact of discharges from the operational water treatment plant to ambient water quality within the Hawthorne Canal/Iron Cove and Rozelle Bay systems when mixing and dilution effects are considered. In this model, Rozelle Bay and Iron Cove have been schematised as their own control volumes whereby the main process of mixing is tidal exchange. This mixing is assumed to be uniform and effective. Stormwater and groundwater concentrations have been averaged over time with Sydney Harbour having constant water quality; and inflows averaged over time. With this assumption, an iterative scheme over many tidal cycles has been created to estimate the final water body concentrations for a selection of analytes.

Scenarios were analysed for no treatment to identify high risk pollutants and with treatment to understand the benefits of treatment to the receiving waterways.

The box model supports the conclusions of the EIS that when mixing and dilution affects are considered, impacts to ambient water quality from treated groundwater within the receiving waterways would be negligible (generally less than three per cent impact to ambient water quality) with the exception of iron and manganese, which would require treatment.

Although some of the other metal and nutrient concentrations in groundwater exceeded the slightly to moderately disturbed ecosystem criteria (as detailed above), they are still sufficiently low such that when considering dilution and mixing affects, discharges during construction are likely to result in a negligible impacts to ambient water quality with no treatment. The benefit of providing treatment to achieve the ANZECC slightly to moderately disturbed criteria for other nutrients and metals (excluding iron and manganese) was assessed in the model and shown to provide a negligible improvement to ambient water quality by comparison with the 'no treatment' option. Furthermore, species protection levels in ANZECC (2000) are not intended to be applied as discharge criteria. As described in section 2.2.1.9 of ANZECC (2000) and in the *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (NSW Department of Environment and Conservation 2005) the guidelines and objectives are intended to apply to ambient waters that receive effluent or stormwater discharges and are just one factor that needs to be considered when developing discharge criteria (such as the impacts of more advanced treatments).

The benefit of providing additional ammonia treatment with consideration to the recreational water quality criteria was also considered. The box model assessment indicated that a negligible benefit to ambient water quality would be achieved by comparison with the 'no treatment' option.

Therefore, when considering the limited benefits to ambient water quality and negative environmental impacts, more advanced treatment is not considered to be required for these lower risk pollutants.

B2.4.5 Work in waterways

The EPA is generally supportive of channel naturalisation treatments where potential contamination legacy issues are assessed and addressed. The EIS states that the project would involve works in and around waterways, including Whites Creek and Rozelle Bay during bridge construction works as part of the realignment of The Crescent as well as widening of Whites Creek to manage flooding and drainage. These works may lead to disturbance of contaminated sediments and erosion of exposed banks once the existing channel's concrete lining has been removed (and prior to construction of the naturalised channel treatment). Construction of new stormwater outlets to receiving bays (Rozelle Bay and Iron Cove) would cause localised mobilisation of potentially contaminated sediments. Sediments settled on top of the hard, lined base of Whites Creek would also be disturbed. No detail was provided on the proposed mitigation measures for in-channel sediment disturbance, including measures for protecting water quality associated with construction/modification activities within and adjacent to waterways.

Recommendation: Further assessment of mitigation measures to address in-channel sediment disturbance.

Response

Section 5.3 of Appendix Q (Technical working paper: Surface water and flooding) of the EIS states that works at Whites Creek and Rozelle Bay during bridge construction may lead to disturbance of contaminated sediments and potentially erosion of exposed banks once the existing channel concrete lining has been removed and prior to construction of naturalised channel treatments. This could result in temporary turbidity impacts to water quality within Whites Creek and Rozelle Bay during construction. Impacts are likely to be temporary until settling occurs and would be managed in accordance with the NSW Department of Primary Industries guidelines for controlled activities on waterfront land including the in-stream works, riparian corridors and watercourse crossings guidelines. Potential impacts associated with contaminated sediments will be managed in accordance with:

- Environmental management measure SW01 (see **Chapter E1** (Environmental management measures)), which requires the preparation and implementation of a CSWMP which will include the measures that will be implemented to manage and monitor potential surface water quality impacts during construction
- Environmental management measure SW02, which requires a program to monitor potential surface water quality impacts due to the project, including the disturbance of contaminated sediment (see SW02 in **Chapter E1** (Environmental management measures))

- Environmental management measure CM01, which requires that potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 1997* (NSW). This includes further investigations in areas of potential contamination identified in the project footprint. If contamination posing a risk to human or ecological receptors is identified, a Remediation Action Plan will be prepared.

Construction environmental management measures, as identified in **Chapter E1** (Environmental management measures), will be captured in a Construction Environmental Management Plan and associated sub-plans, including a CSWMP and erosion and sediment control plans, and prepared in accordance with the relevant conditions of approval.

Furthermore, there are a number of specific environmental management measures proposed in **Chapter E1** (Environmental management measures) relating to construction and operational impacts around Whites Creek and Rozelle Bay including environmental management measures SW03, SW09, OSW17, OSW18, B3, B4 and OB10.

The CSWMP will include the measures that will be implemented to manage and monitor specific surface water quality impacts during construction. Therefore, it is considered suitable that mitigation measures to address in-channel sediment disturbance be developed as part of this process.

B2.4.6 Water quality monitoring program

The EIS states that a program to monitor potential surface water quality impacts associated with the project will be developed and included in the Construction Soil and Water Management Plan. The program will include the water quality monitoring parameters and the monitoring locations identified in Annexure E of Appendix Q (Technical working paper: Surface water and flooding). Although ammonia has been identified as a contaminant of concern, it has not been included as a water quality monitoring parameter.

Recommendation: Inclusion of Ammonia as a water quality monitoring parameter.

Response

It is acknowledged that ammonia should be included as a water quality monitoring parameter and this will be considered in the development of the CSWMP.

B2.4.7 Recommended conditions of consent

NSW EPA recommended a number of conditions of consent that should be considered as part of any planning approval that would be issued for the project.

Response

Conditions of approval are a matter for DP&E to consider during its assessment of the project.

B2.5 Contamination

Refer to Chapter 17 (Contamination) and Appendix R (Technical working paper: Contamination) of the EIS for details of contaminants of potential concern and the existing environment.

B2.5.1 Site identification and characterisation

The EPA notes the presence of former and operational commercial/industrial facilities and service stations surrounding the proposed tunnel alignment. The proposed development traverses various suburbs with areas that have been notified to the NSW EPA under section 60 of the *Contaminated Land Management Act 1997* ('CLM Act') or formerly regulated by the NSW EPA under the CLM Act. The EPA also notes presence of former and operational dry cleaning facilities surrounding the proposed tunnel alignment including but not limited to Haberfield civil and tunnel site (C2a) at Haberfield, Parramatta Road East civil site (C3b) at Haberfield, and Pyrmont Bridge Road Tunnel site at Annandale. Considering this, chlorinated hydrocarbons could be present in soil, groundwater and soil vapour.

Recommendations: Chlorinated hydrocarbons should be included as potential contaminants of concern in future investigation works.

Chapter 16 and Appendix R of the EIS reported that there are notified sites under section 60 of the CLM Act within 300 metres of the tunnel alignment, or sites formerly regulated by the NSW EPA under the CLM Act. The EPA has reviewed the management status of these sites against its internal records.

