# *PROPOSED LANE COVE TUNNEL AND ASSOCIATED ROAD IMPROVEMENTS*

**VOLUME 1**

***Director-General's Report***
*Section 115C of the*
*Environmental Planning and Assessment Act 1979*

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# FOREWORD

The Roads and Traffic Authority of NSW (RTA) proposes to develop the Lane Cove Tunnel and associated road improvements. The Proposal involves the construction of a 3.4km dual two/three lane tunnel connecting Epping Road at Mowbray Road West with the Gore Hill Freeway, an additional lane in each direction on the Gore Hill Freeway, new north facing ramps at the junction of the Warringah Expressway and Falcon Street and surface works on Epping Road including installation of bus lanes. The Proposal, estimated to cost $815 million, would be funded by private sources and likely to be recouped by the successful consortium through the imposition of a toll.

The Proposal is subject to assessment under Division 4, Part 5 of the *Environmental Planning and Assessment Act 1979* (the Act). As such, the approval of the Minister for Planning is required for the works. The RTA has sought the approval of the Minister under Section 115B of the Act. This Report has been prepared in accordance with Section 115C of the Act which requires that the Minister obtain a report from the Director-General of the Department of Planning prior to making a decision.

The purpose of this Report is to review the Environmental Impact Statement (EIS), the issues raised in representations made in response to the public exhibition of the EIS, the additional information provided by the Proponent and other relevant matters pertaining to the potential environmental impacts of the proposed works.

The scale of the Lane Cove Tunnel and associated road improvements has led to a range of complex environmental issues to resolve and the RTA has proposed a number of modifications to reduce impacts and maximise benefits. In particular, the modifications to the ventilation design to improve in-tunnel air quality and visibility, the commitment to providing a bus interchange and pedestrian overbridge on Longueville Road near the corner of Parklands Road and the provision of bus lanes on the Pacific Highway between Miller Street and Longueville Roads would maximise the long term benefits of the Proposal.

The Lane Cove Tunnel would complete the Sydney Orbital freeway/motorway network outlined in the Government's *'Action for Transport – 2010'.* The Proposal would have significant benefits in terms of improved travel times, accessibility, reduced traffic levels on a number of heavily congested roads, would provide facilities and improvements to road-based public transport and improvements for cyclists and pedestrians.

This Report concludes that the potential environmental impacts associated with the Proposal can be mitigated to an acceptable level by adopting management measures referred to in this Report and reflected in the Recommended Conditions of Approval in Chapter 12 of this Report. On that basis, it is recommended that the Proposal be approved subject to the recommended conditions.

Sue Holliday
**Director-General**

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# GLOSSARY AND ABBREVIATIONS

| | |
|---|---|
| AADT | Annual Average Daily Traffic |
| AHD | Australian Height Datum |
| Acid Sulfate Soils (ASS) | Naturally acid clays, mud and other sediments usually found in swamps and estuaries. These may become extremely acidic when drained and exposed to oxygen, and may produce acidic leachate and runoff which can pollute receiving waters and liberate toxins |
| Ambient Noise | The background noise at a point being a composite of sounds from near and far |
| CO | Carbon Monoxide |
| Department, the | Department of Planning |
| Director-General | Director-General of the Department of Planning |
| DLWC | Department of Land and Water Conservation |
| DoP | Department of Planning |
| EIS | Environmental Impact Statement |
| EMP | Environmental Management Plan |
| EPA | Environment Protection Authority (NSW) |
| EP&A Act | Environmental Planning and Assessment Act 1979 |
| GHF | Gore Hill Freeway |
| Grade separation | The separation of a road, rail or other traffic so that crossing of movements, which would otherwise conflict, are at different elevations |
| Interchange | A grade separation of two or more roads with one or more interconnecting carriageways |
| LALC | Local Aboriginal Land Council |
| LCT | Lane Cove Tunnel, the Proposal |
| Median | A strip of road not normally intended for use by traffic, which separates carriageways for traffic in opposite directions |
| $NO_x$ | Oxides of Nitrogen |
| NPWS | National Parks and Wildlife Service |
| PAD | Potential Archaeological Deposit |
| PAR | Preferred Activity Report |
| $PM_{10}$ | Particulate Matter less than 10 microns in diameter |
| RTA | Roads and Traffic Authority |
| Shoulder | The portion of the carriageway beyond the traffic lanes adjacent to the land flush with the surface of the pavement |
| TMP | Traffic Management Plan |
| TSC Act | Threatened Species Conservation Act 1995 |
| VKT | Vehicle Kilometres Travelled |
| VOC | Volatile Organic Compounds |

# EXECUTIVE SUMMARY

## The Proposal

The NSW Roads and Traffic Authority (RTA) proposes to construct the Lane Cove Tunnel and Associated Road Improvements, an $815 million infrastructure project recognised in *Action for Transport 2010*. The key feature of the Proposal is a 3.4 km, dual two/three lane tunnel generally running below the existing Epping and Longueville roads alignment connecting the Gore Hill Freeway at the Pacific Highway with Epping Road at Mowbray Road west. Traffic would be electronically tolled in each direction (approximately $2.00). Two (2) ventilation stacks are proposed, with one each at the eastern and western ends of the tunnel. Associated road improvements include:

- north-facing tolled ramps (approximately $1.00) at Falcon Street;
- an additional lane in each direction on the Gore Hill Freeway between the Pacific Highway and Merrenburn Avenue;
- an eastbound tunnel portal for high occupancy vehicle connection to the Gore Hill Freeway;
- reduction of Epping Road from 6 to generally 4 lanes, including a dedicated bus lane in each direction; and
- an additional 2 lane westbound crossing of the Lane Cove River.

Construction is proposed for commencement in mid 2003 with overall design and construction anticipated to take 40 months. A workforce of 60 management, 250 construction and 20 design positions (up to 60 during detail design development) would be employed.

Figure 1.1 and Figure 2.1 broadly show the Proposal location and key elements.

## Assessment and Approval Process

State Environmental Planning Policy No. 63 – Major Transport Projects (SEPP 63) was gazetted on 2 February 2001 to provide a consistent assessment and decision-making framework under the provisions of Division 4, Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The SEPP was amended on 21 June 2002 to incorporate the Proposal.

An Environmental Impact Statement (EIS) was prepared by the RTA for the Proposal. The EIS was exhibited between 8 November 2001 and 1 February 2002. The RTA received 340 representations in response to the exhibited EIS.

The key issues raised in the representations included air quality (particularly issues relating to the ventilation stacks and in-tunnel air quality), public transport alternatives, pedestrian and cyclist access and noise impacts. Chapter 3 of this Report provides a detailed analysis of all representations received. Generally, the majority of representations showed a broad level of support for the Proposal, though much of the support was conditional on the inclusion of either in-tunnel or stack discharge filtration.

This Report has been prepared in accordance with Section 115C of the EP&A Act which requires the Director-General of the Department of Planning to prepare an assessment report to the Minister for Planning, including recommended conditions of approval to be imposed if the Proposal were approved. The Minister for Planning must grant approval to a Proposal before it can proceed. In determining the Proposal, the RTA's determination must be consistent and in accordance with the approval of the Minister for Planning.

## Proposal Objectives

The key objectives of the Proposal as stated in the EIS are:

- to improve the efficiency of east-west travel along the corridor for road-based transport modes through a reduction in traffic congestion and improved travel times;
- to improve air quality and reduce traffic noise, particularly along the arterial road network, through a reduction in surface traffic volumes and congestion;
- to improve the amenity of the local community and businesses; and
- to provide for cyclists along the corridor.

The Proposal has been justified on the basis that it best meets the need as identified in the EIS including transport, social, environmental (biophysical), economic and ESD considerations.

## Proposed Modifications

The RTA proposes a number of modifications to the original Proposal described in the EIS based on representations to the exhibited EIS and other additional information. The key modifications are:

- relocation of western vent stack to Sirius Road, Lane Cove West;
- inclusion of bus interchange at Epping Road/Longueville Road;
- pedestrian overpass at the Longueville Road/Epping Road and Parklands Avenue intersection;
- improved bus priority on the Pacific Highway between Longueville Road and North Sydney
- inclusion of an extra lane from Warringah Expressway to Falcon Street/Military Road; and
- changes to the cycleway/pedestrian path west of Reserve Road and along Flat Rock Creek.

The modified Proposal was described, together with the rationale for such changes, in a Preferred Activity Report which was placed on public exhibition between 15 July 2002 and 16 August 2002 at all locations where the EIS was exhibited.

Since the preparation of the Representations Report and Preferred Activity Report, two other key modifications have been made. These are:

- redesign of the tunnel ventilation system to accommodate a more stringent in-tunnel carbon monoxide (CO) goals, including a new air-take structure; and
- modification of the Willoughby Road intersection and shared pedestrian and bicycle lane across the Gore Hill Freeway in this location.

The Department has also made a number of recommendations to improve the Proposal's ability to meet the stated objectives. The key recommendations include a number of public transport related improvements. Overall, the Department is satisfied that all modifications proposed, both individually and cumulatively, reduce the detrimental effect of the activity on the environment and broadly supports these modifications on this basis.

## Key Issues

Strategic Justification

The objectives of the Proposal relate to improving road-base transport, both private and public, along the corridor incorporating Epping Road as well as improving local amenity, pedestrian and cyclist access and the natural environment as a result of meeting the transport related objectives. The Proposal would also provide the "missing link" in the Sydney Orbital road system identified by the Government in *Action for Transport 2010* and also has strategic importance in terms of catering for future connections between the F3 and Sydney Orbital.

The stated benefits of the Proposal would be realised in the form of road user benefits (travel time savings, improved safety, reduced operating costs, better public transport) and local community improvements (improved air and noise environment, improved access to facilities, safer and more amenable environment). In particular, it would provide significant road-based public transport improvements along the length of the Proposal and key connecting roads.

*Ventilation Design*

The Department, community, NSW Health and the EPA raised significant concerns regarding the design criteria for the Tunnel as proposed in the EIS. Issues raised by the Department, NSW Health and the EPA resulted in a revised in-tunnel carbon monoxide (CO) design objective of 50 ppm over 30 minutes. This required the RTA to develop a new concept design for the ventilation system.

The revised ventilation design includes:

- provision for one (1) tunnel air extraction point in each of the eastbound and westbound tunnels (i.e. two (2) extraction points);
- additional exhaust tunnels to connect the tunnel air extraction points to the main exhaust tunnels to the ventilation stacks;
- an air intake station at ground level which provides external air to both the eastbound and westbound tunnels, located either at the proposed Moore Street construction compound or vacant RTA land on the southern side of Epping Road, approximately 150 metres east of Moore Street;
- additional exhaust fans at each of the eastern and western ventilation stacks; and
- additional jet/axial fans within both the eastbound and westbound tunnels.

The Department is of the opinion that the revised design for the tunnel ventilation system would be able to meet in-tunnel CO goals as stated above and would also provide the following significant improvements:

- reduced exposure of polluted air on motorist using the tunnel;
- improved visibility within the tunnel; and
- improvement to fire and safety risks for the tunnel through the provision of intermediate air extraction for smoke.

*Stack Location*

The Department considers that finding any location to accommodate a stack that would be tolerated by all members of the community to be difficult if at all possible. Nevertheless, the proposed sites were considered to provide the greatest margin for compliance when compared to other locations. The nominated stack locations appear to follow this principle.

*Air Quality Goals*

A major objective of the Lane Cove Tunnel is to reduce traffic congestion on Epping Road and improve traffic flow efficiency. The EIS predicts a reduction in vehicle emissions for the Sydney network and for the Lane Cove tunnel cordon. These overall reductions would be expected to result in an overall net improvement to air quality within Sydney.

Notwithstanding, the "net improvement" to residents is highly dependent on achieving the forecast road volume reductions and network efficiencies. These forecasts are dependent upon the traffic model and more specifically the modelled changes to total annual vehicle kilometres travelled (vkt) and total annual vehicle hours. Equally, reliance on the traffic model output is dependent upon maintaining the traffic reductions on surrounding roads. It is understood that the community would be naturally anxious about this issue and therefore RTA's commitment to a net improvement of air quality (or at least no worsening) as a result of the construction of the proposal is fundamental and integral to the strategic justification of the Proposal. On this basis, the Department recommends meeting National Environment Protection Measure (NEPM) ambient goals as a way of ensuring accountability to such broad and cumulative commitments. Additionally the Department recommends set stack limits for all key pollutants which would provide stringent control of emissions from the stack, for which the RTA would be accountable.

The use of ambient goals in conjunction with proposed stack emission limits would prevent the ability to "pollute-up" to the ambient goals.

*Air Quality Impacts*

At the local level, pollutant discharges from the ventilation stacks are expected to be manageable. The contributions from the ventilation stack would be very small and the overall concentration levels (background plus contribution from the stack) would be well within air quality goals. Notwithstanding, continued monitoring of ambient conditions in the area should be undertaken to confirm this predicted outcome.

Impacts on high level receptors are also predicted to be well within air quality goals. A comprehensive localised monitoring and mitigation response program is recommended, including monitoring at the air conditioning intake at nearby high-rise buildings.

The air quality impact assessment is consistent with an analysis of the ambient air quality monitoring data for the M5 East which concluded that measured pollutant emissions showed little change between pre and post tunnel opening (*i.e.* the stack would appear to have made little difference on the external air environment of the area) and apart from bushfires and a significant dust storm, the project has been well within the external air quality goals.

*Pollution Control Equipment*

The Department is currently in the process of undertaking an independent review of international best practice for emission treatment. At this stage, filtration of particulate matter ($PM_{10}$) for this Proposal is not considered cost effective or necessary, as the level of particulate matter to be removed would be less than 10% of the total background particulate matter exposure. Furthermore, nitrogen dioxide ($NO_2$) would be a more sensitive pollutant for this Proposal, particularly with respect to elevated receivers.

Notwithstanding it is recommended that provisions be made for the retrofitting of pollution control systems should the need arise and in the case of treatment of gases, if technological developments make such systems available, necessary and cost effective. Extensive monitoring and community involvement would be an essential element in that decision-making.

*Compliance*

The Department has included a recommendation which allows it to direct the RTA to expend money if in-tunnel CO limits are exceeded. It is proposed that any expenditure would be used in the preparation and implementation of a strategy to improve in-tunnel and local air quality.

Moore Street Compound

A number of representations raised significant concerns with the proposed construction compound at Moore Street. The RTA has advised the Department that this site is critical for construction flexibility and hence the timely and cost effective delivery of the Proposal.

The Department's assessment shares many of the concerns raised in representations particularly with respect to noise, dust and local ecological issues. The Department's preferred option would be to find an alternative site, however at this stage accepts that alternative locations considered would have similar if not worse environmental impacts.

Should no acceptable alternative site be found, the Department would accept the use of the site provided that all activities comply with very stringent and transparent conditions. These conditions would be far more stringent than that normally applied to construction compounds. In particular, there would be no night time work, day time operations would be required to meet specified limits and regular dust monitoring would be required. As a further protection measure, the Department has also recommended comprehensive restoration/rehabilitation works to ensure that the ecological attributes of the area are fully rehabilitated.

Traffic

*Regional Traffic and Transport*

The Lane Cove Tunnel would form the final link in the Sydney Orbital ring road system identified in *Action for Transport – 2010*. The key objective of the Proposal was to improve east-west travel along the corridor for road-based transport.

The EIS predicted that without the Proposal, the Epping Road/Longueville Road and Gore Hill Freeway corridor would become more congested in the future due to the predicted population increases within the catchment, in particular the North-West sector. The Epping Road/ Longueville Road corridor was identified as the most appropriate for upgrade to meet the predicted future growth in traffic demand, as it

provides the most direct route between the regions. The RTA has demonstrated the importance of the Proposal as a regional link between North-West Sydney and the North Shore/Northern Beaches/CBD and that generally it would reduce traffic levels on surrounding lower order roads as well as significant positive benefits to public transport. Travel time savings of around 50% between the North-West sector and the North Shore/CBD were predicted during peak periods. Improvements to bus travel times were also predicted through the corridor as a result of the Proposal.

The Department agrees that the broad objectives as stated above would be achieved by the Proposal. However, it is considered that Proposal may potentially induce traffic movements, in particular new trips (as opposed to redistributed trips) due to these improvements. The RTA has reduced this potential to a significant extent by providing bus lanes in both directions on Epping Road and the Pacific Highway. As further assurance, the Department recommends a comprehensive traffic monitoring regime. Should this monitoring identify that there is induced traffic in the corridor (increased traffic measured across western and eastern screenlines and in the tunnel), the Department has recommended that the RTA identify and implement additional physical measures and traffic management measures including consideration of the use of a toll levy or other measures to deter induced trips.

Some concern was also raised about the impact of a future link between the Sydney Orbital and the F3 Freeway. The operation of this link would increase traffic on the Proposal and its approaches requiring additional capacity within the tunnel. Appropriately, the Proponent has made provision for future widening of the tunnel to three lanes eastbound for the full length should it be required in the future.

*Local Traffic*

The Department is cognisant of the potential impacts of the Proposal on many local roads throughout the corridor. Decreases of up to 40% during peak periods on Epping Road and up to 50% of daily traffic levels on Mowbray Road West are expected. However, several of roads, including Reserve Road, Centennial Avenue (north of Epping Road), Badajoz, Wicks and Pittwater Roads are expected to experience increases in traffic following opening of the proposal to traffic.

To minimise impacts on Reserve Road and surrounds the Department has recommended that the Proponent undertake a strategic assessment of access to Chatswood from the Proposal. To reduce the likelihood of traffic increases and discourage toll avoidance, the Department has recommended that the Proponent assess and install where possible Local Area Traffic Management measures on impacted roads and any other local routes in the area. Additionally, the Proponent will need to monitor traffic levels in the area after proposal opening to ensure that no local routes receive significant increases in traffic.

Bus and High Occupancy Vehicle Lanes

The RTA has sought to capture some of the additional road capacity created by proposing about 5km of T2 lanes in each direction on the Gore Hill Freeway and about 11km of dedicated bus lanes on Epping Road in each direction between the Pacific Highway and Mowbray Road West and on the Pacific Highway between Miller Street and Longueville Road.

The Department concurs that measures to improve routes for public transport and high occupancy vehicles (HOVs) is appropriate where additional capacity is provided and opportunities to encourage induced traffic may otherwise occur. To this end, the Department has recommended:

- the establishment of a Public Transport Committee to be chaired by Transport NSW to coordinate public transport facilities as part of the Proposal;
- the continuation of about 1.3km to the existing eastbound T3 lanes west of the Lane Cove River crossing to the Mowbray Road West intersection;
- about 1.1 km of bus priority measures at Mowbray Road West, Pittwater and Delhi Roads westbound and for the southbound traffic between the end of the Gore Hill Freeway and the southbound bus lane on the Warringah Expressway;
- the installation of an eastbound bus lane on Falcon Street/Military Road between the Warringah Expressway and Big Bear Shopping Centre; and
- requirements to install bus and transit lane enforcement bays to enable management of the bus and high occupancy vehicle measures for greatest efficiency.

These measures are in addition to bus lanes and transit lanes proposed by the RTA on Epping Road, Gore Hill Freeway and the Pacific Highway, and in total would provide about 17.5km of continuous, largely unimpeded route, which maximises the benefits of the Proposal for public transport and high occupancy vehicles.

Epping Road Improvements

A key benefit of the Proposal would be the anticipated traffic reductions on Epping Road. This provides an opportunity to 'downgrade' Epping Road to provide less of a regional function and provide better facilities to improve public transport efficiencies and local traffic functions. Additional facilities proposed by the RTA include T2 and bus lanes, a pedestrian/cycle path, landscaping of the surface corridor to create a 'boulevard' experience, reducing traffic speeds and construction of a bus interchange on the north-eastern corner of the Longueville Road intersection.

Whilst it is recognised that Epping Road will always carry a significant amount of traffic, the Department commends the RTA's proactive approach to using the opportunities provided by reduced traffic to improve the local amenity for residents and the broader community. It is also considered that, despite the overall increase in hard paved surfaces as a result of the Proposal, these measures provide a positive message that the creation of additional roadspace need not necessarily be for the sole use of private vehicles.

Toll

A number of representations objected to the toll or raised concerns about the toll cost at the time of opening. The RTA responded that private sector involvement would be fundamental and necessary to facilitate the building of the Proposal in the foreseeable future. The Department acknowledges the concerns raised about toll imposition, however it is cognisant that funding for such large infrastructure projects is difficult and that tolls have been imposed on other sections of the Sydney Orbital of which this Proposal is part.

Differential tolling was raised as a means encouraging increased vehicle occupancy, reducing congestion, increasing public transport patronage and as an effective traffic demand management and "user pays" tool. The provision of electronic tolling provides for the potential differential tolling in the future, particularly in response to increases in induced traffic. The Department has recommended several conditions requiring that buses providing scheduled public passenger transport services and cyclists be exempt from paying all tolls. This would be consistent with other recently improved projects such as the Cross City Tunnel and Western Sydney Orbital.

A number of representations and the Department were concerned about the equity of a toll on motorists using the Falcon Street ramps on the basis that a toll could not be justified for infrastructure which the RTA indicated was required to address a "structural deficiency" in the road network. Following further analysis the Department is satisfied that there is a sufficient nexus between the predicted users of the north-facing Falcon Street ramps and the Proposal.

**Conclusion**

The need and justification of the Lane Cove Tunnel and associated road improvements has been based on issues of improved local amenity, sub-regional traffic operation, wider network capacity and predicted future transport conditions. The Proposal would complete the Sydney Orbital network enabling significant improvements in travel time and accessibility through the corridor and resultant economic benefits to the region and State.

The construction of the Lane Cove Tunnel would remove a significant proportion of the traffic currently using Epping Road and surrounding roads. However, the proposal would result in an overall increase in road capacity as well as increasing traffic on a number of other roads.

The RTA has sought to maximise the sustainability of the Proposal by capturing some of the additional road space created and using this for public transport, pedestrian and cyclist access. These measures are supported by the Department. Further, extensive monitoring and local area traffic management measures would minimise the potential for "rat runs" to occur through local roads as a result of induced traffic and/or toll avoidance.

With respect to construction, significant impacts are anticipated as a result of construction activities particularly at the Moore Street compound site. The RTA has stated that the availability of the Moore Street site provides significant flexibility which is integral to construction of the Proposal. The Department is cognisant of the likely impacts and supports further investigation of alternative compound options. To this end, the Department recommends thorough consideration of any alternative compound locations or methods of construction identified during the tender process which may avoid the need for the Moore Street site. If no suitable options are identified, the Department would accept the use of Moore Street, provided activities complied with the stringent and transparent conditions recommended.

In order to achieve the desired long term and strategic outcomes, the Department has, in particular, placed significant emphasis on maximising public transport enhancement opportunities, ensuring net improvement to regional air quality and the downgrading of Epping Road. The Department's assessment has concluded that the Proposal would of be long term benefit to the community if supplemented by the recommended air quality, regional and local traffic, and Moore Street construction conditions, and that all residual impacts could be appropriately managed.

Other issues of relevance to the Proposal are assessed in Chapters 5 to 9, the key ones include noise and vibration, spoil and waste management, groundwater and settlement, urban design and visual impacts, cyclists and pedestrians and ecological impacts. The assessment concludes that all such impacts can be managed and would not, subject to conditions, result in long term adverse or irreversible effects.

## Recommendations

It is recommended that, should the proposal proceed, it would be essential for extensive and comprehensive conditions to be imposed so as to ensure, to the greatest extent practicable, its long term benefits. Section 12 of this Report lists all the recommended conditions of approval, the key ones include:

- the most stringent in-tunnel carbon monoxide standards in the world (CO of 50 ppm for 30-minutes);
- requirement for community based air quality monitoring stations for each of the ventilation stacks;
- provision for the retro-fitting of pollution control systems subject to air quality impacts and technological improvements in treatment of gases;
- highly prescriptive and transparent conditions related to noise, air quality, transport, water quality and site rehabilitation should the Proponent decide to pursue the Moore Street compound site;
- creation of 1.3 km of new T3 transit lanes between Mowbray Road and Delhi Road and conversion of 0.65 km of transit lane to bus lanes and establishment of 0.45 km of new bus lanes;
- requirement to investigate further opportunities for bus lanes, bus priority or high occupancy vehicle lanes on the Warringah Expressway, Falcon Street and Pacific Highway;
- monitoring or traffic after opening to verify predictions in the EIS and to determine the level of induced traffic as a result of the Proposal and implementation of measures where induced traffic is realised;
- strategic assessment of traffic access to Chatswood to reduce impacts on roads in Artarmon including Reserve Road;
- installation of LATM measures for key locations likely to experience increased traffic volumes;
- preparation of a detailed cycleway and pedestrian plans and a review of the cycleway route in the vicinity of residences in Naremburn;
- development of a community education program regarding the appropriate action to be taken in the event of incidents and emergencies in the tunnel; and
- commitment to supply electrical energy from "green power" for 50% of construction electrical energy requirements and double the Government Energy Management Policy for operations.

# 1 INTRODUCTION

## 1.1 Nature of the Proposal

The Roads and Traffic Authority (RTA) proposes to construct the Lane Cove Tunnel and associated road improvements. The Lane Cove Tunnel would be a 3.4 kilometre twin tunnel which would generally follow beneath the Epping Road alignment. The proposed Tunnel would link the M2 Motorway at East Ryde with the Gore Hill Freeway at Artarmon. Further associated improvements along the M2-Gore Hill corridor would include:

- a new two (2) lane westbound crossing of the Lane Cove River:
- reduction of Epping Road from 6 to generally 4 lanes. This will incorporate conversion of existing transit lanes to dedicated bus lanes in each direction, reinstatement of right turn lanes and a continuous pedestrian/bicycle path between Wicks Road, East Ryde and Naremburn;
- an eastbound tunnel portal for high occupancy vehicle connection to the Gore Hill Freeway;
- widening the Gore Hill Freeway between the Pacific Highway and the Warringah Freeway by one lane in each direction. These lanes would be designated transit lanes; and
- north-facing ramps at Falcon Street from the Warringah Freeway to provide access between the Warringah Freeway and Falcon Street/Military Road.

Figure 1.1 shows the Proposal location.

The proposed Tunnel and associated road improvements are expected to cost approximately $815 million to construct. It would be built by the private sector and funded by a toll on road users of about $2 for vehicles using the Tunnel and $1 at the Falcon Street ramps.

## 1.2 Background and History of the Proposal

The EIS states that the need for the Proposal has resulted from the continued population growth in Sydney's north-west and the associated travel demand resulting in the Epping Road corridor. Increased road capacity provided by the Gore Hill Freeway and the M2 Motorway is said to have exacerbated the transport capacity problem along Epping and Longueville roads. This problem is further increased by the lack of direct traffic routes from north-west sector to Sydney, South Sydney and the Eastern Suburbs.

*Action for Transport 2010* identified the completion of works along the M2 Motorway – Gore Hill Freeway corridor by 2004, including substantial improvements to the public transport system to reduce traffic congestion and air quality. The Proposal would provide the "missing link" in the Sydney Orbital road system identified in *Action for Transport 2010* and is also of strategic importance in terms of catering for future connections between the F3 and Sydney Orbital.

The ongoing traffic growth on the Epping/Longueville Road corridor has had detrimental environmental and social consequences on the Lane Cove community, resulting in increased severance, reduced access to either side of the corridor, increased air pollution and noise levels.

## 1.3 Preparation and Exhibition of the Environmental Impact Statement

The RTA initially sought the requirements of the Director-General for an EIS on 24 March 2000 which were issued on 17 April 2000. An environmental impact statement (EIS) for the Proposal was subsequently prepared by the RTA (RTA, 2001) and publicly exhibited at 13 locations in metropolitan Sydney between 7 November 2001 and 1 February 2002.

Three hundred and forty (340) representations were received in response to the EIS. Copies of all representations were forwarded to the Department as required by the *Environmental Planning and Assessment Act 1979*.

## 1.4 Statutory Provisions and Assessment Process

The Proposal is subject to Part 5 of the EP&A Act 1979. As the RTA is both the Proponent and determining authority for the Proposal, and an EIS was prepared, Division 4 of Part 5 of the EP&A Act applies. As such, the approval of the Minister for Planning is required for the Proposal.

## 1.5 Request for the Approval of the Minister for Planning

In accordance with Section 115B of the EP&A Act, the RTA sought the approval of the Minister for Planing by way of letter dated 24 June 2002. The request for approval was accompanied by a Representations Report which presented the RTA's response to the issues raised in representations received during public exhibition of the EIS.

## 1.6 Purpose of this Report

The purpose of this report is to review the EIS for the Proposal, the issues raised in representations to the public exhibition, submissions made by the Proponent and other matters pertinent to the potential environmental impact of the Proposal.

This report has been prepared in accordance with Section 115C of the EP&A Act, which requires the Director-General of the Department of Planning to assess and report to the Minister on the Proposal. The report documents the outcome of an independent environmental impact assessment by the Department accounting for all issues raised in representations to the EIS.

# 2 PROPOSAL AS DESCRIBED IN THE EIS

*This section of the report provides a description of the Proposal as described in the EIS. It provides an overview of the information presented in the EIS and does not necessarily represent the views of the Department. Section 4 provides a discussion of the proposed modifications to the Proposal following exhibition of the EIS and as outlined in the Preferred Activity Report (PAR) and any supplementary information. The Department's consideration of the modified Proposal is provided in Sections 5 to 9.*

## 2.1 Proposal Description

### 2.1.1 Introduction

The Lane Cove Tunnel (LCT) and Associated Road Improvements incorporate a proposed 3.4 km tunnel between the Lane Cove River and the Gore Hill Freeway. In addition to the proposed Tunnel, the RTA is proposing to provide a number of other transport improvements along the M2 Motorway-Gore Hill Freeway corridor. These include widening of the Gore Hill Freeway to include transit lanes in each direction, the construction and operation of north-facing ramps linking the Warringah Freeway and Falcon Street, North Sydney and reconfiguring Epping Road to reduce general traffic capacity as well as providing dedicated bus lanes and a pedestrian/cycle path. Sections of the Proposal highlighting key elements are shown on Figure 2.1 (a) to (j).

### 2.1.2 Key Features

Key features of the Proposal include:

- dual two (2) / three (3) lane tunnels, 3.4 km long, generally following the Epping Road alignment with the western portal near the Mowbray Road West/Epping Road intersection and the eastern portal just east of the Pacific Highway interchange;
- a new bridge over the Lane Cove River, constructed to the south of the existing bridge and accommodating two (2) westbound Epping Road traffic lanes and a cycleway/pedestrian link;
- an eastbound tunnel portal to provide a connection for high occupancy vehicles from the tunnel to Gore Hill Freeway transit lanes;
- two (2) additional lanes on Gore Hill Freeway for transit (bus and high occupancy vehicle) lanes between the Pacific Highway and Merrenburn Avenue, Naremburn;
- two (2) north-facing ramps from Falcon Street to the Warringah Freeway including modification of the existing intersection with Merlin Street;
- two (2) vent stacks for discharge of exhaust emissions located at Marden Street, Artarmon and Orion Road, Lane Cove; and
- surface road reduction of Epping Road from six (6) to four (4) lanes including two (2) dedicated bus lanes between Mowbray Road West and Longueville Road.

### 2.1.3 Other Design Features

Other design features of the Proposal include:

- Realignment of the Mowbray Road West/Epping Road intersection slightly eastward and over the approach to the western tunnel portal;
- Widening of the existing eastbound ramp from Longueville Road to Pacific Highway;
- alteration of the Pacific Highway/Longueville Road signalised intersection to provide left and right turning movements onto Pacific Highway;

- a right turn underpass of northbound traffic and left turn slip lane for southbound traffic to provide access to the Tunnel from the Pacific Highway via an entry ramp; and
- a tunnel exit portal east of Pacific Highway for eastbound traffic to link with the existing two (2) lane exit ramp to Pacific Highway with turning movements for northbound and southbound traffic at the highway.

### 2.1.4 Property Acquisition

No property acquisition is required west of the Lane Cove River. An area of Crown land would be required to accommodate the bridge widening. Some small areas of land (partial acquisition) would be required to accommodate the reconstruction of the Mowbray Road West/Epping Road intersection.

The tunnel stratum would be located beneath Epping Road and Longueville Road as much as possible. Where the Tunnel is located below a property, the property title may be subdivided horizontally and the lower lot acquired by the Proponent for the Proposal. The existing landowner would retain the title to the upper lot which is limited in depth to the top of the lower stratum accommodating the Tunnel.

Additional property acquisition would be required for the following Proposal components

- proposed air exhaust stack locations at Orion Road, Lane Cove and Marden Street, Artarmon;
- surface property acquisition and subsurface acquisition for the on-loading ramp from the Pacific Highway to the Tunnel near Alto Place, Artarmon;
- partial surface acquisition for the exit ramp to the Pacific Highway;
- acquisition (whole and partial) would be required for the widening of the Gore Hill Freeway. No acquisition is anticipated south-east of Northcote Street, Naremburn as the Proposal would be contained within the existing Gore Hill Freeway corridor.

### 2.1.5 Tunnel Construction

Two (2) tunnel construction methods would be employed – cut and cover and driven tunnelling. Tunnelling works would include construction of the main tunnels, cross and emergency egress passages, fan niches and chambers, ventilation tunnels and shafts, smoke and exhaust stations.

Construction of the Proposal is anticipated to take 40 months with the Tunnel open to traffic in mid 2006. Proposed construction hours would be between 7 am and 6 pm Monday to Friday, 7 am to 1 pm on Saturday with no work on Sundays and public holidays. Approval for 24 hour construction of underground works is sought. This would include tunnel excavations, installation of tunnel supports and tunnel fitout.

### 2.1.6 Construction Issues

Construction of the Lane Cove Tunnel would be put to tender as a build, own, operate and transfer (BOOT) contract. Proposal construction would involve three (3) key phases – establishment and pre-construction activities, construction of project works and commissioning. Up to 13 work compounds are proposed in association with work sites.

Two major compounds are proposed at the corner of Mowbray Road West and Epping Road and at the corner of Longueville Road and the Pacific Highway. The main site compounds would include offices, meeting rooms, reception, general administration, amenity and first aid facilities, equipment and tool storage, material storage, communication facilities and parking areas. Each major work site is

anticipated to generate an average of 120 vehicle movements per day (60 arrivals and 60 departures) and up to a peak of 190 vehicle movements per day (95 arrivals and 95 departures).

## 2.2 Need, Benefit and Proposal Justification

### 2.2.1 Proposal Need

The need for the Lane Cove Tunnel is said to be demonstrated in its current performance, where demand is greater than its present capacity. The provision of a long tunnel provides for transport efficiencies including free flowing traffic and more efficient fuel usage. The benefits of the Tunnel would also be realised in the greater opportunities for the provision of public transport and improved amenity for residents and businesses on Epping and Longueville roads. The objectives of the Proposal are to:

- improve the efficiency of east-west travel along the corridor for road-based transport modes through a reduction in congestion and improved travel times;
- improve air quality and reduce traffic noise, particularly along the arterial road network through a reduction in surface traffic volumes and congestion;
- improve the amenity of the local community and businesses through:
  improving safety, connectivity and access for pedestrians and cyclists on Epping road
  improving air quality and reducing traffic noise along the arterial road network
  a reduction in traffic and congestion on Epping and other roads
  improving local access by reducing restriction on traffic turning movements on Epping Road
  enhancing the urban fabric of the lower North Shore;
- improve the operation of road-based public transport for people in north-western Sydney and along the corridor through an improvement in bus priority through the corridor;
- minimise impacts on the natural environment during both the construction and operation phases of the Proposal
- provide for cyclists along the corridor; and
- provide the benefits of the Proposal to the community at least cost to the Government.

### 2.2.2 Proposal Benefits and Justification

The Proposal has been justified by the RTA on the basis of the benefits it would provide. These are:

- a reduction in surface traffic on Epping and Longueville Roads by over 60% and associated traffic relief on the Pacific Highway (between Longueville Road and Falcon Street) and Falcon Street (west of the ramps);
- local road traffic relief, in particular Mowbray Road West;
- improvement of intersection operation along Epping Road, the Pacific Highway and Falcon Street;
- anticipated travel time savings of 6 to 14 minutes in the AM peak and 15 to 22 minutes in the PM peak;
- improved bus travel times due to dedicated bus and transit lanes, and increased patronage;
- improved air quality, reduced noise and improved safety along Epping Road and generally for residents of Lane Cove and Chatswood West; and
- reduced severance between the Lane Cove North area and the community services and facilities south of Epping Road.

## 2.3 Consequences of Not Proceeding

The consequences of not proceeding with the Proposal have been defined as:

- increasing demand for use of Epping Road by 2006 would add to congestion and further reduce road transport efficiency;
- lower vehicle throughput at peak times, increasing delays in off-peak periods and increased use of alternative routes (rat-running);
- general worsening of intersection performance and decreased regional accessibility; and
- increasingly slow bus travel along Epping Road and deterioration of Epping Road as a long distance bus route.

## 2.4 Alternatives Considered

The EIS states that a range of options for improving the road network within the study area has been extensively investigated since the opening of the Gore Hill Freeway and the Sydney Harbour Tunnel. These options were considered in the *Epping Road Options Study* (RTA, 1994), *Road Development Strategy – M2 Motorway to Warringah Freeway* (RTA, 1995) and the *Tunnel Financial and Feasibility Study* (RTA, 1997).

The *Epping Road Options Study* considered grade separated interchanges and crossings, widening of Epping Road, and construction of either a two (2) lane or four (4) lane tunnel option. This study recommended proceeding with steps necessary to advance the construction of the grade separation option and to pursue further investigations into private sector funding of the four (4) lane tunnel option.

The *Road Development Strategy* was commissioned to examine existing and future travel needs on the arterial road network between the M2 Motorway and the Warringah Freeway and to recommend a road development strategy. The study focussed on tunnel options east of Stringybark Creek, in addition to grade separations for Mowbray Road and Sam Johnson Way intersections. Five (5) tunnel options were considered, including short and long tunnels with different lane configurations. Community preference was for a bored tunnel from near Mowbray Road to Gore Hill.

The *Task Force Options Study* evaluated six (6) schemes involving either partial or full tunnel options along the corridor, options for the Mowbray Road West intersection, the Pacific Highway interchange, the Gore Hill Freeway, ramps at Falcon Street, modifications to Epping Road and tunnel ventilation.

## 2.5 Major Benefits and Adverse Impacts Identified in the EIS

### 2.5.1 Major Benefits

The major benefits of the Proposal as stated by the RTA are discussed in Section 2.2.2.

The key objective of the Proposal was to develop an integrated approach to providing solutions to the corridor's traffic efficiency problems. The Lane Cove Tunnel would complete the "missing link" in the Sydney Orbital road network and combined with other proposed transport improvements would result in travel time savings and safer conditions for motorists, reduced fuel, freight and vehicle operating costs for commercial traffic, better public transport facilities and safer conditions for cyclists. More specific benefits include:

- improved east-west connections between North-West Sydney and the Northern Shore/Northern Beaches;
- more free flowing traffic and reduced traffic congestion;
- improved air quality resulting from reduced traffic congestion; and
- improved local access resulting from downgrade of Epping Road;

### 2.5.2 Adverse Impacts

Construction

During construction, adverse impacts which could eventuate include:

- construction noise;
- dust generation;
- increased traffic impacts due to construction vehicle movements;
- potential impacts on unrecorded indigenous heritage site at Moore St compound;
- potential impacts on non-indigenous heritage items including impacts on boundary of Artarmon Conservation Area and the floral (azalea) sign at Lane Cove as well as indirect impacts on additional locations;
- sediment, erosion and acid sulfate soil disturbance;
- ecological impacts (loss of flora and fauna);
- degradation of water quality; and
- ground settlement.

Operation

Potential impacts that could result from operation of the Proposal include:

- visual impacts of the stack
- operational (traffic) noise impacts;
- increased traffic on some lower order roads;
- loss or reduction in size of certain land uses or loss of potential for activities to be undertaken;
- water quality impacts from road runoff, groundwater seepage, emergency clean-up water (fire fighting, spills etc), tunnel cleaning;
- flooding as a result of increased paved surface area;
- lower level of service for Merlin Street intersection; and
- potential commuter parking and traffic congestion problems in St Leonards and Crows Nest.