Recommendations: The management status of sites listed in Table 16-18, Table 16-19, Table 16-20 and Table 16-21 be updated as follows:

From Table 16-18:

- White Bay Power Station Rozelle - Regulation under CLM Act not required
- Balmain Power Station (Terry Street Rozelle) - Formerly regulated under the CLM Act
- Former Chemplex Factory (35 Terry Street Rozelle) - Formerly regulated under the CLM Act
- Caltex Service Station (121 Victoria Road Rozelle) - Regulation under CLM Act not required
- 7 Eleven Service Station (178-180 Victoria Road Rozelle) - Regulation under CLM Act not required.

From Table 16-49:

- O'Dea Reserve (Salisbury Lane, Camperdown) - Formerly regulated under the CLM Act
- 7 Eleven (Former Mobil) Service Station (198 Parramatta Road Annandale) - Regulation under CLM Act not required.

From Table 16-20:

- Caltex Service Station (26 Enmore Road Newtown) - Regulation under CLM Act not required.

From Table 16-21:

- BP Express Service Station (2 Princes Highway, St Peters) - Regulation under CLM Act not required
- Former Tidyburn Facility (53 Barwon Park Road, St Peters) - Formerly regulated under the CLM Act
- Camdenville Park (May Street, St Peters) - Regulation under CLM Act not required.

Response

Appendix R (Technical working paper: Contamination) of the EIS notes that where potential sources of chlorinated hydrocarbons such as manufacturing and dry cleaners were identified, volatile organic compounds were listed as a potential contaminant of concern. Volatile organic compounds include chlorinated hydrocarbons, as well as halogenated hydrocarbons and other solvents commonly used in industrial processes. Therefore, chlorinated hydrocarbons would be included as potential contaminants of concern in future investigation works.

The reviewed management status of the sites recorded in the EIS is acknowledged and revisions (as appropriate) have been documented in **Chapter A4** (Clarifications). As outlined in environmental management measure CM01, potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the CLM Act (see **Chapter E1** (Environmental management measures)). This includes further investigations in areas of potential contamination identified in the project footprint. If contamination posing a risk to human or ecological receptors is identified, a Remediation Action Plan will be prepared. Environmental management measures to mitigate contamination impacts are described in full in **Chapter E1** (Environmental management measures).

B3 NSW Chief Scientist and Engineer/ACTAQ

This chapter addresses issues raised by NSW Chief Scientist and Engineer/Advisory Committee on Tunnel Air Quality (ACTAQ).

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B3.1 Assessment process

Refer to Chapter 2 (Assessment process) of the Environmental Impact Statement (EIS) for details of the assessment process.

B3.1.1 Main findings of the review

Our overall conclusion of the WestConnex EIS is that it constitutes a thorough review of high quality. It covers all of the major issues and areas that an EIS for a project of this scale should. The information presented is of suitable detail and logical in order. The choices made regarding data used and methods followed have been logical and reasonable and it is our view that the benefit of exploring alternative approaches would be questionable or marginal.

Response

The comments received on the EIS are noted.

B3.2 Air quality

Refer to Chapter 9 (Air quality) and Appendix I (Technical working paper: Air Quality) of the EIS for details of air quality.

B3.2.1 Consideration of cumulative impacts

This project links the New M5 and M4 East projects, both of which are mainly road tunnels. To some degree these other WestConnex projects add road capacity to an existing corridor or route. However, the M4-M5 Link also introduces new high-speed routes across Sydney. It is therefore unsurprising that the EIS predicts an overall increase in vehicle emissions in this area of Sydney relative to the "Do Minimum" option.

It is also unsurprising that this project (as with WestConnex as a whole) will redistribute traffic flows in many parts of the city. However, by linking other tunnels together the M4-M5 Link is unique in Sydney in that it substantially increases the time that a vehicle could spend continuously in tunnels.

This means that, from an air quality point of view, this project presents some similarities and differences to the other WestConnex projects (M4 East and New M5). The major difference that needs to be explicitly considered is the cumulative impacts on ambient air quality, in-tunnel air quality and human exposure to pollutants of the three WestConnex projects.

Response

The comments received on the cumulative impact assessment are noted.

An analysis of the cumulative impacts of the operation of the WestConnex program of works on ambient and in-tunnel air quality is discussed in Chapter 9 (Air quality), section 26.4.2 and Appendix I (Technical working paper: Air quality) of the EIS. Human health cumulative impacts are discussed in section 26.4.4 of the EIS with further detail provided in Appendix K (Technical working paper: Human health risk assessment) of the EIS.

B3.2.2 General comments on assessment methodology

We find that the assessment methodology is sound and represents best practice. All of the models and data used are appropriate and expertly used. We have found no significant errors nor important omissions, other than lack of inclusion of new information on NO_x emissions from late-model diesel light-duty vehicles — discussed in detail below.

Response

The general comment by ACTAQ on the methodology is noted and a response to the detailed comments is provided in **section B3.2.2**.

B3.2.3 Emission modelling

The methodology (models used, assumptions made, etc.) to calculate emissions — in tunnels and on the surface road network, respectively — in the M4-M5 Link EIS is the same as in the New M5 (and M4 East) EIS. The third-party review of the New M5 EIS carried out by us in 2015 concluded regarding the emission modelling: "To summarize, there seems to be no or few weak points in the emission modelling part of the New M5 EIS".

Now, with two years having passed since the last EIS review, the following comments can be made:

- It is stated in the EIS that both of the emission models that have been used for the M4-M5 Link EIS were updated in 2012. Bearing in mind - among other things - the "dieselgate" scandal revealed in 2015, a question and concern thus is if the two models today represent the state of the art regarding emerging knowledge on late-model diesel light-duty vehicles' (LDVs) NO real-world emission performance, including the direct emissions of primary NO₂

For instance, the NO emission factors (EFs) for diesel LDVs complying with the Euro 5 emission standard in the European emission model HBEFA (www.hbefa.net) has been updated twice since late 2015, as new knowledge has emerged, each update resulting in higher EFs compared to the preceding model version. A similar evolution has occurred for diesel LDV Euro 6 emissions. This may have implications for both the baseline and the future emission scenarios for NO and NO₂ for tunnel traffic and traffic on the surface road network

- The consequences of the anticipated non-compliance of many late model diesel light-duty vehicles with regard to the NO_x legislative Euro 5 and 6 emission limits are amplified by the expected strong growth in the share of diesel light-duty vehicles until 2033.

Since any detailed vehicle-specific emission factors have not been presented in the M4-M5 Link EIS, it is not possible to assess the consequences for the emission modelling results of the EIS of the two factors mentioned above, although Annexure E [of Appendix I of the EIS] presents an evaluation of the NSW EPA emissions model conducted in the Lane Cove Tunnel, showing that the model overestimates emissions in that specific application.

Response

Emission factors for light duty vehicles

The emissions factors used for the ventilation design in the EIS were based on the Sydney fleet and were calibrated against tunnel traffic. The calibration report is available on the WestConnex website¹. The in-tunnel emissions for the future years were estimated using the detailed Permanent International Association of Road Congresses (PIARC) method based on the local fleet emissions factors which is a change from the M4 East and New M5 EISs which used the simple PIARC method.