# 3 SUMMARY OF REPRESENTATIONS

## 3.1 Representations Made in Relation to the EIS

The EIS was exhibited between 7 November 2001 and 1 February 2002. A total of 340 representations (including 5 representations counted twice) were received. Of these, 266 (including 3 representations counted twice) were from individuals.

The category types of the representations are summarised below:

| | |
|---|---|
| State Government | 11 |
| Members of Parliament | 1 |
| Local Government (including local councillors' representations) | 9 |
| Non-Government Organisations | 6 |
| Businesses/Institutions | 28 |
| Community Groups | 19 |
| Private Individuals | 266 |
| **Total** | **340** |

Of the representations received, 76 stated in-principle support for the Proposal and 10 clearly objected to the entire Proposal with 22 opposing the proposed Falcon Street ramps, 15 opposing the cycleways and 12 opposing the widening of Epping Road.

## 3.2 Identification of Key Issues from EIS Representations

In its Representations Report, the RTA included a review of all the key issues raised. The Department has examined the specific concerns raised in each of these categories and has undertaken a supplementary assessment of representations in order to better understand the nature of the concerns raised.

Operational air quality was a recurrent issue from representations, in particular the most frequent and significant concern was for pollution control treatment of stack emissions. Other issues frequently raised in the representations were suggested changes to the Proposal design, concerns about tolls, impacts on local roads and concerns about the Moore Street compound. The Department's summary of issues raised in representations is given at Appendix A.

## 3.3 Key Issues Raised

A summary of key issues raised in all representations to the EIS is given in Figure 3.1. The following points provide an overview of the key issues raised.

<u>Support for Further Treatment of Emissions</u>

- in-tunnel treatment of emissions should be adopted;
- either the tunnel or ventilation stacks should be filtered, or in-tunnel filtration implemented to ensure that community health is not compromised;
- unfiltered emissions from the proposed vent stacks will pollute the local environment, increasing the health risk to the community;

- the EIS is dismissive of in-tunnel treatment of emissions as well as the filtering of emissions from the stacks, and takes a flawed position on in-tunnel particulate and gaseous emission filtration technologies; and
- filtration technology both here and overseas, especially in Norway and Japan, should be investigated.

Operational Air Quality

- proposed expansion of road space will contribute to car dependence, growth in traffic and ultimately congestion and air pollution;
- there is a risk of the intake of polluted air into buildings through air conditioning units located in the vicinity of the proposed vent stacks that needs to be assessed;
- there will be no improvement in the quality of Sydney's air shed as the unfiltered stacks will only redistribute pollution to other areas;
- concern about the failure of the Proposal to include monitoring of particulate matter below $PM_{10}$; and
- proposed tunnel will provide a benefit to surrounding communities through improvements in local air quality.

Local Access and Traffic (Epping Rd)

- support for the reinstatement of right hand turns from Centennial Ave southbound into Epping Road westbound;
- support for a number of the proposed changes to traffic movements concerning accessing and exiting Epping Road and the provision of dedicated turning lanes;
- request for reinstatement of right hand turns into local streets from Epping Road to support the aim of returning it to the local residents;
- suggest that Epping Road be made narrower and the signposted speed reduced to discourage through traffic; and
- changes to Epping Road are unnecessary.

Design – Pedestrian/ Cycle ways

- request for clarification of the proposed route of the pedestrian/cycle ways in a number of areas;
- suggest possible variations to the proposed pedestrian/cycle routes, their design and configuration, such as the provision of guard rails, minimisation of delay for cyclists and treating them as vehicles in the phasing of bicycle traffic signals;
- the proposed cycleway at Naremburn is too close to residential properties and will create privacy issues and a loss of amenity for residents;
- safety issues for users of the Naremburn cycleway and destruction of bushland for its construction were also of concern;
- query whether the need for the proposed pedestrian/cycleway at Naremburn could be eliminated by use of a track, by both cyclists and pedestrians, that has already been cleared through the vegetation, and is in close proximity to the proposed cycleway;
- concern about the large shared proportion of the cycle/pedestrian ways and the subsequent safety issues;
- every effort should be made to provide separate cycle and pedestrian facilities;
- visibility should be maximised along the shared paths/cycle ways, or facilities provided which can warn pedestrians of cyclists and vice versa; and

- suggest that the limited numbers of cyclists that use the Longueville Road pathway do not interfere unduly with the movement of pedestrians, and the cycle/pedestrian way could alternatively be improved within its present boundaries.

Local Traffic and Access (General)

- object to the anticipated increase in traffic through Artarmon as these residential streets are not designed for higher traffic levels;
- traffic on Mowbray Road West needs further consideration otherwise it could form a strong and efficient alternative to the tunnel and encourage more driving overall;
- suggests consideration of using the development of the Lane Cove Tunnel in a larger context to encourage improved public transport access and reduce inner Sydney congestion;
- the Proposal will result in large increases in traffic in local streets affecting the Local Government Areas of North Sydney, Lane Cove, Willoughby and Ryde;
- concern about the failure of the Proposal to address the increasing traffic problem on Barwon Road, Lane Cove West;
- further consideration needs to be given to the widening of local roads, intersection improvements and parking bans, given the number of vehicles accessing the Artarmon and Lane Cove West Industrial areas during construction of the proposed ventilation stacks; and
- the significant reduction in traffic on Longueville Road as a result of the proposed tunnel will make the road more conducive to carrying cyclists and local traffic without the need to provide a designated cycleway.

Acquisition for Surface Modifications

- opposes the Proposal to resume property for the purposes of incorporating cycle ways as part of the Lane Cove Tunnel plan;
- suggest that the proposed partial acquisition of properties will result in a loss of value, restrict property development and existing owners rights of use, impact on the enjoyment of the land and bring traffic noise closer to residents;
- the partial acquisition of property will severely impact on the enjoyment of the land, for example additional noise will create a nuisance for occupants;
- concern about the lack of detail provided regarding intentions for the private properties on Longueville Road which will be compulsorily acquired, and the consequent impact on the value of adjacent properties; and
- land acquisition would bring vehicles and associated noise and emissions closer to residences.

Moore Street compound

- concern about the potential adverse impacts of the compound on habitats, the wildlife corridor connecting Hands Quarry Reserve with the Stringybark Creek valley, as well as areas downstream from the proposed worksite;
- suggests potential dangers of the Moore Street work site to the Red-Crowned Toadlet, a threatened species, and the Green Tree Frog and Common Eastern Froglet which are present in an area adjacent to the planned compound;
- concern about the impact of the proposed Moore Street worksite on nearby residents, the safety of children and value of nearby properties;
- suggest that adequate on-site parking for employees be provided at the construction site to avoid congestion in narrow local streets;
- what alternatives to the Moore Street compound were considered;

- concern about the fate of the Moore Street site once works are completed;
- concern that if it was decided not to rehabilitate the Moore Street compound following construction, development of the site may be proposed, resulting in the loss of this wildlife habitat; and
- the Moore Street bushland was identified as being of landscape significance in Lane Cove's 1988 Heritage Study, and the area has been recognised by Lane Cove Council for future regeneration.

Land Clearing/ Loss of Biodiversity

- concern about the loss of native vegetation, mature trees, ecological communities and habitats as a result of the widening of both Epping Road and the Gore Hill Freeway, and the proposed Moore Street compound;
- concern about the destruction of native vegetation and birdlife that will occur as a result of the proposed cycleway between Grandview Street and Fleming Park, Naremburn;
- concern about the removal of trees, which are home to a local bat population, for the purpose of the proposed widening of the Gore Hill Freeway;
- objection to the loss of a number of significant, mature trees as a result of land acquisition on Longueville Road; and
- suggests that the impacts of construction on the estuary of the Lane Cove River and its tributary creeks adjacent the Proposal, and the potential loss of bushland and biodiversity have not been adequately addressed.

# 4 MODIFICATIONS TO THE PROPOSAL FOLLOWING EIS EXHIBITION

*This Section describes the Proposal for which the RTA has sought approval from the Minister for Planning as described in its Representations Report. The modifications to the Proposal described in this Section have been made by the RTA following exhibition of the Environmental Impact Statement and in response to the issues raised in representations. The modifications have been described for the community in a Preferred Activity Report.*

## 4.1 Representations Made Subsequent to the Preferred Activity Report

The RTA modified the Proposal as described in the EIS following consideration of the representations received during exhibition of the EIS. The RTA prepared a Preferred Activity Report (PAR) which detailed these modifications to the Proposal. The PAR was placed on public exhibition between 15 July 2002 and 16 August 2002 at all locations where the EIS was exhibited.

The Department has received a further 60 representations subsequent to closing date for representations to the EIS. Most additional representations were in response to the exhibition of the PAR. A number of the additional representations received were in the format of form letters. The additional representations raised the following issues:

- concerns over the proposed location of exhaust stacks and the need for filtration;
- concerns over traffic and air quality impacts on North and East Ryde;
- concerns over potential impacts to the Pages Creek catchment;
- concerns over impacts to the Moore Street bushland and environmental impacts on the surrounding areas;
- need for improvements to the intersection function at Parklands and Epping Roads; and
- concerns that the proposed bus interchange may lead to safety and crime problems and overdevelopment of the site.

These issues raised in representations to the PAR are dealt with in the relevant sections of this report.

A detailed representation was received from Lane Cove Council dated 2 September 2002 in relation to the PAR. This representation primarily raised concerns regarding the impacts on the Moore Street area and recommended an alternative construction compound site for consideration in the vicinity of Johnstone Crescent with access directly off Sam Johnstone Way. Refer to Section 8.1 for discussion of alternatives to Moore Street compound and a review of the impacts at this proposed site. Council's representation also raised concern over the impact of the Proposal on the 'Azalea beds' on Epping Road (refer to Section 6.1 for further discussion) and concerns about pedestrian access across Little Street and Longueville Roads as a result of the proposed bus interchange (refer to Section 6.4 for further discussion).

A representation was received from Willoughby City Council dated 14 October 2002 raising concerns including:

- the absence of ventilation systems for the proposed exhaust stacks (refer to Section 5.1);
- impacts on local streets in Artarmon (refer to Section 7.2);
- the need to permit left turn movements into the Pacific Highway from the westbound Gore Hill Freeway exit ramp and the need to upgrade the intersection of Mowbray Road and the Pacific Highway as part of the Proposal (refer to Section 7.2);
- suggested removal of proposed tolls on Falcon Street ramps (refer to Section 7.1);

- potential traffic congestion as a result of the merging for eastbound traffic on Epping Road to one general traffic lane east of the Mowbray Road West intersection (refer to Section 6.3);
- the impacts on the Chatswood Rotary Memorial Athletic Field from construction activities (refer to Section 8.2); and
- the need to take into account hydraulic impacts of the cycleway adjacent to Olympia Road (refer to Section 7.3).

A detailed representation was received from the Lane Cove Tunnel Action Group (LCTAG) dated 31 August 2002. This representation was primarily in relation to concerns with the content of the Air Quality Assessment and the Health Risk Assessments that had been prepared on behalf of the RTA. A detailed summary of this representation is contained in Appendix B. Section 5.1 of this report discusses air quality and health issues.

## 4.2 Proposal Modifications in PAR

The PAR outlines nine (9) modifications to the Lane Cove Tunnel concept design assessed in the EIS. The locations of the proposed modifications are shown in Figure 4.1 to Figure 4.10. The modifications outlined in the PAR are summarised in Table 4.1 below.

**Table 4.1 Summary of Design Modifications in PAR**

| Section | Type of Modification | Description |
|---|---|---|
| Epping / Longueville Road and Lane Cove Tunnel | Vent stack relocation | ♦ Western vent stack relocated to Sirius Road |
| | Bus lane alterations | ♦ Changed bus lane eastbound on Epping Road west of Lane Cove River |
| | | ♦ Improved bus priority on the Pacific Highway between Longueville Road and North Sydney |
| | Bus interchange provision | ♦ Bus interchange on the north east corner of Longueville Road/Epping Road and Parklands Road intersection |
| | Improved pedestrian access | ♦ Pedestrian overpass at the Longueville Road/Epping Road and Parklands Avenue intersection |
| Gore Hill Freeway Section Modifications | Improved pedestrian access | ♦ Changes to the cycleway/pedestrian path west of Reserve Road Bridge and along Flat Rock Creek |
| Falcon Street Off-Ramp Modifications | Provision of extra lanes | ♦ Provision of an extra lane on the off ramp from Warringah Freeway to Military Road |
| | Improved pedestrian access | ♦ Pedestrian footpath on the southern side of Falcon Street between Merlin Street and St Leonards Oval |
| Other | Traffic monitoring alterations | ♦ Provision of extra CCTV and Variable Messaging Services (VMS) |

## 4.3 Design Modifications Subsequent to PAR

Subsequent to the exhibition of the PAR, the RTA has determined to make two (2) further modifications to the Proposal as described in the EIS. The Department received formal requests for these modifications on 25 October 2002. The request included justification including how the proposed modifications reduced, or at least resulted in no worse impacts than the previous Proposals. These modifications are:

- a revised ventilation system for the Lane Cove Tunnel which includes the construction of an air intake and new air intake and exhaust tunnel connections to the main tunnel; and

- a revised design at the Gore Hill Freeway and Willoughby Road intersection to enable all six traffic lanes to be provided within the existing road corridor. This revised design would necessitate the removal of the proposed cycleway from the road corridor to a new location adjacent to the Gore Hill Freeway.

## 4.4 Summary of Modifications

### 4.4.1 Major Modifications

Of the 11 design modifications proposed by the RTA pre and post-PAR, five (5) major modifications were proposed. These, which are described briefly below, were the relocation of the western vent stack to Sirius Road, the provision of a bus interchange and pedestrian overbridge on the north east corner of Longueville Road/Epping Road and Parklands Avenue intersection, the revised ventilation design for the Lane Cove Tunnel and the changes at the Willoughby Road interchange.

Western Vent Stack Relocation

The proposed western vent stack would be relocated approximately 150m west from the Orion Road site to 5 Sirius Road. The location of the proposed stack is indicated in Figure 4.1. The top of stack would be approximately 30m above adjacent ground level, with a cross-section area of 38 $m^2$.

The RTA Proposal to change the stack location was primarily due to concerns about the affect of the stack on development potential at the Orion Road sites as a development application had been approved by Lane Cove Council for a commercial building. The Sirius Road site is currently for sale and has an unoccupied industrial/office space building. There are no current plans for redevelopment of this site.

The RTA states that this modification would provide a greater distance from the stack and sensitive receptors such as Lane Cove West residents and public schools. The site would be approximately 200m from the most sensitive elevated receptor – the Compaq building.

Bus Interchange Provision and Pedestrian Overpass – Longueville Road/Parklands Road

A bus interchange at the north eastern corner of the Longueville Road / Parklands Avenue intersection was proposed as an addition to the public transport aspects of the Proposal. This modification involves the construction of a two-platform bus interchange on residue land from four (4) properties identified for acquisition. The location and concept design for the interchange is shown in Figure 4.3.

Further detailed design components as part of the development of the residue land, would include integration of the bus interchange with a pedestrian crossing (see below). The RTA stated that the modification was proposed to improve bus patron facilities, minimise impacts on Epping Road traffic and improve the management of the bus services stopping at this location.

A pedestrian overpass at the Longueville Road/Epping Road intersection with Parklands Avenue would be provided as part of the integrated bus interchange. Due to design constraints, the new pedestrian overpass would include stairs and a lift at either end for access. The new location of the pedestrian bridge would improve north-south pedestrian access compared to the existing pedestrian bridge at Kimberley Avenue, which would be removed following completion of the new overbridge.

Revised Tunnel Ventilation Design

A substantial change to the tunnel ventilation design is proposed by the RTA. The works for the revised ventilation design involve the following:

- provision for a tunnel air extraction point in both the eastbound and westbound tunnels;
- excavation of additional exhaust tunnels to connect the tunnel air extraction points to main exhaust tunnels to the ventilation stacks;
- provision for an air intake station at ground level which provides external air to both the eastbound and westbound tunnels, and associated tunnel excavation;
- utilisation of either the Moore Street compound area or two vacant lots of land (owned by the RTA) on the southern side of Epping Road, approximately 150 metres east of Moore Street at 130 and 132 Epping Road, for provision of the air intake station;
- provision of additional exhaust fans at each of the eastern and western ventilation stacks; and
- provision of additional jet/axial fans within both the eastbound and westbound tunnels.

A schematic layout of the revised ventilation design is shown in Figure 4.6 and indicative layouts for an air intake and fan structure is contained in Figure 4.7.

The revised design was proposed to reduce the potential CO and visibility issues within the tunnel particularly during congested traffic conditions. The potential environmental impacts of the revised design were assessed in an Environmental Assessment prepared by the RTA and included in Appendix C.

Given the environmental sensitivities at Moore Street and the limited information provided by the Proponent, the Department is not satisfied that an air intake system could be installed at this location and minimise impacts. The site on Epping Road with direct access to Epping Road and situated on a large vacant block would appear to be a more logical location for the air intake facility. The Department has therefore recommended the inclusion of Condition of Approval No. 11 requiring that following consultation with local residents and the relevant Council the air intake be situated at 130-132 Epping Road unless otherwise agreed to by the Director-General.

Willoughby Road Interchange

The proposed modification to the Willoughby Road underpass involves amending the road configuration along the Gore Hill Freeway to accommodate the six (6) traffic lanes (three in each direction) wholly within the existing corridor. This would be achieved through a reduction in the lane widths through the underpass of Willoughby Road and the approaches, removal of the shoulders on either side of the Freeway and providing a modified central barrier between opposing traffic. The modification would considerably reduce disturbance to the area during construction.

The removal of the shoulders through this section of the Gore Hill Freeway would preclude the movement of cyclists along the Freeway, other than by using the transit lanes. The modification therefore incorporates options for off-road cycleway facilities around the underpass and connections to and from the Gore Hill Freeway/Warringah Freeway and other local bicycle routes. The proposed modification would require the duplication of the existing pedestrian bridge over Willoughby Road to cater for cyclists. These proposed changes are shown in Figure 4.8.

### 4.4.2 Minor Modifications

Changed Bus Lanes - Epping Road

This modification would see three (3) continuous eastbound lanes on Epping Road between Pittwater Road and the tunnel access ramp (western portal) to improve the flow of public transport to Mowbray Road west. The inside lane would provide Epping Road access to the tunnel and two (2) continuous lanes to the Epping Road/Mowbray Road west intersection. The RTA justifies this modification based on improvements to the eastbound flow of public transport through the area to connect with the proposed bus lane on Epping Road.

Cycleway – Beside Flat Rock Channel

This modification comprises three (3) separate components:

- at approximately 200m west of the Reserve Road bridge the shared pedestrian/cycleway would be elevated over the westbound transit lane of the Gore Hill Freeway, then run beside the northern side of the transit lane for approximately 200m, again cross over the transit lane before descending to ground level near MacLachlan Avenue;
- an adjustment to the cycleway access ramp to Reserve Road, which would maintain the existing access to Reserve Road from the Gore Hill Freeway cycleway via Dickson Avenue and avoid acquisition of a commercial property; and,
- along Flat Rock Creek, the location of the facility would be moved slightly to the north to provide sufficient area for the screening of the facility from residents in Olympia Road.

The RTA justifies the cycleway modifications on reduced impacts on commercial properties and improved resident privacy.

Pedestrian Footpath – Falcon Street

This modification would entail the constructing a cantilever structure on the southern side of the existing Falcon Street bridge between Merlin Street and St Leonards Oval to provide pedestrian access on the southern side of Falcon Street. The RTA suggests that this would reduce use of the existing multi-stage at-grade pedestrian crossing at the Merlin Street intersection and provide improved pedestrian access between Neutral Bay and the St Leonards Oval area.

Widening of Falcon Street Off-Ramp

This modification would see the proposed southbound exit ramp widened to provide an additional lane for 100 metres from the junction with Falcon Street. The RTA stated that the modification provides for extra storage capacity on the ramp by providing three (3) lanes, meaning that during peak hours, queuing on the ramp would not extend back onto the Warringah Freeway.

Bus Lane on Pacific Highway

This modification allows for improved bus priority for the Pacific Highway between North Sydney and the Longueville Road intersection by converting the existing peak hour transit lanes to bus lanes in each direction. The RTA stated that the modification would improve public transport services through the area. The locations of proposed bus lanes are shown in Figure 4.9.

Provision of Extra CCTV and VMS Services

Additional variable message signs (VMS) and closed circuit televisions (CCTV) are proposed at several locations in the study area to further assist in management of traffic generally and during incidents. The locations for these facilities are shown in Figure 4.10. The RTA expects these modifications would enhance traffic monitoring and management of the upgraded corridor and interchanges.

## 4.5 Conclusion

Detailed assessment of the Proposal components including the proposed modifications is provided in Chapters 5 to 9 of this report and therefore information presented here should be considered for comparative purposes only.

The Department has reviewed the modifications to the Proposal and considers them appropriate, providing improved pedestrian and cyclist access, enhanced bus facilities, improved in tunnel air quality and visibility and improved traffic monitoring and management. Overall, in accordance with Section 112(4)(b)(i) of the EP&A Act 1979, the modifications are considered to reduce the detrimental effect of the activity on surrounding residents and businesses. The Department's view is that there is no justification for further environmental impact assessment (by the way of an EIS) as a result of the modifications.

# 5 ASSESSMENT OF KEY ISSUES RELATING TO LANE COVE TUNNEL CONSTRUCTION AND OPERATION

*This Section of the Report provides the Department's assessment of the key environmental impacts of the modified Proposal as they relate to the construction and operation of the tunnel component of the Proposal. The assessment is based on an examination of the EIS, issues raised in representations during the exhibition period, the Proponent's response to these issues in its Representations Report and during further consultation with the Department. The Department's assessments of environmental issues related to other components of the Proposal are addressed in Sections 6-9 of this Report.*

*The Proponent has also provided the Department with an assessment of all issues raised in representations in the Representations Report. This assessment has been reviewed by the Department and further assessment has been undertaken and discussed where required. It is therefore important that this Section be read in conjunction with the Proponent's Representations Report to understand how all issues raised in representations have been addressed.*

## 5.1 Tunnel Ventilation Systems and Operational Air Quality Implications

### 5.1.1 Background

The ventilation system for a road tunnel of substantial length in an urban environment requires significant consideration as it has specific implications for in-tunnel air quality, external air quality and fire safety. Alternative tunnel ventilation systems to manage in-tunnel air quality, external air quality and fire safety were considered in the EIS and subsequent investigations. This initial part of this section focuses on alternative tunnel ventilation systems in the EIS and studies and options available to manage in-tunnel air quality, external air quality and fire safety. Accordingly, a greater emphasis is placed on a qualitative comparison of alternative options. A quantitative analysis of specific air quality impacts of the preferred ventilation option is then provided.

Tunnel Ventilation Design Options

A tunnel ventilation system can be designed using either a longitudinal or a transverse methodology or a hybrid of the two methodologies. The longitudinal methodology is based on fresh air entering the portal where the traffic goes into the tunnel and it being carried along the tube by the aerodynamic drag of the traffic (piston effect) and/or jet fans located on the ceiling of the tunnel. For a longitude tunnel the polluted air can be exhausted via the exit portal or through an exhaust stack. The M5 and Eastern distributor tunnels are examples of longitudinal ventilation tunnels.

The transverse methodology is based on injection of fresh air and or extraction of polluted air at regular intervals in the tunnel. This usually requires an additional fresh air supply tunnel and an exhaust air tunnel. The polluted air in a transverse system is exhausted via an exhaust stack. The Sydney Harbour Tunnel is an example of a transverse ventilation tunnel.

The concept design for the tunnel ventilation system was presented in Working Paper Two of the EIS. Systems considered were:

- Option 1 – Fully longitudinal ventilation system with exhaust stacks at either end. Purely longitudinal smoke extraction through tunnel portals;

- Option 2 – Recirculatory longitudinal ventilation system with central fresh air supply and central exhaust stack. Smoke extraction through stack and tunnel portals;
- Option 3 – Recirculatory longitudinal ventilation system with central fresh air supply and single remote exhaust stack. Smoke extraction through stack and tunnel portals;
- Option 4 – Hybrid longitudinal/transverse ventilation system. Transverse smoke control with central fresh air supply transverse/ and a single remote exhaust stack;
- Option 5 – Fully longitudinal ventilation system with exhaust stacks at either end (Option 1). Plus two emergency smoke extraction systems at either end; and
- Option 6 – Fully longitudinal ventilation system with exhaust stacks at either end (Option 1). Plus two ducted smoke extraction tunnels.

A comparison of the ventilation system options considering excavation, fit out capital cost, running cost, smoke control and complexity concluded that the central supply and exhaust options (Options 2, 3 and 4) should not be considered further because these options had ventilation components close to residential areas. Options 1, 5 and 6 where longitudinally ventilated with two vent stations on for each tunnel. The difference was in the smoke extraction systems.

Tunnel Options - Fire Safety Implications

On the basis of a quantitative assessment of fire risk and that the tunnel would be equipped with high standard fire emergency provisions such as deluge system, monitoring systems, fire fighting equipment, emergency escape passages to non incident tunnel and network traffic management, it was recommended in the EIS that a cost effective solution to the ventilation and fire and smoke control requirements would be Option 1. That is, longitudinal smoke extraction via the portals and the ventilation stacks.

Ventilation Design, Parameters and Fire Safety

The following design input parameters were used in the EIS for the basis of the proposed tunnel ventilation system:

- 80 km/h maximum design speed;
- 20 km/h minimum design speed;
- in tunnel carbon monoxide (CO) level of 87 ppm for 15 minutes;
- visibility limit of 0.005 m-1;
- tunnel air velocity limit of 10 m/s; and
- design fire size of 50 MW.

These parameters where used to develop a concept ventilation system. (It should be noted that the initial design presented in the EIS and furthered in the Representations Report did not consider congested traffic conditions in the tunnel, further discussion is provided Section 5.1.4).

The World Health Organisation Air Quality Guidelines (WHO, 2000) recommends CO levels of 87 ppm for 15 minutes, 50 ppm for 30 minutes, 30 ppm for 1 hour and 10 ppm for 8 hours. These limits are derived by considering "no-observed" health effect with a significant margin of safety.

The 87 ppm for 15 minutes carbon monoxide design parameter was initially used for the ventilation design for the Eastern Distributor and M5 tunnels. It was assumed that for these tunnels and the Lane Cove Tunnel, that no individual person would be in the tunnel for a period greater than 15 minutes (no in tunnel congestion) and this would be managed through traffic management techniques such as closing

the tunnel if an accident occurs in the tunnel, instructing motorists to turn off engines if stationary in the tunnel, activate appropriate recovery and rescue activities for in tunnel accidents and adjust operation of the ventilation system if congest occurs.

Tunnel Options - Air Quality Implications

Important air pollutants requiring consideration in tunnel ventilation system design are:

- oxides of nitrogen (*e.g.* nitric oxide (NO) and nitrogen dioxide ($NO_2$));
- carbon monoxide;
- volatile organic compounds (VOCs) (*e.g.* benzene and 1,3 butadiene); and
- particulates (*e.g.* particulate matter less than 2.5 microns ($PM_{2.5}$), particulate matter less than less than 10 microns ($PM_{10}$) and total suspended particulates (TSP).

The RTA reviewed air quality implications for four longitudinal tunnel ventilation systems as follows:

- longitudinal tunnel, no stacks, emissions untreated and vented via tunnel portals (option 1a);
- longitudinal tunnel, no stacks, emissions treated and vented via tunnel portals (option 1b);
- longitudinal tunnel with treated emissions and twin stack ventilation (option 1c); and
- longitudinal tunnel with untreated emissions and twin stack ventilation (option 1d).

These options were then compared with a "base case" no tunnel option. Options 1(a) and 1(b) substantially exceed the carbon monoxide (CO), nitrogen dioxide ($NO_2$) or particulate matter ($PM_{10}$) goals at sensitive receivers around the tunnel portals. Exceedances for $NO_2$ and $PM_{10}$ extend up to 1.5 km from the tunnel portals in the untreated option and 1 km with treatment. It was therefore concluded that ventilation stacks would be required to mitigate exhaust air through atmospheric dispersion.

Air quality modelling for the twin stack options showed that goals for CO, $NO_2$ and $PM_{10}$ could be met for treated and untreated emissions. Further, there was little difference between ground level exposure to emissions from the stacks with or without treatment (refer to Table 5.1), suggesting that ambient ground level concentrations is the overwhelming contributor to ground-level pollutant concentrations.

**Table 5.1 Tunnel emissions via twin stacks with and without treatment (EIS Table 15-8)**

| Pollutant | EPA Goal | With Stack Treatment | Without Stack Treatment |
|---|---|---|---|
| Carbon monoxide (CO) 1 hour maximum | 25 ppm | 6.2 | 6.4 |
| Carbon monoxide (CO) 8 hour maximum | 9 ppm | 4.3 | 4.4 |
| Nitrogen dioxide ($NO_2$) 1 hour maximum | 12 pphm | 9.2 | 9.6 |
| Particulate Mater $PM_{10}$ 24 hour maximum | 50 µg/$m^3$ | 39.9 | 42.3 |

Stack Location Options Considered in the EIS

Seven (7) potential vent stack locations were investigated in the EIS – three (3) at the western end and four (4) at the eastern end as shown on Figure 5.1 and described below:

- W1 - Behind Shell service station;
- W2 - Sam Johnson Way (Orion Road);
- W3 – between Epping and Mowbray Roads;
- E1 – north of Alto Place;
- E2 (& E5) – Marden Street site;
- E3 – corner of Marden Street and McLachlan Avenue; and

- E4 – Fire station site.

The various stack locations were assessed on the basis of environmental (air quality) performance, technical/operational requirements, surrounding land use and local character, surrounding built form/elements and visual impacts. Air quality modelling included individual stack performance as well as performance of stacks in combination (refer to Table 6.4 of the EIS). Most stack locations, in isolation and in various combinations, could meet air quality goals for CO, $NO_2$ and $PM_{10}$. In considering the factors outlined, the RTA selected the preferred option of twin stacks at Sam Johnson Way/Orion Road (W2) and Marden Street (E2).

Emission Treatment

A review of current world practice for treating vehicular emissions from road tunnels was provided in Working Paper 2 of the EIS. It identified four (4) main technologies that have been applied to tunnel exhaust air emissions or have been the subject of pilot studies: The study concluded that:

- electrostatic precipitators are primarily used in Japan and Norway to reduce in-tunnel particulate matter for visibility reasons. In Norway, this is due to snow tyres (with spikes) generating a road dust. In Japan, this is due to the disproportionately high percentage of diesel vehicles within the Japanese vehicular fleet. Only two (2) tunnels were identified where electrostatic precipitators were installed to control external emissions, that is the Tennozan tunnel in Japan and Festning tunnel in Norway;
- the effectiveness of current electrostatic precipitator technology in removing the particulate fraction which is potentially detrimental to human health is yet to be clearly established;
- at present, Laerdal tunnel in Norway has the only full scale gaseous removal system installed in any of the tunnels reviewed. The system was installed to reduce $NO_2$ levels inside the tunnel; and
- pilot studies into catalytic and biological removal of pollutants from tunnel exhaust air conducted in the last decade have been concluded within the last 2 to 3 years. The current consensus is that continuing research into gaseous treatment systems is unlikely to be the focus of tunnel ventilation developments. This contrasts with the continuing good practice of tunnel ventilation design, emerging vehicle emissions standards and overall fleet renewal.

It was therefore decided that emission treatment equipment would not be installed on the Lane Cove Tunnel; however, provision would be made for possible future installation of air treatment equipment near the ventilation stacks.

Further updated discussions on international experience with air emission treatment are provided below.

### 5.1.2 Key Issues Raised in Representations

Air quality impacts from the Proposal have been extremely controversial and were the most significant issue raised by the community. Key concerns included:

- opposition to the ventilation stacks (7 representations), including concern about impacts on local air quality and adverse health effects for local residents and workers;
- opposition to the siting of the vent stacks (21 representations);
- concern that treatment of tunnel emissions was not part of the Proposal (120 representations), including in-tunnel treatment as well as filtration of either the tunnel or the ventilation stacks; and

- additional treatment of emissions such as installation of electrostatic precipitators (5 representations) including why they cannot be implemented in the Lane Cove Tunnel when they are used in Norway and Japan.

It was suggested that the EIS was too dismissive of in-tunnel treatment of emissions as well as the filtering of emissions from the stacks, and takes a flawed position on in-tunnel particulate and gaseous emission filtration technologies. Representations also indicated that both Norway and Japan have adopted in-tunnel filtration as the best option for the health of communities. The apparent reluctance to accept the need for filtration of the tunnel was also queried.

The Lane Cove Business Group raised significant concerns about the impact of the stack on the Lane Cove Industrial Area, including potential health issues and general perceptions for employees in the area. The Lane Cove Tunnel Action Group submitted a comprehensive and detailed representation raising many issues with regard to air quality; their most important concern was with regard to health impacts of fine particulates.

Issues relating to fire safety aspects arising within the tunnel were discussed in four representations. Specific concerns included the failure to evaluate the health risks of tunnel fires and in-tunnel congestion.

The EPA raised concerns with regard to the air quality assessment specifically:

- the NO2 impact assessment;
- air toxics and health risk assessment;
- stack height, location and exhaust velocity;
- emission concentrations and loads limits;
- hydrocarbon analysis;
- congested traffic conditions – have congested traffic conditions been considered in developing emission concentrations and load limits?
- cold starts; and
- greenhouse gas emissions.

### 5.1.3 Additional Investigations – Since the EIS Exhibition

Stack Locations

An additional investigation of western vent stack options was undertaken (RTA (2002a)) in response to representations received. A number of alternative sites identified in representations (in-median and west of Lane Cove River) were considered as well as an additional site identified by the RTA (Sirius Road). Sites were assessed on the basis of air quality, health, visual, geotechnical and economic impacts. Overall, it was concluded that all sites could meet air quality goals and therefore should not be the determining factor in deciding stack locations.

Options to incorporate the stack into electricity pylons were rejected on the basis of significant works required to change the structures, impacts on existing or proposed national park and visual impacts. Similarly, in-median options were deemed unsuitable on the basis of visibility, even with urban design treatments, proximity to sensitive receptors and additional land requirements to accommodate within the median or adjacent to the roadway. An alternative site at Sirius Road (site S1) was selected by the RTA as the preferred option due to reduced visual impacts, increased distance from Lane Cove West Public

School, existing development of the site which may be combined with the ventilation stack to reduce the visual impact on surrounding development (relative to the Sam Johnson Way site).

Ventilation Options and Air Quality Assessment

Representations from the community, EPA and the Department relating to tunnel congestion led to concerns that motorists could be exposed to high CO levels for longer periods than the 15 minute design criterion. As such a CO design objective of 50 ppm over 30 minutes was considered more appropriate than the 87 ppm over 15 minutes design objective originally used. As a consequence, the ventilation option in the EIS Proposal was not able to accommodate the new design objective. A new concept design (RTA, 2002b) for the ventilation system was prepared and a re-assessment of the air quality affects undertaken for the new design. The revised design included:

- one tunnel air extraction point in approximately the centre of each of the eastbound and westbound tunnels;
- additional exhaust tunnels to connect tunnel air extraction points to the main exhaust tunnels to the ventilation stacks;
- an air intake station at ground level to provide external air to both traffic tunnels;
- additional exhaust fans at each of the eastern and western ventilation stacks; and
- additional jet/axial fans within both the eastbound and westbound tunnels.

A ventilation stack would still be located at Marden Street, Artarmon, and at Sirius Road, Lane Cove West (western end). The proposed Moore Street construction compound or two vacant blocks fronting Epping Road owned by the RTA, approximately 150 metres east of Moore Street were proposed as locations for the air intake. These are shown on Figure 5.2. A layout of the revised ventilation system is detailed in Figure 4.6. Indicative layouts for an air intake and fan structure provided in Figure 4.7.

The RTA has requested that this alteration to the preferred activity be considered under Section 112 (4)(b)(i) of the EP&A Act which allows modification of the proposed activity "so as to eliminate or reduce the detrimental effect of the activity on the environment" (refer to Section 4.3).

A further air quality assessment was included in RTA's request to alter the preferred activity. The conclusions of the air quality assessment were that:

- air quality impacts would in general be much the same or slightly better than the EIS and the PAR options;
- stack contributions to predicted maximum ground level and elevated receptors would remain relatively small compared to background levels;
- predicted maximum ground level and elevated receptor concentrations show that all pollutants measured would be well below the relevant goals;
- lower pollutant concentrations compared to the EIS option would be likely under congested traffic flows due to higher exit velocities at the stack to improve dispersion; and
- the total lifetime cancer risk due to hydrocarbons at the most affected ground level and elevated receptors would be acceptable.

Details with regard to the air quality impacts of the preferred ventilation option are discussed below.

### 5.1.4 Consideration of Key Issues

Physical Considerations

*Stack Locations*

In general the Department considers that it would be difficult to find any location to accommodate a stack that would be entirely acceptable to the community. The Department concurs with the assessment indicating that there is little differentiation between the stack locations considered based on air quality issues and that because of this, other parameters considered, such as visual and urban design impacts are, in this instance of similar importance. Based on the sites' ability to meet air quality goals for stack discharge and the potential to effectively manage the visual and urban design impacts, the Department supports the selection of the Marden Street and Sirius Road sites.

*Tunnel Ventilation*

There is a possibility that individuals/motorists (not associated with tunnel management) to be inside the tunnel for periods greater than 15 minutes. This would mainly be due to possible congestion within the tunnel. As there is no conclusive evidence that traffic congestion will not occur within the proposed Lane Cove Tunnel and can be controlled through traffic management, the Department recommends a precautionary approach to try and avoid longer term exposure and assume that motorist may be inside the tunnel for large periods. On this basis the RTA has reviewed the ventilation design to meet the more stringent internal CO goal of 50ppm 30-minutes.

NSW Health has indicated that an absolute limit for CO would also be appropriate. The Department and NSW Health are not aware of any specific public health guidelines for short term CO impacts. Using the WHO methodology for establishing CO concentration levels to ensure "no-observed" health effect with a significant margin of safety, a short term 200ppm 3 minute average limit for a single point is considered appropriate.

To ensure that the benefits of the revised concept design ventilation system are realised, the Department has recommended conditions 160 to 164 inclusive. These conditions require the Proponent to meet in tunnel CO limits of 50ppm 30-minutes, 87ppm 15-minutes and 200ppm 3-minutes with stringent monitoring, reporting and auditing requirements.

The Department also considers that the Proponent should not solely rely on the ventilation system design to limit CO exposure in-tunnel and should have effective management systems in place to limit individual exposure of CO particularly during congested traffic conditions. To ensure that this occurs, the Department has recommended Condition 157.

*Fire Safety and Smoke Extraction*

A fire incident in a tunnel can be more serious than on the open road for the following reasons:

- smoke cannot vent freely;
- radiation feedback causes fire spread; and
- emergency services access is restricted.

Tunnel fire safety systems can be designed to reduce a major incident, however they can not totally eliminate them.

Currently a performance approach for tunnel design is not possible as there is not sufficient knowledge of the performance of risk mitigation measures. The usual approach for Australian Tunnel design to review tunnel fire incidents, research reports, relevant standards, international practice and local practice is to determine appropriate fire life safety systems.

There does not currently appear to be a complete knowledge of fire behaviour in tunnels. It is possible to provide an increasing number of safety systems however the cost/benefit of further safety features reduce. In addition systems become so complex ability to operate them reliably may diminish.

Permanent International Association of Road Congresses (PIARC) issues, on a four yearly cycle, a series of recommendations on fire safety. These are based on the experience of thirteen participating Nations and represent the convergence of views of the many experts involved. The result of their work has been published in 1999 as a PIARC report entitled 'Fire and smoke control in road tunnels'. The PIARC documents raise issues to be considered and provide suggested approaches but are not prescriptive standards. As a result of recent fires, French Authorities have issued the Technical Instruction Relating to Safety Measures in New Road Tunnels (Design and Operation) as Appendix No 2 to the Inter-Ministry Circular No 2000-63 of 25 August 2000 relating to the safety of tunnels in the national highways network. The USA approach on fire safety in tunnels is detailed in NFPA 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways 1998 Edition.

Typically the Lane Cove Tunnel design is similar to the recommendations in the French and PIARC practices with the following exceptions:

- design fire is 30MW in PIARC and France standards and 50MW for LCT;
- emergency equipment cabinet spacing is 200m in PIARC and France standards and 60m in Australia
- deluge is provided for LCT;
- egress spacing is 200m in PIARC and France standards and 120m in LCT; and
- massive extraction is provided at 500m intervals in France as well as longitudinal ventilation whereas only longitudinal ventilation was provided in the initial EIS design.

The French Guideline states that:

> *While it is always possible that the provisions in this text may not be implemented strictly if it can be demonstrated that the proposed measures ensure at least an equivalent level of overall safety, for example by strengthening some aspects in order to compensate for a choice of lesser performance from others.*

The ventilation system considered in the EIS had the potential for smoke being drawn along the length (up to 3.4 km) of the tunnel to the ventilation stack or the portals during a fire or other smoke generating incident. Under the revised ventilation design, smoke would now travel a maximum of two (2) kilometres along the tunnel.

The Department considers that the new design is a substantial improvement over the initial design and that the set of safety provisions proposed by the Proponent will ensure that fire safety will be an integral consideration in the detail design and operation of the tunnel.

The Department has recommended conditions requiring the Proponent to develop a scope of works, to the satisfaction of the NSW Fire Brigade, for tunnel fire safety requirements, auditing of fire safety

systems, simulation and smoke testing and a community education program to advise the public of actions to be taken during a fire or similar emergency in the tunnel.

The Department's position is supported by correspondence from the NSW Fire Brigades (refer to Appendix D).

External Air Quality Impacts

*Regional Air Quality Changes (Total Airshed Emissions)*

The key objective of the Lane Cove Tunnel is to reduce traffic congestion on Epping Road and improve traffic flow efficiency. The EIS predicts a reduction in total fuel consumption and $CO_2$ emissions for the Sydney network and for the Lane Cove tunnel cordon as shown in Table 5.2. These overall reductions would be expected to result in an overall net improvement to air quality within Sydney.

**Table 5.2 Predicted Fuel Consumption and $CO_2$ Emissions**

| Emissions (tonnes) | 1999 | | 2006 | | 2016 | |
|---|---|---|---|---|---|---|
| | Fuel (mill. litres) | $CO_2$ (kt) | Fuel (mill. litres) | $CO_2$ (kt) | Fuel (mill. litres) | $CO_2$ (kt) |
| **Total Network** | | | | | | |
| With tunnel | - | | 4,027 | | 4,825 | |
| Without tunnel | 3,474 | 9,428 | 4,083 | 11,081 | 4,905 | 13,312 |
| **Lane Cove Tunnel Cordon** | | | | | | |
| With tunnel | - | - | 181 | 491 | 212 | 575 |
| Without tunnel | 176 | 478 | 196 | 532 | 233 | 632 |

Notwithstanding, the "net improvement" to residents is highly dependent on achieving the forecast road volume reductions and network efficiencies. These forecasts are dependent upon the traffic model and more specifically the modelled changes to total annual vehicle kilometres travelled (vkt) and total annual vehicle hours. Equally, reliance on the traffic model output is dependent upon maintaining the traffic reductions on surrounding roads. It is understood that the community would be naturally anxious about this issue and therefore there is a requirement to ensure that the RTA is accountable to such commitments. The requirement to monitor ambient goals would address this issue and has been included in the Departments Recommended Conditions of Approval.

*Ambient Air Quality Goals*

- General

Air quality standards or goals are used as an indicator to assess the potential for ambient air quality to give rise to adverse health or nuisance effects. Air quality goals for $NO_2$ and CO have been determined by the World Health Organisation (WHO). In addition, the National Environment Protection Council of Australia (NEPC) has developed air quality goals, for CO, $NO_2$, Ozone, sulphur dioxide, lead and $PM_{10}$, for adoption at a national level, which are part of the National Environment Protection Measure (NEPM). The NEPM goals relate to regional air quality. The NEPM is a regional ambient goal that addresses all sources of pollution.

- PM2.5

The NEPC has released a draft NEPM for 'advisory reporting standards' for fine particles up to 2.5 microns in diameter ($PM_{2.5}$). The purpose of the proposed $PM_{2.5}$ NEPM is to provide a framework to gather the data with a view to setting compliance standards in the future. Initially states will not be

required to comply with these levels, but simply to report against them, as there is not yet sufficient data available to provide an adequate basis for setting compliance standards.

Each State will be required to establish at least one (1) monitoring station and will be able to employ either a continuous or gravimetric monitoring method. The NEPM will only apply to regional air quality and not to specific premises or facilities.

Comments on the NEPM have been sought by the end of this year. The final NEPM would then be considered by the Council in April and, if approved, would be made at that time. It is important to note that as this NEPM is being established for reporting purposes only, the EPA advises that it is therefore not appropriate to apply these benchmarks as compliance goals for the Lane Cove Tunnel.

In this regard, it is proposed that $PM_{2.5}$ is not used as a compliance limit but nonetheless retained for monitoring and reporting purposes. Requirements for monitoring and reporting on $PM_{2.5}$ levels are specified in Recommended Condition of Approval 164 to 167 inclusive and 172.

*Existing Ambient Air Quality*

Background air quality monitoring was undertaken at Epping Road, Mowbray Road and Military Road for the Proposal. In addition, EPA has an air quality monitoring site at Lindfield. Results of background monitoring are provided in the EIS. These results indicated that maximum measured CO ambient concentration levels (*i.e.* without the stack) would be approximately 30% to 50% of NEPM guidelines. $NO_2$ and $PM_{10}$ measured maximum concentration levels are approximately 70% of the NEPM.

It is suggested in the EIS that the RTA monitoring sites provide an indication of the existing air quality in the study area and the monitoring data from the EPA site at Lindfield would be more of an indication of background levels as it is located away from significant road impacts. The EPA has indicated concurrence with this approach.

*Impact of Stack Discharge*

Air quality impacts from stacks are typically considered separately for ground level receptors and elevated receptors as air quality impacts at elevated levels can be higher due to less opportunity for pollution dispersal.

Air quality impact predictions were undertaken for local residential ground level receptors. Air quality predictions were conducted for normal traffic flows in the tunnel and for congested conditions within the tunnel. The results shown that the overall concentration levels (background plus contribution from the stack) would be well below air quality goals even at the most (*i.e.* Worst case) affected residential receivers.

In addition, contributions from the ventilation stack would also be such that the overall concentration levels (background plus contribution from the stack) would be well below air quality goals at the most affected building (*i.e.* the Compac or Corinthian buildings) or at the most sensitive ground level receivers. The Department concurs with these findings.

Maximum predicted pollutant concentrations for ground level and elevated receptors are provided in the air quality assessment in Appendix C.

*Stack Discharge Exit Velocities*

Air quality predictions have been based on stack exit velocities of between 5 metres per second (m/s) and a maximum velocity of 12.7 m/s in the eastern ventilation stack and 5 m/s and a maximum of 7.8 m/s in the western ventilation stack under normal operating conditions. For congested conditions within the tunnel, stack exit velocity would be in the order of 20 m/s.

Segmentation of the ventilation stack is an option to manage the exit velocities to enable the stacks to cater for both normal and congested operating conditions. This would enable a proportion of the stack to be closed off during congested conditions to increase exit velocities. During periods of normal traffic volumes, the full stack area would be available and the exit velocities reduced.

The RTA stated that consideration was given for higher velocities up to a maximum velocity of at least 15 m/s for normal operating conditions. However, no reasons were given for not using higher stack velocities. Higher stack velocities would provide better dispersion of pollutants, however, this would need to be balanced with greater energy consumption. The Department recommends that at the detailed design stage a further investigation should be provided to optimise stack exit air velocities. This requirement is specified in Recommended Condition of Approval No. 173.

*Health Risk Assessment – Volatile Organic Compounds*

There will be a number of potentially harmful vehicle emissions (volatile organic compounds – VOCs) in the discharge from the ventilation stacks including 1,3-butadiene, formaldehyde, benzo(a)pyrene, acetaldehyde and benzene. The RTA conducted a health risk assessment which focused on the effects of vent stack emissions from the two preferred sites at Sirius Road and Marden Street at the most affected ground-level receptors regardless of the land use at the location, and the most affected elevated receptor. The aggregate risk, based on the RTA methodology, (*i.e.* of the toxins listed above) is well below the NSW EPA's one in a million assessment criterion. The results of the air quality health risk assessment are provided in RTA (2002b)

The EPA considered the methodology adopted by the RTA to be overly optimistic with respect to VOC reductions in the future. An alternative methodology for calculation of health risk was recommended based upon changing emission standards and developments in fuel cell technology. The EPA suggested three scenarios:

- scenario 1 – Emission Standards as already promulgated by the Federal Government. This gives 70-year average emission levels that are 35% of current VOC emission levels;
- scenario 2 – Emission Standards as already promulgated by the Federal Government plus Euro 4 coming into force in 2010. This gives 70-year average emission levels that are 26% of current VOC emission levels; and
- scenario 3 – Emission Standards as already promulgated by the Federal Government plus Euro 4 in 2010 and fuel cell technology (zero emissions) in 2030. This gives 70-year average emission levels that are 18% of current VOC emission levels.

The results of the alternative assessment indicated that Scenarios 2 and 3 would comply with the EPA's goal of one in a million assessment criterion. Scenario 1 only marginally exceeds the criterion (by $0.01 \times 10^{-6}$). These results are provided in RTA (2002b). The RTA suggests that Scenario 1 is unlikely to occur in practice and is very conservative as it assumes no additional measures to reduce VOC emissions beyond those already in place and from 2030 there would be no VOC emissions. In the last 13 years vehicle emission standards have reduced VOC emissions by a factor of 50. It would seem

unduly pessimistic not to allow for further reduction in the period 2010 to 2030 in terms of risk assessment.

Air Quality Management

*Regulation of Impacts*

The EPA's preferred approach to regulate emissions from point sources is to develop site-specific emission limits using the air quality assessment conducted for the EIS, taking into account ambient standards and existing background conditions. The EPA's reasoning for adopting this approach is that a pollutant present in ambient air would be emitted from a variety of sources and making one (1) premise or activity alone responsible for meeting an ambient air quality standard is unreasonable. It is also extremely difficult to determine compliance.

In this regard the EPA's preferred approach is to set stack limits for all key pollutants. This would provide more stringent control of emissions from the stack, for which the RTA would be accountable, than applying ambient standards alone, as it would incorporate the worst-case background levels of pollutants. This would also prevent the Proponent from 'polluting up' often cited as a significant community concern. This approach has also been adopted by the Victorian EPA for the operation of the Burnley and Domain tunnels as part of the City Link tunnel in Melbourne. Recommended stack limits for $NO_2$, $PM_{10}$, CO and VOCs are provided in Appendix E. The RTA has recommended that concentrations and mass of pollutants be incorporated with an additional 10% allowance. Reasoning for the additional 10% allowance has not been provided, as such has not been adopted by the Department.

The Department considers that whilst the establishment of stack limits places a more direct control on operations, it may not ensure that the RTA (as a provider of public infrastructure) is accountable to its broader public commitments to improving the regional air shed through predicted improvements to travel efficiency resulting from the Proposal. For example, the EIS clearly indicates that the construction of the tunnel would reduce the total vehicle emissions across the Sydney road network due to the reduction in overall traffic congestion. If this is the case then this should be reflected in ambient air quality improvements.

The Department considers that the RTA's public statements and commitments to a net improvement to air quality (or at least no worsening) as a result of the construction of the Lane Cove tunnel is fundamental and integral to the strategic justification of the Proposal. On this basis, the Department recommends that the NEPM goals should be retained for this Proposal as a way of ensuring accountability to such strategic air quality commitments. Used in conjunction with the stack limits, this would address the ability to "pollute up" but also given the community an assurance that net improvements to the regional air shed will be achieved.

As part of strategic air quality management, the Department considers it appropriate for the RTA to install an ambient air quality monitoring network and for monitoring results to be made publicly available. Should results indicate exceedance of the regional NEPM goals the RTA must provide a detailed written report outlining the circumstances of the exceedance and options available to prevent recurrence including improvements to traffic management or ventilation systems or installation of pollution control systems. This recommendation is specified in the Department's Recommended Condition of Approval No. 170.

In implementing the above, the Department accepts that the likely worst case for air quality would be within the first 3 to 5 years from opening and by that time there should be clear indications of improvement trends. In this regard, the need to continue monitoring of ambient air quality could be reviewed after 3 years. Any recommendation to discontinue monitoring would require the approval of the Director-General. The requirement to meet NEPM ambient air quality goals is specified in Recommended Condition of Approval No.169.

*Treatment of Emissions – International Best Practice*

The Conditions of Approval for the M5 East require the RTA to examine international developments in tunnel emission treatment systems each year for five (5) years from approval and is further extended by inclusion in the Cross City Tunnel approval. The study (October 2001) and the draft study (October 2002) investigated approximately 150 tunnels in the USA and over 1000 tunnels in Europe and found that there are no full scale tunnel emission treatments systems installed anywhere in the world apart from Norway, Korea and Japan. The findings are summarised below.

*Norwegian Experience*

Norway has 700 tunnels with electro-static precipitators (ESPs) installed in 6. ESPs are not operating in at least four (4) of the tunnels in which they have been installed as in-tunnel conditions have been acceptable. The ESP installed in the Ekeberg tunnel is operational, however it is not know if the ESP in the Drammen tunnel (otherwise known as Stromsas) is operational. The Ekeberg tunnel ESP operates only in peak periods for in-tunnel conditions and reportedly cleans only a third of the tunnel air. The Bragernes tunnel in Drammen is a single bore two-lane road tunnel which forms part of the Drammen ring road. It will be 2.4km long when finished. Work started in June 1999 and construction is continuing. According to information supplied, the tunnel will be longitudinally ventilated with an exhaust stack and some portal emissions. It is planned to install an ESP at the base of the ventilation shaft for external air quality reasons. No further information is available.

A Norwegian Government study[1] indicates that during the initial hours after a successful maintenance wash, it is possible to achieve a level of separation (filtration efficiency) of 90-95% but after 35-40 hours, the separation efficiency fell to 50% for the Oslo (Festning) tunnel. High variability in efficiency was found over the filter area in all measurements. It should be noted that the ESP has only been used in commissioning tests and not during operational conditions. Removal rates of 45-50% were recorded in the Ekeberg and Granfos tunnels and a 15% average (0-64%) in the Hell tunnel outside Trondheim. The study also showed that the percentage of inorganic/mineral dust deposited on the filter was disproportionately higher than soot. It should be noted that the inorganic matter is from the general environment (i.e. general dust) and that soot is the result of fuel combustion. Samples of the deposited dust on the plates at saturation load were about 50% of the manufacturers stated saturation load.

Filtration systems in the Oslo and Hell tunnels have not been used for some time. Granfos tunnel has never been used in an operational situation. Filtration in the Ekeberg tunnel is also currently subject to a cost/usefulness/health risk evaluation to determine its ongoing use. The study concludes that ESPs should not be recommended in road tunnels with heavy two-way traffic or short one-way traffic. It also indicated that new projects in Norway are looking at alternative measures to electro-static filters.

[1] Myran T and Bulvik H, Particulate Cleaning in Norwegian Urban Road Tunnels, Norwegian Public Roads Administration.

*Japanese/Korean Experience*

Recent public attention with regard to tunnel filtration appears to have moved away from Norway and towards Japan which has approximately 24 tunnels with filtration systems. Table 5.3 shows the tunnel with treatment installed, the type of treatment and the reason for installation.

**Table 5.3 Filtration Used in Japanese Tunnels**

| Tunnel | Air Treatment Installed | Criteria for Installation |
|---|---|---|
| Enasan | ESP | internal visibility |
| Gorigamine | ESP | internal visibility |
| Hanna | ESP | internal visibility |
| Happuzan | ESP | internal visibility |
| Higo | ESP | internal visibility |
| Kanmon | ESP | external air adjacent to portals |
| Keihinjima | ESP | internal visibility |
| Koshirazu | ESP | internal visibility |
| Nihonzaka | ESP | external air adjacent to portals |
| Ryugatake | ESP | internal visibility |
| Ryu-ohzan | ESP | internal visibility |
| Sekido | ESP | internal visibility |
| Suginami-ku | ESP | unknown |
| Tachitohge | ESP | internal visibility |
| Takanomine | ESP | internal visibility |
| Tennohzan | ESP | external air adjacent to portals |
| Tokyo Bay (TTB) | ESP | internal visibility |
| Toroyama | ESP | internal visibility |
| Turuga | ESP | Unknown |
| Tsyruga | ESP | internal visibility |
| Uji | ESP | internal visibility |

The RTA indicates that electro-static precipitators have been installed in 16 tunnels for internal visibility requirements due to the high proportion of diesel trucks and three (3) for external emissions where portal venting is used. Diesel engines generate a greater percentage of combusted particles and the emissions can create a "smoky" environment. Where reasons for ESP installation is unknown, these tunnels have a very small capacity air flow (60m/s and 240 m/s) compared with the Lane Cove Tunnel (800m/s).

The Tennohzan tunnel, completed in 1998 relies on portal emissions without a ventilation stack and carries around 108,000 vehicles per day, of which around 26% are heavy vehicles. ESPs were installed to control the tunnel exit environment conditions near the tunnel portals[2].

An ESP has been installed in the Chinbu tunnel in Korea for visibility reasons and is automatically switched on by opacity meters. It has only ever operated for 4 hours following a false reading where soot build up triggered operation. No other operational occurrences have triggered operation of the filtration system. In-tunnel conditions are the dominant factor in determining whether or not the ESP operates.

[2] Sakayama, Y., Daiti, N., Era, Y., Japan. On the Introduction of a Tunnel-exit Concentrated Exhaust Type Longitudinal Ventilation System Provided with an Electrostatic Precipitator in order to Improve the Tunnel-exit Environment Conditions at the Re-constructed Tennozan Tunnel on Meishin Highway

Efficiency testing indicated a fractional efficiency for particles between 0.3 µm and 10 µm from 94 to 97% while maintaining air velocities through the filters in excess of 10m/s.

Independent Expert Opinion

As indicated above, a study by the Norwegian Public Roads Administration on the efficiency of filters in Norwegian tunnels[1] concluded that the use of electro static filters in road tunnels with heavy two way traffic or short one-way traffic should not be recommended. It also indicated that new projects in Norway are looking at alternative measures to electrofilters.

Dr Peter Manins from the CSIRO stated at a Parliamentary Inquiry held in May 2002 "…. *treatment of the emissions, the particle emissions, is feasible but that it is rather poor value scientifically*." He advised that it is far more cost effective to reduce pollutants at the source, using improved fuel standards and engine technology.

The Victorian Government commissioned Mr Bongiorno, QC to assess the potential for tunnel filtration for the Melbourne City Link project. His conclusions were that ESPs did not represent proven technology for in-tunnel air cleaning or for environmental reasons. He also concluded that ESPs may not be risk-free in relation to health impacts.

### 5.1.5 Consideration of Lane Cove Tunnel Action Group (LCTAG) Representations

The Lane Cove Tunnel Action Group (LCTAG) made a substantial representation following the public release of the Preferred Activity Report with major concerns regarding the air quality assessment and impacts on the Lane Cove area. Overall, the LCTAG representation raises a number of issues with respect to the health impacts of particles. These issues were common with a number of other representations and therefore the LCTAG representation is used as a base to address the key issues. Consideration of the key issues of the LCTAG representation is provided below.

Use of Ambient Standards

This issue is discussed previously with regard to regulating stack discharge. The Department has recommended that monitoring and compliance against the NEPM (ambient goals) be retained to ensure accountability for commitments made by the RTA to improving air quality and used in conjunction with stack limits provides the tightest control. Without ambient criteria, the long term health impacts on residents could be compromised. That is, stack limits could be met but ambient air quality could exceed the goals.

*Health Impacts of Small Particles*

The Department does not dispute that it is likely that finer particles are more harmful. However, there is no standard anywhere in the world for $PM_1$ particles let alone for smaller particles. Adverse health outcomes are correlated with measurements which includes all particles which are less than 10 microns in diameter. In this regard, the $PM_{10}$ measurement includes all particles less than 10 microns including $PM_{2.5}$ and $PM_1$. It is on $PM_{10}$ measurements that most epidemiological studies have been based.

The USA has a $PM_{2.5}$ standard of 65ug/$m^3$. As $PM_{2.5}$ is a percentage of $PM_{10,}$ (around 50 to 70%) a $PM_{10}$ standard of 50ug/$m^3$ is far more stringent than the US standard. Further, the UK Expert Panel on air quality standards (Item 27) makes the comment "*the evidence indicates that acute health effects occur after pollution episodes lasting at least 24 hours. No studies have investigated episodes of*

*shorter duration. In the absence of such studies we have therefore concluded that $PM_{10}$ should be measured as a 24-hour running average*."

NSW Health has advised that there are only a few studies which show an association between short term (hour) exposure to particulate matter and any health effects, and certainly no basis for attempting to set a limit or goal. Notwithstanding, the Department is assured that this has been flagged as an emerging issue for investigation by the United States Environmental Protection Agency (USEPA) and is unlikely to be resolved at least within the next five (5) years.

The LCTAG report also indicates a concern that the assessment has not taken into account the at-risk population such as people with asthma, bronchitis, heart disease, the elderly and the young. Overall, there is no reason to believe that the affected population would be any different to the general population on which the epidemiological studies are based.

Another key argument of LCTAG is that once a particle is deposited in the lung, it remains there permanently. This assertion is by no means accepted universally (for example, WM Foster (1999) Deposition and Clearance of Inhaled Particles published in Air Pollution and Health.)

*Particulates from Car Exhaust are More Carcinogenic than Other Particulates*

The LCTAG makes the statement that particles from car exhaust are more carcinogenic than other particles. Whilst this statement may be true, the traffic in the tunnel will be essentially the same as that currently using Epping Road. The air quality goals for particles have been derived from epidemiological studies undertaken on a population exposed to a range of particles found in Sydney and thus is integral to the assessment.

The Proposal is anticipated to significantly improve air quality along Epping Road as a result of significant reduction in vehicles. Pollution from vehicles in the tunnel would be dispersed (albeit more concentrated) but at a higher level in the atmosphere. This generally enables better dilution and dispersion.

*Monitoring of Background Pollution and Modelling Concerns*

The LCTAG representation raises concerns about background air quality monitoring and modelling of impacts. Overall, it concludes that the assessment has significantly underestimated the background air quality, the impact of stack emissions and accordingly surmises that the stack contributions will exceed the recommended goals.

In general, predictive tools, particularly with respect to air quality, build in a high level of conservatism. Similar concerns were raised during the planning and assessment phase of the M5 East and yet monitoring of external pollutants has shown the impacts to be well within the predictions made[3]. (It is noted that there have been concerns with the M5 East relating to in-tunnel CO levels and do not relate to this particular issue raised in the representation by LCTAG).

The Precautionary Principle states that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. With respect to the overall scientific uncertainties raised about monitoring and modelling, the Department recommends that if ambient air quality monitoring exceeds

[3] Holmes Air Sciences for the RTA, October 2002, Analysis of M5 East Ambient Air Quality Monitoring Data to Assess the Effect that Ventilation Stack Emissions have on Local Air Quality.

the stated goals, then the RTA must consider measures to prevent recurrence, including but not limited to the possible installation of ESPs or other suitable treatment systems. This requirement is specified in Recommended Condition of Approval No. 171.

*Difficulty in Measuring/Detecting the Extent and Frequency of any Exceedance*

Despite the argument that the modelling has severely underestimated the impacts of particle emissions from the stack (see above), the LCTAG makes what appears to be a contradictory argument is stating that "*given the state of technology, … it may be impossible to define clearly and detect the extent and frequency of exceedances due to $PM_{10}$ emissions from the stacks*". The fact that LCTAG suggests that it will take a very complex monitoring regime to detect an exceedance would appear to actually support the Proponent's assertion regarding the small and insignificant contribution the stack will make to ambient conditions.

The representation also indicates that the use of averaging is inappropriate as it would disguise major concentration peaks. However, this factor ignores the fact that the particulate matter concentrations are generally high throughout the day and evening. For example, data from the M5 East monitoring stations show a trend of reasonably high background $PM_{10}$ levels throughout the day and night (Refer to Figure 5.4 monitoring under taken at the M5 East Thompson Street site) . Furthermore, the highest readings tend to occur outside the major traffic peaks.

Similarly, the modelling provided in the EIS (Working Paper Nine Figures H13 and H14c) shows a similar pattern for the Lane Cove Tunnel.

A report analysing the ambient air quality monitoring data for the M5 East[3] has concluded that measured $PM_{10}$ 24hour averaging and 15 minute averaging concentration levels show little change between pre and post tunnel opening (*i.e.* the stack would appear to have made little difference on the external air environment of the area) and apart from bushfires and a significant dust storm, the project has been well within the external $PM_{10}$ air quality goals as specified (See Figure 5.4 and Figure 5.5).

*Correction Factors*

$PM_{10}$ monitoring data measured at the Lindfield site, using a TEOM, was used in the EIS to establish background $PM_{10}$ concentration levels to be added to model predictions to determine overall pollutant levels. The LCTAG representation suggests that as these background monitoring levels were not corrected for environmental conditions such as temperature as stipulated by the CSIRO, underestimate the true $PM_{10}$ background concentration and thus resulted in an underestimation of the $PM_{10}$ impacts.

The adjustment factors proposed by the CSIRO do not come into effect for measurements made at a daily average temperature above 15 to 17 degrees. Monitoring data has been reworked with the CSIRO correction factors and was found to have an insignificant impact.

*Short Term $PM_{10}$ Level and Compliance*

The LCTAG representation in many areas indicates "proof" that the stack will exceed goals for a number of pollutants. For example, the LCTAG representation claims that the hourly averages for $PM_{10}$ show regular exceedance of the goal.

This is a clear misinterpretation of the goals which are based on a 24 hour average. It is inappropriate and misleading to compare 1-hour $PM_{10}$ readings with 24 hour ambient goals. Air quality standards

comprise two parts, concentrations and exposure time. The representation by LCTAG does not consider the latter. By way of analogy, the 8-hour goal for CO is 10mg/$m^3$ whilst the 15-minute goal is 108mg/$m^3$, an order of magnitude higher. At this stage there are no short term $PM_{10}$ goals. The UK Expert Panel on air quality standards states "*the evidence indicates that acute health effects occur after pollution episodes lasting at least 24 hours. No studies have investigated episodes of shorter duration. In the absence of such studies we have therefore concluded that $PM_{10}$ should be measured as a 24-hour running average*."

There are shorter term (*i.e.* 8-hour) Australian Occupational Health and Safety standards for certain particles such as carbon black (3,000 µg/$m^3$) and airborne particles (10,000 µg/$m^3$). These exposure levels are significantly higher than the $PM_{10}$ standard (50µg/$m^3$), however these are unlikely to be directly applicable anyway as they are not based on particles containing potentially toxic substances.

*Conclusion*

In summary, the LCTAG representation raises a number of issues with respect to health impacts on particles. As a general response, the concerns are acknowledged and indeed in most cases factual. However what appears to be lacking throughout the argument is one of context. What the assessment is primarily doing is assessing change in impact. With respect to receivers close to the stacks the difference with or without the stack would be very small.

The core of the specific concerns by LCTAG essentially relate to:

- the apparent inadequacy of the existing standard for particulate matter in terms of particle size definition and shorter exposure time;
- scientific uncertainty with the modelling and monitoring; and
- the need to adopt international best practice with respect to filtration.

The Department's assessment cannot be about setting new health standards for particulate matter for specific projects, particularly when such standards have not been adopted elsewhere in the world. Changing air quality goals is necessarily an issue of a much broader policy nature. Notwithstanding, the need for refinements of the standard for particulate matter is undergoing constant review. At this stage the advice is that the current 24-hour $PM_{10}$ standard is adequate as a compliance goal for ambient air. Whilst a $PM_{2.5}$ standard is under consideration, at this stage it is only recommended for reporting purposes. There is no particulate matter standard for a period less than 24 hours and to compare impacts of short duration exposure (*i.e*. 1-hour) against a 24-hour standard is misleading.

The issues raised regarding background monitoring and modelling are not unexpected considering the technical complexities, predictive nature and scientific uncertainties. Similar modelling undertaken for ventilation systems for the M5 East and Eastern Distributor indicate an acceptable degree of confidence in the predictions against actual impacts. Notwithstanding, the Department has recommended a precautious approach which would requires monitoring and if goals are exceeded, consideration and implementation of alternative measures to minimise further occurrences. Measures which could be considered include, but are not limited to further improvements to installed systems such as traffic management or ventilation as well as the installation of pollution control systems.

### 5.1.6 Conclusion

At a broad regional air shed and greenhouse perspective, the Proposal has the potential to bring about net improvements to air quality due to predicted improvements to traffic efficiency across the regional road network. However, these traffic improvements cannot be relied upon in isolation, as the construction of the Lane Cove Tunnel has the potential to induce and/or re-direct traffic, a problematic issue for traffic models to accurately quantify. The commitments and recommendations regarding public transport improvements are therefore imperative and integral to the justification of the Proposal particularly in terms of the potential to bring about net improvements to regional air quality.

Overall, the Department recognises that the change in pollution exposure levels for residents is important. However, as all air quality goals would be met with the additional contributions of the Proposal, the health risks are considered acceptable. Contributions from the ventilation stack would be such that the overall concentration levels (background plus contribution from the stack) would not exceed air quality goals. Notwithstanding, the Department acknowledges the significant and extensive community concerns that predicted impacts are based on modelling and assumptions and therefore a high degree of assurance is required that the predictions turn into reality. This assurance, particularly in terms of air quality impact monitoring and general air shed improvements, is strongly encapsulated in the Recommended Conditions of Approval. Continued monitoring of ambient conditions in this local area would confirm the predictions. As Recommended in the Approval air quality monitoring will be conducted at a minimum of six locations in the Proposal area around the ventilation stacks and portals at ground level and at closest elevated receptors. The monitoring programme is the most comprehensive air quality monitoring programme for any infrastructure project in NSW.

The Department considers that the new ventilation is a considerable improvement compared to the initial design in the EIS as it will reduce in tunnel carbon monoxide exposure and improve smoke control in the tunnel.

Discharge from the LCT ventilation stacks in combination with background air quality is expected to be well within air quality goals and therefore does not at this stage provide a strong or immediate justification for filtration or other treatment systems. Nevertheless, it is considered appropriate that provisions be made in the design and construction of the tunnel and ventilation stacks for the retrofitting of pollution control systems should the need arise.

## 5.2 Regional Traffic and Transport

### 5.2.1 Background

The Lane Cove Tunnel would form the final link in the completed Orbital Ring Road system for Sydney as identified in *Action for Transport – 2010* and has been designed primarily to improve the efficiency of east-west travel along the corridor for road-based transport modes. The EIS indicates that some of the additional road capacity created by the Proposal would be made available for private motorists and the remainder for buses and high occupancy vehicles through the provision of bus and transit lanes.

One of the key justifications for the Proposal as described in the EIS is to improve inter-regional traffic and transport flows, particularly between North-West Sydney and the North Shore/CBD/Eastern Suburbs or the Northern Beaches. Few east-west arterial roads exist to service this inter-regional traffic flow. This has led to significant congestion on routes servicing this demand such as Victoria and Epping Roads and has led to the use of a number of lower order roads being used as 'rat runs' such as Mowbray Road West and Delhi Road.

The EIS predicted that without the Proposal, the Epping Road/Longueville Road and Gore Hill Freeway corridor would become more congested in the future due to the predicted increase in the population of the catchment, particularly the North-West sector. The Epping Road/Longueville Road corridor was identified as the most appropriate for upgrade to meet the predicted future growth in traffic demand, as it provides the most direct route between the regions.

The completion of the Orbital would also allow for a motorway standard of road around Sydney improving accessibility and travel times for motorists. These improvements are expected to result in significant economic benefits for Sydney.

Traffic modelling was used to test the regional implications with the Proposal and assess its impacts on other routes by establishing 'screenlines' with predicted traffic volumes with and without the Proposal. A summary of the EIS findings against the western and eastern screenlines is provided Appendix G. The assessment shows that with the Proposal, moderate increases in traffic flows across the screenlines would occur primarily due to traffic reassigning to the corridor. The Proposal is predicted to lead to increases in vehicle kilometres travelled (vkt) across the entire metropolitan road network of around 0.13%.

The regional traffic assessment in the EIS indicated that the largest increases in traffic due to the Proposal would occur on routes connecting to the Proposal such as the M2. Wicks Road, Pittwater Road and Badajoz Roads were predicted to experience increased traffic levels. Increases were also predicted at Reserve Road and other roads through the Artarmon area. Minor increases, mainly in the counter peak direction were predicted on Military Road.

Decreases in traffic volumes were predicted on Epping Road/Longueville Road (up to 62%), Mowbray Road West, Delhi Road, Victoria Road, the Pacific Highway and Falcon Street (west of the Warringah Expressway) were predicted to have the largest reductions in traffic levels.

The EIS estimated that the Proposal would lead to reductions of travel time of around 50% during peak periods between the north-west sector and the North Shore/CBD. Significant reductions in travel times were also predicted in trips to Chatswood and Artarmon. Improvements to bus travel times were also predicted through the corridor as a result of the Proposal.

### 5.2.2 Key Issues Raised

A number of representations raised issues in relation to the effects of the Proposal on regional traffic flows. The key issues raised in representations:

- concerns about induced traffic;
- need to look at demand management or public transport options in preference to increases in road capacity;
- concerns about the impacts of the Proposal on connecting roads such as the Warringah Expressway and Harbour Bridge;
- implications of the M2/WSO to F3 Freeway connections;
- concerns about regional switches and greater use of Wicks Road, Pittwater Road, Badajoz Road and Centennial Avenue; and
- concerns about routes used for toll avoidance.

### 5.2.3 Consideration of Key Issues Raised

Induced Traffic

There are broadly two (2) types of induced traffic. The first is where traffic is redirected to a new or upgraded road from existing routes due to improvements in travel times and/or speeds. The second type of induced traffic is where trip patterns change through the making of additional trips or changes in transport mode (i.e. mode shift) as a result of an upgrade or new road. The second type of induced traffic is of particular concern as it has the potential to significantly increase vehicle kilometres travelled across the network and can result in environmental impacts as well as reduced patronage and viability of public transport services.

The EIS identified that predictions of induced traffic are difficult and depend upon the elasticity of demand *i.e.* the proportional change in the number of vehicles using the system as a ratio of the proportional change in the cost or travel time on the modified system. The EIS estimated that the Proposal was largely inelastic *i.e.* significant changes in new demand were not predicted by the reduction in travel times.

Despite the RTA's assessment in the EIS, some representations raised concerns that induced traffic would result from the Proposal, eroding the benefits of improved traffic flows and potentially affect the viability of public transport alternatives such as the Parramatta to Chatswood Rail Link. In response, the Representations Report stated that induced traffic levels, *i.e.* new trips, on the Proposal would be fairly low due to capacity constraints on approach roads and that the proposed toll would act as a deterrent to discretionary trip making.

The Department is aware that the impacts of induced traffic can be significant and may have in the past been underestimated for similar roads. For those trips with origins or destinations in North-West Sydney there are few public transport alternatives to the private vehicle which reduce the potential for induced traffic through transport mode switching, such as the well patronised private bus services. However, new public transport infrastructure such as the Epping to Mungarie Park Rail Link and the bus transitways are proposed for this growing sector. Induced traffic resulting from the Proposal could impact on the patronage of these future public transport services.

The Department believes that generally the RTA has taken advantage where possible of additional road capacity created by the Proposal through the provision of bus lanes. However, the Department is concerned that the impact more broadly on the existing and future regional transport network of induced traffic has not been addressed. These issues are further discussed below.

Demand Management/Public Transport

A number of representations requested further detailed consideration of travel demand management and/or public transport options as an alternative to additional road capacity. In response, the RTA stated that alternatives to the Proposal were considered as part of the EIS and referred to the sections of the EIS discussing the implications of the Parramatta to Chatswood Rail Link on the need for the Proposal. The EIS found that although the new rail link would remove some traffic from the route and vice versa it would not significantly affect the estimated growth in traffic numbers through the corridor and the increased demand for the Proposal. The RTA suggested that the two (2) Proposals could coexist without significant impacts.

In relation to demand management, the RTA suggested that significantly more buses would be required to carry the predicted growth volumes in the corridor which, in the absence of the Proposal, would result in worsening congestion and already poor travel conditions to that currently experienced. It was identified that other demand management measures that could be considered include parking restrictions, car pooling and higher road user charges.

The Department is aware that where the Proposal has led to substantial reductions in traffic levels on existing roads such as Epping Road, new bus lanes have been proposed. The Proposal was modified in the Representations Report to include bus lanes on the Pacific Highway between Longueville Road and North Sydney in both directions to take advantage of additional road capacity as a result of the Proposal. Bus travel times through the corridor are expected to improve by around 10% as a result.

Victoria Road would benefit from the Proposal and carries a large number buses particularly during peak periods. However, the evidence from the traffic modelling indicates that the traffic levels on Victoria Road after the Proposal is constructed would be higher than those currently modelled to use the congested route, potentially reducing any opportunities to take advantage of additional road capacity. Other roads to benefit from traffic reductions are generally not significant public transport routes. Local area measures such as traffic calming and landscaping would be a more appropriate measure to address excess road capacity for these routes (refer to Section 6.2).

To ensure compliance with the RTA's contention that the Proposal would not result in significant induced traffic, the Department recommends monitoring of actual traffic flows including those across through the western and eastern screenlines following opening of the Proposal to traffic. Should the monitoring at the screenlines indicate traffic levels 5% or higher than levels predicted during peak times and 10% or higher within the tunnel, the Department recommends appropriate action be taken to reduce this induced traffic and its potential impacts including investigating demand management techniques and the potential implementation of a peak hour toll levy. These requirements are specified in Recommended Condition of Approval No. 36.

Impacts on Warringah Expressway and Harbour Crossings

Concerns were raised by the Department and some representations that the Proposal would lead to greater congestion on the Gore Hill Freeway, Warringah Expressway and Harbour crossings. There were concerns raised that congestion on the Gore Hill Freeway may lead to congestion and queuing in the tunnel. The RTA responded that traffic management measures would be put in place to limit the amount of potential congestion at the Gore Hill Freeway and to reduce the potential for queuing back into the tunnel.

Additional traffic modelling was undertaken of the Warringah Expressway and Sydney Harbour crossing which indicated that the Proposal would lead to increased traffic flows across the Harbour of up to 4.3% northbound in the evening peak. On the Warringah Freeway south of Falcon Street there would be an increase in traffic levels of 3.8% southbound in the morning peak but slight decreases in traffic levels in other directions during the morning and evening peak hours. The RTA indicated that the increases were not substantial and were generally the result of traffic switching from other routes.

The Department is satisfied that the predicted increases are relatively minor but believes that the critical issue is whether the Proposal induces significant levels of additional new traffic movements which are measured on these routes. These issues are addressed above.

Implications of F3 to M2/WSO Corridors

The Department raised concerns that the implications of a potential link between the F3 and M2/WSO had not been considered in the traffic modelling as part of the EIS.

In response the RTA stated that the link had not been included in the modelling as a preferred route had not been determined. Additional modelling based on a potential link between the F3 and M2 near the existing toll booths indicated that additional traffic would be generated on the Proposal necessitating the construction of a third lane in the tunnel for the entire eastbound direction. It was stated that the construction of the proposed Lane Cove Tunnel would include a stub tunnel to allow for future construction of a third lane eastbound along the length of the tunnel should it be required.

Switching Traffic/Toll Avoidance

A number of representations raised concerns about traffic switching to use new routes either to access the Proposal or to avoid the toll. Roads that were forecast in the EIS to have increases in traffic in some directions during certain peak periods as a result of the Proposal included Pittwater Road, Centennial Avenue, Wicks Road, Badajoz Road and Reserve Road. The representations raised concern regarding the impacts and requested that the RTA provide further details on potential mitigation measures.

In response, the RTA prepared additional reports investigating the impacts of predicted traffic level increases. These reports are provided in Appendix F. These indicate that there are predicted increases of up to 20% combined in the southbound morning peak direction in traffic levels on Badajoz Road, Wicks Road and Pittwater Road. These increases appear to be as a result of traffic switching to use Victoria Road and Anzac bridge to access the CBD, in part to avoid the toll. The report concluded that the predicted increase was relatively modest and that with appropriate local area measures the additional traffic could be encouraged to use the higher order Lane Cove Road. Local area traffic management issues are discussed in further detail in Section 6.3 and 7.2.