The emissions factors used for the ambient air quality modelling was based on the NSW Environment Protection Authority (NSW EPA) emissions model, which is based on real-world monitoring data, and not based on manufacturers specifications. The accuracy of the NSW EPA model² in representing vehicle emissions (carbon monoxide (CO), oxides of nitrogen (NO_x), nitrogen dioxide (NO₂), particulate matter 10 micrometers or less in diameter (PM₁₀) and particulate matter 2.5 micrometers or less in diameter (PM_{2.5})) was investigated using measurements from the ventilation outlets of the Lane Cove Tunnel during October and November 2013. The ventilation conditions in the tunnel result in all vehicle emissions being released from the ventilation outlets. No pollution is released from the tunnel portals. This makes it possible to compare the predicted mass emission rate (in grams per hour) for the traffic in each direction of the tunnel with the observed emission rate in the corresponding ventilation outlet. On average, the model overestimated emissions of each pollutant in the tunnel, and by a factor of between 1.7 and 3.3.

¹ https://www.westconnex.com.au/local-updates?default_view=2&project=14&updates=9

² It should be noted that this work excludes the changes to the fuel splits for cars and light commercial vehicles following the Roads and Maritime fleet model revision in 2016.

Implications for baseline and future scenarios

Although it is possible that the inclusion of Euro 6 emission factors in the NSW EPA model could have meant that NO_x emissions from diesel light vehicles were underestimated in the assessment, overall it is likely that the approach used would, in itself, have tended to give a conservative estimate of emissions. For example, all diesel light-duty vehicles in Australia are imported, and hence Euro 6 vehicles will enter the fleet irrespective of promulgating ADR79/05, and they will probably reflect the enhanced standards incorporating real driving emissions (RDE). To develop the Euro 6 emission factors in the NSW EPA model, the European real-world Euro 5 NO_x emissions were scaled by the ratio of the Euro 6 and Euro 5 limit values. Given that the Euro 5 emission factors accounted for high real-world emissions, while Euro 6 will impose RDE, the Euro 6 NO_x emission factors in the NSW EPA model are likely to be conservative.

The introduction of Euro 6 in Australia is likely to have minimal impact on emissions from petrol light-duty vehicles. The Euro 6 emission factors in the NSW EPA model are estimated to be 10 per cent lower than Euro 5 for HC, CO, NO_x and PM. Given the introduction of particle number (PN) limits for gasoline direct injection (GDI) vehicles in Euro 6, and the large uptake of GDI technology, the PM assumption is also likely to be conservative.

Alternative models

Consideration was given to the use of alternative models such as the Handbook Emission Factors for Road Transport (HBEFA) or COPERT (EU version) in preference to PIARC or the NSW EPA model. In both cases there are arguments to support the models that were used. PIARC is the recognised international model for calculating tunnel ventilation requirements, and includes assumptions/algorithms that are specific to vehicle operation in tunnels.

For the reasons stated in the air quality assessment (Annexure E of Appendix I (Technical working paper: Air quality) of the EIS), the NSW EPA model was considered to be the most suitable for the surface road assessment having been based on and validated against the local vehicle fleet. It is based on tests on Australian vehicles and includes assumptions relating specifically to vehicles in NSW. Neither the NSW EPA or PIARC models had been updated at the commencement of modelling for the EIS assessment in late 2016.

Primary NO₂

The lack of up-to-date data on primary NO₂ emissions is not relevant to the assessment, as primary NO₂ emissions are not used for surface road emissions and ambient air quality assessment. Rather, the approach used predicts total NO_x emissions and conducts an empirical conversion to NO₂ using up-to-date ambient air quality monitoring data.

B3.2.4 In-tunnel air quality

The M4-M5 Link ventilation report is a very ambitious, comprehensive and detailed report, successfully serving its purpose of assessing both in-tunnel air quality and emissions to surrounding environments for further dispersion calculations. One of its main conclusions is that "the tunnel design meets the in-tunnel pollution criteria for all traffic conditions", which is also the most likely one. It has been out of the scope of this review to review all the modelling exercises and calculation results in detail. However, a few remarks of concern can be made, similar to those for the emission modelling part of the M4-M5 Link EIS in general:

- The emission model/emission data (PIARC) used represents the state of knowledge about five years ago (2012) regarding (real-world) road vehicle emissions²
- The most recently updated emission models, e.g. HBEFA, have in particular revised the emission factors for NO valid for late model (i.e. complying with the Euro 5 and 6 standards) diesel light-duty vehicles (passenger cars and light commercial vehicles) to gradually higher values, as a result of many vehicles having much higher emissions in real world driving than anticipated from the emission level given by the Euro standard
- It is also mentioned in the ventilation report that, as for the PIARC data used, "The LDV fleet is fixed at 50% petrol and 50% diesel, whereas it is forecast to be dominated by diesel vehicles by the time the M4-M5 link opens". This is not consistent with the data presented for the emission model calculations in Chapter 8 in Appendix I of the EIS, where the diesel fraction is considerably lower (Table 8-7)

- The fleet NO₂:NO_x ratios for Euro 3 and Euro 4 diesel light-duty vehicles (both passenger cars and what is assumed to be light commercial vehicles (entitled "LDV")) appear to be much higher than what is known from the literature/other emission models.

Since the emission calculations and underlying assumptions presented in the ventilation report of the M4-M5 Link EIS are very conservative, the main conclusion about in-tunnel air quality should still be valid, despite the above concerns. A quantitative assessment of the difference in results, if updated and higher emission factors were used, would represent a significant amount of additional work.

Footnote 2 from issue addressed in first bullet: In addition, regarding PIARC data, it is stated in the EIS that "No methodology for estimating (in tunnel emissions) beyond 2020 is provided".

Response

The comments received on the ventilation report are noted.

B3.2.5 In-tunnel cumulative impacts

We are satisfied that the EIS has comprehensively addressed the issue of cumulative exposure arising from journeys through multiple consecutive tunnels made possible by the M4-M5 Link.

Response

The comments received on the in-tunnel cumulative impact assessment are noted.

B3.2.6 GRAMM/GRAL model evaluation

The GRAMM-GRAL dispersion modelling suite has been used appropriately and appears to be giving credible results. We recognise that the 'validation' of the dispersion model presented within the EIS has significant methodological limitations (the observational data available was not collected for, and is not particularly well suited to, this purpose) — this is indeed why a separate study to validate GRAL in the Australasian context has been commissioned. However, the validation assessment provided within this EIS indicates that the method for assessing background concentrations, and for modelling short-term ambient NO₂ concentrations (both discussed further below), are now the weakest links in the assessment.

Response

The comments received on the GRAMM/GRAL model evaluation are noted (the GRAMM/GRAL is a system consisting of two main modules: a prognostic wind field model (Graz Mesoscale Model - GRAMM) and a dispersion model (GRAL itself).

B3.2.7 Assessment of background air quality

Assessment of background air quality is a surprisingly challenging aspect of any EIS like this. In common with previous WestConnex and NorthConnex projects considerable funds have been spent on air quality monitoring, putting the M4-M5 Link in the enviable position of having a far richer observational dataset available than most, if not all, comparable projects. Within this context, therefore, the assessment of background air quality in this EIS may be seen as good rather than best practice.

We call particular attention to the fact that datasets of < 1 year (due to monitoring starting too late) have been under-used or discarded, despite the fact that these data could be extrapolated to 1 year with acceptable uncertainty.

The consequence appears to be unnecessary uncertainty in several background estimates. This makes it difficult to evaluate dispersion model performance and to explore equity and distributional issues (see further comment below). It also makes it difficult to assess the margin of compliance with the NEPM for PM_{2.5}. This is an issue because Sydney's air quality is marginally non-compliant with the current NEPM and is unlikely to meet the 2025 NEPM target without further interventions (as indicated by projections of future PM_{2.5} emissions provided in the EIS). The role that the WestConnex projects could play in meeting the NEPM is difficult to assess without a more accurate understanding of the current state of background air quality.

On the other hand, we do not believe that the weakness in background air quality assessment is seriously influencing the key conclusions of the EIS, and in particular does not impact the health risk assessment.

Therefore, despite these limitations, we find the current assessment of background air quality to be acceptable and fit for purpose. However, we recommend that careful consideration is given to this issue for the assessment of any future road and road tunnel projects in Sydney.

Response

The ACTAQ's comments in relation to the acceptability of the background air quality assessment are noted. The use of any National Environment Protection (Ambient Air Quality) Measure (AAQNEPM) air quality criteria in relation to the assessment of projects and developments is outside the scope of the AAQNEPM itself, and is decided by the State and territory jurisdictions. The criteria for air quality assessments for projects/developments in NSW are contained in the NSW EPA Approved Methods.

The base year of the assessment was 2015. Consequently, the available data for 2015 was included in the determination of background concentrations. The exceptions to this were the following background sites:

- St Peters Public School in Church Street, St Peters
- Bestic Street, Rockdale
- Beverly Hills Park, Beverly Hills.

For these sites, monitoring data was only available for the second half of 2015. The extension of the data from these sites to the whole of 2015 would have an uncertainty of its own. This might have improved some aspects of the background concentrations (eg spatial definition of annual mean NO_x), but it is not clear how short-term (one hour, 24 hour) concentrations would be determined for these sites for use in the synthetic profiles, unless the reviewers are only referring to annual means.

Three project-specific air quality monitoring stations are in operation and will provide data to inform the design and construction contractor's air quality modelling during the detailed design of the project.

B3.2.8 Method to estimate NO₂ concentration

The method used has limitations, which the EIS appropriately acknowledges. However, we find the empirical approach of estimating NO₂ concentrations using observational NO₂ and NO data to be sound, appropriate and the approach most suited to the purposes of the EIS.

Response

The comments received on the methodology used to estimate NO₂ concentration are noted.

B3.2.9 Assessment and management of construction impacts

With a few exceptions, the methodology applied for the assessment of construction impacts in the WestConnex M4-M5 Link EIS is the same as the one applied in the New M5 EIS from 2015 (as well as the M4 East EIS, also from 2015). Thus, it is based on the guidance provided by the UK Institute of Air Quality Management in 2014, but adapted for use in Sydney, taking into account factors such as the assessment criteria for ambient PM₁₀ concentrations.

One potentially important distinction, and possible improvement, between the M4-M5 Link and the New M5/M4 East construction impacts assessment is the grouping of the above-ground construction activities for the M4-M5 Link (taking place at a number of separate locations, with the work staggered in time) into 12 distinct compounds. To avoid underestimations of the risks, given that the construction activities in several of these compounds are expected to take place concurrently and in close proximity to one another, the 12 compounds were combined according to seven "worst case" scenarios for the assessment. For each of these scenarios a risk assessment for each of the three dust impacts types (dust soiling, human health and ecological, respectively) and each of the four construction activities (demolition, earthworks, construction and track-out, respectively) was made, i.e. in all 84 individual risk assessments, whereas in the New M5/M4 East EIS in all only 12 individual risk assessments were made. This enabled in the M4-M5 Link case that mitigation measures in some instances could be specifically tailored for individual - or at least groups of - scenarios, which was not the case for the New M5/M4 East construction projects, thus a likely improvement in methodology.

It appears that the risk of dust impacts on human health on average is assessed as being in the range "Medium" to "Low Risk" for the M4-M5 Link, whereas it is assessed as "High Risk" for the New M5, and this should deserve some explanation or attention in the M4-M5 Link EIS.

Response

The comments received on the methodology used to assess construction works are noted.

The construction air quality assessment in the New M5 EIS assessed a single worst case scenario with the scale of the overall project component was determined to be 'Large' for each activity (demolition, earthworks, construction and track-out). The approach was refined in the M4-M5 Link work with the assessment of risk completed for each compound, rather than as a whole, where the scale of each activity in accordance with the proposed construction program varying from 'Small' to 'Large'. As the scale of the activity has significant bearing on the outcome of the risk assessment, the risk assessment in the New M5 works could be considered highly conservative. Refer to Table 7-1 of Appendix H (Technical working paper: Air Quality) of the New M5 EIS for the criteria for assessing the potential scale of emissions.

B3.2.10 Grouping of receptor categories

A potential downside of the M4-M5 Link construction impact assessment compared to that of the New M5/M4 East assessments, is that in the former it appears that the three human receptor categories "Child Care", "Educational" and "Aged Care" are lumped into one single receptor category "Community", whereas these are identified separately in the latter. This may be significant for the risk assessment and associated mitigation measures, since small children and elderly people are believed to be more vulnerable to air pollution than the population at large.

Response

The outcome of the construction assessment is not influenced by grouping of the receptor categories as this information is only used to calculate the number of people potentially exposed to dust impacts. As per section 7.5.2 of Appendix I (Technical working paper: Air quality) of the EIS, community receptors are defined and include community centres, schools and childcare centres with approximate receptor populations provided. The number of receptors in each distance band from construction sites was estimated from land use zoning of the site.

The exact number of 'human receptors' is not required by the Institute of Air Quality Management (IAQM) guidance, which recommends that judgement is used to determine the approximate number of receptors within each distance band. For receptors that are not dwellings, judgement was used to determine the number of human receptors. The results of the screening assessment of receptors in proximity to the various construction sites are shown in Figure 9-14 of Chapter 9 (Air quality) of the EIS. The assumed numbers of people (receptors) in each building are provided in section 9.6.2 of the EIS.

B3.2.11 Assessment conclusions and equity issues

Overall, the project (as assessed) seems to deliver improved air quality at a majority of receptors despite increased emissions and traffic — a simple yet important conclusion that the EIS does not emphasise. However it is unclear how much of this is due to improved pollutant removal/dispersion (i.e. use of stacks) versus spatial redistribution of traffic or emissions.

The EIS clearly indicates that the project leads to some highly localised improvements to air quality in some areas and similarly localised worsening of air quality in other areas. However, it does not discuss whether these changes increase or decrease the range of concentrations, i.e. how changes are related to absolute concentrations. We accept that the SEARS do not require a consideration of equity of impacts, however such a consideration can be of value to stakeholders. A cursory examination of both the maps and the community receptor results appears to show that improvements in air quality (DSC relative to DM scenarios) are predominantly in areas of relatively poorer air quality, i.e. the project has an overall tendency to narrow the distribution of concentration, reducing inequality of impacts.

Response

As noted in the ACTAQ's comment, consideration of equity of air quality impacts is not a requirement of the SEARS set for the project. Any increases in air quality emissions due to the project are small, so any changes in the equity of air quality impacts will also be small.

It should also be noted that for metrics such as one hour NO₂ and 24 hour PM₁₀, exceedances of the criteria were predicted to occur both with and without the project. However, the total numbers of receptors with exceedances decreased slightly with the project and in the cumulative scenarios. This is consistent with ACTAQ's tentative conclusion that the project has an overall tendency to narrow the distribution of concentration, reducing inequality of impacts.