Traffic on Centennial Avenue between Mowbray Road West and Epping Road was predicted to increase by up to 100% during the evening peak period. This increase is predicted to be partly due to the re-introduction of the right-turn movement from Epping Road to Centennial Avenue and due to the travel time benefits for local traffic using Mowbray Road West and Centennial Avenue to access Epping Road rather than using Epping Road. Consideration of local area traffic management measures was recommended for Mowbray Road West and Centennial Avenue to reduce the attractiveness of this route. These issues are discussed in further detail in Section 6.2.

Traffic levels on Reserve Road, north of the Gore Hill Freeway, were also predicted to increase by 30-40%. This increase would have flow on increases for routes such as Jersey Road and Hampden Road through Artarmon. The report suggested that the large increases were due to traffic switching from other routes to Reserve Road as a result of its improved access to the Gore Hill Freeway and Lane Cove Tunnel. The report recommended the consideration of local area traffic management measures to discourage use of Reserve Road for access to Chatswood and to encourage traffic to use the Pacific Highway. These issues are discussed in further detail in Section 7.2.

The Department believes that Proposals at such a large scale will inevitably lead to increases in traffic levels on some roads, generally those that provide a direct connection with the Proposal. The traffic modelling, whilst providing an indication of the likely impacts of traffic flows, can only predict what will happen after opening. In general, the Department believes that the Proposal will lead to reduced traffic on a number of surrounding roads as traffic is attracted to the Proposal.

For those roads where traffic increases are predicted as a result of the Proposal, the Department recommends a two-tiered approach to minimise impacts. The first stage would be to implement local area traffic management measures to reduce the attractiveness of these routes and the second stage is to monitor actual traffic flows after opening. The Department therefore recommends the inclusion of Condition of Approval No. 37 requiring the preparation of local area traffic management plans and Condition of Approval No. 33 requiring post-opening monitoring of traffic flows.

### 5.2.4 Conclusion

The Proposal would complete the Orbital ring road system for Sydney. Completion of the Orbital would lead to significant improvements to accessibility for motorists and flow on benefits to economic activity.

In particular, the Proposal would be an important regional link between the North-West sector of Sydney and the North Shore/Northern Beaches/CBD. It would reduce traffic levels on most surrounding lower order roads. Where increases are predicted, local area traffic management measures would be required to reduce impacts. Induced traffic as part of the Proposal would be a key risk in meeting the stated benefits.

The Department has recommended a number of conditions such as local area traffic management plans, monitoring of post-opening traffic conditions for the presence of induced traffic and implementation of a mitigation measures to reduce demand should the monitoring identify significant levels of induced traffic.

## 5.3 Bus and High Occupancy Vehicle Lane Operation

### 5.3.1 Background

The RTA proposed in the EIS to convert the existing T2 lanes on Epping Road, between Mowbray Road West and the Pacific Highway into 24 hour bus lanes and to install an eastbound bus lane on Falcon Street/Military Road between the Warringah Expressway turnoff and the Big Bear Shopping Centre at Neutral Bay. An additional lane in each direction on the Gore Hill Freeway would be designated as a 24 hour T2 transit lane. These proposed measures were estimated to reduce bus travel times in peak hour through the corridor by approximately 10%.

Section 6.4 of this Report discusses the provision of bus lanes and associated infrastructure on Epping Road. Section 7.1 discusses bus priority measures in the vicinity of the proposed Falcon Street ramps.

### 5.3.2 Key Issues Raised

Key issues raised include:

- the Proposal is an opportunity to provide a public transport showcase;
- there should be encouragement to transfer from private vehicles to public transport and other modes;
- more enforcement of bus and transit lanes required;
- opportunities for bus commuters to interchange with the rail network and improved linkages with other bus services are required;
- the need for a bus lane or T3 transit lane on the Gore Hill Freeway and Warringah Freeway;
- the complexity of transition between bus lanes and transit lanes;

- the need for a bus stop on the Gore Hill Freeway to service the Artarmon Industrial Area; and
- an alternative bus layover facility is required on the Warringah Expressway for citybound buses.

### 5.3.3 Consideration of Key Issues

Improvements to Public Transport Operation

The RTA states that the Lane Cove Tunnel is likely to cause only small modal shifts from buses to private transport as private travel to and from the CBD is strongly influenced by parking costs and availability and the proposed toll. It is also the RTA's view that major improvements to the reliability, amenity and convenience of the bus system are anticipated as a result of the Proposal particularly on Epping Road.

It is the Department's view that the attractiveness of the public transport system will be enhanced by reducing traffic on Epping Road in conjunction with the provision of bus lanes on Epping Road and the Pacific Highway between Longueville Road and North Sydney. Notwithstanding, the Proposal would also lead to substantial improvements to private vehicle movements which if they lead to induced traffic may erode these potential benefits (refer to Section 9.1).

Opportunities for Additional Investment in Public Transport, Cycling and Walking

The RTA states that the provision of additional bus lanes and a continuous and often separated cycling and pedestrian path as part of the Proposal will assist to improve the attractiveness of all transport modes. The RTA also advises that in order to meet all the objectives of the Proposal, including the need to improve local amenity and local access along the Epping Road corridor, the optimum solution would be through the removal of existing traffic from the surface roads (through the provision of a tunnel), which then creates sufficient capacity for bus lanes, cyclist and pedestrian paths.

In response, the RTA proposes to convert the existing transit lanes on the Pacific Highway between North Sydney and Longueville Road to dedicated bus lanes as well as providing a bus interchange and associated overbridge at the corner of Longueville and Epping Roads. The location of these bus lanes are shown in Figure 4.9.

The Department recognises that in assessing the Proposal options, including demand management and maintaining the existing road system, it is accepted that the provision of additional bus lanes and cycling/pedestrian paths is an important initiative in encouraging more trips by means other than car. The Department has recognised additional opportunities for bus lanes and transit lanes as part of the Proposal which are discussed further below and in Section 6.3.

Enforcement of Bus and Transit Lanes

Concerns were raised that the Proposal should include measures for greater enforcement of bus and transit lanes. In response, the RTA stated that Bus Lane Camera Enforcement Systems would be installed as part of the Proposal on Epping Road and enforcement bays along the Gore Hill Freeway would be investigated.

The Department believes that the effective enforcement of bus and transit lanes as part of the Proposal will be a critical component in meeting the objectives of improving public transport use and increasing vehicle occupancy. The Department therefore recommends the inclusion of Condition of Approval No. 231 requiring the installation of transit lane enforcement bays on the Gore Hill Freeway prior to opening.

Similarly the Department recommends the inclusion of Condition of Approval No. 215 requiring the installation of bus lane enforcement measures on Epping Road in consultation with STA and NSW Police.

Bus and Rail Transport Connections

Concerns were raised by some representations that the Proposal should include improved bus and rail transport connections. In response, the RTA has advised that improvements in the connection of bus and rail transport, and improved connections to North Ryde and the residential areas to the north-west would be enhanced by the expected improvements in bus services. Ultimately, it would be the responsibility of bus service providers to ensure better connections to services. It is noted by the Department that the proposed modification to provide a dedicated bus interchange facility at the corner of Longueville and Epping Roads would improve these passenger connections.

Bus/Transit Lane Arrangement on the Gore Hill Freeway and Warringah Freeway

Several representations including those from TransportNSW and the STA raised concerns that the proposed T2 lane on the Gore Hill Freeway would be inconsistent with bus lanes on connecting roads and requested consideration of T3 or bus lanes. It was recommended that a consistent approach be adopted, with a preference for implementation of bus lanes for standard times (either 24 or 13 hours (6 am to 7 pm) or peak hour restrictions.

The traffic modelling for the Proposal indicated that T3 or bus lanes would cause significant congestion in the morning peak on the Pacific Highway merge lane with the eastbound Gore Hill Freeway traffic exiting from the Lane Cove Tunnel. The traffic modelling for the year 2016 indicated that this congestion could cause considerable congestion and delays for all southbound Pacific Highway traffic. The RTA further suggested that the T3 transit lane would only result in minor (less than one minute each bus) improvements in bus travel times through the corridor including the Gore Hill Freeway.

At the Department's request, the RTA analysed the benefit to these buses against any potential delays to southbound Pacific Highway buses north of the Gore Hill Freeway. The analysis indicated that whilst the numbers of buses and passengers were far lower in the morning peak on the Pacific Highway north of the Gore Hill Freeway than on the Gore Hill Freeway itself, the extent of delays to the Pacific Highway services would result in a considerable net disbenefit to bus services.

Notwithstanding the above analysis, the Department is aware that the traffic modelling is only a prediction and that given the high levels of bus usage on the route better bus priority should be investigated in the future. Therefore, the Department recommends the inclusion of Condition of Approval No. 50 requiring that the Proponent monitor the performance of the T2 lane on the Gore Hill Freeway and Pacific Highway merge and where possible install T3 or bus lanes in the future. The Department has also recommended the inclusion of Conditions of Approval No. 53 requiring that the Proponent monitor the performance of bus priority measures after opening against predicted benefits in the EIS and install further measures if necessary.

The STA also recommended to the Department that a bus lane should be installed to link with the end of the Gore Hill Freeway at Willoughby Road to join the existing southbound bus lane on the Warringah Expressway beginning north of Falcon Street. The RTA previously stated that such a continuation of bus lane to Willoughby Road was not preferred due to the numbers of merges and weaving of traffic through this section.

The Department is aware that similar merging and weaving arrangements in relation to bus lanes occur further south on the approaches to the Harbour Crossings and also along Military Road and does not believe that the continuation of bus lanes further north to Willoughby Road would cause undue inconvenience. Therefore the Department recommends the inclusion of Condition of Approval No. 229 requiring the RTA to investigate bus priority measures including the use of a southbound peak hour bus lane on Warringah Expressway connecting from the Willoughby Road merge to the existing bus lane.

Bus Lane/Transit Lane Complexity

Concerns were raised in representations including that from the STA about inconsistency and resulting complexity of bus and transit lanes through the corridor. In response the RTA recognised that while there would be changes through the Epping Road/ Gore Hill Freeway Corridor from bus lanes to transit lanes to bus lanes again on the Warringah Freeway that were not optimum, it advised that as these changes occur over significant distances, with sufficient signposting, commuters would become familiar with the changes.

The Department considers that a consistent approach in maximising roadspace for bus/HOV lanes is appropriate to minimise the potential for driver confusion and conflicts created by weave movements where lane changes are required. The Department concurs that while it would be desirable to maintain consistency in bus and transit lanes through the corridor and has attempted to achieve this to the greatest extent practicable, commuters can recognise and adjust to the varying arrangements, particularly as these arrangements occur over different road environments, that is, the Sydney Harbour Bridge, Gore Hill Freeway and Epping Road.

Bus Stop for Artarmon Industrial Area

A few representations suggested that a new bus stop on the Gore Hill Freeway should be considered in the vicinity of the intersection with Reserve Road to serve the employees in the Artarmon Industrial Area. The RTA responded that bus stop facilities would be difficult to include as part of the design due to limited space available. Nonetheless, the Department believes that it is appropriate that the potential for such facilities including an assessment of possible demand is identified during the detailed design process and has recommended these issues for consideration of the PTC (refer below).

Bus Layover Facility

The STA raised concerns in its representation about the loss of the bus layover facility on the Warringah Expressway just north of Falcon Street to allow construction of the Falcon Street ramps. The Department has recommended the inclusion of Condition of Approval No. 230 to compensate for the loss of these facilities which requires that alternative facilities are made available to the satisfaction of the STA prior to the commencement of construction of the proposed ramps.

### 5.3.4 Conclusion

The Department is satisfied that with the inclusion of additional bus priority measures the Proposal would benefit bus commuters. Given that the Lane Cove area and the lower North Shore are well serviced by public transport, it is important that while general private vehicle capacity is increasing, the Proposal should also make public transport options as attractive as possible. In principle, buses should have priority for any capacity improvements as a result of the Proposal. The provision of bus lanes along Epping Road and the Pacific Highway and the provision of a T2 Lane along the Gore Hill Freeway would significantly assist in satisfying this public transport objective.

Notwithstanding, there is a range of public transport enhancement measures and local area traffic management measures which could further increase the attractiveness of public transport and high occupancy trips through the corridor which would be coordinated by the PTC to be established under the conditions of approval. The PTC would receive financial support for administration and implementation of measures from the RTA.

## 5.4 Noise and Vibration

### 5.4.1 Background

Noise impacts from construction of the Lane Cove Tunnel would include noise associated with the two (2) tunnel portal sites at Mowbray Road (west) and the Pacific Highway/Gore Hill Freeway works associated with the tunnel access and spoil removal compound at Moore Street and regenerated noise from the driven tunnel construction. Issues related to the Moore Street compound site are discussed in Section 8.1.

The EIS stated that aboveground works, including works at the tunnel portals, would be generally undertaken during normal daytime construction hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturdays and at no time on Sundays or public holidays. The RTA stated that some surface construction works associated with the tunnel portals would be required outside of standard daytime hours to minimise impacts on traffic flow and safety implications. The EIS predicted that for a number of the noisier construction activities such as excavation works at tunnel portals and spoil truck movements, relevant construction noise guidelines would be exceeded.

To reduce construction noise impacts from the portals it was suggested that at the western tunnel portal, a temporary enclosed structure could be constructed. The EIS estimated that there would be sufficient space near the tunnel portals to temporarily store excavated material without the need for night time spoil transport.

The EIS stated that tunnel construction would occur 24 hours a day with roadheaders or possibly tunnel boring machines (TBMs). Much of the tunnel would be constructed at fairly shallow depths (less than 30m) from the existing ground surface creating potentially significant regenerated noise. Regenerated noise is caused by vibration which can be transmitted into the ground by certain activities and cause low frequency rumblings within buildings. The EIS, although suggesting that a regenerated construction noise night time criteria of 40 dB(A) would be appropriate for tunnelling activities stated that where the tunnel was close to the ground surface regenerated noise levels during construction could exceed this level for a period of up to one week at any location.

Potential operational noise sources associated with the tunnel include the ventilation stack operation, and the tunnel control building. The EIS estimated that operational noise generated by the ventilation stacks and their associated fans, with the implementation of internal silencers, would be within relevant criteria levels at the nearest sensitive receptor.

The revised ventilation design as described in Section 4.3 includes an air intake structure proposed by the RTA at either 130-132 Epping Road or on the Moore Street construction site.

### 5.4.2 Key Issues Raised

The key issues raised in representations:

- concerns about construction noise from the various compounds and associated truck movements particularly at night;
- concerns about potential construction noise and vibration impacts on residences close to the tunnel; and
- concerns about operational noise levels of the western exhaust stack.

In addition, the EPA raised a number of issues particularly in relation to the conceptual level of assessment of construction noise in the EIS. Some of their recommendations relevant to the construction of the tunnel included:

- that areas are identified where significant night time activities would occur including tunnel ventilation and that associated noise issues are discussed in more detail;
- discussion of potential night-time truck movements;
- that blasting not be undertaken; and
- that regenerated construction noise not exceed 40 dB(A) during the evening period from 6.00pm to 10.00pm and 35 dB(A) during the night time period between 10.00pm and 7.00am.

Despite these concerns raised by the EPA, the Representations Report contains little additional information in relation to construction noise and vibration.

### 5.4.3 Consideration of Key Issues Raised

Tunnel Portals and Spoil Truck Removal

The RTA has committed to undertake additional background noise monitoring near the western (Mowbray Road West) portal site and to investigate all reasonable and feasible mitigation measures during the detailed design stage. Possible mitigation measures include putting a roof on the western portal cut and cover works and construction of a totally enclosed shed to store fill material at night.

The RTA stated that no significant out of hours work would be required at portal sites and committed to consult with the EPA for any work that may be conducted out of normal working hours. It was stated that there would not be any night time truck movement of spoil except from the Marden Road site (near the eastern portal). This site is surrounded by an industrial estate and the RTA propose that spoil removal would occur 20 hours per day. In other cases, it was estimated that temporary storage of spoil at night would occur within the tunnel for removal during the day. It was stated that tunnel ventilation fans for construction purposes at portal sites would be fitted with silencers, enclosed and situated at least 50m from the actual tunnel portal to minimise after hour noise impacts.

Because of the conceptual nature of construction noise assessment the Department recommends a precautionary approach to construction noise management for the entire Proposal. The Department therefore recommends that a detailed Construction Noise and Vibration Management Sub Plan and Construction Noise Impact Statements be prepared to specifically address noise impacts at each of the major construction sites.

In relation to night time noise impacts during construction, the Department supports the RTA's recommendations that spoil transport is restricted to only day time movements and has included this

within Recommended Condition of Approval No. 118. The Department accepts the RTA Proposal to remove spoil 20 hours per day from the Marden Road site due to the industrial surrounds and as long as traffic routes used are primarily major roads such as the Pacific Highway and Epping Road.

It is apparent that there will be a need at times for construction work outside of normal hours, some of which will be associated with the access to the tunnel. Based on advice from the EPA, the Department recommends that the scheduling of noisy activities after 10.00pm and over consecutive nights in the same locality be avoided where possible. The issue of respite periods and night time noise limits must be addressed in each Construction Noise Impact Statement.

Discussion of construction noise issues for the Moore Street compound site is detailed in Section 8.1 and for all other construction compound sites for the total Proposal in Section 8.3.

Regenerated Noise

The Department, EPA and other representations raised concerns about the impacts of the proposed 24 hour tunnel construction in relation to regenerated noise. The EPA suggested specific limits on night time regenerated noise including not exceeding 40 dB(A) during the evening period from 6.00pm to 10.00pm and 35 dB(A) during the night time period between 10.00pm and 7.00am.

In response, the RTA stated that it would be difficult to meet the EPA's suggested regenerated noise criteria as the tunnel was shallow in many locations and that the noise would only be transient. The RTA estimated that for any given residences 25m above the road header it was anticipated that there would be an exceedance of the 35 dB(A) criteria for between 2-3 weeks and the 40 dB(A) criteria for 1.5 weeks. It was stated that an extensive community relations program would need to be instigated prior tunnelling works to reduce impacts.

The Department is concerned that the RTA has not sufficiently justified the exceedance of the EPA recommended evening and night time regenerated noise criteria. Whilst it is recognised that there could be advantages in 24 hour tunnelling, by reducing the total construction time for the Proposal, the Department believes in the absence of additional mitigation measures that it is unreasonable for some residents to endure regenerated noise levels that could disturb sleep for periods in excess of three (3) weeks. The Department therefore has recommended the inclusion of Condition of Approval No. 62 requiring that regenerated noise from construction works do not exceed the criteria levels recommended by the EPA. Should exceedances of these criteria be predicted by the Proponent, the Condition requires an extensive noise assessment report be prepared to the satisfaction of the EPA. The Condition is consistent with the approach applied to the recently approved Cross City Tunnel project.

Rockbreakers, used to break up pockets of very hard rock, can produce elevated levels of regenerated noise up to 10 to 15 dB(A) higher than that generated by a road header. To reduce the impacts of these activities it is recommended that Condition of Approval No. 186 is adopted restricting these activities to within standard day time construction hours.

Blasting

In response to the EPA's concerns that there should not be any blasting associated with the Proposal the RTA confirmed in the Representations Report that no blasting was proposed. However, the subsequent REF prepared for the tunnel and ventilation system redesign indicates that small blasts may be required to remove small sections of difficult rock material. In some cases, such blasting can result in reduced noise and vibration impacts compared to the prolonged use of rock breaking equipment. As

the impact of blasting has not been assessed in detail, the Department recommends that a precautionary approach be undertaken. To this end, Recommended Condition of Approval No. 72 is included which limits the overpressure level from any blasting to 95dBLin, a level which is not discernible to residents above the tunnel. Any blasting which requires greater overpressure levels would require further assessment and approval.

Operational Noise at Exhaust Stacks and Air Intake

Concerns were raised in some representations about the operational noise impacts from the exhaust stacks. Based on the *Industrial Noise Policy* the RTA established design criteria for the nearest sensitive receptors (residences) to the exhaust stacks at 36 dB(A) for the western stack and 45 dB(A) for the eastern stack. It was estimated in the EIS that attenuation such as silencers would be needed at the eastern stack to reduce noise by up to 20 dB(A).

The Representations Report included further assessment of operational noise impacts of the western stack in the modified location at Sirius Road. The assessment found that the nearest residences in Alder Avenue to the east would be approximately 480 m from the stack. To meet the relevant criteria at these residences it was estimated that attenuation to reduce operational noise by 27 dB(A) would be required at the stack. An evaluation of the noise impacts on the nearest commercial/industrial receptors and nearby schools was also conducted which found that attenuation at the stack to meet the nearest residential receptor criteria would also meet the relevant noise criteria for other landuses.

As part of the changes to the tunnel ventilation design the Proponent undertook an environmental assessment of the potential operational noise impacts of the air intake facility included in Appendix C The assessment stated that an appropriate limit for the facilities, given they will be operating 24 hours per day, would be 45 dB(A) at the nearest sensitive receptors. It was stated that these limits could be met with the inclusion of extensive mitigation measures such as silencers.

The Department is supportive of the proposed attenuation of ventilation stacks and the air intake by the Proponent. To ensure that this attenuation meets the relevant criteria the Department recommends the inclusion of Condition of Approval No. 187 requiring that the ventilation system meet specific noise limits as specified in Table 7 of the Conditions of Approval.

### 5.4.4 Conclusions

Noise, as a result of the construction and operation of the Lane Cove Tunnel, would result from construction works at the tunnel portals, spoil movement, tunnel construction and operation of the exhaust stacks and air intake. The Department has taken a precautionary approach to noise associated with tunnel construction requiring the preparation of detailed Noise Impact Statements and limiting evening and night time regenerated noise to specific levels designed to minimise impacts. These Conditions of Approval would complement the requirements of the EPA in the issuing of any construction license for the Proposal.

The Department has also required that the RTA engage an independent EMR and ICLR for the Proposal to help address any construction noise issues that arise as well as a range of community consultation requirements. Although construction noise associated with the Proposal would cause an annoyance for some residents at times, the implementation of the conditions and best practice mitigation measures would ensure the minimisation of impacts.

## 5.5 Spoil and Waste Management

### 5.5.1 Background

Spoil from the excavation of the tunnel would be the main waste product generated during construction. The EIS estimated that approximately 1,050,000 $m^3$ of bulked spoil would be generated during construction of the Proposal and few opportunities (eg fill batters) exist within the Proposal design for reuse.

The revised tunnel ventilation design as described in Section 4.3 increases the level of spoil material that would be generated by the Proposal to a total of 1,290,000$m^3$ bulked material. The main sites where spoil is predicted to be removed from the Proposal includes:

- Moore Street Compound – 325,000$m^3$;
- Mowbray Road West Compound – 253,000$m^3$; and
- Marden Street Compound – 395,000$m^3$.

The categories of all waste likely to be generated by the Proposal during all construction phases and is summarised in the following table.

**Table 5.4 Waste Generation during Construction and Operation**

| Stage | Phase | Waste | Source |
|---|---|---|---|
| Construction | Phase One | Green Waste (vegetation)<br>Excavated material (soil and rock)<br>Concrete, asphalt and gravel<br>Contaminated soil/Acid Sulphate Soils | Clearing and Grubbing<br>Surface excavation works, haul road excavation<br>Removal of kerbs, pavement and retaining structures<br>Topsoil stripping and excavation |
| | Phase Two | Excavated material (soil and rock)<br><br>Soil<br>Cardboard, timber, scrap metal<br>Glass, paper, food waste<br>Contaminated soil/Acid Sulphate Soils<br>Oil and grease | Tunnelling works, construction of retaining walls and barrier kerbs<br>Construction of bridges<br>Packaging of materials and equipment<br>Construction compound<br>Excavation works<br>Fuelling and maintenance equipment |
| | Phase Three | Green waste (vegetation)<br>Glass, paper food waste | Landscaping and vegetation works<br>Construction Compounds |
| Operation | | Glass, paper, food waste<br>General litter | Offices<br>Roads, depots and offices |

The EIS stated that contractors would be required to prepare spoil and waste management plans. The impacts of waste management, in particular spoil removal, in terms of traffic and noise impacts are addressed in Sections 8.2 and 8.3.

### 5.5.2 Key Issues Raised in Representations

Concerns were raised in a few representations in regard to spoil removal, including:

- the need to consider recycling of spoil where possible such as the use in the construction industry and identify where the fill will be going given the number of other large tunnel projects in Sydney;
- concerns about the level of trucks required to move spoil and the need to consider alternative transport such as the use of barges; and

- possible impacts upon floodplains and hydrology (if used to fill low-lying areas) and groundwater (if used to fill quarries etc).

### 5.5.3 Consideration of Key Issues

Disposal Locations

Sydney will, over the next 2 to 5 years have a number of large tunnelling projects occurring concurrently including the Cross City Tunnel and the Parramatta to Chatswood Rail Link. The Proposal would add approximately 1,290,000 $m^3$ of spoil to the amounts generated by those projects.

Although spoil disposal options were briefly investigated in the EIS, final arrangements for spoil disposal were stated by the RTA as being determined by the successful contractor. Similarly, disposal sites for spoil generated by the Cross-City Tunnel and Parramatta Rail Link (PRL) projects had not been determined at the time of this report.

The Department and other representations stated that the Proponent should further clarify the potential locations for spoil disposal and likely transport routes to be taken. Some representations suggested that the Proponent should maximise the reuse of spoil wherever possible.

In response, the RTA provided further information identifying the likely routes to be used in transporting spoil from the construction compounds and is shown on Figure 5.7. The RTA however, reiterated that the final disposal sites would be determined by the successful contractor at the detailed design stage.

The Department has therefore recommended Condition of Approval No. 120 requiring the preparation of a comprehensive Spoil Management Plan prior to construction to consider a range of issues relating to spoil generation, handling, reuse and disposal. As part of the Spoil Management Plan beneficial uses such reuse on the Proposal or elsewhere for excavated material must be identified in preference to spoil disposal. Spoil transportation by truck would only be permitted by those routes shown on Figure 5.6 (Recommended Condition of Approval No. 117).

Transport of Spoil

The EIS identified road transport as the preferred method for transporting spoil from the Proposal although barge and rail (or combination) was briefly considered. The EIS estimated that average daily delivery and haulage truck movements from all construction compound sites would range from approximately 810 to 1030, however this assumes that all works are being undertaken concurrently and does not take into account the additional spoil to be generated due to the redesign of the ventilation system. Spoil truck movements are addressed in more detail in Section 8.2.

The Department requested additional information regarding the feasibility of barging spoil along the Lane Cove River. Other representations also requested the RTA investigate transporting spoil by barge or rail.

In response, the Representations Report included hydrographic surveys of the Lane Cove River based on which it stated that approximately 142,000$m^3$ of dredging would be required to allow a 55m long and 15m wide barge with a capacity of 2,000 dry weight tonnes to access the Mowbray Road construction compound. The anticipated costs and environmental impacts of the dredging required were said to exceed the benefits gained from reduced truck transport. The RTA also stated that the dredged materials from the River may be contaminated as a result of past industrial uses adding significant time

and cost to the Proposal. Other considerations in assessing barging of spoil is the need to build a wharf or other loading facility near the Mowbray Road West construction site and the means by which spoil is transported from the tunnel to this location.

The RTA stated that transporting spoil by rail was not feasible due to the need for a siding near the North Shore Rail line, double handling of material resulting in significant cost increases and provision of a suitable loading site near the railway line. In addition, it would be necessary to know where the spoil is being transported to and access to similar facilities at the destination point.

Notwithstanding the potential problems with the use of barges and rail, road transport of all the spoil could have significant environmental impacts, particularly when considered cumulatively with other large spoil generating projects. The environmental impact externalities of spoil truck transport has been shown to be comparatively high compared to other spoil transport. Therefore, the Department has requested that alternative spoil transportation methods be investigated in the preparation of the Spoil Management Plan.

Impacts on Floodplains and Hydrology

Concerns were raised in a representation about the need to assess the impacts of any spoil disposal of the may have upon the hydrology and other critical environmental elements of disposal areas.

In response, the RTA reiterated that the likely spoil disposal locations are not known at this time and an assessment could therefore not be undertaken at this stage. The Spoil Management Plan must consider a range of issues related to spoil generation and disposal, and identifies management measures for these.

### 5.5.4 Conclusion

Waste, particularly spoil management is a significant issue for a Proposal of this scale and requires considerable management to mitigate the range of impacts on the environment and communities affected by spoil disposal. The RTA has stated that the transport types, routes and final locations for spoil disposal would not be determined until the detailed design stage by the construction contractor. The Department has therefore required that a comprehensive Spoil Management Plan be prepared prior to construction.

The Proposal would also generate a number of other wastes as outlined in Table 5.. The Department has therefore also required that the Proponent prepare a comprehensive Waste Management and Reuse Sub Plan prior to construction and operational phases. The Sub Plan must be prepared in accordance with the Government's waste hierarchy of avoid, reduce, reuse and recycle.

## 5.6 Toll

### 5.6.1 Background

The Lane Cove Tunnel is proposed as a toll road with motorists required to pay an estimated $2 toll (1999 dollars) collected electronically in each direction near tunnel entry points. An additional $1 toll (1999 dollars) would be charged for traffic using the new north facing ramps at Falcon Street (refer to Section 7.1 for further discussion on Falcon Street tolls). Tolls would be collected by the road operator who would also pay for and construct the Proposal on behalf of the RTA.

Electronic tolling is a cashless method of payment, negating the need for toll plaza construction. Ideally, the system requires motorists to have a tag which allows the toll to be automatically deducted from the motorist's account, although suitable provision would be made for casual (non-tag) users. The tolling system would be compatible with systems on other toll roads in Sydney.

### 5.6.2 Key Issues Raised

Key issues raised in representations included:

- objection to the toll;
- concerns that the toll would increase traffic on local roads and concerns about the cumulative impacts of multiple tolls from the City to the North-West sector; and
- the need for differential tolling for public transport and high occupancy vehicles.

### 5.6.3 Consideration of Key Issues Raised

Toll Imposition

A number of representations objected to the toll or raised concerns about the likely toll level at the time of opening. Some representations suggested that it was inequitable that motorists likely to use the route should be forced to pay a toll particularly when the broader study area was already burdened with numerous tolls (*i.e*. M2 and Harbour Crossings).

The RTA responded that private sector involvement was necessary to facilitate the timely provision of the Proposal. It was further stated that to fully finance the construction of the $815 million Proposal, the Government would need to utilise limited funds or rely on borrowing which could delay other critical projects. Private sector involvement would necessitate the imposition of a toll, although alternative toll free routes to the Proposal would remain.

The RTA stated in the EIS that the final toll level would be determined through negotiation between the RTA and the private operator prior to the Proposal opening. A $2 toll for the Tunnel and $1 toll for the Falcon Street ramps (1999 dollars) was suggested as a realistic, financially viable toll level for the Proposal and any toll increases would be based on increases in the Consumer Price Index.

The Department acknowledges the concerns raised about the equity of toll imposition, however it is also aware that funding of such large infrastructure projects wholly by Government is difficult. Private funding has been used for a number of similar projects in Sydney such as the M5, M2, M4, Eastern Distributor and in the future the Cross City Tunnel and Western Sydney Orbital and potentially the M4 East. Toll roads can also have the added benefit of reducing potential induced travel demand and therefore reduced negative impacts on existing or proposed public transport infrastructure. Issues related to the toll on the proposed Falcon Street ramps are discussed in Section 7.1.

To ensure that motorists are fully aware of alternative routes to the tolled tunnel and Falcon Street ramps the Department has recommended the inclusion of Condition of Approval No. 55 requiring the Proponent to appropriately locate signs informing motorists of the toll, and allowing for the choice of alternative toll free routes.

Traffic Impacts

A number of concerns were raised that a toll on the Tunnel would increase use of some local roads as 'rat-runs'. There was also concern raised that the number of tolls between the CBD and the North-West sector would create cumulative impacts, increasing traffic levels on alternative roads.

In response, the RTA recognised that by tolling the Proposal there would be higher levels of traffic on surrounding streets such as Epping Road than in a 'no-toll' situation. The EIS predicted that traffic within the tunnel would be 27% lower for the tolled Proposal scenario compared to the non-tolled scenario. Most of this traffic would continue to use Epping Road. However, the RTA stated that the tolled Proposal would lead to substantial decreases in traffic levels in comparison to the predicted traffic levels on surface roads without the Proposal (refer to Section 9.2 for further discussion). The Department is also aware that the traffic modelling indicates that a non-tolled option would probably require the provision of three (3) traffic lanes in the tunnel in both directions substantially adding to the capital costs of the Proposal and potentially leading to a greater level of induced traffic.

From a regional cumulative traffic perspective, the RTA stated that the traffic modelling for the Proposal included the effect of multiple tolls along the North-West sector to City corridor when determining traffic volumes and toll avoidance levels (refer to Section 5.1 for further discussion).

Differential Tolling

Some representations suggested that the Proposal should include some form of differential tolling eg. peak hour tolling or lower/no tolls for buses and high occupancy vehicles, to increase vehicle occupancy, reduce congestion and increase public transport usage. It was suggested that differential tolling could be used as an effective traffic demand management tool particularly during peak periods.

In response to the representations, the RTA stated that Government buses using the tunnel and Falcon Street ramps would be exempt from any tolls. Consistent with the approach that the Minister for Planning has taken for recently approved projects such as the Cross City Tunnel and Western Sydney Orbital the Department recommends the inclusion of Condition of Approval No. 56 requiring that all buses providing scheduled public passenger transport services shall be exempt from all tolls on the Proposal.

The RTA did not respond specifically to the issue of differential tolling for high occupancy vehicles or to reduce congestion during peak periods although the RTA has previously recognised that electronic tolling could be used for this purpose. The Department believes that the need for such differential tolling measures could be triggered if the Proposal were to lead to higher traffic levels than predicted due to significant levels of induced traffic being created. Induced traffic has the potential to impact on existing and future public transport provision as well as eroding the benefits of the Proposal to all road users. The issues of induced and regional traffic flows are discussed in further detail in Section 5.1.

### 5.6.4 Conclusions

The Department accepts that it is unlikely that the proposed Lane Cove Tunnel would be constructed in the immediate future without the provision of private sector funding recouped through a user toll. Given that the Proposal forms an important connection completing the 'Orbital' system around Sydney it is important that significant delays in the completion of the Proposal are not caused as a result of scarce Government funds. Moreover, Sydney motorists have now become more accustomed to "user pay"

charges for high quality road provision and the tolls themselves offer a potential traffic demand management tool.

The provision of electronic tolling also allows for the potential for different tolls to be levied as a way of reducing induced traffic demand. The Department has recommended that as part of the Proposal, no buses providing scheduled public transport services shall be charged a toll.

## 5.7 Groundwater and Settlement

### 5.7.1 Background

The proposed Lane Cove Tunnel is located within Triassic age Hawkesbury Sandstone, with the exception of the eastern extent which is situated within Triassic Ashfield Shale overlying Hawkesbury Sandstone at depth. Groundwater recharge is likely to be as a result of infiltration from precipitation and lateral movement of groundwater. The EIS predicted that the potential for contaminated groundwater was highest east of the Pacific Highway due to the previous and current landuses of quarrying and industry in the area.

The EIS predicted that groundwater inflow into the proposed tunnel would be generally low due to low rock permeability and the storage capacity of the Hawkesbury Sandstone and Ashfield Shale reducing the possibility of settlement problems caused by construction. The highest potential groundwater inflows were predicted at Stringybark Creek, the western portal and Turrumbarra Reserve. Groundwater levels are likely to be below the surface soils and building foundation influence zones on Hawkesbury Sandstone. Previous construction is thought to have resulted in localised lowering of groundwater levels near the Longueville Road/Epping Road intersection where some buildings are understood to have drained basements and at the old quarry off Marden Street.

The EIS predicted that a number of non-groundwater based components of the Proposal have the potential to cause ground settlement or other instability issues as a result of construction and associated activities such as tunnel excavation. Whilst the anticipated movements are small (between 5mm and 16mm) and unlikely to cause major distress to existing nearby surface and underground structures along the route, appropriate design requirements and safeguards would be required to prevent or minimise any such impacts.

### 5.7.2 Key Issues Raised in Representations

Key issues raised in representations included:

- impacts of proposed works on groundwater quality and quantity need to be addressed;
- impacts on groundwater users to be assessed if groundwater drawdown is proposed at any stage; and
- concerns that the Proposal would result in damage to surface property or subsidence around Epping Road, buildings around the western ventilation stack and the exhaust tunnel to the eastern ventilation stack.

### 5.7.3 Additional Investigations

Lane Cove Tunnel Geotechnical Interpretation Report

In response to the concerns raised, the Proponent provided the Department with additional geotechnical information primarily related to tunnel construction (RTA, 2001 - Coffey) in Appendix E. The report describes in greater detail than the EIS the geotechnical conditions of the proposed route and the implications for construction, including treatments which may be required to prevent settlement and provide stabilisation during construction and operation. Potential geotechnical issues/problems were identified in the following general areas:

- the eastern portal including the entry ramp from the Pacific Highway;
- batters and areas affected by fill of the former quarry at Marden Street; and
- tunnel gradient and embankment support at Moore Street.

### 5.7.4 Consideration of Key Issues

Groundwater Quality and Quantity

The Department of Land and Water Conservation noted in its representation that the impacts of the proposed works on groundwater quality and quantity had not been addressed sufficiently. However, It was further stated that the assessment undertaken for the EIS and associated working papers appeared technically sound and appropriate, provided the further detailed investigations outlined in the EIS and working paper were undertaken as stated.

In the EIS, total groundwater inflow rates are anticipated to be <5 L/s/km for the east and westbound tunnels in combination during construction (i.e. across 3.4 km). Inflows associated with individual features are anticipated to be < 1L/s however if dykes or major fault zones are present, these could result in significant localised inflows to the tunnel (>10 L/s), particularly if these are located close to surface waters.

The Proponent stated that the potential for groundwater contamination was considered low west of the Pacific Highway and higher to the east, based on the inferred catchment areas for recharge being residential/commercial and industrial respectively. It is stated in Working Paper 12 that the potential for existing groundwater contamination as well as the potential for works associated with the Proposal to contaminate groundwater will be the subject of investigations, including detailed site histories during the detailed design stage.

Based on the information provided, the Department recommends a precautionary approach be taken in terms of groundwater quantity and quality. The Department therefore recommends the inclusion of Conditions of Approval Nos. 196 and 197 requiring that a detailed Groundwater Management Sub Plan including measures to treat any potential contaminated groundwater and outlining the requirements for additional geotechnical/ groundwater monitoring and management during construction.

Groundwater Drawdown and Induced Settlement

Concerns were raised by some representations that the groundwater inflow associated with the tunnels construction could impact on existing groundwater users and if it led to groundwater draw down may impact on surface properties as a result of settlement.

The EIS did not identify any existing groundwater users in the vicinity of the proposed activities. Working Paper 12 of the EIS states that mitigation measures such as grouting and tunnel lining at areas of high flow will minimise the potential for surface settlement due to potential groundwater draw down. Further geotechnical investigations by the Proponent identified that sensitivity was highest for deformation and dewatering induced settlement at the exit/entry ramps from the Pacific Highway and for the western vent stack exhaust tunnel under Stringybark Creek. The report stated that uncontrolled dewatering could induce settlement, causing damage to buried services, roadways, structures, buildings on George Place, Artarmon and the SC Johnson car park, West Lane Cove without appropriate measures. Settlement due to deformation and dewatering at the Pacific Highway above the tunnel loop centreline is estimated to be 35mm. The Working Paper recommends further detailed geotechnical investigations as part of detailed design, with particular reference to identified high risk areas at Stringybark Creek, the western portal and Turrumbarra Reserve. Accordingly, this is reflected in the Department's Recommended Condition of Approval No.195.

Settlement – Non Groundwater Related

Concerns were raised in a number of representations about potential impacts of settlement on properties caused by the Proposal. Property impacts are discussed in further detail in Section 5.7.