B3.2.12 Recommendations for future projects

We note that at least three more major road tunnel projects are being considered for Sydney. We make the following recommendations for any future EIS relating to these projects:

- 1) That meteorological and dispersion modelling considers and responds to the findings of the study: "Optimisation of the application of GRAL in the Australian context", which was commissioned on behalf of the Advisory Committee on Tunnel Air Quality
- 2) Stakeholders consider whether an assessment of equity is desired and should be included in the SEARs
- 3) After recent studies to validate the emissions and dispersion models used in the WestConnex EISs, the methods for assessing background concentrations (see section 1e above) and for modelling short-term ambient NO₂ concentration (see section 1f above), are now the weakest links in the assessment. We recommend that the large amount of ambient air quality data for Sydney that has become available due to the NorthConnex and WestConnex projects is analysed and mined to inform new models of background air quality.

Response

The comments received regarding recommendations for future EISs are noted.

B3.2.13 Minor errors

Main report (1B) Table 9-3 —the hourly CO, daily NO₂, annual PM₁₀ and daily PM_{2.5} 'criteria' "by 2020" for New Zealand do not exist. These appear to be the 2002 Guidelines <http://www.mfe.govt.nz/publications/air/ambient-air-quality-guidelines-2002-update>

Response

This error is noted and clarified in **Chapter A4** (Clarifications).

B3.3 Human health risk

Refer to Chapter 11 (Human health risk) and Appendix K (Technical working paper: Human health risk assessment) of the EIS for details of the human health risk assessment.

B3.3.1 Health risk assessment

We find the health risk assessment to be sound and agree with its findings.

Response

The comments received on the human health risk assessment are noted.

B4 Sydney Water Corporation

This chapter addresses issues raised by Sydney Water Corporation.

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B4.1 General comments

B4.1.1 Requested amendments to the Utilities Management Strategy

Volume 2B Section 1.7.1 NSW Legislation - please add *Sydney Water Act 1994*.

Volume 2B Section 2.3 Major Utility Services includes:

- Potable Water (Sydney Water) - mains of 250 millimetre diameter or greater
- Wastewater (Sydney Water) - pipes greater than 300 millimetre diameter
- Stormwater (Sydney Water) - mains of 375 millimetre diameter or greater including, culverts and open channels.

Response

Sydney Water's comments regarding the requested amendments to Volume 2B are noted.

The purpose of the Utilities Management Strategy is to provide a framework and process for identifying potential impacts of the project on utilities, with a focus on the major (trunk) utility works rather than identifying all utilities which may be affected. Section 2.3 of the Utilities Management Strategy (refer to Appendix F (Utilities Management Strategy) of the Environmental Impact Statement (EIS)) outlines the utility services that were considered during the development of the concept design and the strategy.

During detailed design, further consultation will be undertaken with utility service providers and relevant agencies, including Sydney Water, in relation to any potential impacts on their infrastructure. As identified in environmental management measure PL12 (see **Chapter E1** (Environmental management measures)) interface agreements will be entered into with the owners of infrastructure and utility services likely to be impacted by construction of the project. The agreements will identify as required:

- Minimum separation distances and appropriate settlement criteria for utility infrastructure
- Settlement monitoring requirements during construction
- Contingency actions in the event that settlement limits are exceeded.

B4.1.2 Assessment of impacts to Sydney Water assets

Volume 2B Section 3.8.1 Sydney Water Utility Services - amend the statement:

'It is expected the Sydney Water assets would not be adversely impacted' to 'It is expected the Sydney Water assets should not be adversely impacted'. There is currently no detailed assessment that confirms the assets would not be adversely impacted by the Main Line tunnel.

Volume 2B Section 3.8.1 Sydney Water Utility Services - amend the statement:

'It is expected that the potential vibration and settlement impacts on these utility services would be negligible and can be managed' to 'Potential vibration and settlement impacts on the City and Pressure tunnels are not yet determined until further assessments are conducted. Once determined, suitable control measures must be implemented to minimise vibration and settlement impacts.'

Response

A preliminary assessment of the potential settlement and vibration impacts due to construction of the project has been considered in the vicinity of major (trunk) utility services including the Sydney Water Pressure Tunnel and City Tunnel. The preliminary assessment, discussed in section 12.3.4 of the EIS, identified that the base of the M4-M5 Link mainline tunnels are located about 12 metres above the obvert level for the Pressure Tunnel. The closest construction/access shaft for the Pressure Tunnel (shaft 14) is around 45 metres from the M4-M5 Link mainline tunnels. With regards to the City Tunnel, the M4-M5 Link mainline tunnel alignment is proposed to pass below the City Tunnel in the vicinity of the Princes Highway and Alice Street at Newtown, with the top of the M4-M5 Link mainline tunnels located about 11 metres below the invert level for the City Tunnel.

The preliminary assessment discussed in section 12.3.4 of the EIS also noted that due to the clearance achieved by the M4-M5 Link tunnel alignment relative to the Sydney Water tunnels, and the geological conditions in the areas where these crossover points occur, it is expected the Sydney Water assets would not be adversely impacted by the project. Preliminary settlement assessments have predicted that both of the Sydney Water tunnels would experience minimal movement:

- Around two to five millimetres (upward heave) and maximum angular distortion of one in 3,000 for the Pressure Tunnel
- Around 10 to 16 millimetres (settlement) and maximum angular distortion of one in 2,000 for the City Tunnel.

The assessment was based on assumptions about the strength and stiffness of the water tunnels given that limited information about the design and condition of these assets was available at the time the assessment was undertaken.

Section 3.8 of Appendix F (Utilities Management Strategy) of the EIS identified that detailed surveys should be undertaken to verify the levels and condition of these Sydney Water assets. In addition, the environmental management measures in **Chapter E1** (Environmental management measures) that directly relate to these aspects include:

- Further assessment of potential settlement impacts, including numerical modelling (environmental management measure PL7)
- Preparation of a settlement monitoring plan (environmental management measure PL8)
- Interface agreements will be entered into with the owners of infrastructure and utility services likely to be impacted by construction of the project (environmental management measure PL12). The agreements will identify as required:
 - Minimum separation distances and appropriate settlement criteria for utility infrastructure
 - Settlement monitoring requirements during construction
 - Contingency actions in the event that settlement limits are exceeded
- Preparation and implementation of a Construction Noise and Vibration Management Plan (environmental management measure NV2)
- Location and activity specific noise and vibration impact assessments, if applicable (environmental management measure NV4)
- Monitoring at the commencement of activities for which a location and activity specific noise and vibration impact assessment has been prepared to confirm that actual noise and vibration levels are consistent with noise and vibration impact predictions and that the management measures that have been implemented are appropriate (environmental management measure NV6).

B4.2 Construction work

Refer to Chapter 6 (Construction work) of the EIS for details of the construction strategy.

B4.2.1 Staging and timing of construction work

Sydney Water recommends early consideration of staging and timing design for work and delivery of the project. This is very critical to allow sufficient time for Sydney Water to schedule and program shutdowns and reconnections of our assets. This will ensure that Sydney Water continues to meet its Operating Licence and most importantly maintain services to our customers. A Water Service Coordinator can assist you with this process.

Response

Sydney Water's comment is noted.

The project is proposed to be constructed and opened in two stages (as noted in section 1.1.2 of Appendix F (Utilities Management Strategy) and section 5.1.3 of the EIS), with Stage 1 – mainline tunnels, due to commence construction in 2018 and be open to traffic in 2022. Stage 2 – Rozelle interchange and the Iron Cove Link are due to commence construction in late 2018 and be open to traffic in 2023. Indicative timing and duration of utility works is presented in section 6.5 of Appendix F (Utilities Management Strategy) of the EIS.