*Building Impacts*

The EIS identified potential impacts to a number of buildings adjacent to the Proposal including the Warman building, buildings on quarry fill in George Place, Artarmon and impacts on basements of buildings at the Epping Road/Longueville Road intersection. Recommendations for additional investigations and support treatments for each of these locations have been identified. However, Recommended Condition of Approval No. 141 requires that a dilapidation survey be conducted at all structures potentially impacted and identify appropriate mitigation measures.

*Geotechnical Model*

The Proponent stated that a detailed geotechnical model would need to be developed for the route and its environs identifying significant geological structures. It would also need to include full details of existing and currently proposed excavations, basements and other sub-surface structures that may be affected by the Proposal. The Department supports the preparation of a geotechnical model and has detailed this requirement in Recommended Condition of Approval No. 190.

*Impacts on Utility Infrastructure*

To minimise potential impacts of tunnelling on buried services and utilities close to the proposed tunnel the Department has recommended Condition of Approval No. 192 requiring that settlement criteria for identified utilities and services be determined in consultation with the relevant authorities.

*Other Measures*

To further ensure that the construction of the Proposal does not cause significant settlement the Proponent outlined the following measures:

- identification of those sections of the work with the potential for significant impact on nearby infrastructure or properties;

- a detailed inspection of the structures potentially affected by the works including tunnels, utilities and buildings;
- a pre-construction dilapidation survey to identify the current condition of all buildings considered at risk;
- design appropriate support measures and/or rock mass reinforcement within the cut or tunnel to restrict ground movements near sensitive structures;
- a range of stabilisation and/or reinforcing measures for those structures that are likely to be critically affected by the works;
- monitor for displacements within the tunnel, surrounding rock mass and at the surface; and
- monitor critical structures for movement during construction and for periods of 3-6 months following completion of works.

The Department supports this approach by the RTA and recommends that a monitoring network be established using inclinometers and settlement monuments in high risk locations *e.g.* near Stringybark Creek. These requirements are specified in Recommended Condition of Approval No. 193. Settlement would need to be monitored for a period of time as specified by the Independent Property Impact Assessment Panel as reflected in Recommended Condition of Approval No.194.

## 5.8 Property Impacts – Tunnel

### 5.8.1 Background

The Proposal would result in only a small amount of direct surface acquisitions of properties (14 lots). Construction of the tunnel, including ventilation tunnels and exit/entry ramps tunnels at the Pacific Highway, would also require permanent acquisition of subsurface stratum allotments from an estimated 224 properties (it is noted that the number of properties is likely to increase as a result of the changes to the ventilation design).

Subsurface stratum acquisition means that the Proponent can hold freehold title of the affected stratum lot, and that the ownership of the surface lot is not affected. No easement or 'Right of Way' is required through the surface lots where stratum allotments are acquired below the surface allotments. The RTA would compulsorily acquire the lower lot in the Deposited Plan and a new title would be issued for the upper lot, which would remain in the registered proprietor's ownership.

The EIS stated that all surface and sub-surface acquisitions would be in accordance with the *Land Acquisitions (Just Terms Compensation) Act 1991*.

### 5.8.2 Key Issues Raised In Representations

The key issues raised in relation to the potential property impacts of tunnelling were:

- levels of compensation payable for acquisitions and the need for a buyback guarantee;
- future development potential and property values; and
- matters relating to the location of the exhaust vent stacks and the possible impacts on property values.

### 5.8.3 Consideration of Key Issues

Building Protection / Compensation

A number of representations were concerned with building protection during construction and ensuring that appropriate compensation was available. Reference was made in representations to the M5 East buy back scheme. A number of representations expressed concern about the possibility of property damage being caused as a result of subsidence. Much of the tunnel will be through Hawkesbury Sandstone, and the EIS found that structural damage to properties would be unlikely. Notwithstanding, additional investigations, including additional geotechnical investigations to identify high risk areas of settlement are required during detailed design and prior to construction commencement to further decrease the risk of property damage (refer to Section 5.7 for further discussion).

Notwithstanding, detailed construction surveys of buildings around the construction area would be undertaken prior to commencement of construction. The Department does view the issue of property damage very seriously, and recommends that detailed measures be followed to protect landowners.

The Proponent states in the Representations Report that no compensation is payable for substratum acquisition, however local residents would receive benefits from reduced traffic on Epping Road and improved local air quality as a result of this. Notwithstanding direct compensation for acquisition of the substratum being payable, building protection must be assured and appropriate compensation available where damage due to construction is found to have occurred. Recent experiences with regard to the Eastern Distributor construction have highlighted this issue. To this end, the Department recommends the inclusion of Condition of Approval No. 78 requiring that surveys be undertaken of buildings, including basements, within the zone of influence of construction and shall include:

- all buildings/ structures within 50 metres of construction works or within a plan distance equal to twice the invert depth from the edge of the tunnel and/or excavation works; and
- any heritage buildings identified in the Heritage and Archaeology Management Sub Plan or other sensitive structures within 100 metres from the edge of the tunnel and/or excavation works.

A copy of the building condition survey would need to be provided to the property owner. In addition to the above traditional methods for control of property damage, the Department also recommends the establishment of an Independent Property Impact Assessment Panel to resolve disputes arising from potential and/or actual property impacts and this requirement is specified in Recommended Condition of Approval No.80.

Tunnel Protection and Future Development Potential

Concern was also raised, apart from the properties directly affected through acquisition, that other properties in the locality would also be affected by reduced development potential and property values.

State Environmental Planning Policy No. 65 – Major Transport Projects (SEPP 63) identifies the need to ensure tunnel protection from future development. Clause 8 of the SEPP 63 outlines a notification process for all proposed future buildings located within the zone of influence of the tunnel to ensure the structural integrity of the tunnel over time. In practice, this could result in restrictions on future buildings and subsurface developments within the zone of influence of the tunnel to include provisions to ensure that:

- tunnel infrastructure and associated support, such as permanent rock bolts are not affected or removed for new development;
- building loads resulting from any new development do not add significantly to the load on the tunnel structure;
- new developments do not change the in-situ stress regime of the area of the tunnel to the extent that there would be a significant reduction in the ability of the rock mass surrounding the tunnel to perform in accordance with the design requirements; and
- any new developments particularly those involving basement excavations are constructed in a way which controls ground movements to acceptable levels, avoiding any significant impacts on the tunnel structure.

The Department is cognisant that existing landowners may have development rights prior to any Proposal approval which would be affected by the Proposal and as such, could be considered for compensation in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. The low density residential nature of the majority of the study area should reduce the potential impacts on existing and future property impacts as a result of the Proposal. Appropriate criteria would include lodgement of a development application, preparation of development plans or other evidence of development plans which were prepared prior to the Proposal approval. This requirement is outlined in Recommended Condition of Approval No. 81.

Property Impacts of Ventilation Stacks

Concerns were also raised by some representations about the impacts on property values in the vicinity of the proposed ventilation stacks. Representations also suggested that some form of property value guarantee should be given.

In response, the RTA stated that a property value guarantee was not proposed. It was stated that the air quality and other impacts of the proposed ventilation stacks had been assessed and found to have negligible impacts on surrounds. Air quality impacts of the Proposal are discussed further in Section 5.1.

## 5.9 Visual and Landscaping

### 5.9.1 Background

The EIS included the installation of a western and eastern ventilation stack as part of the Proposal located in the Lane Cove industrial estate off Orion Road and in the Artarmon industrial estate off Marden Street respectively. The Representations Report included a modification to the location of the western ventilation stack to a nearby site in the Lane Cove industrial estate at 5 Sirius Road.

The eastern ventilation stack would be situated in an old quarry, rising a minimum of 54 metres (to 134 m AHD) from the base of the quarry to be 18 metres above the adjacent top of the Corinthian building on the Pacific Highway. The EIS estimated that the stack would be highly visible from the Corinthian building and Marden Street and be viewed from a distance from the residential area in Artarmon.

The western ventilation stack at Sirius Road would be a minimum of 30 metres above the ground level (62 m AHD). The tallest building in the area, the Compaq building, is approximately 200 metres east-northeast of the stack rising to 71 m AHD. The stack would be a similar height to a number of nearby buildings and would be visible from Epping Road and residential areas in East Ryde.

Appendix H of the Representations Report included an additional assessment of the visual impacts of the ventilation stacks at Marden Street and Sirius Road. Photomontages were produced as part of this assessment envisaging that the stack would generally have a cylindrical design to be determined by the successful contractor.

As described in Section 4.3 the Proposal includes a redesign of the ventilation which is likely to include an air intake facility either at 130-132 Epping Road or at Moore Street. The Proponent stated that the majority of the air intake facilities could be located underground.

### 5.9.2 Key Issues Raised in Representations

Key issues raised in representations in relation to the ventilation stacks, included:

- the bulk and scale of the vent stacks is not in keeping with the surrounding buildings and would not be disguised by landscaping;
- the western stack location is inappropriate due to inconsistency with surrounding land use, number of employees within the view shed and length of time exposed to view; and
- concerns about the short and long distance views of the vent stacks, particularly the western stack.

### 5.9.3 Consideration of Key Issues

Visual Impacts of the Vent Stacks

In response to concerns regarding the vent stack, the RTA advised as part of the Representations Report that the eastern vent stack would mainly be visible to residents on the northern side of the Gore Hill Freeway, who would have distant views over the Artarmon Industrial Area. The existing Corinthian building would screen the stack to residential areas on the western side of the Pacific Highway.

The existing building on the location of the western ventilation stack, at 5 Sirius Road Lane Cove West, is vacant and about 18m tall and is built on sloping ground. While the stack and associated buildings are subject to detailed design, one option is for the stack to be located within a new building – the vent would extend some 12 metres above the roofline (based on a 30m stack). The RTA stated that the site is within the Lane Cove Industrial Area and therefore mid and long distance views of the vent stack would be against a background of commercial / industrial buildings.

The RTA concluded that the visual impact of the Sirius Road was comparable to the Orion Road location proposed in the EIS. Given the revised location had other advantages in terms of air quality and land use characteristics, Sirius Road is the proposed location of the western vent stack.

The installation of a ventilation stack in any location would have significant visual impacts. The Department is satisfied that the locations for ventilation stacks both situated in primarily industrial areas generally minimises the impacts to immediate views. If it could be achieved there is likely to be some visual advantages to encompassing the stacks within associated buildings. As the visual impacts of the stacks have only been assessed on a conceptual basis the Department recommends that Condition of Approval No. 87 be included that ensures that the final stack designs including treatments and finishes be addressed in a specific Urban Design and Landscape Sub Plan which would be subject to further community consultation and approval by the Department. The Sub Plan would also need to address the urban design and visual issues associated with any air intake structure.

# 6 ASSESSMENT OF KEY ISSUES RELATED TO EPPING ROAD SURFACE MODIFICATIONS

*This Section of the Report provides the Department's assessment of the key environmental impacts of the modified Proposal related to the Epping Road surface based on an examination of the EIS, issues raised in representations during the exhibition period and the Proponent's response to these issues in its Representations Report and during further consultation with the Department. The Department's assessment of the other environmental issues related to other elements of the Proposal are addressed in Sections 5, 7, 8 and 9 of this Report.*

## 6.1 Urban Design and Visual Impacts

### 6.1.1 Background

The Proposal has considered urban design on two (2) levels in both the EIS and the Representations Report. The Proposal as a whole was considered and assessed on its merits, against the Proposal objectives. This section considers the urban design and visual impacts associated with the Epping Road surface modifications between Wicks Road and the Pacific Highway.

The Epping Road surface works Proposal includes:

- a new separate pedestrian and bicycle path network, connecting Wicks Road through to the western end of the proposed Epping Road/ Longueville Road works (to the west of the Lane Cove Bridge);
- a new 2 lane westbound Lane Cove River Bridge crossing, realignment of the Mowbray Road West intersection and the western tunnel portal;
- reconfiguration of Epping Road and Longueville Road between Mowbray Road West and the Pacific Highway, new bus lanes, provision for cyclists, improved pedestrian conditions and improved street tree planting.

The Mowbray Road West intersection and the western tunnel portal mark the separation of the through traffic heading into the tunnel from traffic choosing the Epping Road surface route. The RTA proposes that this area become the western threshold or 'gateway' to Lane Cove, signalling the start of the reduced speed environment and capacity of Epping Road through to Lane Cove and the upgraded quality of Epping Road as a public space.

Proposed landscaping aims to create a 'boulevard' experience along Epping Road, between Centennial Avenue and Parklands Road. This would be achieved through a reduced traffic environment once operation of the tunnel has commenced, undergrounding of power lines, additional street trees and low scale median planting. While some changes would be required to the existing grassed embankment on the northern side of Epping Road between Centennial Avenue and Parklands Avenue, the existing azalea planting would not be affected.

The intersection of Epping Road, Longueville Road and Parklands Avenue is considered by many to be the eastern 'gateway' to Lane Cove retail and commercial area. It is proposed to introduce additional street planting (where feasible), a new two–platform bus interchange on the north–eastern side of Epping Road and an overhead pedestrian bridge connecting the northern and southern sides of Epping Road.

The pedestrian and cyclist aspects of the Epping Road surface works are discussed in Section 6.2.

### 6.1.2 Key Issues Raised

Key issues raised in representations included

- concerns regarding the increase in hard paved areas and the removal of existing vegetation;
- concern that the expected improvements to Lane Cove would not be realised;
- the need to retain existing features of Epping Road, in particular, the azalea display; and
- the pedestrian/bus commuter/cyclist interface, particularly around bus stops and major road intersections.

### 6.1.3 Consideration of Key Issues

Widening of Epping Road and Associated Works

A number of representations were received questioning the widening of Epping Road and removal of existing vegetation to accommodate increases in hard paved surfaces while at the same time reducing traffic capacity and promoting a "downgraded" boulevard character.

In response to these issues, the RTA commissioned an extensive assessment of the finished streetscape along Epping Road (refer to Appendix J of the Representations Report). This included consideration of various additional facilities, such as bus lanes, dedicated cyclist and pedestrian paths and enhanced median and strip landscaping within the Epping Road corridor. The consequences of providing some of these facilities, particularly where the road corridor is adjacent to residential areas, would result in impacts on some of the existing vegetation and local features. The RTA has identified and attempted to limit these impacts as much as possible as well as proposing enhancements to the remaining landscape in compensation.

In principle, while increases in hard paved surfaces should not be encouraged, the Department considers that the inclusion of dedicated bus lanes, cycleways and pedestrian paths would bring significant benefits to the local and commuting communities, including increased safety for all users. The Representations Report identifies further landscaping opportunities to ameliorate the increases in hard paved surfaces, such as the introduction of planting on medians and verges to divide traffic lanes. Tall avenue planting either side of Epping Road would also help reduce the scale of the road by creating a sense of enclosure, assisting in the creation of a 'boulevard' character. The Department recommends a condition regarding the preparation and implementation of a landscape and urban design plan specifically for the Epping Road surface works prepared in accordance with a framework prepared for the entire Proposal.

*Ability of Proposal to Achieve Objectives*

A number of representations expressed concern that the Lane Cove Tunnel may not provide the expected improvements in regard to the anticipated reduction in traffic along Epping Road and the consequent improvement to the visual environment and local amenity. A number of representations also raised concerns that the ability of the Proposal to deliver the boulevard character to the streetscape was questionable with the additional widening of Epping Road.

In response the RTA advised that an extensive assessment of the finished streetscape along Epping Road was undertaken which identified opportunities for additional planting to reduce the perception of

Epping Road as an arterial road. These enhancements include the provision of a feature wall along the northern side of Epping Road between Centennial Avenue and Parklands Avenue, augmentation of existing planting and the development of "Gateway" concepts at each end of Epping Road. Additional opportunities for street tree planting, median strip landscaping and the undergrounding of powerlines were identified by the RTA in the Representations Report.

The Department concurs that the anticipated reduction in traffic volumes, additional opportunities for landscaping and pedestrian and cyclist path should ensure that local amenity is greatly improved. Recommended Condition No. 221 requires a specific Urban Design and Landscaping Management Sub Plan for the Epping Road corridor between Mowbray Road West and the Pacific Highway which requires the Proponent to incorporate any of the proposed urban design measures stated in the EIS and subsequent reports.

*Maintaining Existing Features*

Representations were received stating the importance of maintaining the existing main landscape features of Epping Road, in particular, the azalea bed on the northern side of Epping Road between Centennial Avenue and Parklands Avenue.

The RTA advised that areas of existing landscaping and vegetation, impacted by the works and that are also surplus to the area needed for the Proposal, would be rehabilitated in consultation with the local community. The RTA stated that the azalea beds would not be affected and construction techniques would be employed by the contractor to ensure that the beds are retained in their existing condition or are enhanced. The community and the relevant Council would be consulted through all stages of the design and construction process for these works. While the azalea beds themselves would not be physically impacted, road widening may affect the embankment. Recommended Condition 217 requires specific consideration of the azalea beds during the detailed design stage.

Pedestrian/Bus Commuter/Cyclist Interface

Representations were made concerning the interface of pedestrians, bus commuters and cyclists, particularly around bus stops and major road intersections. This issue was particularly pertinent at the Epping Road/Longueville Road intersection. The Department also raised several concerns regarding this issue, including the need for the RTA to consider options for this intersection, such as opportunities for improved bus queuing, easier pedestrian access (particularly for the mobility impaired) to Lane Cove retail and commercial area, and increased landscaping.

In response the RTA advised that the shared facilities and bus stops design considered and has sought to minimise conflict between cyclists, general pedestrians (including the less mobile) and bus patrons by separation of all users as much as possible. A detailed assessment of the signposting and line marking and other visual clues at these locations would be undertaken during the detailed design phase to maximise the separation of all users and to enhance the awareness of interaction of all road users.

*Improved Access Across Longueville Road*

The proposed interchange on the north-eastern corner of Epping Road and Longueville Road/ Parklands Road a pedestrian bridge across Longueville Road to Phoenix Street. The overbridge would incorporate stairs and lifts on either side due to physical constraints which would not enable a ramp access to be built. The existing Kimberley Street bridge is not sympathetic to the existing landscape nor is it in keeping with the urban design objectives for this section of the Epping Road corridor. The Department has recommended Condition of Approval No. 223 requiring that the Kimberley Street bridge be removed following completion of the new bridge and interchange.

The RTA state that further investigations would be required to consider the integration of the bus interchange and pedestrian bridge with the development of air space above the interchange for commercial and residential purposes. The RTA has confirmed that the pedestrian overbridge and bus interchange will be provided, regardless of the outcomes of the further investigations (which would be subject to Council approval).

The Department considers that the proposed overbridge would provide significant improvements to the access across Longueville Road, particularly for bus commuters. However, it is also considered that the proposed location of the pedestrian overbridge is appropriate with regards to major origin and destination points when compared with the Kimberley Street bridge. The Department also recommends that the overall design of the pedestrian bridge and bus interchange consider the overall Proposal urban design objectives, existing landscape, the intersection's role as the eastern "gateway" to Epping Road and beyond, and the landscape plan by Hassell "*Epping Road Planting Opportunities (Centennial Avenue to Parklands Avenue)"*. Local council and community input into the final design would assist in ensuring that the design reflects many of the local community's needs.

## 6.2 Pedestrians and Cyclists

### 6.2.1 Background

The Proposal includes provision of a 3m wide cycleway or a 4m wide shared cycleway/ pedestrian footpath (intended for pedestrian and pedal bicycle use) from Wicks Road North Ryde to Park Road Naremburn. This section of the report considers the section of path between Wicks Road and the Pacific Highway.

The EIS states that the proposed cycleway facilities would connect with future cycleways to be provided between the Sydney Harbour Bridge and North-West Sydney, thereby contributing to reduced car dependency. The pedestrian path would be constructed adjacent to the cycleway on the southern side of Epping Road and would provide a continuous pedestrian facility along its length. Sections of the cycleway/pedestrian path would be shared due to physical constraints that would not enable separate paths to be provided. The shared path would be marked to encourage separation between cyclists and pedestrians.

One of the stated EIS Proposal objectives is to improve amenity for the community and businesses by improving connectivity, safety and access for pedestrians and cyclists on Epping Road and to provide for cyclists along the corridor. In addition to the predicted reduced traffic conditions in the corridor, the Proposal also includes specific pedestrian facilities to improve connectivity.

### 6.2.2 Key Issues Raised

Key issues raised in representations included:

- concerns regarding pedestrian access over the M2 Motorway and Delhi Road to connect station sites of the Parramatta – Chatswood Rail Link to areas south of Epping Road;
- desirability of an at-grade crossing of Epping Road at Mowbray Road West;
- need for improved north- south pedestrian crossings of Epping Road differing needs of recreational and commuter cyclists;
- comments that the cycleway should be a continuous facility from the M2 motorway through to Lane Cove and the Sydney Harbour Bridge and include links to planned cycleways such as the North Shore rail cycleway;
- continuity and safety of the cycleway, including safety issues regarding driveway crossings, local road crossings and transition between dedicated and shared facilities; and
- interface of cyclists and pedestrians at bus stops.

### 6.2.3 Consideration of Key Issues Raised

Cycleway Design

A number of representations, including Bicycle NSW, suggested that the cycle facility as designed would probably cater mostly for commuter cyclists though some sections would also provide excellent local access and a backbone into which local routes feed. However, the representations considered that this would not be seen as a recreational route. Bicycle NSW recommended that the cycle facility should be more aligned with road traffic than with pedestrians and this would be equally appropriate along the Gore Hill Freeway section. In response, the RTA contends that it has considered the needs of all including both commuter and recreational cyclists. The cycleway would be intended for users of all competency levels and such a facility could not be provided in an on-road facility.

The RTA considered that a shared cycleway and pedestrian facility along the Epping Road corridor to be a reasonable approach to achieving a balance between the needs of commuter and recreational cyclists. Although it may be preferable to provide for a separate cycle facility for the length of the cycleway, the Department agrees that the cycleway is a reasonable approach for meeting the needs of recreational and commuter cyclists taking into consideration the safety issues and the available land (without the need for further acquisition of private land).

The Department concurs that the proposed cycleway will provide additional opportunities for both recreational and commuter cyclists along this section of Epping Road and will encourage cycle trips by providing a connecting route to the lower North Shore and Chatswood cycleways. To ensure that the final design meets the needs of most members of the community, it is important that local councils, local user groups and local communities along the chosen route are consulted during detailed design.

Cycleway Connectivity

A number of representations raised concerns that the cycleway facility did not provide a continuous and uninterrupted link from the M2 through to Lane Cove and The Harbour Bridge. In particular Bicycle NSW raised the concern that under the Proposal a cyclist travelling east along the M2 shoulder must exit at Delhi Road, cross at the lights and then access the shared pathway and return west on a corresponding route.

A number of representations suggested that future planned North Shore cycleways including the cycleway to follow the railway line should be coordinated concurrently with the LCT Proposal. The RTA advised that it has considered the links with cycleways on the North Shore, has prepared a plan identifying planned cycleways for the area, and confirms the connections between the cycleways has been considered as part of the broader cycleway strategy for the North Shore area. These are shown in Figure 6.1.

The Department considers that the facility provided would enhance the bicycle network, both from a regional perspective and through the Lane Cove municipality. Extensive consultation by the RTA with the cycling community has been acknowledged by Bicycle NSW. It is the Department's view that the proposed combination of on road and off road facilities is appropriate, given the topography, landscape and safety issues and that network linkages have been satisfactorily addressed by the RTA.

While it is acknowledged that the Proposal forms part of a wider network plan for the North Shore, it is considered appropriate that a Cycleway and Pedestrian Plan be prepared during detailed design which considers issues of connectivity to surrounding roads and cycleways as well as other necessary safety and design aspects.

Continuity and Safety Issues

A number of representations raised concerns about the continuity and safety of an off road cycleway facility. The limited separation of the shared cycleway and pedestrian path and cyclist speeds, particularly westward between Sam Johnson Way and Centennial Avenue. Commuter cyclist choice to use bus lanes, due to the shared facilities and perception of impediment to commuter travel rather than the cycleway was an additional concern. It was suggested that if it was not possible to construct separate cyclist facilities on both sides of Epping Road, then the ability to easily access the shared path from the bus lane (at least for westbound cyclists) should be available through frequent ramp access on the uphill sections of the route. Continuity concerns also referred to the crossing of minor side streets and major intersections.

In response, the RTA stated that a primary objective in development of the cyclist facilities is to limit the conflict by the separation of road users with differing speeds as much as possible. As a consequence an off road facility was developed. Separate cycleway and pedestrian paths would be provided where feasible in areas of high pedestrian use. The EIS identified that areas where cyclists were likely to achieve speeds of 40km/hr or more were also of low pedestrian occupancy and separation of the facility by linemarking would be adequate. For busier pedestrian areas, such as between Centennial Avenue and Parklands Avenue, a dedicated cycleway has been provided to separate cyclists from areas of high pedestrian occupancy.

The Department has considered the needs of both commuter and recreational cyclists, the landscape and topography that the facility would pass through, and objectives of the Proposal, including improving safety, connectivity and access for pedestrians and cyclists on Epping Road and right along the Proposal corridor. It is acknowledges that when providing cyclist facilities, there is a question of priorities between the provision of quieter back street/off-road routes, which are often attractive to leisure riders, and the provision of direct on-road facilities for commuters that regard cycling as a transport mode. The Epping Road corridor is a significant route for all road-based transport modes. For cyclists it also represents the link between the M2 motorway and the Gore Hill Freeway, both of which are accessible to cyclists prepared to ride in the shoulder lanes.

Pedestrian Access Across Epping Road

In response to representations and the Department's comments, the RTA as part of the Representations Report obtained advice regarding crossing points. Pedestrian safety was an important consideration of that specialist report. The findings of the report confirmed the need to:

- improve the at grade crossing at Mowbray Road West; and
- provide continuous pedestrian facilities on the southern side of Epping Road. Given low pedestrian numbers and the lack of existing facilities, the provision of similar facilities on the northern side were considered unnecessary.

The study found that there were insufficient pedestrian numbers at Centennial Avenue to justify an overbridge. The proposed intersection design allows for pedestrian crossing on all four (4) approaches. This would cater for the high number of pedestrians using this crossing in the evening peak. The Department concurs with this finding, based on the reduced traffic flows estimated along Epping Road following opening of the tunnel.

In response to the Departments comments, the RTA looked at a number of options for the Longueville Road and Epping Road intersection. The preferred solution for this intersection is for a pedestrian overbridge at Phoenix Street which would cater for the majority of pedestrian movements including access for the mobility impaired. This is discussed further in following sections.

*Mowbray Road West*

A number of representations were received regarding the need for improved pedestrian access for both pedestrian and cyclists between the M2, Delhi Road and Epping Road. Aside from providing an advisory role on relevant development applications, the RTA has not proposed any further improvements.

Representations were raised regarding the need to retain existing pedestrian access via the underpass at Epping Road/ Mowbray Road West. The RTA plans to remove the underpass and replace it with an at-grade crossing, which the RTA believes would provide a safer, more accessible pedestrian crossing. Given the width of the intersection, the RTA acknowledges in its Representation Report that the walk time would be fairly high and that this may result in separate walk phases for each half of the road.

The Department has considered and concurs with the RTA's concerns in relation to the safety issues regarding the existing underpass particularly in a relatively remote location. However, in relation to the proposed pedestrian at-grade crossing, the Department believes that the option of requiring pedestrians to cross in two phases would result in reduced pedestrian access and priority when compared with the current at grade and underpass crossings. Pedestrian safety may also be compromised if pedestrians choose to cross away from or between crossing phases. The Department has also considered the opportunity to provide equity in terms of crossing for pedestrians at this location, particularly given the Proposal's objective of providing enhanced north–south pedestrian links and that this intersection is part of the surface route of Epping Road which is downgraded in terms of vehicle numbers. As a result, the Department recommends Condition of Approval No. 216 to provide an at-grade, single stage, uninterrupted pedestrian crossing.

- Longueville Road/Epping Road Intersection

A number of representations raised the adequacy of pedestrian access to bus stops on either side of Epping Road at Centennial Avenue and Longueville Road. Existing access to these locations is via signalised at-grade crossings and/or the existing footbridge at Kimberly Avenue. The Department also commented that an objective of the Proposal is to improve safety, connectivity and access for pedestrians across Epping Road. The RTA proposes to construct a new overhead bridge from the proposed bus interchange at the north-east corner of the Epping Road/Longueville Road intersection across Epping Road.

The Department concurs that the provision of an overhead bridge, with lift access, will greatly enhance the connectivity of the northern and southern sides of Epping Road meeting one of the Proposal objectives. However, the Department is cognisant that some sections of the community may prefer at-grade crossings and that there would be periods (maintenance/vandalism) when the overbridge lifts would not be available. As such, the Department considers it essential that an alternative crossing is available, in particular for the mobility impaired. Recommended Condition of Approval No. 216 requires that at-grade crossing is maintained across Parklands Avenue and Epping Road (west of Parklands Avenue).

### 6.2.4 Conclusion

The Department believes that the RTA has sufficiently demonstrated that the Proposal would meet the pedestrian and cyclist objectives as outlined in the EIS. The cyclist route connects the Lane Cove area, particularly the Epping Road corridor to the M2 in the west and St Leonards, the lower North Shore and the Sydney Harbour Bridge. The route offers a reasonable balance between commuter and recreational alternatives within the physical constraints of Epping Road.

The Department recognises that the Proposal would enable substantial improvements for pedestrians crossing Epping Road, between Parklands Ave / Longueville Road and Centennial Avenue. The proposed overhead bridge with lift access at Longueville Road / Epping Road will ensure safe and unimpeded crossing to and from the Lane Cove retail, educational and commercial precinct and the at-grade crossing would ensure that this movement is not compromised, particularly when lifts on the overbridge are not available. These improvements, combined with the projected reduction in traffic along Epping Road should improve local amenity and safety for those living along and using the Epping Road corridor

## 6.3 Local Access and Traffic Management

### 6.3.1 Background

Extensive traffic modelling was undertaken for the EIS and predicted traffic levels on local and connecting roads. For the Epping Road section, the assessment was divided into local traffic changes east and west of the Lane Cove River. Changes in traffic patterns on the Pacific Highway and further east are discussed in Section 7.2.

<u>East of Lane Cove River</u>

The main traffic benefit of the Proposal is the predicted substantial reductions in traffic on Epping and Longueville Road (approximately 40% during peak periods) between Mowbray Road West and Pacific Highway. A reduction in traffic lanes along the route and the installation of bus lanes in both directions

is proposed as a result of traffic reductions on Epping Road. The RTA also proposes to reinstate some right turn movements to and from Epping Road including those at Parklands Avenue and Centennial Avenue for westbound Longueville/Epping Road traffic.

Mowbray Road West is currently used as an alternative route for traffic wishing to avoid Epping Road congestion and is also predicted and to benefit 50% reduction in daily traffic levels at the western end reducing to approximately 25% immediately west of the Pacific Highway intersection. M2 eastbound traffic would only be able to access Mowbray Road West by exiting at Delhi Road and continuing along Epping Road, which would reduce the route's attractiveness.

Traffic levels on Centennial Avenue north of Epping Road are predicted to increase by up to 100% northbound in the evening peak period. This increase is partly due to the reinstating of the right turn movement from Epping Road westbound and also the reduced volumes on Mowbray Road West which would make this a more attractive route for access to Chatswood. Increased traffic levels of approximately 10% are expected on Centennial Avenue south of Epping Road, though similar levels would be expected on Centennial Avenue near Penrose Street with or without the Proposal.

West of Lane Cove River

Traffic levels on Epping Road where the tunnel traffic rejoins Epping Road east of the Lane Cove River crossing are predicted to increase significantly particularly in the westbound direction by up to 40% in the evening peak. Smaller increases of 10-15% are predicted in the eastbound direction during peak periods. Two additional westbound lanes on the Lane Cove River crossing and one additional westbound lane to Wicks Road are proposed to cater for this additional traffic.

M2 traffic volumes are predicted to increase by up to 40% as a result of the Proposal during peak periods and the section of Delhi Road between the M2 and Epping Road is also predicted to increase by approximately 20% on an average daily basis primarily as M2 traffic could only access Epping Road by exiting at Delhi Road. Other sections of Delhi Road east of the M2 would benefit from the Proposal by 15-20% reductions in traffic levels. These benefits continue through to Fullers Road as the continuation of the Delhi Road route.

Predicted traffic levels on other north-south routes south of Epping Road including Wicks Road, Badajoz Road and Pittwater Road were less consistent. Some routes were predicted to have reduced traffic levels during certain peak periods whereas others were predicted to have increases. Across these three routes, the largest predicted increase was approximately 20% in southbound traffic during the morning peak. Additional investigations subsequent to the EIS indicated that these predicted increases were primarily due to traffic switching to Victoria Road and ANZAC Bridge to access the CBD, in part to avoid the toll.

### 6.3.2 Key Issues Raised

A number of representations including those from Lane Cove Council and Ryde City Council raised issues in relation to the effects of the Proposal on local traffic flows. Key issues raised in representations were:

- the need for Local Area Traffic Management measures to reduce traffic on Centennial Avenue;
- the need to reinstate right turn movement from Centennial Avenue to Epping Road;
- concerns in regard to traffic levels on Barwon Road in Lane Cove West;
- concerns that the narrowing of Epping Road would lead to increased traffic on Mowbray Road West;

- concerns about the increase in traffic on Pittwater Road and other north-south routes; and
- need for east-facing M2 ramps at Lane Cove Road intersection.

### 6.3.3 Consideration of Key Issues Raised

Centennial Avenue

A few representations raised concerns about the predicted increased traffic levels particularly north of Epping Road on Centennial Avenue and the need to prevent these increases with traffic management measures. Lane Cove Council recommended that the right-turn movement from Centennial Avenue right into Epping Road westbound should be reinstated as part of the Proposal.

In response, additional investigations were conducted and are reproduced in Appendix F. The results indicate that around 50% of the predicted increase in traffic was as a result of the reinstating of the right hand turn movement from Epping Road into Centennial Avenue northbound. The remaining additional traffic was as a result of the Centennial Avenue and Mowbray Road West routes becoming a quicker route to Chatswood as a result of the reduction in traffic volumes on Mowbray Road West and as a result of the reduced capacity on Epping Road.

It was considered that Centennial Avenue north of Epping Road had sufficient capacity to accommodate the additional traffic. It was suggested that local area traffic management measures such as additional parking on Mowbray Road West would reduce the attractiveness of this route. The Department concurs with this assessment and recommends the inclusion of Condition of Approval No. 37 requiring that Local Area Traffic Management measures be assessed and where possible put in place prior to opening with specific consideration of Mowbray Road West.

In regard to reinstating right turn movements from Centennial Avenue into Epping Road westbound, the RTA stated that a dedicated right hand turn bay would necessitate redesign of the interchange and property acquisition. The study found that a shared through and right hand turn lane (during non peak hours) would achieve a satisfactory level of service for the intersection but could lead to safety concerns. The Department believes that a substantial redesign of the intersection would not be necessary but recommends through detailed design of LATM measures that potential options for reinstating this movement be considered, so as to not compromise safety.

Barwon Road

Concerns were raised by some residents about traffic increases on Barwon Road as a 'rat-run' alternative to using Centennial Avenue. A morning peak hour 'boom gate' has been installed by Council on Moore Street to discourage these through trips. Some individual representations suggested that as part of the Proposal this through traffic should be removed.

The Proponent did not respond to these representations, however the Department understands that with reduced traffic volumes on Epping Road it is unlikely that this route would be as attractive to motorists. Further, Lane Cove Council may wish to retain the 'boom gates' for peak hour periods after Proposal opening. It is noted that traffic calming measures such as speedhumps and chicanes have already been installed in Barwon Road.

Mowbray Road West

Concerns were raised by some representations that reductions in road capacity on Epping Road could lead to higher traffic levels on Mowbray Road West. In response, the RTA reiterated that traffic modelling indicated that traffic levels on Mowbray Road West would substantially decrease as a result of the Proposal.

To further reduce the road capacity of Mowbray Road West and its attractiveness as an alternative route, the Department has recommended that the Local Area Traffic Management measures as part of the Proposal.

Pittwater, Badajoz and Wicks Roads

Representations including Ryde City Council raised concerns about the impacts of the Proposal on traffic levels on Pittwater Road and other north-south routes such as Badajoz and Wicks Roads. They were particularly concerned that reductions in capacity on Epping Road may increase the attractiveness of routes such as Pittwater Road.

As stated earlier the analysis predicted that there would be increases and decreases on these routes as a result of the Proposal but that these would not be significant. Again, the Department believes that it is appropriate that any Local Area Traffic Management measures look at ways of reducing traffic on these routes and encouraging traffic onto Lane Cove Road.

East Facing M2 Ramps at Lane Cove Road

Ryde City Council as part of its representation suggested that east facing ramps should be added from Lane Cove Road onto the M2 as part of the Proposal to reduce traffic congestion in the area. RTA did not respond and as such, any consideration of new ramps would be a matter between the RTA and Council and is beyond the scope of this Proposal and this assessment.

### 6.3.4 Conclusions

Traffic improvements would be predicted on most lower order roads due to substantial reductions in traffic levels where currently there are "rat runs". Epping Road, Delhi Road and Mowbray Road West would be the main beneficiaries whereas the north-south routes of Centennial Avenue, Pittwater Road, Badajoz and Wicks Road would experience reductions and some increases.

To reduce the likelihood of traffic increases and discourage toll avoidance the Department has recommended that the Proponent assess and install Local Area Traffic Management measures on these roads and any other local routes in the area where possible. Additionally the RTA would need to monitor traffic levels in the area after the Proposal opens to ensure that no local routes receive significant increases in traffic.

## 6.4 Public Transport Facilities

### 6.4.1 Background

A key commitment of the Proposal was the conversion of an existing traffic lane on Epping Road/ Longueville Road in each direction (currently a peak hour T3 transit lane) into a dedicated 24 hour bus

lane between Mowbray Road West and the Pacific Highway. The proposed bus lane would use the spare road capacity on Epping Road created as a result of the tunnel. As well as the bus lanes, some bus stops on Epping Road would be removed, indented where possible, or relocated to minimise spacing between stops to no more than 400m. The EIS stated that bus cycle times would be improved by approximately 10% as a result of these improvements. Further discussion of the overall benefits of bus and transit lanes is discussed in Section 5.3. The EIS stated that bus lane enforcement cameras would be installed at locations along Epping Road as part of the Proposal.

Following concerns raised by the STA, the RTA put forward a proposed modification in the Representations Report to create a bus interchange on the north–east corner of Epping and Longueville Roads incorporating a new pedestrian bridge across Epping Road. The bus interchange would consist of two platforms to cater for buses using the Gore Hill Freeway and Pacific Highway.

As part of the Representations Report, a modification to widen Epping Road to provide three continuous eastbound lanes between the Pittwater Road intersection and the intersection with Mowbray Road West was proposed. The RTA stated that this modification would improve bus flow through the area.

### 6.4.2 Key Issues Raised

A number of representations raised issues related to public transport provision along this corridor including:

- the need to consider more bus stops, including indentation, adequate shelter, access and real time information;
- the need for further details on the operation of the proposed bus interchange at Epping Road/Longueville Road including concerns about potential commercial/residential developments associated with interchange;
- the need for continuous bus lanes on Epping Road; and
- the need for further bus priority measures on Epping Road west of the Mowbray Road West intersection.

### 6.4.3 Consideration of Key Issues

Bus Facilities on Epping Road

The EIS proposes to relocate, close or amalgamate a number of bus stops as part of intersection relocations or the introduction of new pedestrian facilities. A number of bus stops would be closed including the Fraser Street Red Arrow Bus stop, stops near the Longueville Road intersection, 120 metres east of Munro Street and beside the Shell Service Station.

A number of representations requested additional or alternative bus stops and the amalgamation of some existing stops along Epping Road. TransportNSW's representation suggests further relocation of a number of bus stops along Epping Road, including the Epping Road westbound approaching McDonalds, eastbound near Johnston Crescent, Fraser Street stop and a number of stops east and west of Longueville Road. TransportNSW also suggested a number of improvements to bus bay arrangements, bus priority measures and the opportunity to incorporate real time information services along the corridor. The STA stated in its representation that the most important issues for public transport infrastructure included adequate shelter at bus stops, accessible bus stops and providing passengers with real time information on bus services.

In response, the RTA stated that it had reviewed the location and number of stops in conjunction with the Department of Transport, the State Transit Authority and private bus operators. The RTA proposed to establish a Public Transport Committee (PTC) during the detailed design phase to further assess bus stop requirements along the Epping Road corridor and the provision of bus facilities.

The Department endorses the commitment by the RTA to form a PTC and has incorporated it into recommended Condition of Approval 49. The PTC would be required to coordinate the provision of public transport measures in the corridor and other public transport opportunities resulting from a change in traffic and would be chaired by the Department of Transport.

Bus Interchange

A concept design of the proposed bus interchange is shown in Figure 6.2. The RTA stated that further development of the concepts for the bus interchange would be undertaken during detailed design in accordance with the urban design objectives for the Proposal. Some representations received subsequent to the Representations Report and PAR requested further details of the bus interchange including concerns about possible safety and security problems. The Department requested clarification that the proposed interchange was not premised on the inclusion of a commercial/residential development.

The RTA confirmed that the bus interchange facility was not proposed to include any commercial or residential development on residual land at this time. The RTA stated that the construction of the interchange provided potential development opportunities but that any development would have to be discussed with Lane Cove Council and would be subject to a separate development application. The Department endorses this approach.

In regard to the final design of the facility, the Department has recommended the inclusion of Condition of Approval No. 222 requiring the Proponent to prepare a specific Urban Design and Landscape Plan for the Longueville Road bus interchange and pedestrian overbridge. The Plan needs to include a review of pedestrian safety and visibility. Issues in relation to urban design are discussed further in Section 6.1.

Continuity of Bus Lanes

The STA and other representations raised concern that the proposed bus lanes on Epping Road would not be continuous near the intersections of some cross streets. The STA stated that there were a number of other examples of bus lanes that were continuous despite cross street access and that motorists were familiar with the ability to use the bus lane to make a left hand turn.

The Department concurs with the STA and believes that it is important that the continuation of a marked bus lane for the full length of Epping Road is required. Therefore, the Department recommends the inclusion of Condition of Approval No. 212 requiring that the Proponent install continuous 24 hour bus lanes in both directions.

Bus Priority Measures West of Mowbray Road West

Concerns were raised by the STA and Transport NSW in their representations about the lack of bus priority on Epping Road west of the intersection with Mowbray Road West and the tunnel portal. It was suggested that bus lanes or transit lanes should be incorporated.

In response the RTA conducted some modelling of various transit lane/bus lane arrangements through this section of Epping Road. As a result of these investigations, the Department recommends the inclusion of Condition of Approval No. 214 requiring the Proponent install a morning peak T3 – transit lane for eastbound traffic on Epping Road between Delhi Road and Mowbray Road West. This transit lane would start from the existing T3 transit lane on Epping Road west of Delhi Road and connect with the proposed bus lane on Epping Road east of the intersection with Mowbray Road West.

Due to traffic capacity restrictions associated with the merge with tunnel exit traffic in the westbound direction on Epping Road, the Department recommends the inclusion of Condition of Approval No. 213 requiring that the Proponent install bus priority facilities (such as 'B' signals) at the Epping intersections with Mowbray Road West, Pittwater Road and Delhi Road. The Department is confident that, with these proposed additional bus priority measures, a suitable level of improvement to bus services through this section can be achieved.

### 6.4.4 Conclusion

The Proposal will introduce a numerous measures to improve the public transport operation along the Epping Road corridor. These improvements include the provision of bus lanes, a new bus interchange facility at Longueville Road/Epping Road corridor and the amalgamation and relocation of bus stops to minimise delays in merging with the general traffic.

The Department has also recommended the continuity of bus lanes along Epping Road further transit lanes and further bus priority measures on Epping Road west of Mowbray Road West. These measures combined with the establishment of PTC would attempt to maximise outcomes for bus services through the corridor.

## 6.5 Noise and Vibration

### 6.5.1 Background

Residents near Epping Road are currently subjected to high road traffic noise levels due to the substantial traffic movements on Epping Road. Background noise level monitoring found day time $L_{Aeq}$ levels of up to 73 dB(A) and night time levels of up to 69 dB(A). Typical day time maximum noise levels up to 86 dB(A)were measured. It was estimated that relevant traffic noise criteria were exceeded at approximately 545 dwellings by up to 13 dB(A) during both day time and night time periods. The EIS divided receptors along Epping Road into a number of noise catchment areas (NCAs) as shown in Figure 6.3.

The EIS estimated that there would be construction impacts associated with road widening works (including bridge construction) on residences close to Epping Road between Mowbray Road West and Wicks Road. These works are predicted to have substantial exceedances of construction noise guidelines in some cases (up to 35 dB(A)). There would also be surface construction works on the surface east of Mowbray Road West to widen the corridor.

Most receptors near Epping Road would largely benefit from a reduction in road traffic noise as a result of the Proposal. The EIS estimated that road traffic noise would remain above EPA guideline levels at the nearest receptors to Epping Road, east of Mowbray Road West, but would reduce by up to 4 to 5 dB(A) in $L_{Aeq}$ terms (*i.e.* traffic noise loudness taking into account the level and frequency of noise events) after tunnel opening. Residents affected by Epping Road traffic noise west of Mowbray Road

West would have increases of approximately 1.3 dB(A) due to increased traffic volumes and the widened road corridor bringing this traffic closer to some receptors.

### 6.5.2 Key Issues Raised

Concerns were raised in regards to increased road traffic noise levels and the need for noise barriers associated with the Epping Road widening.

### 6.5.3 Consideration of Key Issues Raised

Construction Noise

The RTA has committed to undertaking the majority of construction work during standard working hours and to extensive community consultation prior to construction activities. The Department supports these commitments and has recommended a number of Conditions of Approval including preparation of construction noise management plans and impact statements designed to ensure that the construction of the Proposal utilises best practice measures. These recommended Conditions of Approval are further outlined in Section 8.3.

Epping Road Traffic Noise

The RTA stated that as a result of the reduction in traffic on Epping Road and the separation of houses from general traffic by bus lanes, road traffic noise would reduce east of Mowbray Road West following opening of the Proposal. The RTA assessed the impacts on receptors near Epping Road as part of a cost effectiveness and feasibility assessment in the Representations Report. This assessment recognised that road traffic noise levels for receptors near Epping Road west of Mowbray Road West would increase. It was stated that as these levels were predicted to be less than 2 dB(A) they would not be perceptible to receptors. The residential area near the junction of Wicks and Epping Roads (W01) was predicted to have noise levels below the ECRTN criteria levels and therefore no mitigation measures were necessary. All other NCAs assessed along Epping Road were predicted to experience reductions in traffic noise levels as a result of the Proposal. Although a number of these areas would still have traffic noise levels above the criteria the RTA stated that noise barriers were not proposed.

The Department although cognisant that the operational noise levels along areas of Epping Road would be above the relevant ECRTN levels believes that as the Proposals would significantly reduce noise levels it would not be reasonable to require the installation of noise mitigation. Noise barriers would also be out of character with future urban design Proposal for a boulevard character and connectivity of Epping Road.

Bus Interchange at Longueville/Epping Road intersection

As described in Chapter 4 and Section 6.4 the modified Proposal includes the provision of a new bus interchange on the north-eastern corner of the Longueville/Epping Road intersection. The demolition of the four buildings on the site of the proposed interchange would mean that house and units at the rear of this area would be exposed to elevated traffic noise levels from both Epping Road and the new bus interchange.

The Representations Report indicates that the traffic noise levels are predicted to be up to 12 dB(A) above the relevant criteria at the nearest sensitive receptors. To reduce predicted noise levels to the relevant criteria 3.2 m noise barriers would need to be constructed around the rear of the bus

interchange. The Representations Report suggests that barriers at 3.2 m height may not be appropriate due to visual impacts and the need for vehicular access to the rear of one of the properties. It was suggested that various treatments such as a combination of barriers and architectural treatment would be considered in consultation with residents during detailed design and in consultation with residents affected.

The Department endorses the RTA's commitment to consult with residents about effective noise management during the detailed design stage.

### 6.5.4 Conclusions

Construction works on Epping Road, although temporary, would cause significant noise impacts on close receptors. The Department has recommended the inclusion of a number of conditions including requirements to produce site specific Noise Impact Statements to minimise noise wherever possible. The majority of construction works associated with the proposed surface works on Epping Road would be undertaken during the day reducing impacts on residential areas during the evening and night time periods.

The proposed Lane Cove Tunnel would remove a substantial amount of traffic from Epping Road east of Mowbray Road West reducing noise on nearby receptors. West of Mowbray Road West there would be increases in road traffic noise as a result of higher traffic flows. Although the predictions are for relatively small incremental increases in road traffic noise the Department recommends the inclusion of Condition of Approval No. 60 requiring detailed monitoring of road traffic noise after opening.

## 6.6 Property Impacts – Surface Improvements

### 6.6.1 Background

Surface roadworks proposed along Epping Road and Longueville Road to improve amenity and traffic flow would involve some property acquisition.

Key acquisition requirements include:

- part properties for the Mowbray Road deviation, cycleway, merging lane and a substation compound;
- various acquisitions affecting 10 properties along Epping Road, Moore Street and Centennial Avenue for cycleway and road widening including an easement over the BP Service Station close to the corner of Epping Road and Centennial Avenue;
- four properties on the corner of Parklands Avenue and Longueville Road for a bus interchange; and
- acquisitions affecting sixteen properties along Birdwood Avenue, Longueville Road, Phoenix Street and Mafeking Avenue for the cycleway.

### 6.6.2 Key Issues Raised in Representations

Representations received on the EIS raised the following key issues:

- objection to land acquisition and concerns regarding property values;
- land acquisition would make operation of the BP service station difficult;
- compulsory acquisition of land would reduce economic value of properties and restrict future land acquisition;

- acquisition requirements on Epping Road between Ryrie St and Wicks road are unclear; and
- concerns about the removal of street trees and private vegetation.

### 6.6.3 Consideration of Key Issues

A number of representations raised concerns that property values would be reduced as a result of acquisition required for the Epping Road surface improvements.

The Proponent contends that property acquisitions have been kept to a minimum and that any land not required for operation of the Proposal would be rehabilitated. It is further stated that benefits from reduced traffic on Epping Road, improved access, reduced noise and improved air quality through the corridor which would provide a positive impact on the general property values in the area.

The Department considers that the Proposal has minimised the potential property impacts. However, a number of conditions of approval are recommended for privately owned land acquisition or temporary leasing over the construction period. These include acquisition in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and/or access requirements and rectification of damage to property as a result of direct or indirect impacts.

Business Impacts

The acquisition of an easement along the Epping Road frontage of the BP service station is proposed. BP submitted a detailed representation outlining the impacts of the changed property boundary and the relationship to its petrol and gas storage tanks. This indicated that the proposed acquisition would mean that the service station would not be able to comply with the relevant Australian Standards and its Dangerous Goods licence. The representation makes specific reference to *AS1940 The Storage and Handling of Flammable and Combustible Liquids* and *AS1596 The Storage and Handling of LP Gas*.

The acquisition proposed in the EIS would have moved the property boundary to within minimum setback distances required by the standards. In response, the RTA has amended the Proposal to acquire an easement rather than acquiring the land so that the property boundary would remain unchanged and therefore the amended Proposal would satisfy the requirements of AS1940.

AS1596 refers to the distance to a *public place.* Therefore, even if an easement is acquired, the public place (cycleway and footpath) may be within the minimum distances required. This may require amendment to the Proposal during detailed design to ensure full compliance with the standard. Recommended Condition of Approval No. 219 requires that the design and land/easement acquisition ensure that the relevant standards for the operation of the service station are met.

Mowbray Road Intersection

A representation was made by Penfords Australia Ltd at 710 Epping Road, concerned that acquisition of land presently used for car parking will reduce the level of carparking available onsite to an unacceptable level. Other issues such as access to and from their site, particularly for heavy vehicles are also of concern.

The Department considers that these issues are important, as it is essential that businesses experience the minimum possible disruption through the construction and operational phases. This issue applies to other businesses along the length of the road works. In response, the Department has included

Recommended Condition of Approval No. 218, which requires the preparation of a Business Management Strategy.

### 6.6.4 Conclusion

Whilst some property acquisitions would be required for the construction of the Proposal much of this would be partial acquisition for the cycleway and pedestrian path. Easement acquisition at the BP Service Station could have implications for the owners' operating licence, however the Proposal may require minor modification during detailed design.

# 7 ASSESSMENT OF KEY ISSUES RELATING TO GORE HILL FREEWAY IMPROVEMENTS

*This Section of the Report provides the Department's assessment of the key environmental impacts of the modified Proposal related to the Epping Road surface based on an examination of the EIS, issues raised in representations during the exhibition period and the Proponent's response to these issues in its Representations Report and during further consultation with the Department. The Department's assessment of the other environmental issues related to other elements of the Proposal are addressed in Sections 5, 6, 8 and 9 of this Report.*

## 7.1 Falcon Street Ramps

### 7.1.1 Background

The Proposal includes the provision of new north-facing exit and entry ramps to/from the Warringah Expressway to Falcon Street as shown in Figure 4.5. The new ramps would necessitate some changes to the interchange at Falcon Street/Military Road to ensure efficient traffic movement. Modifications to the interchange include the realignment of Merlin Street at its intersection with Military Road and the possible purchase of some land from the southern side of the residential 'island' between Military Road and Falcon Street to allow access to the ramp.

Use of the ramps would be tolled at an indicative level of $1 (1999 dollars) in each direction to help cover the costs of the entire Proposal, including the ramps and widening of the Gore Hill Freeway. The RTA has stated that the Falcon Street ramps are integral to the Proposal, helping facilitate an east-west route between the North Shore and North-West Sydney and that they would address a long term structural deficiency in the road network. The ramps would reduce traffic currently using Falcon Street and the Pacific Highway through Crows Nest and St Leonards.

### 7.1.2 Key Issues Raised

Key issues raised in representations related to the Falcon Street ramps included:

- need for redesign of Military Road / Falcon Street interchange including removal of the 'residential island';
- concerns about increased traffic, noise and reduced access for pedestrians and public transport through the intersection; and
- justification and equity issues related to the proposed toll.

### 7.1.3 Consideration of Key Issues Raised

Design Issues

A number of representations, including one from North Sydney City Council, suggested that the proposed ramps should only be constructed as part of a broader scheme to widen Falcon Street east of the Warringah Expressway to allow for two-way traffic flows. This would require removal of the 'residential island' between Military Road and Falcon Street and redevelopment of this area.

North Sydney City Council also made a representation to the Department subsequent to the exhibition of the PAR further recommending that the whole interchange be 'redesigned' as part of the Proposal.

Council noted in its representation that they had begun a master planning process for the area including the residential island.

In response, the RTA recognised previous schemes for widening Falcon Street, including resumption of the 'residential island' and redevelopment of the area. However, these works were not part of the Proposal as there was minimal, if any, benefit in traffic flow or network operation from these works. It was further stated in the Representations Report that the proposed north-facing ramps and the changes to the intersection arrangement would not prevent or inhibit construction of any future widening scheme for Falcon Street.

Whilst the Department is cognisant of the concerns raised about the intersection design and the removal of the 'residential island', from a statutory point of view, the Department must assess the Proposal as submitted by the RTA. Nonetheless, given that North Sydney City Council has indicated that it is undertaking a master planning exercise for the area, the Department has recommended the inclusion of Condition of Approval No. 236 requiring the RTA to consult with Council and incorporate any relevant recommendations of the master planning process during detailed design.

Operational Impacts

A number of representations raised concerns that the new northbound ramps would lead to higher traffic flows on Military Road and Falcon Street, particularly east of the Warringah Expressway. There was concern that these increased traffic flows would increase noise, air pollution, and reduce safety and accessibility for local residents. Concerns were raised about the Proposal's impacts on the Merlin Street/Military Road intersection and that the new intersection arrangements would inhibit pedestrian, cyclist and public transport movements.

The Proposal would result in only marginal traffic increases on Military Road / Falcon Street (estimated to be up to 7% in the PM peak in 2016). The Department considers that the impacts on noise and air pollution due to the Proposal in this location to be minor.

*Noise*

The Representations Report included an assessment of feasible and reasonable noise treatments for road traffic noise. Three (3) noise catchment areas (NCAs) were assessed near the proposed Falcon Street ramps (refer to Figure 6.4). Although the assessment predicted that noise levels would not increase in these NCAs by more than 2 dB(A) due to the Proposal, noise mitigation measures were investigated as noise levels were predicted to be above 65 dB(A). The conclusion of this assessment was that:

- no additional treatment was proposed for NCA-EO14 (the residential island) there is limited is any opportunity for noise mitigation;
- a new 7m noise barrier would be constructed east of Warringah Expressway and adjacent to the proposed off-ramp north of Military Road (NCA – E015); and
- architectural treatments would be offered to owners of ground and first floor dwellings west of the Warringah Expressway where road traffic noise was predicted to be above 65 dB(A) (NCA – E016).

Since the Representations Report, the Department has raised concerns with the RTA about the scale of the proposed 7m noise barrier. In response, the RTA stated that the 7m noise barrier was indicative only and would be subject to discussions with local residents. At the Departments request, the RTA produced artist's impressions of the barriers shown at Figure 7.1. These indicate that barriers could be

effectively screened from the roadway, but do not indicate the likely visual impacts from the residences. The Department therefore recommends Condition of Approval No. 241 requiring the RTA to assess appropriate noise mitigation measures based on the RTA's Environmental Noise Management Manual that considers cost effectiveness and community views.

*Transport and Pedestrian Access*

Representations raised concerns about the performance of the Merlin Street and Military Road intersection which is predicted to deteriorate to an unacceptable Level of Service (LoS) F. The changes to the Merlin Street intersection operation were primarily due to pedestrian crossings across Falcon Street and Military Road. The RTA has modified the Proposal intersection to include three (3) lanes on the southbound Warringah Expressway to improve traffic flow through the area, resulting in a LoS D. The Department is satisfied that this modification and other potential changes to the intersection during the detailed design stage would ensure that efficient traffic flows can be maintained.

To improve pedestrian access through the proposed intersection the RTA has modified the Proposal to include a pedestrian walkway on the southern side of Falcon Street between Merlin Street and St Leonards Oval. A multi-staged pedestrian crossing of Falcon Street and Military Road between the northern and southern sides of Merlin Street as described in the EIS would be retained. The Department is satisfied that such measures would result in a range of improvements and not negatively impact on pedestrian access through the area. Condition of Approval No. 235 is recommended to ensure that pedestrian access through the area is maintained.

In response to concerns raised about impacts on bus travel times through the revised interchange, the RTA conducted additional modelling which found that there would not be any perceptible impacts on bus travel times. Modelling showed that most traffic flow increases through the intersection would occur in the counter-peak direction, reducing any significant delays to buses.

The STA in its representation raised concerns that the Proponent had not clearly stated bus priority measures through the area including the need for a bus indent bay near Merlin Street north and the need for bus lanes in the eastbound direction. The Department has therefore recommended the inclusion of Conditions of Approval Nos. 238 and 237 requiring the installation of a bus indent bay near Merlin Street North and the installation of a continuous bus lane in the eastbound direction to the Big Bear Shopping Centre.

Based on the RTA's traffic modelling, the proposed north-facing ramps would significantly reduce traffic on Falcon Street west of the Warringah Expressway. To ensure that the additional road capacity created is not taken up by potential induced traffic the Department recommends Condition of Approval No. 239 and 240 which requires investigations into the potential installation of bus lanes or other measures as agreed to by the Director-General. The Department notes that a relatively low number of buses use this route, reducing the need for the installation of a bus lane.

The Department is satisfied that the environmental impacts of the proposed north-facing Falcon Street ramps and modified interchange would be relatively minor. Issues in regard to local area traffic management are discussed in Section 7.2.

<u>Toll Justification</u>

The Department and several representations to the EIS raised concerns that there was insufficient justification in the EIS for charging a toll on the proposed Falcon Street ramps. A number of

representations were concerned about the equity of a toll on motorists using the Falcon Street ramps particularly as it was suggested that the toll was not reflective of the actual costs of construction of the ramps. It was also suggested that a toll could not be justified for a piece of infrastructure that the RTA identified as addressing a 'structural deficiency' in the road network.

In response, the RTA stated in the Representations Report that it would be necessary to increase the proposed toll for the tunnel if no toll were charged at the Falcon Street ramps and that this would cause increased traffic on Epping Road due to toll avoidance. The RTA stated that the proposed ramps were a key Proposal element and when combined with a widened Gore Hill Freeway and new Lane Cove Tunnel, dramatically improved east-west traffic connections between North-West Sydney and the North Shore/Northern Beaches.

To further substantiate a nexus between the ramps and use of the Gore Hill Freeway and Lane Cove Tunnel, the RTA provided a 'select link' traffic analysis with a toll, indicating the routes of the cars using the ramps. The analysis indicated that between 73% and 87% of Falcon Street ramp traffic would use the Gore Hill Freeway and between 47% and 62% would use the Lane Cove Tunnel.

In comparison, a select link analysis of a non-tolled scenario indicated that significantly higher volumes of traffic would use the ramps if there were no toll and between 67% and 77% of traffic from the Falcon Street ramps would use the Gore Hill Freeway and between 33% and 46% would use the Lane Cove Tunnel. The proportions indicate that without tolling the ramps, there would be a greater proportion of traffic using the ramps for 'local' trip making mixing with regional traffic on the approach routes. Further analysis found that without tolling the ramps, 3.6% of the total road user benefits estimated to accrue from the Proposal would not eventuate.

Another way of interpreting the results of the 'select link' analysis is that the modelled vehicles using the ramps and not the Lane Cove Tunnel are in some way benefiting from the Proposal either by use of the ramps themselves or the widened Gore Hill Freeway. If no toll was levied on these road users then it could be argued that this traffic was being subsidised by those paying increased tolls in the Lane Cove Tunnel. Whilst it is unusual for ramps to be specifically tolled, the use of tolls for new road infrastructure in Sydney has recently become more common (*e.g.,* William Street ramps on the Eastern Distributor). A toll on the Falcon Street ramps is not considered inconsistent with current practice.

The Department is satisfied that the results of the select link analysis indicate a sufficient nexus between predicted users of the north-facing Falcon Street ramps and use of the Gore Hill Freeway and Lane Cove Tunnel.

To maximise the benefits of the Proposal to public transport services (including cross-regional bus services) the Department recommends inclusion of Condition of Approval No. 56 which exempts all scheduled bus services from payment of any tolls on the Proposal including the Falcon Street ramps.

### 7.1.4 Conclusion

The Department believes that the RTA has sufficiently demonstrated the need for the proposed north-facing ramps at Falcon Street. The ramps would reduce the regional traffic movements on Falcon Street and the Pacific Highway allowing for the provision of dedicated bus lanes on the Pacific Highway as part of the modified Proposal.

The majority of the traffic predicted to use the ramps is also predicted to use the Gore Hill Freeway and Lane Cove Tunnel. This indicates a nexus between the components of proposed works and provides a connection between the proposed ramps and the charging of a toll.

East of the Warringah Freeway the proposed ramps are predicted to result in minor increases in traffic flows on Military Road mainly in the counter peak direction. It is not expected that these minor increases would result in significant impacts air or noise pollution, or impacts on public transport travel times.

## 7.2 Local Access and Traffic Management

### 7.2.1 Background

Traffic modelling in the EIS included predictions for traffic levels on the Gore Hill Freeway, Pacific Highway and connecting roads. Changes in traffic patterns on the Mowbray Road West and roads further west are discussed in Section 6.3. Changes in traffic patterns on Falcon Street and Military Road as a result of the Falcon Street ramps are discussed in Section 7.1, however, changes to the Pacific Highway and Ernest Street are discussed further below.

Pacific Highway

The Proposal would, in general, result in substantial benefits to traffic levels on the Pacific Highway particularly to the south of the Gore Hill Freeway/Longueville Road intersection. A summary of the morning and evening peak hour reductions in 2006 and 2016 as a result of the Proposal are shown in Table 7.1.

**Table 7.1 Pacific Highway Traffic Reductions**

| | Morning Peak Hour Increase/(Reduction) | | Evening Peak Hour Increase/(Reduction) | |
|---|---|---|---|---|
| Location | 2006 | 2016 | 2006 | 2016 |
| Pacific Hwy Nth of GHF NB | (39%) | (34%) | (43%) | (45%) |
| Pacific Hwy Nth of GHF SB | (14%) | (11%) | (45%) | (42%) |
| Pacific Hwy Nth of Greenwich Rd NB | 3% | (4%) | 8% | 5% |
| Pacific Hwy Nth of Greenwich Rd SB | (29%) | (15%) | (27%) | (19%) |
| Pacific Hwy East of Christie St EB | (27%) | (23%) | (18%) | (19%) |
| Pacific Hwy East of Christie St WB | (21%) | (22%) | 9% | 17% |

Reductions are due to traffic reassigning trips to the Gore Hill Freeway/Lane Cove Tunnel due to improved travel times and capacity and the Falcon Street ramps. Where increases are predicted these are generally in the counter peak direction and/or are only marginal. To ensure that the additional road capacity on the Pacific Highway was not taken by induced traffic, the RTA proposed the installation of bus lanes where transit lanes currently exist.

Marginal decreases to traffic levels are predicted north of the Mowbray Road West/Pacific Highway intersection.

Gore Hill Freeway and Surrounds

Significant increases in traffic levels on the Gore Hill Freeway (GHF) (36% additional traffic in 2006 in the morning peak hour EB, 32% additional traffic in 2006 in the evening peak WB) are predicted with the

Proposal. An additional lane is proposed in each direction on the GHF between the Pacific Highway and the Willoughby Road intersections to accommodate this increase in traffic.

Westbound traffic on the Gore Hill Freeway wishing to exit at the Pacific Highway would no longer be able to make the left hand turn on to the Pacific Highway southbound due to reconfiguration of this intersection. Traffic modelling shows that preventing this movement has the affect of increasing movements on the GHF ramps at Reserve Road significantly increasing flows north and south of the Gore Hill Freeway. Northbound annual average daily traffic (AADT) levels on Reserve Road were predicted to increase by up to 58% with the Proposal which increase traffic movements on other roads through Artarmon such as Jersey and Hampden Roads. The EIS suggested that these increases north of the GHF were largely due to Chatswood-bound traffic avoiding the Pacific Highway and Mowbray Road alternative route due to low the low level of service at this intersection.

Traffic volumes on Willoughby Road are predicted to be at similar levels with or without the Proposal. AADT levels are predicted to increase by up to 6% for southbound traffic and decrease by up to 4% for northbound traffic.

Traffic volumes on Ernest Street would increase significantly in some locations with the Proposal (28% AADT increase westbound east of Miller Street and up to 31% AADT increase eastbound east of Merlin Street). The EIS suggested that the increases on Ernest Street predicted were largely as a result of traffic being 'pushed' from Falcon Street by traffic wishing to use the new ramps. It was stated that Ernest Street had sufficient capacity to accommodate the additional traffic volumes.

### 7.2.2 Key Issues Raised

A number of representations including those from Willoughby City Council and North Sydney City Council raised issues in relation to the effects of the Proposal on local traffic flows. The key issues raised in representations were:

- concerns in regard to additional traffic on Reserve Road and lower order roads in Artarmon and Naremburn;
- concerns about the deletion of left hand turns onto the Pacific Highway from the Gore Hill Freeway and performance of the intersection; and
- the need for local traffic Improvements on the Pacific Highway and surrounds to take advantage of reduced traffic.

### 7.2.3 Consideration of Key Issues Raised

<u>Reserve Road and Surrounds</u>

A number of representations raised concerns in regard to the significant traffic level increases on Reserve Road and surrounding roads. Some representations raised concerns about increases on roads through Artarmon such as Jersey, Hampden and Barton Roads north of the GHF. Others were concerned about increased traffic south of the GHF through the Artarmon industrial area and into the Naremburn residential area.

Willoughby City Council suggested that the right turn facility from Pacific Highway northbound to Mowbray Road eastbound should be lengthened and widened to increase the attractiveness of this route. Notwithstanding, Council officers advised that traffic calming measures have been installed on roads connecting to Reserve Road and that there are few options for additional local area traffic

management measures and these would be unlikely to have a significant effect in reducing traffic through this area.

In response to concerns raised, the RTA undertook additional modelling of Reserve Road and surrounding roads north of the GHF. The assessment found that the traffic flow impacts in Artarmon had been overstated in the EIS. Traffic modelling on Reserve Road at a point further north than that modelled in the EIS showed that two way AADT levels were predicted to increase 20% in 2006 and 29% in 2016 as a result of the Proposal. When connecting roads were modelled, the increases were further reduced for example Hampden Road through the Artarmon shops would increase by only 9% in two-way AADT flows in 2006.

The RTA stated that some of the additional traffic on Reserve Road and through Artarmon was through traffic diverting from alternative routes such as the Pacific Highway. It was also found that a relatively large proportion of the additional traffic was locally generated and accessing the GHF and improved connectors through Reserve Road.

Additional modelling of the Pacific Highway and Mowbray Road West intersection was undertaken with an increased capacity right turn as suggested by Willoughby Council. This found that the Proposal would result in slight improvements to the intersection performance although in 2016 the intersection would operate at a LOS F in the morning peak hour. Measures such as widening and lengthening the right turn bay from Pacific Highway (northbound) to Mowbray Road (eastbound) and introducing a dedicated left turn bay from Mowbray Road (westbound) to Pacific Highway (southbound) were considered. Despite slight improvements to intersection performance with the inclusion of the suggested measures, a LOS F in the morning peak hour was still predicted.

The RTA did not specifically respond to the concerns raised about additional traffic on Reserve Road south of the GHF and the potential to 'spill over' into the Naremburn residential area. The EIS however, suggested that as traffic travelling southbound would be forced to use roads such as Cleg Street and Frederick Street, the amount of 'spill over' to residential areas would be minimised.

The Department believes further investigation of measures to reduce the attractiveness of roads through Artarmon and has recommended the inclusion of Condition of Approval No. 34. Additionally the Department has recommended Condition of Approval No. 33 requiring that the RTA monitors traffic levels in Artarmon and at the intersection of Pacific Highway and Mowbray Road after Proposal opening. Additional measures must be put in place should significant increases in traffic be measured through Artarmon. The intersection of the Pacific Highway and GHF is discussed below.

In relation to Naremburn, the Department believes that traffic wishing to access this area via Reserve Road is likely to be local traffic switching from other routes such as the Pacific Highway.

Pacific Highway Intersection

Concerns were raised by some representations about the operation of the revised interchange of Longueville Road/Lane Cove Tunnel/Pacific Highway and Gore Hill Freeway interchange. There was concern regarding the deletion of left hand turn for westbound Gore Hill Freeway traffic southbound onto the Pacific Highway. Some of the concerns raised in representations were linked to concerns about additional traffic on Reserve Road and through the Artarmon area (refer to above discussion).

In response, the RTA stated that the modelling indicated that the deletion of the left hand turn would only result in approximately 70 vehicles per hour in the peak period being forced to use the Reserve

Road exit. The issues in regard to the intersection were not addressed in the Representations Report. Working Paper No. 4 of the EIS, however, included an assessment of the intersection which showed that the Level of Service for all existing movements would be improved with the Proposal.

Pacific Highway Local Traffic Measures

A few representations suggested that the RTA undertake local traffic improvement works on the Pacific Highway including additional right turns to take advantage of reduced traffic levels on the Pacific Highway.

In response to the issues raised, the RTA has modified the Proposal to include the installation of dedicated peak hour bus lanes on the Pacific Highway where transit lanes currently exist between North Sydney and the Longueville Road intersection. The bus lanes would be installed to 'take up' the additional road capacity on this section of the Pacific Highway created by the Proposal.

The Department believes that given the reductions in traffic predicted on the Pacific Highway in this area that the RTA look at LATM measures for connecting roads such as reinstating right hand turn movements where required and has required that these measures be addressed as part of the recommended Condition of Approval No. 37.

### 7.2.4 Conclusions

The Proposal would result in substantial reductions in traffic volumes on the Pacific Highway. The additional traffic generated as a result of the Proposal would be funnelled onto the Gore Hill Freeway which would be widened to accommodate the flows. The advantages of the Gore Hill Freeway/Lane Cove Tunnel route would however result in increased traffic on Reserve Road and more vehicles through lower order streets in Artarmon.

To reduce the likelihood of these increases, the Department has recommended that the Proponent investigate and install LATM measures for Artarmon. The Department has also recommended that the RTA investigate measures such as the installation of right hand turns at some intersections to take advantage of the reductions in traffic on the Pacific Highway.

## 7.3 Cyclists and Pedestrians

### 7.3.1 Background

The Proposal includes the provision of a 3m wide cycleway or a 4m wide shared cycleway/shared pedestrian footpath (intended for pedestrian and pedal bicycle use) from Wicks Road North Ryde to Park Road Naremburn. This section considers the cycleways and pedestrian paths along the Gore Hill Freeway corridor.

The RTA has proposed a modification to the works at the Willoughby Road interchange that would necessitate the cycleway being relocated from the freeway shoulder to adjacent to and behind existing noise walls on the southern side of the freeway. The route would pass through the parking area in front of the shops at the Willoughby Road interchange before crossing the Gore Hill Freeway. The existing pedestrian overbridge would be converted for cyclist use and a new pedestrian bridge constructed adjacent to and on the northern side.

The EIS states that the cycleway facilities, including the Gore Hill Freeway corridor section of the link, would connect with future cycleways to be provided between the Sydney Harbour Bridge and the north west of Sydney, thereby contributing to reduced car dependency. These connections are shown on Figure 6.1.

The EIS states that improved cyclist access would also be provided at the Pacific Highway and Gore Hill Freeway as cyclists would be able to access the Pacific Highway via a shared pathway or continue east along a shared pathway that runs underneath the Pacific Highway. Pedestrian facilities are proposed at the Reserve Road ramps. A cantilever structure would provide pedestrian access along the southern side of Falcon Street, enabling access to facilities in North Sydney.

### 7.3.2 Key issues Raised

The key issues raised in the representations regarding cyclists included:

- the need for a pedestrian crossing of the Gore Hill Freeway;
- the need to maintain or improve pedestrian access along Falcon Street over the Gore Hill Freeway
- issues of privacy, security, loss of vegetation, effects of noise and lighting, safety of pedestrians and cyclists, and the potential for flooding of the off-road facility in Naremburn; and
- the need for additional cycleway facilities in Naremburn and alternative options including the construction of a new cycleway on the northern side of the Gore Hill Freeway.

### 7.3.3 Consideration of Key Issues

Cycleway

The RTA advised that the cycle route along and beneath the Gore Hill Freeway was chosen as it was considered suitable for all users and links with existing and future routes.

In order to address the concerns regarding security and safety, the RTA propose a modification to the comprising three components: elevating and relocating the section of the cyclist route near Reserve Road, maintenance of the existing access ramp to Reserve Road from the Gore Hill Freeway cycleway via Dickson Avenue to avoid property acquisition, and moving the Flat Rock Creek section of the facility further into the batter between the Flat Rock Creek channel and the Gore Hill Freeway.

The Department agrees that the modifications proposed would avoid the need for property acquisition, the changes to the Flat Rock Creek section would provide a suitable area for vegetative screening from Olympia Road residents and that there will be no additional contribution to local flooding. Notwithstanding, the RTA is continuing to investigate options for incorporating the cycleway with in the existing path through this section, however grades at either end are not currently suitable for cyclists. The location of the cycleway would be further from the property boundaries, however, as it is on higher ground, additional privacy issues would need to be addressed at the detailed design stage (refer to Recommended Condition of Approval No. 233).

The Department recognises the need to relocate the cycleway to an off-road facility to enable all road widening at Willoughby Road to be included within the road reserve. The modification would provide an acceptable alternative with the added benefits of connections across the Gore Hill Freeway near Ruth Street (existing path beneath the viaduct) and via the existing pedestrian bridge at Willoughby Road. The Department concurs with these modifications and considers that the additional connectivity is a benefit that would otherwise not be realised.

Pedestrian Facilities

*Reserve Road*

A number of representations were received regarding the need to reinstitute a crossing of the Gore Hill Freeway. The RTA advised that pedestrian facilities would be provided to enable crossing of Reserve Road. Willoughby City Council raised pedestrian access across Reserve Road as a concern. Council stated that there is currently high pedestrian usage along Reserve Road and across the Gore Hill Freeway between Artarmon residential and industrial areas. Currently there are no dedicated pedestrian crossing points. It is considered that these would be necessary from a safety perspective, particularly if the increased traffic levels predicted for Reserve Road are realised. Council suggested that a signalised crossing could be provided without causing delay to the phasing of the lights for the Reserve Road ramps. The Department concurs with this and has Recommended Condition of Approval No. 232 which requires the installation of pedestrian crossing on Reserve Road near the Gore Hill Freeway.

*Falcon Street*

Representations also raised concerns regarding the need to maintain existing pedestrian routes to facilities along Falcon Street. The RTA has addressed this concern through the construction of a cantilever path to the southern side of Falcon Street. This would provide unimpeded access along both the northern and southern sides of Falcon Street improving pedestrian access. The RTA advises that the proposed multi-phase, at grade pedestrian crossing would be reassessed following completion of the Proposal to determine the delay to traffic movements caused by the crossing, particularly to bus movements on Falcon Street. However, the Department recommends that an at-grade pedestrian crossing be maintained between Merlin Street on either side of Falcon Street.

### 7.3.4 Conclusions

The Department believes that the RTA has sufficiently demonstrated that the Proposal meets the pedestrian and cyclist objectives as outlined in the EIS. The cyclist route connects the Lane Cove area, particularly the Epping Road corridor to the M2 in the west and St Leonards, the lower North Shore and the Sydney Harbour Bridge. The route, working with the physical constraints, offers a reasonable balance between commuter and recreational alternatives. In principle, the Department concurs with the cycleway and proposed modifications but recognises that further investigations during detailed design would seek to further enhance the Proposal, particularly with respect to the location, safety and privacy.

The Department recognises that the Proposal offers some improvements for pedestrians living and working in the vicinity of the Gore Hill Freeway. The provision of pedestrian access on the southern side of Falcon Street would offer an alternative means for accessing facilities in this highly trafficked area.

## 7.4 Noise and Vibration

### 7.4.1 Background

The Gore Hill Freeway (GHF) proceeds through the residential areas of Naremburn and Artarmon and the Artarmon industrial area. Existing noise barriers and mounding are situated along the majority of both sides of the GHF to reduce existing road traffic noise.

The EIS recognised that the proposed works associated with the widening of the GHF would lead to construction related noise and increases in road traffic noise for the surrounding area. Background noise measurements were undertaken as part of the EIS in the vicinity of the GHF and indicative noise catchment areas (NCAs) were defined. These catchments are shown in Figure 6.3.

The EIS estimated that construction activities associated with the widening of the viaduct on the GHF and the works associated cut and cover tunnelling and intersection works at Willoughby Road would result in exceedances of relevant construction noise guideline levels.

In relation to operational noise the EIS estimated that the combination of higher traffic volumes and the closer proximity of traffic on the GHF would increase road traffic noise by up to 2.8 dB(A) at the nearest sensitive receptors. Criteria levels adopted were based on the EPA's Environmental Criteria for Road Traffic Noise (ECRTN) which recommends for a redevelopment of a freeway $L_{Aeq\ (15\ hour)}$ (daytime) limits of 60 dB(A) and a $L_{Aeq\ (9\ hour)}$ (night time) limit of 55 dB(A). The existing noise barriers and mounding on the GHF were designed to meet existing noise criteria at the time of opening, that being an $L_{A10\ (18hour)}$ of 63 dB(A). The EIS included a brief assessment of the need for architectural and or barrier treatments to meet the ECRTN levels and it was concluded that barriers up to 8m high would be required to meet the relevant criteria levels (refer below for further discussion of reasonable and feasible noise control measures).

### 7.4.2 Key Issues Raised

The key issues raised in representations:

- concerns raised about noise near the GHF during construction and the need for tight restrictions on construction hours;
- concerns that gaps in the GHF noise barriers would continue to undermine noise attenuation;
- concerns about the noise impacts of road widening on upper floors of units in close proximity to Willoughby Road; and
- concerns about the noise impacts on areas of Artarmon as a result of additional traffic.

The Department also requested that a further cost effectiveness assessment be undertaken to evaluate realistic noise mitigation for elevated road traffic noise on the GHF.