Consultation with Sydney Water with regards to the staging, timing and duration of works and potential impacts to Sydney Water assets and operations would be ongoing during the detailed design and construction phase.

B4.3 Utilities

Refer to Appendix F (Utilities Management Strategy) of the EIS for details of potential impacts on utilities.

B4.3.1 Sydney Water assets

Sydney Water owns and operates trunk and reticulation assets located within and adjacent to the project boundary for the proposed Stage 3 WestConnex M4-M5 Link Project. These assets provide wastewater and potable water services to our customers in the affected area. Sydney Water must continue to provide these services during and post project works for the Stage 3 WestConnex M4-M5 Link Project as per Sydney Water Operating Licence and regulatory requirements. These assets include (but are not limited to) the City and Pressure Tunnels, Balmain Slopes Submain at Iron Cove and Sewage Pumping Station (SP0006) at Easton Park.

Response

The proponent acknowledges the importance of the water and wastewater services that Sydney Water provides to customers and the need to avoid, or minimise, any disruptions to the services. The Utilities Management Strategy includes an assessment of the potential impacts from the M4-M5 Link on utility assets, including Sydney Water assets, and environmental management measures are proposed, where appropriate, in **Chapter E1** (Environmental management measures).

Chapter 3 of the Utilities Management Strategy identifies a number of trunk Sydney Water assets for the areas of interest located within the project footprint and outside the project footprint and these are discussed in sections 3.2 to 3.8 of Appendix F (Utilities Management Strategy) of the EIS. Proposed works outside the project footprint are discussed in section 5.4 of Appendix F (Utilities Management Strategy). In relation to the specific assets listed in Sydney Water's comments:

- The City Tunnel and Pressure Tunnel are discussed in section 3.8.1 of Appendix F (Utilities Management Strategy) of the EIS, with proposed management measures in Table 3-8 of Appendix F (Utilities Management Strategy) of the EIS
- The Balmain Slopes Submain at Iron Cove is discussed in section 3.5 of Appendix F (Utilities Management Strategy) of the EIS
- The Sewage Pumping Station SP0006 at Easton Park is outside the project footprint, but was discussed in Chapter 20 (Non-Aboriginal) of the EIS, with more detailed discussion in Chapter 6 and Table 6-15 of Appendix U (Technical working paper: Non-Aboriginal heritage) of the EIS.

As discussed in section 2.4 of Appendix F (Utilities Management Strategy) of the EIS, the approach proposed for treating utility services is to:

- Avoid or minimise impacts on utility services where practicable such as by adjusting the project design and construction methodology
- Retain and protect utility services if and where required
- Relocate utilities, including removing utility services and re-laying those services in a designated utility service corridor in a different location within or immediately adjacent to the project footprint where practicable. If a service needs to be relocated outside the project footprint, locations within an existing road reserve or infrastructure corridor would be preferred
- Remove or suitably isolate any redundant utility services as agreed with the appropriate utility service provider.

Ongoing consultation and coordination of activities will occur with utility service providers with assets in close proximity to project locations to ensure that the services they provide are not unreasonably affected and they can continue to access, operate and maintain their assets.

B4.3.2 Access to assets during construction and operation

Sydney Water reserves the right to assess, based on final project layout and construction designs prepared by the project team and or their contractors, the impacts on our assets located within the project scope, and the potential needs for adjustments funded by the project to accommodate accessibility of our pipes for operational and maintenance purposes, new pavement locations and changes to structures.

Sydney Water requires safe unrestricted access to our assets throughout the life of the project. We need to ensure these assets are fully operational at all times.

Response

Sydney Water's items raised are noted.

Ongoing consultation and coordination of activities will occur with utility service providers with assets in close proximity to project locations to ensure that the services they provide are not unreasonably affected and they can continue to access, operate and maintain their assets during construction and operation of the project.

B4.3.3 Sydney Water processes

Sydney Water Asset Adjustment process, found on the Sydney Water website, should be adhered to for the relocation, adjustment and/or protection of our assets. Additionally, if assets are required to be changed, the environmental approval will need to cover any works identified that may fall outside of the project boundary, but be a result of the project works.

Response

Sydney Water's comment in relation to asset adjustment process is noted.

Utilities requiring adjustment or relocation within the construction footprint or in defined areas outside the project footprint would be confirmed during detailed design and would be adjusted according to utility provider requirements. If there are project changes proposed during detailed design, these would be subject to an updated environmental constraints analysis and risk assessment to confirm if the proposed management measures in the Utilities Relocation Management Plan (for works undertaken prior to the approval of the Construction Environmental Management Plan (CEMP)), and the CEMP (for works undertaken after the approval), are appropriate.

This process is summarised in Figure 1-4 and discussed in section 9.2 of Appendix F (Utilities Management Strategy) of the EIS). Consultation on these matters has commenced with Sydney Water and will be ongoing during the detailed design and construction phases.

B4.3.4 Utilities Management Strategy

Sydney Water endorses this strategy to work together with all utilities involved in this project throughout detailed design and construction phases to ensure protection of all utilities assets. This is referenced in the Utility Management Strategy (Volume 2B, Appendix F) of the EIS.

Also create a clash register which can prioritise high to low risk assets.

Response

Sydney Water's endorsement of the Utilities Management Strategy is noted. A clash register or similar will be developed by the design and construction contractor(s) during detailed design in consultation with relevant utility providers including Sydney Water.

B4.4 Consultation

Refer to Chapter 7 (Consultation) and Appendix F (Utilities Management Strategy) of the EIS for details regarding consultation, including for utilities management.

B4.4.1 Early consultation

Sydney Water encourages the contractor for these works to conduct early consultation and discussions with Sydney Water. We also recommend that all relevant information, plans and needs specifications for these assets are requested from Sydney Water.

Response

The items raised by Sydney Water are noted.

Consultation with Sydney Water on matters associated with the M4-M5 Link project will continue during the detailed design and construction phases.

B4.4.2 Consultation regarding flood assessment

Continual communication with Sydney Water regarding the detailed design and flood assessment will be required. Any weakening of the EIS position during detailed design will be critically examined by Sydney Water. Sydney Water recommends continued meetings to discuss designs and constraints will benefit the project.

Response

Consultation with Sydney Water will be ongoing during the detailed design and construction phases. Sydney Water has been identified as a project stakeholder in Appendix G (Draft community consultation framework) and in Appendix F (Utilities Management Strategy) of the EIS. In addition, consultation with Sydney Water has been committed to in a number of the environmental management measures presented in **Chapter E1** (Environmental management measures)). This includes consultation regarding the Flood Mitigation Strategy (FMS) (environmental management measures FD01).

During detailed design, hydrologic and hydraulic assessments will be carried out for all temporary project components (including ancillary facilities) and permanent design features that have the potential to affect flood levels in the vicinity of the project. The results of these assessments will inform the preparation of the flood mitigation strategy and the development of the design (see environmental management measure FD02 in **Chapter E1** (Environmental management measures)).

Measures developed to manage potential flood impacts, as identified in the flood mitigation strategy, will be incorporated into the design of temporary and permanent project components and construction and operational management systems as relevant (see environmental management measure FD03 in **Chapter E1** (Environmental management measures)).