### 7.4.3 Additional Investigations

The Department raised concerns that the Proponent needed to further investigate traffic noise levels associated with the upgrade to the GHF based on realistic noise control measures. This concern was raised as the EIS was predicated on the noise controls required to meet relevant criteria levels, whereas in reality control measures would be based upon cost effectiveness investigations.

In response to these issues, the RTA in the Representations Report completed a Cost Effectiveness and Feasibility Study for Noise Control Options. The assessment was based on guidelines for application of noise control measures detailed in Practice Note IV of the recent RTA publication *Environmental Noise Management Manual 2001* (ENMM) which has been endorsed by the EPA. In accordance with the ENMM the RTA assessed noise mitigation measures on the basis that where the Proposal led to an increase of more than 2 dB(A) in traffic noise levels and these noise levels were predicted to be above the appropriate criteria level from the ECRTN the RTA would provide mitigation measures. However, where the predicted increase was below 2 dB(A) as a result of the Proposal but

noise levels were above 65 dB(A) investigations were also undertaken in the report into reasonable and feasible noise mitigation.

The report found that most NCAs adjacent to the GHF traffic noise levels in 2016 were predicted to increase by less than 2 dB(A) from predicted 2006 noise levels without the Proposal. A summary of the proposed measures and residual impacts are contained in Table 7.2.

**Table 7.2 Summary of GHF Noise Measures and Residual Impacts**

| NCA | Existing Barriers | Proposed Barriers | No. of Residents 65 dB(A) to 70 dB(A) | No. of residents 70 dB(A) and above | Comments |
|---|---|---|---|---|---|
| E04 | 3.8m | Replace existing | 9 | 9 | Architectural treatment offered to residents |
| E05 | 3.6-3.8m | Replace existing | 17 | 4 | Architectural treatment offered to residents |
| E06 | As per E05 | As per E05 | 0 | 0 | No additional treatment |
| E07 | - | - | 0 | 0 | No additional treatment |
| E08 | 4.8m | Replace existing | 1 | 0 | Architectural treatment offered to residents |
| E09 | 3.8m | Existing noise barrier extended | 6 | 0 | Architectural treatments offered to residents |
| E010 | - | Replace existing | 0 | 0 | No additional treatment |
| E011 | 3.8m | Replace existing | 2 | 33 | No additional treatment – noise levels influenced by Willoughby Road |
| E012 | - | New 4m barrier to be provided | 0 | 2 | Architectural treatments offered to residents |
| E013a | - | New 5m barrier to be provided | 0 | 0 | No additional treatment other than noise barriers |
| E013b | 5m | Replace existing | 0 | 0 | No additional treatment |

Table 7.2 indicates that new noise barriers for NCAs at E012 and E013a would be constructed and the noise barrier at E09 would be extended. In all other cases the RTA committed to reinstall noise barriers at the existing heights for the widened GHF. A number of receptors would be offered architectural treatments where traffic noise levels would exceed 65 dB(A) even after installing barriers.

### 7.4.4 Consideration of Key Issues Raised

Construction Impacts

Concerns were raised in some representations about the construction noise impacts on people situated around the GHF. It was suggested that strict adherence to construction hours was required to reduce impacts.

In response, the RTA committed the majority of construction activities to be undertaken during standard daytime construction hours of 7am to 6pm Monday to Friday, 8am to 1pm on Saturdays and at no times on Sundays or public holidays. Construction outside of these hours would occur where work would otherwise have significant traffic flow and safety implications. The RTA has stated that the community would be notified of upcoming construction activities including those which would be outside of standard hours prior to those activities occurring.

Because of the conceptual nature of the construction noise assessment the Department has recommended several conditions of approval related to construction noise including the need to prepare Construction Noise Impact Statements at each of the main construction sites. The Department has also recommended the inclusion of Condition of Approval No. 67 requiring the installation of operational noise controls as early as possible to reduce the impacts of construction noise where reasonable and feasible. Recommended Conditions of Approval related to construction noise are addressed in more detail in Section 8.3.

Operation Noise from GHF

Concerns were raised about the operational noise impacts of the Proposal including specifically the impacts of gaps in the noise barriers, impacts on upper floors of units and the impacts on the Artarmon area.

As described above additional assessment of road traffic noise and noise control measures was conducted as part of the Representations Report. The assessment was based on predicted noise levels and the required attenuation at an indicative first floor level for the NCA (4.5m above ground level).

The report concluded that existing noise barriers and mounds would be replaced in all cases and in some cases, additional noise barriers would be constructed. The report predicted that there would be a number of dwellings subjected to acute traffic noise levels (above 65 dB(A)) despite the noise barriers. It is understood that the majority of these dwellings would be second floor and above units in apartment blocks and where applicable, these residents would be offered architectural treatment.

The RTA also reiterated that the proposed GHF widening includes the provision of open graded asphalt as a pavement which reduces noise compared to other pavement alternatives.

The RTA did not directly address the issue of gaps in the noise barriers for cyclist access etc leading to elevated noise levels which was raised in a representation. It is understood, however, that the RTA's modelling of road traffic noise and cost effectiveness assessment took any 'gaps' in existing and proposed barriers into account when determining mitigation.

The Department is satisfied that the assessment has generally identified realistic and reasonable noise mitigation measures for inclusion. To ensure that mitigation measures are implemented equitably the Department recommends the inclusion of Condition of Approval No. 59 requiring the Proponent to prepare a detailed Operational Noise Management Sub Plan as part of the Operations EMP to identify all appropriate mitigation measures to be installed.

To ensure that predicted noise levels and therefore mitigation measures are appropriate to the actual traffic noise levels measured the Department recommends including of Condition of Approval No. 60 requiring the Proponent to monitor noise after opening and implement further mitigation measures should the monitoring indicate exceedances of predicted noise levels.

Operation Noise from Surrounding Roads

Concerns were raised by a respondent about noise levels in Artarmon as a result of increased traffic due to the Proposal. The assessment in the EIS indicates that while there will be some increases in roads connecting to or in close proximity to the proposed upgraded GHF the increases would not lead to significant road traffic noise level increases (greater than 2 dB(A)) and therefore no mitigation measures were required.

### 7.4.5 Conclusions

The noise and vibration assessments in the EIS and Representations Report indicate that the proposed upgrade of the GHF would lead to significant noise impacts during construction and operation. During construction, it would be problematic to meet relevant noise guideline levels. With the majority of construction taking place during normal day time hours and with the inclusion of best practice mitigation and community consultation impacts would be reduced. During operation, road traffic noise would be minimised by the use of open graded asphalt pavement and the installation of noise barriers. Architectural treatment of other dwellings such as elevated receptors would further reduce impacts.

The Department has recommended a comprehensive set of Conditions to ensure that the construction and operational noise impacts related to the GHF would be minimised.

## 7.5 Hydrology and Flooding

### 7.5.1 Background

The Proposal crosses the Lane Cove River, Stringybark Creek (a tributary of Lane Cove River) and Flat Rock Creek. A new bridge is proposed for the Lane Cove River crossing to provide additional traffic capacity and to support the shared pedestrian/cycleway. Treated tunnel drainage would be discharged via Stringybark Creek. Widening of Gore Hill Freeway will increase impervious areas in the Flat Rock Creek catchment. Additional throttling of flows from the northern tributary of Flat Rock Creek is proposed to manage resulting increased flows.

### 7.5.2 Key Issues Raised in Representations

Few issues regarding hydrology and flooding were raised. Several representations raised the issue of flooding on Flat Rock Creek in the context of opposing the location of the cycleway through Naremburn. Other issues raised were:

- the cycleway along Flat Rock Creek could be undermined and damaged by swift flowing waters and that the creek is prone to flood;
- it is not clear that the full range of potential flood events has been considered for Stringybark Creek and Flat Rock Creek, or that the combined impact of pumped tunnel drainage flows and catchment flooding in Stringybark Creek was assessed; and
- investigation of possible flooding from Flat Rock Creek and the impact on residential areas is required.

### 7.5.3 Consideration of Issues

<u>Flat Rock Creek</u>

The Gore Hill Freeway widening is anticipated to result in additional runoff to Flat Rock Creek due to increased impervious surfaces. Freeway widening without mitigation would result in a 0.6 $m^3/s$ increase in peak discharge, or a 30 mm increase in peak water surface level upstream of Willoughby Road from RL 47.6 to RL 47.63. From the information provided by the Proponent, it would appear that the increase in peak water surface level is small, however the land bordering Flat Rock Creek is currently flood prone in medium to major storm events. This flooding is due to limitations in the hydraulic capacity of the creek and the bridge at Willoughby Rd.

The RTA has stated that no above-floor inundation will be experienced in the residences on the southern side of the creek in the event of a 100 year flood, either under present day or post- road widening conditions. Recent surveys have confirmed an 800mm freeboard for the lowest floor level during the 100 year average recurrence interval (100y ARI) event. The Proposal would reduce the freeboard by 30mm but would not render any properties flood prone. It is proposed that attenuation of flows at the retarding basin in Artarmon Reserve could achieve a reduction in flows and flood levels. Increasing the hydraulic capacity of the bridge at Willoughby Road was considered but rejected on environmental grounds, potential impacts on surrounding development and conflicts with other works by Council.

The Department recommends Condition No. 235 which requires additional hydrological assessment to confirm findings and consider the range of attenuation measures available to ensure the best environmental outcome.

*Cycleway*

The Department notes concerns regarding the possibility of flooding of the proposed cycleway. The proposed modification (refer to Section 7.3) would result in the cycleway being on higher ground and less likely to be affected by creek flooding. Further investigation of the cycleway location would take into account potential flooding issues. The Department concurs with this approach.

Stringybark Creek

Runoff from the tunnel would be collected and treated to remove sediment and oil before being discharged via pump to Stringybark Creek. Similarly, Epping Road (surface) drains to Stringybark Creek. The EIS states that the reduced width and landscaping along Epping Road will result in a small reduction in impervious area within the catchment. However, with the widening of Epping Road and tunnel construction, the area of impervious surfaces would in fact increase. This would result in a corresponding increase in road runoff. The Department considers that further investigation of tunnel drainage, including fire water management, runoff volumes and treatment is required and has recommended a condition requiring this.

### 7.5.4 Conclusion

The information provided in the EIS and subsequent advice from the RTA suggests that, in principle, flooding and impacts on hydrology as a result of the Proposal will be minimal and can be managed such that the peak water level and discharge are not affected in sensitive locations. The Department recommends a number of conditions to confirm that these predictions to minimise the impacts on residences and existing hydrologic conditions.

# 8 ASSESSMENT OF KEY ISSUES RELATING TO CONSTRUCTION FACILITIES

*This Section of the Report provides the Department's assessment of the key environmental impacts of the modified Proposal related to the Epping Road surface based on an examination of the EIS, issues raised in representations during the exhibition period and the Proponent's response to these issues in its Representations Report and during further consultation with the Department. The Department's assessment of the other environmental issues related to other elements of the Proposal are addressed in Sections 5, 6, 7 and 9 of this Report.*

## 8.1 Moore Street Compound

### 8.1.1 Background

The EIS identified a key construction compound to be located in the area between Epping Road, Barwon Road and Moore Street, Lane Cove West as shown in Figure 2.1. Seven (7) houses are located directly opposite the site and one house (17 Moore Street) is located immediately adjacent to its northern boundary. Another two (2) houses with frontage to Moore Street are located close to the proposed site.

The compound is for the excavation of an access tunnel to connect with the main Lane Cove Tunnel approximately half way along its length. This would provide the construction contractor with the flexibility to operate road header machines east towards the Gore Hill Freeway and west towards the Lane Cove West tunnel portals, providing two (2) additional working faces thereby reducing the overall construction period.

The EIS estimated that a total of 231,000$m^3$ of bulked spoil would be removed through the Moore Street site. The proposed compound would include spoil stockpiling, plant hard stand, truck wash down bays, power generation, materials storage, repair workshops, ventilation equipment, parking and equipment storage. The period of construction at the site was estimated to be approximately 16 months. The layout of the proposed compound is shown in Figure 8.1.

The site preparation would require clearing and filling of the site to create a level surface. Filling would necessitate piping the creek under the compound site. It is proposed that all fill material would be removed following construction completion and the site rehabilitated to its 'natural state'.

### 8.1.2 Key Issues

A number of representations were made to the EIS in regard to the Moore Street compound raising significant environmental and amenity issues, questioning its suitability for use as a construction compound. These issues include:

- the need to consider alternatives sites and alternative designs;
- noise generation from the compound and the resultant impacts upon the nearby residential area;
- traffic and safety issues;
- dust impacts;
- flora and fauna issues associated with clearing of a large area of vegetation and rehabilitation;
- impacts upon indigenous and non-indigenous heritage; and
- erosion and sedimentation issues.

### 8.1.3 Additional Investigations

As a result of issues raised in representations and by Government agencies, the Proponent undertook significant additional environmental assessment of the Moore Street site including assessment of traffic and access, air quality, noise, flora and fauna impacts, heritage and socio-economic issues. The assessment outlined the impact mitigation measures proposed to address the key impacts. The assessment found that noise and air quality impacts would be considerable during construction even with mitigation. These issues are discussed further below.

Redesign of the tunnel ventilation system also identified that the amount of spoil to be removed through the Moore Street compound increased to an estimated 324,700m$^3$ (refer to Appendix C). The Moore Street compound site was also identified as a potential site for an air intake as part of the revised tunnel ventilation design.

### 8.1.4 Consideration of Key Issues

Alternative Sites and Site Designs

The Department and other representations raised concern with the proposed layout provided for the Moore Street compound site, on the basis of the range of significant environmental impacts predicted and recommended that alternative sites and alternative designs at Moore Street be investigated. In response, the RTA stated in the Representations Report that alternative locations to the Moore Street compound were investigated such as Tantallon Oval but were found to have similar environmental issues to Moore Street and did not offer the same construction advantages of the proposed site.

Subsequent to the exhibition of the PAR, Lane Cove Council identified an alternative construction site to Moore Street compound located off Sam Johnson Way (refer to Figure 8.2). In response, the Proponent provided a preliminary assessment of the Council recommended site which identified that, although this could provide the benefit of direct traffic access from Sam Johnson Way to the site, there were several disadvantages including the need for a longer and steeper access tunnel, greater impacts on flora and fauna and there were unlikely to be improvements in noise and air quality impacts to residences compared to Moore Street.

Concerns raised about the site layout at Moore Street included the location of truck access and a wheel wash adjacent to a residence and the possible need to enclose the spoil stockpile and other key noise generating facilities. The Proponent stated that the final design of the compound would be determined by the successful contractor.

The Department remains concerned at the level of environmental impacts which would result from construction activities at Moore Street and considers that it is necessary to identify prior to construction that there are no more suitable alternative sites to Moore Street. The Department also recommends that further investigation of alternative site layouts and operating conditions is required at Moore Street. To this end, the Department recommends the inclusion of Condition of Approval No. 243 requiring that a report be submitted for the Director-General's approval prior to commencement of any works at the Moore Street site which considers:

- detailed comparative assessment of all viable alternative sites and justification for the need for the compound ;
- potential for reducing the scale of the site;

- alternative site layouts including accessways, stockpiles, administration and other buildings, carparking areas and all ancillary facilities;
- impact mitigation measures including sediment basins, vehicle wheel wash areas and acoustic fencing etc and locations of such;
- spoil transport alternatives by which environmental impacts could be reduced such as the use of conveyor belts to load trucks at Epping Road;
- alternative mitigation measures to address noise and dust emission issues;
- operational matters including construction timeframes, vehicle movements and hours of operation; and
- rehabilitation works and program.

The final nominated construction site and design would require the approval of the Director-General.

Construction Program

The spoil removal program, estimated to occur over 14 months, is premised on spoil haulage occurring 30 days per month. This program does not take into account that standard construction works would not be permitted on Sundays and would be restricted on Saturdays. Coupled with increased spoil removal as a result of the revised ventilation design the spoil removal program and associated impacts will likely extend significantly beyond the estimated 14 months. The Departments assessment is therefore based on a longer occupation of the site for construction purposes.

Noise Generation

Noise would be generated by three (3) key sources on site during construction, namely the ventilation system, mobile equipment, road trucks and general vehicle movements. These are discussed below.

*Ventilation Systems*

Ventilation systems for the access tunnel will require mitigation and management so that impacts on adjoining dwellings are avoided as far as possible. These systems would need to operate 24 hours a day during tunnel spoil excavation works. It was estimated that the ventilation systems could exceed night-time criteria, based on the EPA's *Industrial Noise Policy,* by up to 28 dB(A) at the most affected residences without the use of mitigation. Potential mitigation measures identified included:

- enclosure of ventilation fans;
- silencers on fans;
- encasing the ductwork;
- enclosing the dust collector system with acoustic insulation; and
- design of the discharge to ensure minimum impacts.

It was estimated that with the use of these mitigation measures, noise levels could be reduced to below the criteria levels.

*Mobile Equipment and Road Trucks*

The EIS predicted that equipment noise generation, including loaders and specialised tunnel spoil haulage trucks, will exceed the construction noise guideline levels as specified in the EPA's *Environmental Noise Control Manual*. Noise monitoring was undertaken at numbers 17, 20 and 26

Moore Street, which estimated that without noise mitigation, noise exceedances during the day of 10, 4 and 2 dB(A) respectively at these residences would result from these mobile sources.

To mitigate noise a 5m acoustic barrier was suggested around the site which was found to be effective in reducing impacts for 20 Moore Street such that the construction noise guideline levels from these sources of noise would be satisfied. However, continued exceedances of 6 dB(A) and 2 dB(A) would still occur at numbers 17 and 26 Moore Street respectively were predicted. The Proponent indicates in the REF that further mitigation measures such as the enclosure of the stockpiling operations and truck loading area may be possible means of reducing further noise levels from these sources in the order of 10 to 15 dB(A).

The Department remains concerned about construction noise impacts that would result from the operations on site. A 5m noise barrier around the site would appear to be a relatively ineffective measure and the practicalities of enclosing the stockpile and other sources of noise has not been assessed by the Proponent. As part of recommended Condition of Approval No. 243 the Proponent would need to investigate all feasible and reasonable measures to reduce noise including changes to the site layout. Notwithstanding this assessment, the Department recommends the inclusion of Condition of Approval No. 252 limiting noise emanating from the compound to realistic and achievable levels that would reduce the potential construction noise impacts on surrounding residential areas. Recommended Condition of Approval No. 252 limits the hours of external construction work at Moore Street to standard construction hours.

Traffic and Safety Issues

Based of the revised ventilation design, the Proponent estimated that 62 trucks (124 movements) per day would be required to transport tunnel spoil from the site. In addition to spoil removal, an average of 120 vehicle movements per day is anticipated, with a peak of 190 vehicle movements a day for employee access and deliveries. This equates to an average total of 22 to 29 vehicle movements per hour, between 7am and 6pm, the period where external construction activities would be permitted. Peaks would occur during the day as staff arrive and depart at the end/start of shifts etc.

Concerns were raised by a number of representations that traffic generation could have significant impacts on the operation of Moore Street and other adjacent local roads. Two (2) access points to the site from Moore Street are proposed – a general vehicle/delivery access and a heavy vehicle (mainly trucks and delivery of heavy machinery etc) access. The general vehicle access is proposed approximately half way along the Moore Street frontage. The truck access and wheel wash is located at the westernmost extent of the Moore Street frontage due to turning circle constraints of the site. This proposed truck access point would maximise the distance trucks need to travel along Moore Street and is immediately adjacent to a residence.

The Department believes that alternative spoil management on site and/or alternative access points and truck wheel wash need to be considered and has required these aspects be specifically addressed as part of the requirements in Recommended Condition of Approval No. 243. The Condition also requires the Proponent to investigate alternative spoil removal options such as directly from Epping Road through the potential use of a spoil conveyor on site.

The gate located at the corner of Moore Street and Barwon Road is currently used to restrict morning usage of Moore Street and Barwon Road as a "rat-run" between Epping Road and Centennial Avenue. The Proponent identified that it would be necessary to operate the gate during construction for access and egress of employee vehicles, deliveries and spoil transport. The Department considers that careful

management of the gate during periods when it would normally be closed will be required to ensure that "rat runs" do not occur.

Concerns were raised in representations about the construction traffic accessing Epping Road, particularly the safety of any right hand turns to and from Epping Road. In response, the Department has recommended the inclusion of Condition of Approval No. 249 restricting the construction vehicles to and from the site to left in/left out arrangements at Epping Road.

Representations also raised concern in relation to pedestrian safety. The pedestrian bridge crossing Epping Road adjacent to the site serves as an important pedestrian link to community facilities located on the northern side of Epping Road and provides general access for residents. Representations suggested that pedestrians using the bridge generally cross Moore Street either close to its intersection with Epping Road or down the hill close to the Moore Street/Barwon Road intersection. Without adequate safety considerations, the vehicle movements generated by the Moore Street construction site will have implications for pedestrians and cyclist safety in the area. The Department concurs that these issues will need to be carefully considered as part of the overall operation and traffic planning for the site.

Air Quality

The EIS estimated that dust would be generated from four key sources, namely:

- from trucks bringing material from the tunnel portal to the stockpile;
- emissions from trucks dumping to the stockpile;
- from trucks taking materials from the stockpile; and
- wind erosion from exposed areas and the stockpile.

Total daily dust generation from these sources is calculated to be 72.8 kg. The great bulk of this material would be generated from the transportation and handling of the spoil, with the stockpiling itself only contributing 2.4kg per day of emissions.

A number of representations raised concern in relation to the likelihood of significantly reduced air quality due to dust and exhaust fumes immediately around the site. Concerns were raised that dust and pollution have the potential to cause amenity and health concerns.

Additional environmental assessment by the Proponent for Moore Street included an air quality assessment which found that air quality goals would be regularly exceeded at sensitive receptors even with the use of conventional mitigation strategies. Significant modifications/mitigation measures at the site would be required to meet EPA air quality goals for dust.

Houses on the western and eastern side of Moore Street near the compound site would be most affected by dust. Even with typical controls in place (including watering of haul roads), the predicted 24-hour $PM_{10}$ concentrations would still be up to 10 times the NSW EPA goals. The assessment identified three (3) methods that may reduce dust to below criteria levels, including:

- transporting spoil directly from the tunnel to the disposal point without stockpiling;
- more intensive watering of haul roads; and
- stockpile watering.

The assessment concluded that on the basis that ALL of these methods were adopted, the dust emissions could, in theory, be reduced by 91% from levels expected thereby bringing overall dust levels to just within the EPA goals. The assessment did not discuss the feasibility of removing the spoil stockpile.

The annual average $PM_{10}$ concentrations at nearby residences are predicted to be over three (3) times higher than the EPA $PM_{10}$ goals and TSP concentrations at the most affected residences are predicted to be over double the goal established by the NHMRC guidelines as a result of construction activities. Similar to dust deposition the largest reduction in particulates is yielded from avoiding the need to stockpile.

The assessment also stated that it may be possible to enclose and ventilate the stockpile area and ramp to the tunnel to mitigate construction dust impacts. However, the air quality assessment did not investigate the relative impacts or feasibility of this mitigation method.

The Department considers that the Proponent has not demonstrated that dust generation and particulate levels from these construction sources can realistically meet criteria levels. It has been shown that conventional measures alone will not achieve the required levels and that other, more stringent measures will be needed. Such changes may lead to fundamental changes to use of the site, most notably the deletion or possible complete enclosure of the spoil stockpile, the feasibility for which has not been assessed.

The Department has therefore taken a precautionary and prescriptive approach to the issue of construction air quality including Recommended Condition of Approval No. 250 limiting dust levels to no more than 4g/$m^3$/month and particulates to 90 µg/$m^3$ in accordance with relevant goals. In addition, Recommended Condition of Approval No. 251 requires the implementation of a reactive dust management plan during construction. The Department believes that these limits coupled with stringent monitoring should ensure that air quality impacts on nearby receptors from the site would be reduced to acceptable levels.

Ecological Issues

The Moore Street site would need to be extensively cleared to enable proposed works on the site. The native understorey of the site has been largely invaded by weeds though native species remain in the canopy and mid-storey including Smooth-barked Apple (*Angophora costata*), Large-fruited Red Mahogany (*Eucalyptus resinifera*), Snow-in-Summer Paperbark (*Melaleuca linariifolia*) and Tick Bush (*Kunzea ambigua*). There is evidence of fauna habitat including nesting sites for Common Ringtail Possums.

Several representations expressed concern that vegetation loss as proposed would further fragment the urban bushland in this locality. Particular concern was raised in relation to the value of this bushland as part of a broader wildlife corridor. The RTA has stated that inadequate vegetation exists in this part of the reserve to form a continuous link for fauna movement. In addition to the need for fauna to cross Moore Street, the RTA stated that the site would be of limited value as a wildlife corridor, given its degraded condition.

The Department considers that the bushland, although degraded, is very likely to play a more important role in fauna movement through the corridor to the Hands Quarry Reserve than that suggested by the Proponent. Removal of this link would therefore result in increasing the barrier to fauna movement created by Epping Road and Moore Street.

The Department considers that, while the bushland is an important wildlife corridor, it is probable that the area could be rehabilitated after construction in such a way that could reinstate an improved corridor for fauna movement. The Department considers that for long term mitigation and compensation for the construction impacts on the corridor, the Proponent should be involved in enhancing and rehabilitating the overall bushland corridor. The Department has recommended the rehabilitation of the site and surrounding areas following decommissioning of the construction compound as part of Recommended Conditions of Approval No. 256 and 257. The rehabilitation would need to include monitoring for five (5) years following construction and in accordance with a site rehabilitation and revegetation management plan prepared specifically for the Moore Street compound.

*Threatened Species*

One (1) threatened species, *Szyzigum paniculatum*, was recorded on the Moore Street site although there are records of the Red-Crowned Toadlet (*Pseudophryne australis*) and *Epacris purpurascens* on adjoining sites.

In relation to the *Szyzigium paniculatum* recorded on site, consultation with the Royal Botanical Gardens confirmed that it is unlikely that these trees were naturally occurring, as the species is not locally endemic. These trees would need to be removed during site preparation for the construction compound works. An 8 part test was prepared for this species and found that as it is not a naturally occurring species, such a loss was not regarded as having the same significance as if the species were naturally occurring at this location. The Department concurs that the potential impacts on this species are unlikely to be significant.

The Red Crowned Toadlet has been recorded in Batten Reserve to the north of the proposed compound site. Whilst it was concluded that there may be a small chance that the Toadlet could be present on site, it was considered that the site in its current condition does not provide suitable habitat. The Department concurs with this conclusion.

*Epacris purpurascens* is known from Hands Quarry Reserve though it was not recorded at Moore Street. The Proponent concluded that although the compound would remove some potential habitat for the species, it would not impact upon the survival of the species in the area.

<u>Heritage Impacts</u>

*Landscape Heritage*

The southern part of the site was identified in the Lane Cove Heritage Study as being of landscape significance. Additional information in the Representations Report (Statement of Heritage Impact) found that "*The bushland corridor represents the importance placed on the municipality's natural values … [and the] corridor has a medium level of heritage significance at a local level*".

Proposed mitigation is based on leaving a vegetated (including trees) buffer around the compound to "mask" the break in the bushland corridor and the site in general. An artist's impression is provided in Figure 8.3 which includes the use of a potential 5m noise barrier. In order to re-establish the site following construction, the Department recommends Condition of Approval No. 257 which requires that a Site Rehabilitation and Landscape Management Plan be prepared which includes consideration of and existing landscape heritage values and incorporation of these into the final landscape where practicable.

*Indigenous Heritage*

The whole of Stringybark Creek, including the Moore Street compound site was identified as a Potential Archaeological Deposit (PAD). Two (2) known archaeological sites exist within the PAD, however these are located outside the proposed compound site. The compound area was identified as having low potential for sites as a result of previous high disturbance.

The Department recommends Condition of Approval 254 that requires a more detailed assessment of potential archaeological deposits prior to construction at the site. Further consultation with the Metropolitan Local Aboriginal Land Council and NPWS would be required during these investigations.

*Non Indigenous Heritage*

No items listed on any heritage registers, including the Lane Cove LEP is known from the site, however, a sandstone drain of unknown significance was located in the vicinity of the proposed compound site. A Statement of Heritage Impact (SoHI) was submitted with the Representations Report which concluded that the drain is of low heritage significance at the local level and that the proposed compound would not impact significantly on the channel. Furthermore, it indicated that with appropriate mitigation measures such as protection while under the imported fill, and careful removal of the fill, the channel could be re-exposed during the rehabilitation of the site without damage. The Rehabilitation Plan for the site is required to include investigation of options regarding fill removal or otherwise and the implications of these for heritage items/values of the site.

Erosion and sedimentation

The following construction activities have the potential to result in erosion and sedimentation impacts in the Stringybark Creek catchment:

- site filling to provide level access, storage, and working areas;
- spoil stockpiling ;
- trucks and other vehicle movements; and
- rehabilitation works.

A sedimentation basin is proposed by the Proponent at the western end of the site although no detailed plans or information about the basin exists. The Department considers that more detailed information is required in regard to the sedimentation basin and is recommended as part of the integrated development plan required in Condition of Approval No. 243. In addition, the Department recommends Condition of Approval No. 253 requiring that all erosion and sedimentation control measures be in place on the site prior to any stockpiling and construction activities.

Air Intake

As described in Section 5.1, the revised ventilation design included a potential air intake at Moore Street. The Proponent has not detailed precisely what the air intake facilities would encompass although it is understood that the majority of facilities could be located underground. The aboveground facilities would need to include service and access buildings as well as an access road.

Given the environmental impacts of the construction site at Moore Street the Department is concerned that a permanent air intake facility at this site would be unacceptable. Similarly an air intake facility at

this location would jeopardise the benefits of the rehabilitation of the site. The Department's preference at this stage is that the air intake be located at the other nominated site at 130-132 Epping Road as is specified in Recommended Condition of Approval No. 182. The Proponent would need to seek an approval from the Director-General for any changes to this site.

### 8.1.5 Conclusion

The Department considers that the Moore Street compound as described in the Representations Report would have potentially significant environmental and amenity impacts for the surrounding residential area and potential long term environmental impacts for the Stringybark Creek wildlife corridor. It has however, been identified by the Proponent as a fundamental and integral part of the construction phase of the Proposal to ensure reduced construction times and to achieve the associated economic and environmental benefits in a reduced timeframe.

The stated benefits of using the Moore Street site may be potentially compromised by the scale of environmental impacts although the RTA does not believe this to be the case. Conscious of the stated benefits of the establishment of the compound the Department has recommended a precautionary approach whereby all viable alternative sites shall be investigated during the detailed design process. Should Moore Street compound site still be preferred, the Department has recommended a number of stringent conditions be imposed upon any the use of this site. The Conditions include careful consideration of site designs to reduce potential impacts generated from the compound site. The RTA will need to demonstrate that these conditions can be realistically met prior to any construction activities. Compliance with the conditions imposed for general environmental issues will remain irrespective of the final site layout selected.

As a further measure and assurance to achieving a sustainable long term outcome, the Department recommends the inclusion of two conditions which allow the Director-General to order the RTA to rectify any identified breaches of conditions and where necessary impose a financial penalty to mitigate the impacts of any non-compliance.

## 8.2 Construction Traffic and Access

### 8.2.1 Background

Due to the complexity of the construction task, and the lack of suitable land available, the EIS envisages the establishment of 15 construction compounds as part of the Proposal. The two major compounds to be established would be at either end of the Lane Cove Tunnel and would provide for staff levels of up to 120 at each site. Intermediate sized compounds (20 to 30 staff) would be provided at both the exhaust stack locations and at Moore Street. The other ten compounds would be relatively small accommodating 5-15 workers at each. A summary of the compounds and the EIS estimated daily traffic to be generated from each as well as site access points is contained in Table 8.1.

**Table 8.1 Site Compounds**

| Compound | Access Points | Daily Staff Vehicle Movements | Daily Delivery and Haulage Vehicle Movements | Total Daily Vehicle Movements |
|---|---|---|---|---|
| A – Mowbray Rd West | From Mowbray Road West near Epping Road | 180-220 | 180-220 | 360-440 |
| B – Pacific Hwy /Longueville Rd | Left in/Left out access from Pacific Hwy | 240-260 | 30-40 | 270-300 |
| C – Broughton Rd | From Broughton Road | 20-30 | 10-20 | 30-50 |
| D – Longueville Rd Off Ramp | Eastbound Longueville Road left in and left out | 20-30 | 10-20 | 30-50 |
| E – Pacific Highway On Ramp | Left in/Left out access from Pacific Hwy | 20-30 | 10-20 | 30-50 |
| F – Gore Hill Freeway | From Gore Hill Freeway | 30-40 | 160-180 | 190-220 |
| G – Burra Rd | From Burra Road or Chelmsford Avenue | 20-30 | 10-20 | 30-50 |
| H – Park Road | From Park Rd or Walter Street | 20-30 | 10-20 | 30-50 |
| I – Donnelly Road | From Donnelly Rd and Brook Street | 20-30 | 30-40 | 50-70 |
| J – Falcon Street Centre | Ernest Street and Warringah Expressway and out of the site onto Falcon Street | 20-30 | 10-20 | 30-50 |
| K – Falcon Street Northbound | Warringah Expressway and Falcon Street | 20-30 | 10-20 | 30-50 |
| L – Falcon Street Southbound | Warringah Expressway | 20-30 | 10-20 | 30-50 |
| M – Moore Street | Left out/Right in at Moore Street | 50-60 | 120-140 | 170-200 |
| N – Exhaust Stack – Orion Road* | Access off Orion Road* | 40-50 | 20-30 | 60-80 |
| O – Exhaust Stack – Marden Street | Access off Marden Street | 50-60 | 200-220 | 250-280 |

* NB – Exhaust Stack location moved to Sirius Road in Representations Report with direct access to and from Sirius Road.

The above table indicates that the proposed construction compounds would generate a significant level of traffic both as a result of construction staff and the delivery of machinery and spoil movements. The EIS suggested that this level of construction traffic when mixing with existing traffic would not have significant impacts on the surrounding road network. Traffic levels at construction sites accessed off local roads in residential areas could cause amenity impacts and the EIS recommended mitigation measures such as restricted hours for access and access routes.

A number of the works both within and near the compounds would be in the vicinity of heavily trafficked existing roads such as Mowbray Road West, Epping Road, Longueville Road, Pacific Highway, Gore Hill Freeway and the Warringah Expressway. The EIS stated that temporary lane closure and/or road closures would be kept to a minimum during construction to reduce traffic disruption.

The EIS suggested that a Traffic Management Plan (TMP) would be prepared for each site to address construction traffic and access issues prior to construction.

The traffic and access issues associated with the movement of spoil generated by the Proposal and the Moore Street compound are discussed in Sections 5.3 and 8.1 respectively. Traffic levels to and from some construction sites will be higher than those levels predicted in the EIS as a result of the revised tunnel ventilation design.

### 8.2.2 Key Issues Raised

A number of representations raised issues in relation to the effects of the construction of the Proposal on local traffic flows. The key issues raised in representations were:

- need for a detailed assessment of access and parking arrangements at the construction compounds and encourage the use of public transport for workers;
- concerns about the impacts of the Mowbray Road West compound on the operations of the Chatswood Rotary Athletic Field;
- need to maintain current traffic lanes on Gore Hill Freeway and Warringah Expressway during construction;
- need to maintain bicycle, pedestrian and public transport access near construction compounds and works; and
- need to designate preferred routes from construction compounds and assess traffic impacts.

### 8.2.3 Consideration of Key Issues Raised

Access and Parking Arrangements

The Department requested that the RTA provide further details on the access arrangements to the proposed construction compounds and the availability of on-site parking. Another representation suggested that construction workers should use public transport services for access to and from the compounds.

In response to the Department's concerns, Hyder Consulting (on behalf of the RTA) produced 'Lane Cove Tunnel – Construction Compound Sites' provided in Appendix H. This report discussed indicative access and parking arrangements for each of the proposed compound sites. The report particularly focussed on the proposed work compounds to be located close to residential areas and the key findings included:

- Compound C, Broughton Road – Only approximately 50% of the parking demand for the site could be accommodated within the compound and the report suggested that additional parking demand could be on adjacent streets. The preferred access to the site would be left in/left out at Pacific Highway and through the residential streets of Rimmington to the end of Broughton Road. It was estimated that there would be a maximum of 6 heavy vehicle movements to and from the site per hour.

- Compound D, Longueville Road – The physical constraints of the site were predicted to force any staff parking onto surrounding streets. Initial access to and from the site would only be for eastbound Longueville Rd traffic, however as the temporary ramp is constructed to the Pacific Highway access would be possible on this route.

- Compound F, Gore Hill Freeway – The report assumed that staff and visitor parking demands could be met within the compound. This site would involve a substantial amount of spoil removal. It was anticipated that spoil haulage from the site would be divided between Longueville Road and Reserve Road from the Gore Hill Freeway.

- Compound G, Burra Road – It was estimated that staff and visitor parking demands could be met within this compound. Two potential accesses to the site are available, the first being from the end of Burra Road through the Artarmon Reserve access road and the second off Chelmsford Avenue.

The Artarmon Reserve access is undesirable due to potential mixing with vehicles and pedestrians using the reserve and the long journey through residential areas. The Chelmsford Avenue access would have to cross a pedestrian/cyclist route and also traverse residential areas.

- Compound H, Park Road – This compound would be generally situated underneath the Gore Hill Freeway viaduct in an area of open space. It was estimated that due to site constraints the majority of staff parking would need to be accommodated on surrounding streets. Access to and from the compound would be from Parks Road, Lambs Road and Cleg Street through residential areas. Up to 30 heavy vehicle daily movements would be required to the site. Alternative access off Willoughby Road and/or Walter Street was investigated but would be difficult due to relative heights. With the proposed post Representations Report modifications to the Willoughby Road intersection (refer to Section 4.3) it is possible that this compound may be at a smaller scale.
- Compounds J, K and L, Falcon Street – It was estimated that sufficient space was available for each of these compounds for on site parking. Access to the sites would generally be directly off the Warringah Expressway accessed from Ernest Street. From Compounds J and K egress for the site would be available directly (left turn only) onto Falcon Street. The report suggested that for Compound L construction egress would be required onto Merlin Street.

Whilst the Department is cognisant of the constrained nature of the study area in relation to adequate areas for construction compound it is concerned about any compounds located in or near residential areas. To minimise the impacts of these compounds the Department has required that strict day time construction hours are adhered and has recommended the inclusion of Condition of Approval No. 30 requiring that a detailed TMP for each compound is prepared as part of the CMS.

Given the reductions to construction works at the Willoughby Road interchange with the Proposal it may be possible to reduce the scale at the proposed Park Road worksite located within a residential area.

To minimise the potential for on-street parking associated with the proposed compounds the Department has recommended the inclusion of Condition of Approval No. 32 requiring that the Proponent investigate the use of buses and/or car pooling schemes for workers.

<u>Mowbray Road West Compound</u>

The major construction compound at the western end of the Proposal is situated off Mowbray Road West adjacent to the Chatswood Rotary Memorial Athletics Field. The compound would be situated in an area currently used as an overflow carpark for the athletics field.

Willoughby City Council in their representation sent to the Department, after the PAR exhibition, raised concern that the construction compound would significantly affect regular school carnivals and other use of the athletics field. They suggested that the overflow car park was full during these carnivals and that any loss of the car park would render the facilities virtually inoperable. Council stated that they had met with RTA officers to voice these concerns and alternatives had been considered such as realigning Mowbray Road West in the earliest stages of construction and making use of the old roadway corridor for the construction site.

The Department concurs with Council's representation that a solution to the potential impact on the athletics field needs to be resolved prior to construction at the site. As described earlier, the Department has recommended the inclusion of Condition of Approval No. 30 requiring that the Proponent prepare a TMP for each construction site. The TMP for the Mowbray Road West compound

would need to be prepared in consultation with Council and address the design of the compound relative to existing access and parking arrangements.

Gore Hill Freeway and Warringah Expressway

Concerns were raised by some representations that the construction activities associated with the Proposal could cause significant traffic implications on main roads such as the Gore Hill Freeway and Warringah Expressway if lanes were closed.

In response, the RTA stated that in general traffic capacity on Epping Road, Gore Hill Freeway, Warringah Expressway and Falcon Street and other roads would be maintained at current levels during construction. In some cases such as the Falcon Street ramps the RTA has suggested that traffic lanes would need to be diverted around construction compounds and works but that the number of lanes would be retained. The RTA further stated that traffic management devices such as variable message signs would be established prior to construction.