B4.5 Soil and water quality

Refer to Chapter 15 (Soil and water) and Appendix Q (Technical working paper: Surface water and Flooding) of the EIS for details of potential impacts on water quality during construction and operation.

B4.5.1 Surface water impacts

Overall the approach to managing surface water impacts of the project is sound. Close consultation with Sydney Water during the concept and detailed design, construction and operational phases of the project will be required to ensure that the objectives are met and that the impacts to Sydney Water stormwater assets is minimised, or improvements to the receiving environment can be achieved.

Response

Sydney Water's comment regarding the approach for managing surface water impacts is noted. Consultation with Sydney Water on matters associated with the M4-M5 Link project will be ongoing during the detailed design and construction phases.

B4.5.2 Water quality objectives

We commend the EIS position aiming to achieve best practice outcomes for the entire project. We also support adoption of the NSW Water Quality Objectives, ANZECC Water Quality Guidelines, Sydney Harbour and Botany Bay Water Quality Improvement Plans.

Response

The applicability of the documents referred to by Sydney Water have been considered by the project. The NSW Water Quality Objectives and the Australian and New Zealand Environment Conservation Council (ANZECC) Water Quality Guidelines (2000) are discussed in section 15.1.4 of the EIS and sections 3.2.2 and 3.2.1 of Appendix Q (Technical working paper: Surface water and flooding) of the EIS respectively. The water quality improvement plans for Sydney Harbour and Botany Bay are discussed in section 3.2.4 and 3.2.5 of Appendix Q (Technical working paper: Surface water and flooding) of the EIS.

B4.5.3 Annual pollutant reduction targets not met

However, the EIS advises that the stormwater mean annual pollutant load reduction targets would not be achieved for the project or for the individual catchments, based on the treatment measures that could practically or readily be implemented. Table 15-12 'MUSIC modelling results for operational water quality' shows that the project fails to meet 20 out of 25 pollutant reduction targets. Sydney Water is concerned that even at this early stage of the project design development there appears to be a lack of application by the project to meet suitable targets.

Response

The project is located within the Sydney Harbour and Parramatta River catchment and the Cooks River catchment. Existing water quality in these catchments is generally poor, indicative of a highly urbanised catchment, with a number of the waterways having been concrete lined (including Whites Creek and Johnstons Creek). However, a number of waterways are considered to be sensitive receiving environments, including Iron Cove at Rozelle, constructed wetlands along Whites Creek and Johnstons Creek and mapped Key Fish Habitat including at Rozelle Bay, White Bay, Alexandra Canal and downstream portions of Dobroyd Canal (Iron Cove Creek) and Hawthorne Canal.

A summary of the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) modelling which was carried out to assess the performance of the proposed water quality treatment measures against pollutant reduction targets is presented in section 15.4.2 and Table 15-1 of the EIS. The modelling results for the main locations where water would be discharged (Rozelle Bay, Iron Cove, White Bay and Whites Creek) and for the project as a whole indicate that:

- The project would generally reduce the mean annual stormwater pollutant loads being discharged to the Sydney Harbour and the Parramatta River estuary, when compared to the existing conditions
- The project would generally reduce the mean annual stormwater pollutant loads being discharged to the five receiving waterways, when compared to the existing conditions (except for total phosphorus loading to Dobroyd Canal (Iron Cove Creek), which would be slightly higher than the existing loading)
- The stormwater mean annual pollutant load reduction targets (refer to section 15.1.5 of the EIS) would not be achieved for the project or for the individual catchments, based on the treatment measures that could practically or readily be implemented.

The pollutant load reduction targets were not achieved due to the following:

- Highly constrained nature of the existing project footprint particularly the surface roads adjacent to Rozelle Bay, which limits potential treatment options to the use of proprietary devices
- The assumptions applied in the model for proprietary devices (used in highly constrained catchments) were conservative due to uncertainty in the practicality, feasibility and type of device which might be implemented at detailed design. Opportunities for potential improvements in treatment performance in highly constrained catchments will be investigated further during detailed design
- Oversizing other treatment measures further to offset the reduced treatment for the project is not generally practical within the available project footprint, given that this would reduce the area available for operational road infrastructure and/or open space.

In the highly constrained areas, proprietary devices or good practice treatment techniques would be deployed where feasible and reasonable to achieve the criteria, as reflected in the environmental management measures in **Chapter E1** (Environmental management measures).

B4.5.4 Tunnel water discharge targets

In view of the substantial annual volumes of groundwater delivered to the two concentrated outlets (Darley Road - Hawthorne Canal and Rozelle - proposed wetland), there is a potential for unsuitable quality groundwater to overwhelm benefits associated with current and future catchment wide stormwater management / treatment efforts by Sydney Water and Councils for these locations.

Sydney Water requests that the establishment of appropriate tunnel water discharge treatment targets be reviewed and determined by a suitable independent expert and that the project designers apply a high degree of verifiable effort to meet the targets.

Response

The operational water treatment facilities will be designed and managed such that effluent will be of suitable quality for discharge to the receiving environment. Opportunities to incorporate nutrient treatment within the plant at Darley Road will be investigated during detailed design. Discharge criteria will be developed in accordance with ANZECC (2000), with consideration of the species protection levels for slightly to moderately disturbed marine waters and relevant NSW WQOs, and will also include the following discharge criteria:

- 0.3 milligrams per litre for iron
- 1.9 milligrams per litre for manganese.

The discharge criteria for the treatment facilities will be nominated during detailed design in consultation with relevant stakeholders and included in the OEMP (see environmental management measure OSW16 in **Chapter E1** (Environmental management measures)) and the conditions of approval for the project.

Given the consultation proposed, it is not considered necessary for an independent review to be undertaken.

B4.5.5 Stormwater quality targets

Sydney Water's stormwater quality targets will apply when a connection to our asset is required (refer to Sydney Water's website <http://www.sydneywater.com.au/SW/water-the-environment/how-we-manage-sydney-s-water/stormwater-network/stormwater-quality-targets/index.htm>)

Response

The project would include treatment devices during operation to achieve the Sydney Water pollutant load reduction targets for direct connections to Sydney Water assets where feasible and reasonable.

The Sydney Water pollutant load reduction targets for construction would not be applied for the M4-M5 Link project due to:

- The Sydney Water targets as described within the policy on Sydney Waters website are not intended to be used for construction
- The Sydney Water policy states that eWater's MUSIC model be used to demonstrate compliance. The NSW MUSIC modelling guidelines (BMT WBM 2015) which are state wide current best practice guidelines, state that only post-development sediment basins should be modelled in MUSIC and that construction phase sediment basins shall be sized using the methods in Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom 2004)
- There would be significant difficulties in demonstrating compliance as construction ancillary facility layouts are refined during detailed construction planning and adapted during their use (eg changes in impervious area). In addition, controls for water management would be flexible and adaptive to the configuration and use of construction ancillary facilities, therefore modelling a proposed layout and controls for water management prior to commencement of the project may not be representative of the construction works. Ongoing modelling or monitoring to demonstrate compliance is not considered to be feasible or reasonable
- Vegetated systems used to achieve the targets take months to establish and are highly susceptible to failure when exposed to high sediment loads (a characteristic of a construction site)

and as such aren't appropriate for construction. Proprietary devices for tertiary treatment to achieve the targets are also susceptible to failure with high sediment loads

- It is noted that pollutant loading during construction is primarily related to tunnelling works. Tunnel water is to be treated by construction water treatment plants. Concentration based discharge criteria will be set for the construction water treatment plants, not pollutant load reduction targets.

B4.5.6 Stormwater quality monitoring results

Stormwater quality monitoring results for stormwater discharges should be provided to Sydney Water throughout including pre, during and post construction of the road (3 years).

Response

A program to monitor potential surface water quality impacts due to the construction of the project will be developed and included in the Construction and Soil Water Management Plan. The monitoring program will commence prior to any ground disturbance to establish appropriate baseline conditions and continue for the duration of construction. The program will include monitoring of project discharges (see environmental management measure SW02 in **Chapter E1** (Environmental management measures)).

B4.6 Flooding and drainage

Refer to Chapter 17 (Flooding and drainage) and Appendix Q (Technical working paper: Surface water and Flooding) of the EIS for details of potential impacts on flooding and drainage during construction and operation.

B4.6.1 Discharge protocols of chlorinated water

The environmental approval needs to meet the discharge protocols of chlorinated water due to watermain shutdown and reconnection of live Sydney Water assets that will need to be adjusted.

Response

Sydney Water's discharge protocols will be followed for water main shutdown and reconnection of live Sydney Water assets.

B4.6.2 Asset amplification

Consultation with Sydney Water is required early to ensure any amplifications are identified, planned and confirmed early in the process. Amplification of assets may be required to facilitate future growth along the development corridor. This will be assessed as adjustment applications are referred to Sydney Water for review.

Response

Utility infrastructure that requires adjustment or relocation due to construction of the project will be confirmed during detailed design and would be adjusted according to utility provider requirements on a like for like basis. Where future network extensions or capacity expansions planned by utility service providers coincide with utility works proposed as part of the project, there is the opportunity to undertake both at the same time to avoid future impacts on receivers in the vicinity (subject to complying with the relevant conditions of approval). If amplification was required to accommodate future growth, then the details of amplification will need to be provided by Sydney Water to Roads and Maritime prior to the preparation of detailed design.

B4.6.3 Design of stormwater infrastructure

Sydney Water requests that the project designers consider the project in the context of the broader catchment and likely long-term flood mitigation service requirements. Any stormwater infrastructure should also be designed in a way that enhances biodiversity, aesthetics and social amenity whilst also achieving flood mitigation and water quality objectives.

Response

It is agreed that the design of the project should consider the broader catchment and long-term flood mitigation service requirements, where possible, while still enhancing biodiversity, aesthetics and the social amenity of the area.

The EIS has considered the existing environment and relevant local plans and policies in the flood assessment. A FMS will be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, the NSW Office of Environment and Heritage, Sydney Water and relevant local councils. Identification of flood risks to the project and adjoining areas will consider local drainage catchment assessments and climate change implications on rainfall, drainage and tidal characteristics (see environmental management measure FD01 in **Chapter E1** (Environmental management measures)).

Chapter 13 (Urban design and visual amenity) of the EIS discusses how the project will minimise impacts on visual amenity and enhance the aesthetic of the surrounding area. This is discussed in more detail in section 5.5.6 of Appendix L (Technical working paper: Urban design) of the EIS which notes that water sensitive urban design is a fundamental consideration in the final design of the project, which would have environmental, aesthetic and amenity benefits. Consideration and implementation of water sensitive urban design is also specified in the environmental management measure OSW12 (see **Chapter E1** (Environmental management measures)) whereby the final design of stormwater treatment devices will be supported by water sensitive urban design principles.

The project will be subject to the preparation of Urban Design and Landscape Plans, which will include the design of water treatment facilities. This will include works associated with the design of drainage channels and the wetland as part of the new open space at the Rozelle Rail Yards, the outlet to Rozelle Bay, integration of naturalisation works at Whites Creek (as described in section 5.1.3 and illustrated in Figure 5.6 of Appendix L (Technical working paper: Urban design) of the EIS) and the design of the bioretention facility at King George Park to treat surface water run-off from Victoria Road.

To enhance biodiversity, consultation will be undertaken with Sydney Water regarding integration of naturalisation works at Whites Creek, including re-establishment of vegetation where possible following construction activities. Vegetation re-establishment will be undertaken in accordance with *Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and management biodiversity on RTA project* (NSW Roads and Traffic Authority 2011) (see environmental management measure OB10 in **Chapter E1** (Environmental management measures)).

B4.7 Non-Aboriginal Heritage

Refer to Chapter 20 (Non-Aboriginal heritage) and Appendix U (Technical working paper: Non-Aboriginal) of the EIS for details of potential impacts to non-Aboriginal heritage.

B4.7.1 Heritage and environmental management

Works around the Rozelle Railyard will require heritage and environmental safeguards, which are site specific and may not be currently covered by the conservation management plan for the canal. Sydney Water must be included in the consultation with the Environmental Protection Authority and WestConnex on this issue.

Response

Non-Aboriginal heritage considerations associated with the Rozelle Rail Yards, including the Lilyfield Road Stormwater Canal (Easton Park drain), are discussed in section 20.2.3 and Appendix U (Technical working paper: Non-Aboriginal) of the EIS. This includes discussion of the potential for the underground section of the canal, which is not heritage listed under SREP 26, to have potential archaeological significance.

Archival photographic recording will be undertaken of the Whites Creek Stormwater Channel No. 95, in the area to be impacted and the Lilyfield Road Stormwater Canal in accordance with the NSW Heritage Office guidelines *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006). The photographic recording will occur prior to any works that have the potential to impact upon the items as noted in the environmental management measure NAH03 presented in **Chapter E1** (Environmental management measures) and the conditions of approval set by the NSW Department of Planning and Environment.

Any items of potential heritage conservation significance, including those which may be discovered in the underground section of Lilyfield Road Stormwater Canal, will be managed in accordance with an Unexpected Finds Protocol (see environmental management measure NAH08 in **Chapter E1** (Environmental management measures)).

Consultation with Sydney Water on matters associated with the M4-M5 Link project will continue during the detailed design and construction phases.

B4.8 Resource use and waste minimisation

Refer to Chapter 23 (Resource use and waste minimisation) of the EIS for details of resource use and waste management.

B4.8.1 Availability and volume of potable water

The Environmental Impact Statement provides a figure for potable water use within and for the project. The availability and volume of these flows will depend on system capability and will be confirmed during detail design.

Response

Sydney Water's comment is noted.

B4.8.2 Trade waste licencing

Any trade waste licence request, most notably for removal of leachate, will need to meet Sydney Water's requirements.

Response

Sydney Water's comment is noted.

B4.8.3 Opportunities to reuse for irrigation of open spaces

There may be opportunities to irrigate surrounding open spaces with broader catchment stormwater and tunnel water. This could go a significant way to helping the project achieve its water quality commitments whilst also reducing potable water demands and providing more liveable open space outcomes for the community.

Response

The EIS recognises that opportunities for the reuse of treated groundwater would be considered in preference to discharge to the stormwater system or receiving waterbodies. This could include irrigation of landscaped areas within the project footprint, such as the new open space at the Rozelle Rail Yards (see environmental management measure OpRW3 in **Chapter E1** (Environmental management measures)).

Whilst it may be possible to reuse stormwater collected in the constructed wetland (subject to final arrangement), additional storage would be required for a separated stormwater harvesting system, which would need to either occupy additional area of open space or be sited underground. As the groundwater is a more constant supply, and will be treated by the water treatment plant and the wetland, it is considered that on-site reuse of treated groundwater may represent a better whole of life outcome for the project.

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