As part of the TMPs for each compound to be prepared the Department requires that all temporary changes to existing roads are identified and specific traffic management measures identified.

Bicycle, Pedestrian and Public Transport Access

Concerns were raised in some representations about the impacts and potential disruption of construction activities on pedestrian and cyclist facilities and public transport services. In response, the RTA stated in the Representations Report that generally cyclist, pedestrian and public transport facilities would be maintained at a similar standard to existing during the construction period. The EIS suggested that there may be a requirement to move existing bus stops to temporary locations to avoid potential conflicts with construction activities. No further details were provided by the Proponent.

The Department believes that the TMPs would be the appropriate mechanism, during the detailed design phase, to address specific issues relating to pedestrian and cyclist access and public transport connectivity during construction works and requirements are incorporated into Recommended Condition of Approval No. 30.

Routes to and from Construction Compounds and Traffic Impacts

A few representations and the Department requested that the RTA clarify the suggested routes to be used to and from each proposed construction compound including spoil trucks. Additionally, the Department requested details on the traffic implications of construction generated traffic.

In response, the Hyder Report prepared for the RTA detailed the preferred access routes to be used from the proposed compounds. In general, these preferred routes were chosen so as to minimise the distance through residential areas and to the arterial road network. The preferred routes in relation to the proposed compound sites are shown in Figure 5.6.

The Hyder Report suggested that the traffic levels estimated to be generated by each construction site (refer to estimates in Table 8.1) would not cause a significant impact on any of the preferred access routes. The cumulative impacts of the construction traffic from all compounds were briefly assessed in the Hyder Report in relation to Mowbray Road West and Centennial Avenue. The report found that it would be unlikely for construction traffic including spoil haulage to use Mowbray Road West or

Centennial Avenue thereby reducing potential impacts. Impacts in relation to spoil transport and routes are discussed in further detail in Section 5.5 of this report.

The Department concurs with the general principle of minimising use of residential streets and minimising distance to arterial roads adopted by the RTA in nominating preferred access routes. As part of the requirements for investigations during the preparation of each construction site TMP the Department has required that access routes are specified.

### 8.2.4 Conclusions

The scale and complexity of the construction task for the Proposal is reflected in the proposed establishment of 15 construction worksites, some of which have been placed by necessity in residential areas. The Department believes that it is critical that the issues of construction access and transport impacts are affectively managed during the construction phase. As such, the Department has recommended a hierarchy of TMPs with a Framework TMP to address the overall construction traffic impacts, measures and cumulative impacts and individual TMPs for each construction compound.

## 8.3 Noise and Vibration

### 8.3.1 Background

This section deals with construction noise and vibration impacts from construction compounds proposed for the Proposal other than the Moore Street compound and construction compounds at the portals. Noise and vibration issues for the Moore Street compound site are discussed in Section 8.1and for the portals are presented in Section 5.1.

Construction is predicted to take approximately three years. The EIS has stated that construction of the Proposal would involve establishment of a number of different work sites as identified in in Table 8.1.
. The EIS proposes that construction would generally be undertaken during the normal daytime construction hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturdays and at no time on Sundays or Public Holidays. It was stated that some surface construction works associated with the tunnel portals would be required outside of standard daytime hours to minimise impacts on traffic flow and safety implications.

The EIS and Working Paper No 10, includes an initial assessment of the construction noise and vibration impacts. The noise assessment has involved representative measurements of the existing noise levels through the study area and modelling of the predicted construction noise levels. Noise predictions indicate that the EPA's construction noise goals would be exceeded by up to 30 dB(A) at some sites. The EIS notes that this assessment is based on the most likely construction plant and equipment to be used at each of the major work sites and anticipated durations and states that the selected contractor would determine the actual construction procedures.

The EIS proposes the use of a large number of standard noise mitigation measures, namely:

- restricting rock-breaking works to within standard construction hours;
- erection of temporary and/or permanent noise barriers;
- fitting efficient silencers or more efficient exhaust systems to mobile plant;
- regular maintenance of all plant and machinery;
- use of dampened rock hammers; and
- active community consultation.

### 8.3.2 Key Issues Raised

There were a number of representations which raised issues with regard to construction noise impacts. Specifically there were 15 representations expressing concern about the impacts of construction noise, four of which referred specifically to construction road traffic noise. Concerns included the impacts of noise on residents both during construction of the tunnel and the widening of the Gore Hill Freeway. A summary of key issues raised are:

- has all reasonable and feasible noise mitigation been considered in the EIS;
- concerns about night time construction;
- noise levels measured at residential boundaries should not exceed background plus 5dB(A) for the duration of work;
- residents should always be informed when construction is to take place, and noise-generating activities should be scheduled to include respite periods;
- concerns about possible regenerated noise or vibration impacts in residences where the tunnel is below buildings;
- concerned that vibrations could damage buildings;
- residents near the Gore Hill Freeway express concern about noise levels during the proposed Freeway expansion;
- more specific data is required on anticipated noise levels at construction sites in order to assess potential impacts on residential and commercial amenity;
- noise reduction in relation to truck movements requires further investigation; and
- requests for provision of a 24 hour number to call if there is any breach of conditions relating to noise or any cause for complaint about construction activities.

### 8.3.3 Consideration of Key Issues Raised

As construction is expected to take approximately three years, the appropriate construction noise goal is background plus 5 dB(A), for the entire duration of construction. This requirement is reflected in Recommended Condition of Approval No. 62. The EIS predicts that a large number of residences and businesses would experience exceedances of the goal to levels up to 30 dB(A).

Because of the conceptual nature of construction noise assessment the Department recommends a precautionary approach to construction noise management for the entire Proposal. The Department therefore recommends that a detailed Construction Noise and Vibration Management Sub Plan and Construction Noise Impact Statements be prepared to specifically address noise impacts at each of the major construction sites. These Statements would be prepared in accordance with the Construction Noise and Vibration Management Plan which would detail cohesive management techniques and processes for all construction noise and vibration impacts. These Noise Impact Statements, required by the Department's Recommended Condition of Approval No. 58 would detail proposed construction activities and processes including noise impacts from road haulage and traffic diversions, and commit to specific noise mitigation measures, respite periods and notification and consultation protocols as appropriate.

To ensure that construction noise impacts are effectively managed, the Department's Recommended Condition of Approval No. 64 would require the Proponent to monitor construction noise impacts and, where exceedances are noted, implement best available mitigation measures to the satisfaction of the EPA. In order to further minimise noise impacts during construction, the Department also recommends that where practicable, and in consultation with relevant Council(s), the Proponent erect operational

noise mitigation measures prior to the commencement of construction. This requirement is reflected in Recommended Condition of Approval No. 67.

The RTA has indicated that there will be a need at times for construction work outside of normal hours. In addition to the conditions of approval, the Proposal would require an environment protection license from the EPA. The license would place conditions upon the works which would limit the effect on the environment and local residents covering issues such as noise, dust and vibration.

Were work is required outside standard hours, the EPA would generally be consulted prior to that work commencing. Based on previous advice from the EPA the Department recommends that the scheduling of noisy activities after 10.00pm and over consecutive nights in the same locality be avoided where possible. The issue of respite periods and night time noise limits must be addressed in each Noise Impact Statement.

Proposed construction activities including use of rock breakers, road headers, and vibratory compacters may result in vibration impacts. The Department's Recommended Condition No. 71 sets limits for construction vibration to ensure that the potential for structural damage and unacceptable human exposure is minimised. To ensure that sensitive structures such as heritage items are not adversely affected by vibration, the Department's Recommended Condition of Approval No. 73 limits vibration at the foundations of such structures to no more than 3 mm/s.

The issue of regenerated noise and vibration during construction are discussed in Section 5.4.

### 8.3.4 Conclusions

In conclusion, the Department recommends that a detailed Construction Noise and Vibration Management Sub Plan and Construction Noise Impact Statements be prepared to specifically address noise impacts at each of the major construction sites. The Department also requires that the RTA engage independent EMRs and ICLRs on the Proposal to help address any construction noise issues that arise as well as a suite of community consultation requirements. Although construction noise associated with the Proposal will cause an annoyance for some residents, the implementation of the conditions and best practice mitigation measures would ensure the minimisation of impacts.

## 8.4 Construction Air Quality and Dust

### 8.4.1 Background

Construction activities contributing to air quality and dust impacts have been identified in the EIS as including:

- transporting material from tunnel to stockpiles;
- dust emissions from spoil dumping;
- dust emissions from reloading trucks;
- truck movements transporting spoil to disposal sites; and
- wind erosion from exposed areas and stockpiles.

Other minor dust generating activities may occur at construction sites. Dust generation from the western section of the Proposal apart from Moore Street have been estimated at 46.8kg/day. The EIS predicted 24 hour $PM_{10}$ and annual average $PM_{10}$ concentrations at the most affected residences near the Epping Road/Mowbray Road intersection to be 210µg/m$^3$ and 75µg/m$^3$ respectively. Annual

average total suspended particle concentrations (TSP) and annual average dust deposition levels due to construction activities were predicted to reach 90µg/$m^3$ and 3g/$m^2$/month respectively.

Mitigation measures including monitoring, stockpile and exposed area watering, preparation of a dust management plans as well as other standard dust management procedures were outlined in the EIS.

Construction air quality and dust issues relating to the Moore Street compound are considered separately in Section 8.1of this report.

### 8.4.2 Key Issues Raised in Representations

The following issues were raised in representations in relation to dust:

- effective dust suppression should be provided to control dust from both construction and spoil transport activities;
- clarification is required on the level of analysis that has been undertaken regarding the effects of construction dust on air-conditioning units and the need for increased maintenance to be communicated to building managers;
- clarification is required on current dust deposition levels near Mowbray Road West and Epping Road, and what affects construction would have on these levels; and
- $PM_{10}$ levels and diesel fumes during construction is a concern.

### 8.4.3 Consideration of Key Issues

In response to concerns raised, the Proponent indicated that dust mitigation measures would be addressed in a Dust Management Plan prepared prior to construction. Notwithstanding, it is noted that dust levels are likely to exceed EPA goals at some locations. A range of mitigation measures have been identified that would be implemented to limit the impact on the surrounding community and environment.

The Department endorses the Proponent's commitment and notes that the effectiveness of dust mitigation measures is dependent on diligent monitoring and maintenance. To this end, the Department's Recommended Condition of Approval No. 44 requires the preparation of a detailed Dust Management Sub Plan. This Sub Plan would detail the management and implementation of measures and procedures to ensure dust deposition is limited to no more than 2g/$m^2$/month on an annual average basis. The Department also recommends that:

- dust sensitive land uses are identified prior to construction and appropriate mitigation measures are installed;
- the Proponent undertake a regular dust monitoring program;
- trucks carrying dust generating loads are covered;
- wheel wash facilities are used so dirt in not tracked onto public roads; and
- no open incineration be permitted.

These requirements are specified in Recommended Conditions of Approval Nos. 45 through 48. The Department also recommends that when conditions are excessively dusty and dust emissions cannot be maintained within the specified goal, all dust generating activities cease until dust suppression can be adequately carried out.

## 8.5 Ecological Impacts

### 8.5.1 Background

Seven (7) construction compound sites were identified where there is potential to affect biodiversity during the construction of the Proposal. These include the Mowbray Road construction compound and water quality pond, Lane Cove River bridge construction area, eastern tunnel portals, Epping Road and Gore Hill Freeway widening and the Moore Street compound. In general, the assessment in the EIS found that limited native vegetation remains at any of the sites and much of the remaining vegetation is heavily disturbed, exotic or artificially planted. Vegetation types identified included dry sclerophyll forest and mangroves. No threatened flora or fauna species were identified at any site apart from the Moore Street compound site.

Issues regarding the ecological impacts of a construction compound at Moore Street are considered in Section 8.1.

### 8.5.2 Key Issues Raised in Representations

A number of representations raised issues related to the potential impacts of construction on the ecological attributes of the area. Key concerns included:

- land clearing/loss of biodiversity resulting from the Proposal
- loss of significant, mature trees on Longueville Road and native vegetation associated with cycleway construction;
- need for explicit investigation of the Pages Creek and its stormwater catchment; and
- that several frog species, including the threatened species of Red-Crowned Toadlet are present in an area adjacent to the compounds.

### 8.5.3 Consideration of Key Issues

<u>Loss of Vegetation</u>

The EIS was unclear as the total area of vegetation to be cleared for the construction of the Proposal. However, the largest area of relatively in tact native vegetation (with the exception of the Moore Street compound) is at Pages Creek on the western side of the Lane Cove Bridge (Pages Creek) where up to 0.3 ha may be cleared (200 m x up to 15 m). Small sections of the mangrove community lining the Lane Cove River may be cleared for the bridge extension and abutments construction. Other construction compounds and work areas are not vegetated or support "artificial" plantings/remnant individual plants of limited conservation value.

The predicted impacts on the mangrove community on the Lane Cove River are unclear from the EIS although it appears that some clearing is inevitable. NSW Fisheries has stated a preference for a single span bridge in this location to minimise impacts. The RTA stated that the proposed bridge will mirror the existing bridge in terms of pier locations. Mangroves directly beneath the bridge are likely to be affected in the long term by permanent shading, much as has occurred subsequent to the building of the existing bridges. Given the long term effects on the mangrove community as a result of bridge construction, the Department recommends that specific consideration be given to minimise the impacts on mangrove communities adjacent to the bridges during detailed design of the new bridge, including shading impacts.

The Department concurs that only the vegetation on the western banks of the Lane Cove River is relatively undisturbed, however neither any individual species nor the community present is threatened or likely to become threatened as a result of the Proposal. The mangrove stand, whilst not a threatened community, has important ecological functions within this setting as a fish breeding habitat for aquatic species and as a vegetation corridor linking those areas north and south of the bridge for terrestrial species. Notwithstanding, the area west of the existing bridge is part of a large area of vegetation originally contiguous with the Lane Cove National Park though the existing road and bridges form an obstacle (if not a barrier) to movement. Further clearing of either terrestrial or mangrove communities adjacent to this would be expected to further exacerbate any barriers to movement along the north-south corridor. Condition 92 requires that any clearing shall be confined to the construction footprint and fenced to minimise impacts to vegetation to any areas outside that of direct construction influence. Additional conditions require that seed of locally native species be collected for propagation and use in revegetation and rehabilitation of any construction compounds and work areas not required following construction completion.

Fauna

Fauna surveys revealed low fauna diversity at all sites and little suitable habitat was identified within the subject sites with the exception of the bridge construction area at the western end of the Lane Cove River bridge adjacent to Pages Creek. Some mature trees may provide nesting opportunities for birds, however no threatened fauna habitat or species were identified or are considered likely to be present or critically dependent on the resources available. Numerous representations raised concerns regarding recent and nearby sightings of the Red-crowned Toadlet (*Pseudophryne australis*). Neither the species, nor suitable habitat was identified during the survey period in the areas to be affected. Subsequent reconnaissance surveys for the species confirmed these findings. This is discussed further with respect to the Moore Street compound in Section 8.1.

The Department is cognisant of Red-crowned Toadlet records near Hands Quarry Creek and in the Lane Cove River National Park. Given the lack of suitable habitat and the species small dispersion area from breeding habitat, it is considered unlikely that it is present in the areas to be affected by construction. It is recognised that potential habitat trees for fauna may be removed during construction. The Department has recommended preparation of a detailed Flora and Fauna Management Sub Plan to outline a range of measures, including fauna handling to ensure that impacts on flora and fauna are minimised. If threatened species are located which are likely to be affected by construction activities, Recommended Condition of Approval No. 90 requires that work cease until the NPWS and Department have been consulted as to the appropriate measures to be taken to avoid or minimise impacts.

Pages Creek

Several representations raised concerns regarding the potential impacts of the Proposal on Pages Creek and suggested that more extensive survey of this area was necessary. The Department concurs with the finding that the Pages Creek area in general is the least disturbed of the areas surveyed for the EIS. Notwithstanding, the area to be affected for widening of Epping Road is somewhat disturbed from weed infestation and provides a buffer to less disturbed areas away from the effects of the road.

Potential impacts on this area are anticipated to be limited to no more than 0.3 ha. It is recognised that the Proposal would further encroach into the relatively undisturbed areas thereby relocating the buffer further into the bushland. However it is considered that the construction impacts, including direct impacts on vegetation, erosion and siltation would be relatively minor with the preparation and implementation of a best practice Flora and Fauna Management Sub Plan.

### 8.5.4 Conclusion

The Department concurs that there is limited vegetation and native habitat within the areas to be affected by construction. Of these locations, only one other than Moore Street is considered to support native vegetation in a relatively undisturbed state and that clearing of this vegetation is unavoidable for the road widening west of the Lane Cove River. Similarly, cumulative impacts on the mangrove communities surrounding the existing and future bridge abutments are also unavoidable. The Department is satisfied that threatened species are unlikely to be present nor critically dependent upon habitat present at any of the construction sites and that further degradation of surrounding bushland can be managed through implementation of mitigation measures suggested and the Conditions of Approval.

# 9 CONSIDERATION OF OTHER ISSUES

*This Section of the Report provides the Department's assessment of the key environmental impacts of the modified Proposal related to the Epping Road surface based on an examination of the EIS, issues raised in representations during the exhibition period and the Proponent's response to these issues in its Representations Report and during further consultation with the Department. The Department's assessment of the other environmental issues related to other elements of the Proposal are addressed in Sections 5, 6, 7 and 8 of this Report.*

## 9.1 Cumulative Impacts

### 9.1.1 Background

Cumulative impacts may arise from the interaction of the Proposal's construction and operation with other significant Proposals and projects in the area and within Sydney overall. When considered cumulatively these may result in substantial compounded or synergistic impacts on the environment. The EIS identified potential negative cumulative impacts including water quality impacts on the Lane Cove River due to combined pollution with the Parramatta to Chatswood Rail Link (PCRL), cumulative construction and spoil transport impacts with other large infrastructure projects and the induced development pressures particularly in North-West Sydney as a result of the improved accessibility resulting from the Proposal.

### 9.1.2 Key Issues Raised

Concerns were raised in a few representations about cumulative impacts including:

- impacts on public transport services;
- water quality impacts on the Lane Cove River combined with the PCRL; and
- truck spoil movements of the Proposal and other spoil generating developments on the road network and surrounds.

### 9.1.3 Consideration of Key Issues Raised

Public Transport Services

Concerns were raised by some representations that the Proposal would adversely affect existing public transport services in the corridor and affect potential patronage of new public transport infrastructure such as the PCRL.

In response, the RTA stated that the Proposal would improve bus travel times by the inclusion of bus lanes and priority measures through the study area. The RTA also stated that whilst the Proposal may reduce patronage on the PCRL the affect was likely to be slight. Refer to Section 5.1 for a detailed discussion of the regional transport impacts of the Proposal.

The Department is satisfied that through the provision of bus lanes and additional bus priority measures coordinated by the Public Transport Committee, the Proposal would have a beneficial impact on bus services and a relatively neutral affect on public transport patronage. The main concern would be the possibility of high levels of induced traffic being attracted by the Proposal and thereby producing new trips or trips which might otherwise have been taken using alternative transport modes. To reduce the potential for induced traffic the Department has recommended the inclusion of Conditions of Approval

No. 35 and 36 requiring the monitoring of traffic levels and the introduction of a relevant mitigation measures including the potential use of a toll levy if high levels of induced traffic are identified.

Water Quality in Lane Cove River

Concern was raised by a representation that the construction of the new bridge and associated works near the Lane Cove River and works upstream associated with the cut and cover tunnel crossing for the PCRL would have a cumulative impact on water quality of the River.

The RTA responded by stating that the works associated with the PCRL would have an independent set of environmental controls in place to minimise impacts on water quality. It was stated that with strict independent controls for both projects it was unlikely that significant cumulative impacts on the Lane Cove River would occur.

The Department has recommended the inclusion of strict erosion and sediment controls for the Proposal (further detailed discussion is contained in Section 9.7). The Department also notes that an EPA licence for construction works would be required for the Proposal and the PCRL further regulating compliance to reduce potential for significant water quality impacts on the Lane Cove River.

Spoil Movement

Concerns were raised in representations including that by the Department about the cumulative impacts of spoil movements by truck from the Proposal with other large spoil generating infrastructure projects. Some representations suggested that rail and/or barge be used as an alternative to reduce impacts of spoil truck movements.

The EIS recognised that the construction and spoil movement from the Proposal would likely coincide with major infrastructure projects including the Cross City Tunnel and the Western Sydney Orbital but estimated that the spoil to be moved from the Proposal would not coincide with spoil movements associated with the PCRL. The Department however, understands that the majority of spoil generated by the PCRL will need to be removed from mid-2003 and will likely coincide with spoil removal from the Proposal. Although the destination of the spoil to be removed from the PCRL has not been finalised the Department is aware that the majority of spoil (approx. 85%) from PCRL will be removed from the M2 worksite straight onto the M2 prior to its final destination.

Although a large amount of spoil generated from the Proposal would be removed from the proposed construction compound at Mowbray Road West (adjacent to the Lane Cove River) the RTA stated that the depth of the Lane Cove River up to the construction compound was not sufficient to enable barging of spoil. The RTA stated that significant levels of dredging would be required on the river to enable barging of spoil. The RTA also stated that spoil transportation by rail was not preferred due to the high costs of double handling material.

The Department believes that although there is likely to be cumulative impacts of spoil transportation, the use of major routes should reduce impacts due to the already high volumes of traffic. The RTA has identified the transportation routes to be used from each worksite by construction traffic minimising the use of lower order roads. The Department has recommended the inclusion of Condition of Approval No. 120 requiring the preparation of a Spoil Management Plan (SMP) prior to construction. The SMP must consider all viable alternatives to the transportation of spoil by truck and the potential cumulative impacts of truck transport with other major spoil generating development.

### 9.1.4 Conclusions

The proposed construction of the Lane Cove Tunnel is likely to coincide with the construction of a number of other major infrastructure projects. Generally the potential cumulative impacts of these projects are limited due to their geographical separation. The main potential cumulative impact is through the transportation of spoil by truck. The Department has required the Proponent prepare a SMP prior to construction to identify and where possible mitigate any potential cumulative environmental impacts as a result of this spoil transport.

## 9.2 Hazards and Risks

### 9.2.1 Background

A qualitative assessment of hazards associated with the operation of the Proposal was undertaken for the EIS. The primary hazards and safety issue identified in the EIS was for an incident to occur within the tunnel, including fire, resulting in a significant impact on traffic within the tunnel and surrounding areas. The Proponent states in the EIS that dangerous goods movement through the tunnel would be prohibited consistent with similar prohibitions for the Eastern Distributor, M5 East, M2 and Cross City Tunnel. This measure is aimed at preventing an explosion, fire or release of toxic material that may affect the integrity of the tunnel or may be large enough to significantly affect land uses outside the tunnel.

The Proponent has identified measures to be incorporated into detailed design and/or to be implemented during operation of the tunnel to minimise the potential for such incidents to occur and to minimise the effects of any incidents that do occur. Further, it is stated that an Emergency Response Plan would be developed to ensure that the response to any incident/emergency in the tunnel is handled effectively and efficiently to minimise impacts.

A detailed discussion of fire safety and hazardous goods in the tunnel is contained in Section 5.1.

Construction risk was not considered in the EIS. This was deferred to further investigation to be undertaken during detailed design.

### 9.2.2 Key Issues Raised in Representations

Apart from fire safety issues raised in regard to tunnel operations, hazard and risk issues raised in representations included:

- need for a more detailed assessment of potential construction risks;
- need for appropriate traffic management measures to ensure dangerous goods do not travel in the tunnel;
- need to assess the potential increase in risks on surface roads as a result of increased dangerous goods;
- potential hazards were raised with regard to air emissions and cycleway use. These issues are discussed in Sections 5.1 (air quality and health) and 6.2 and 7.3 (cycleway).

### 9.2.3 Additional Investigations

In response to the concerns raised in representations, including that made by the Department, an additional Hazard and Risk Assessment was prepared by Sinclair Knight Merz on behalf of the RTA (included in Appendix I). The assessment included a review of construction risks and operational risks.

The assessment tabulated potential risks during construction and based on a review of likelihood and consequence rated injury to road users (mainly pedestrians and cyclists) near work compounds and damage to major utility services during excavation as the most significant potential risks. The assessment stated that it was anticipated that diesel fuel required for construction vehicles would not be stored on site.

In relation to operational risks, the assessment focussed on the number of dangerous goods vehicles on surface roads and estimated accident rates. The assessment found that based on traffic modelling, accident rates were predicted to increase on the Gore Hill Freeway and on Centennial Avenue (between Penrose Street and Mowbray Road West) as a result of the Proposal. The increase in accidents on the Gore Hill Freeway was considered not to be significant given the high existing safety levels on the route.

A quantitative assessment of risks was undertaken for Centennial Avenue which found that the individual fatality risk to surrounding residents as a result of a dangerous goods accident would be 3 in 1 million (or an incremental increase of 0.5 in a million as a result of the Proposal). The overall fatality risk would be above criteria levels of 1 in 1 million for a new Proposal but below the 10 in 1 million criteria levels for existing situations.

The Department recommends a precautionary approach to the issue of potential risks on Centennial Avenue with Recommended Condition of Approval No. 127 requiring the Proponent undertake additional surveys of dangerous goods vehicles using this route and additional risk assessment prior to operations. The Department also notes that the LATM scheme to be developed for the area, as detailed in Condition of Approval No. 37 may reduce the level of traffic using this route as a result of the Proposal (refer to Section 6.3 for further discussion).

### 9.2.4 Consideration of Key Issues

Construction Risks

To ensure that construction risks are effectively managed the Department recommends that the Proponent prepare a detailed Emergency Response Sub Plan and Construction Safety Study prior to construction. These requirements are specified in Recommended Conditions of Approval Nos. 131 and 134.

Recommended Condition of Approval No. 128 restricts the quantities of dangerous goods stored or handled during construction to levels defined as dangerous under the Australian Dangerous Goods Code. Recommended Conditions of Approval Nos. 131and 132 require the Proponent identify, assess risks and seek the approval of the Director-General for any temporary storage of diesel fuel at construction compounds.

In relation to impacts on pedestrians and cyclists from construction activities the Department has required that the Proponent prepare detailed TMPs for each construction compound to reduce potential conflicts.

The Department believes that with the implementation of these conditions, construction hazards and risks can be effectively minimised.

Traffic Management for Dangerous Goods

Consistent with the practice in most other tunnels in Sydney, dangerous goods vehicles would be restricted from using the proposed Lane Cove Tunnel. Dangerous Goods vehicles would be directed to alternative routes such as Delhi Road and Epping Road.

Concerns were raised by the Department and some representations about the ability of the RTA to restrict dangerous goods vehicles using the tunnel. The Department has therefore included Recommended Conditions of Approval Nos. 183 and 184 requiring that the Proponent employ all practicable traffic management measures and develop a program to restrict dangerous goods vehicles from using the tunnel. The potential impacts of a dangerous goods vehicle accident in the tunnel are discussed in Section 5.1.

Operational Surface Road Risks

As described above, the Proponent has conducted an additional qualitative and quantitative risk assessment for dangerous goods vehicles on surface roads through the study area. Although dangerous good vehicles would be directed away from the tunnel and most would use Epping Road, the risks would be reduced because of reduced traffic levels and accident rates on Epping Road. The Department accepts the findings of this assessment and believes that the Proposal would generally reduce hazards and risks on surface roads. The Department also notes that the Proposal is estimated to substantially reduce road accidents through the study area.

To further reduce potential operational risks the Department has included Recommended Condition of Approval No. 131 requiring the Proponent prepare an Emergency Response Plan at least six months prior to Proposal opening. Recommended Condition of Approval No. 136 also requires the Proponent to undertake an annual hazard review of any hazardous impacts during operations.

## 9.3 Social Impacts

### 9.3.1 Background

The EIS described that social impacts are commonly defined as events experienced by people as positive and negative changes in their way of life, their culture and their community. The EIS outlined the community consultation that had been undertaken as part of the Proposal development. Through this consultation process, expected benefits and negative impacts of the Proposal were identified and are briefly outlined below:

Expected Benefits

The EIS anticipated that the main benefits would include reductions in surface level traffic and congestion and reductions in associated environmental impacts such as noise, improvements to local areas through improved local access and reduced rat-running and improved pedestrian and cyclist environment.

Expected Negative Impacts

Potential negative social impacts identified as part of the EIS included concerns from some in the community about the health impacts related to stack emissions, noise and disruption impacts during construction, conflicting interests of pedestrian, cyclist and public transport on a limited roadway space on Epping Road and concerns about the change in travel patterns as a result of the Proposal.

### 9.3.2 Key Issues Raised

Representations received during the EIS exhibition reflected the issues discussed in the social impact assessment in the EIS. Some of the key specific issues raised in representations included:

- concerns about the potential amenity impacts and conflicts at construction sites with pedestrian access (including school children);
- concerns about the health and property impacts of the proposed stacks;
- concerns about the new cycleway and potential impacts on home safety; and
- impacts on the 'traffic island' area off Military Road in Neutral Bay;

### 9.3.3 Consideration of Key Issues Raised

Construction Impacts

Concerns were raised by a number of representations about the impacts of construction including dust, noise, use of open space and traffic movements. Particular concerns were raised with regard to the proposed construction compound at Moore Street including the potential conflicts of construction activities such as truck movements with local pedestrian movements including school children traversing the area.

The Department is cognisant that construction activities associated with such a large infrastructure Proposal would lead to temporary amenity impacts that have the potential to lead to associated social impacts such as stress. To reduce these impacts the Department has recommended the inclusion of a number of conditions including:

- that the majority of surface construction activities are undertaken during normal day time hours;
- comprehensive construction noise and vibration and air quality monitoring throughout construction works;
- the implementation of an extensive communication strategy including the establishment of a 24 hour complaints telephone line and the appointment of Independent Community Liaison Representative(s) to liaise with the community when significant impacts arise.

The Department believes that with the inclusion of these measures the amenity impacts during construction would be reduced.

Exhaust Stacks

Of particular concern in a number of representations was the perceived health and property impacts of the proposed exhaust stacks. Often these concerns were raised in representations opposing the inclusion and/or location of exhaust stacks or recommending the including of filters to treat emissions. These issues are discussed in more detail in the relevant sections in Chapter 5.

Cycleways

Concerns were raised by a number of representations that the new cycleway constructed adjacent to Epping Road and the Gore Hill Freeway would impact on privacy and some people were worried the new routes could be used by people for illegal access into properties. In response to the privacy concerns, the RTA has slightly modified the alignment of the proposed cycleway in the vicinity of Naremburn to allow for the inclusion of landscaping to screen the cycleway from residences.

In relation to the implications for security, the Department recommends the inclusion of a Security and Crime Management Strategy prior to operations to specifically look at security and safety issues related to the complete Proposal including the new cycleway. The Strategy is described in recommended Condition of Approval No. 130. Further discussion of issues related to the proposed cycleway is contained in Section 6.2 and 7.3.

Traffic Island

Concerns were raised by a number of representations about the impacts of the Proposal on the 'residential island' between the Falcon Street and Military Road routes in Neutral Bay, increased traffic and the resulting impacts in terms of noise and reduced pedestrian and local access through the area. Often these issues were raised in representations that recommended a redesign of the area to remove the 'residential island'.

In response the RTA stated that traffic modelling of the Proposal indicated that there would not be any substantial increases in traffic in the area reducing any associated environmental impacts and that the Proposal did not preclude the future reconstruction of the area including the removal of the 'residential island'. Further, the Proposal was modified in the Representations Report to include pedestrian access on the southern side of Falcon Street crossing the Warringah Freeway improving connectivity.

The Department is generally satisfied that the proposed Falcon Street ramps would not have a significant impact on the amenity and connectivity through the area. These issues are discussed in further detail in Section 7.1.

### 9.3.4 Conclusions

Social impacts in the form of changes to character and amenity during construction are an unfortunate but inevitable result of such a large infrastructure Proposal. As the Proposal includes the construction of a tunnel and works on existing road corridors the long term operational adverse changes to character would be minimised and result in significant benefits. To ensure that the adverse impacts on surrounding communities are minimised the Department has recommended the inclusion of a number of conditions to minimise the visual, noise and air quality impacts.

## 9.4 Economic Impacts

### 9.4.1 Background

The economic evaluation of the EIS was based around a road user costs benefit analysis (RUCBA) methodology in accordance with the RTA's *Economic Analysis Manual*. The costs evaluated included land acquisition, construction costs, operating and maintenance costs. The road user benefits assessed included travel time savings, vehicle operating cost savings and reduced accident costs. The RUCBA estimated that the benefit to cost ratio (BCR) for the Proposal at a 7% discount rate would be 4.3:1 (*i.e.*

benefits would outweigh costs by 4.3 times). Travel time savings as a result of the Proposal represents, in net present value (NPV) terms, 72.6% of all estimated Proposal benefits. The EIS included some sensitivity testing which indicated that even with a 75% reduction in estimated travel time savings the benefits of the Proposal would still exceed costs.

In recognition of potential externality costs and benefits of the Proposal, the economic evaluation also quantified emission impacts such as air pollution, greenhouse gas emissions and noise impacts. The BCR for the Proposal with the inclusion of emission impacts was estimated to be 4.7:1. The higher BCR was mainly due to more efficient traffic movements as a result of the Proposal resulting in low emissions and reduced greenhouse gases. Other potential externality costs and benefits were described qualitatively in the analysis.

The EIS also stated that the construction of the Proposal would result in approximately 250 direct jobs and flow on indirect employment and income impacts on the economy during the estimated 40 months of construction.

### 9.4.2 Key Issues Raised

The key issues raised in representations included:

- requests for compensation for the impacts of the Proposal on property values;
- concerns over the methodology used in the cost benefit analysis including the consideration of external costs; and
- concerns that the Proposal did not result in good value for money.

### 9.4.3 Consideration of Key Issues Raised

Property Values

A number of representations raised concerns about the impacts of the Proposal on property values and the need for compensation or other financial measures to be paid by the Proponent. Concerns were raised in relation to the property impacts of the proposed tunnel, access tunnel from the Pacific Highway, ventilation tunnels and stacks, Moore Street construction compound, increased traffic on Falcon Street and Military Road and increased traffic through Artarmon.

In response, the RTA stated that under the *Land Acquisition (Just Terms Compensation) Act 1991* only surface acquisition is subject to compensation. The RTA stated that traffic flows would be marginally changed in relation to Falcon Street and Military Road and that local area traffic management works would ensure that potential traffic impacts of the Proposal on the Artarmon area would be minimised. Refer to Sections 5.7 and 6.6 for further discussion of property impacts related to the Proposal.

Cost Benefit Analysis

Some representations raised concerns that the cost benefit analysis did not sufficiently detail all of the relevant costs of the Proposal such as impacts on air quality, water and the social and community costs. In response the RTA stated that the EIS was based on the appropriate guidelines and quantified where possible externality impacts. Other externality impacts that were difficult to quantify were discussed in the economic evaluation qualitatively.

The Department believes that due to the size of the BCR it is unlikely that quantification of all of the externality costs associated with the Proposal would result in the Proposal becoming uneconomic (*i.e.* costs outweighing benefits). Further, with the implementation of recommended mitigation measures encapsulated in the Proposal and through the recommended conditions, some of these outstanding externalities would be internalised.

Value for Money

Concerns were raised in some representations that the Proposal cost was excessive and could be better spent on other options such as enhancement of public transport. In response, the RTA stated that due to the private sector funding of the Proposal the costs would not be borne directly by taxpayers. Issues related to the alternatives to the Proposal are discussed in Section 2.4.

### 9.4.4 Conclusions

The Department believes that the benefits of the Proposal are likely to substantially outweigh the costs even taking into account unquantified external costs and with the elimination of small travel time savings. With the inclusion of the recommended conditions of approval including public transport benefits, the benefits to the whole of the society from the Proposal would be realised.

## 9.5 Services and Utilities

### 9.5.1 Background

The EIS recognised that the Proposal would result in some conflicts with services including electricity, telephone, gas, water supply, stormwater drainage and sewerage. Significant potential conflicts were identified where surface changes were proposed such as on the Gore Hill Freeway, Epping/Longueville Road and with the proposed Pacific Highway on ramp to the tunnel near Alto Place.

The Proposal would also require the use of and connection to existing services both during construction and operation. Four new substations were estimated to be required to augment power supply for the proposed tunnel. A new drainage system would be required for the proposed tunnel including spill containment devices. The EIS stated that 'clean' water collected by the drainage system would be discharged into the stormwater drainage system

### 9.5.2 Key Issues Raised

Two representations were received in relation to utilities and services. The representation received from Sydney Water Corporation recommended that the RTA liaise closely with them in regard water servicing arrangements for the Proposal. The other representation encouraged the RTA in considering the undergrounding of electricity transmission lines as part of the upgrade of Epping/Longueville Roads.

### 9.5.3 Consideration of Key Issues Raised

Neither the EIS nor the Representations Report provides specific details of both the services and utilities that may be affected during construction or the need for and use of existing services and utilities during construction and operation. Further discussion of these issues was deferred by the RTA until the detailed design. The Department therefore recommends the inclusion of Conditions of Approval Nos. 137 and 138 requiring that the Proponent identify all affected utilities and services and determine in consultation with relevant service providers what works are required. To ensure that service disruptions

on surrounding business and residences are minimised, the Department recommends the inclusion of Condition of Approval No. 140 requiring the Proponent to advise residents and business owners of any service disruptions during construction.

In relation to the undergrounding of electricity transmission lines as part of the changes to Epping Road, the Proponent stated that this would be considered during the detailed design process as part of the urban design assessment. The Department has therefore included the requirement to consider the undergrounding of electricity transmission lines on Epping Road as part of the Urban Design and Landscaping Sub Plan required as part of Recommended Condition of Approval No. 221(e).

### 9.5.4 Conclusions

The Department has recommended several Conditions of Approval which require the Proponent to identify and discuss service and utility infrastructure impacts as a result of the Proposal.

## 9.6 Indigenous and Non-Indigenous Heritage –

### 9.6.1 Background

Heritage assessments were undertaken corridor to determine the archaeological and cultural significance and potential impacts of the Proposal's construction and operation. Six (6) indigenous heritage items were identified comprising 4 sites, all of which are rock shelter sites and listed in the NPWS Sites Register. In addition, two PADs (potential archaeological deposits) were also identified, one on the western side of the Lane Cover River to the south of the proposed southern bridge alignment, and the other (which is identified in the Lane Cover LEP Heritage Register) along the whole of Stringybark Creek. Three of the rock shelter sites are located within the PADs.

A total of 19 non-indigenous heritage sites were found. Sixteen (16) of these are on existing registers and 3 were identified during field surveys and include landscape areas (9 sites), 8 built structures and 2 potential archaeological sites. Six items could be directly impacted by the Proposal and a further 7 indirectly affected.

### 9.6.2 Key Issues Raised in Representations

The issues raised by representation included:

- concerns regarding impacts on sites along Stringybark Creek;
- impacts of proposed Moore Street compound on the bushland identified in the Lane Cove Heritage Study as being of landscape significance; and
- the need for additional archaeological investigation of the potential archaeological deposits.

### 9.6.3 Consideration of Key Issues

<u>Indigenous Heritage</u>

Two of the four indigenous heritage items (45-6-1854 and 45-6-1855) are located away from construction areas and impact zones, and would not be affected. Two sites however (45-6-1354 and 45-6-1940), are within or immediately adjacent to the proposed tunnel route and modifications to Epping Road. There is potential for construction vibration to cause damage to the sandstone structures from vibration during construction.

PAD 1 extends along the Lane Cove River south from the existing bridge and includes an indigenous heritage site and a large number of sandstone outcrops and surfaces which may contain additional shelter sites, grinding grooves and engraving sites. The EIS states that there would be no impact on the PAD although the northern part of the PAD may be indirectly impacted during bridge construction.

PAD 2 extends along Stringybark Creek and contains a large number of sandstone outcrops and surfaces which may contain shelter sites, grinding grooves and engraving sites. There has been previous damage to the area much of it remains undisturbed. This PAD would be directly impacted by the construction and operation of the Moore Street works compound and there is potential for indirect impact during road works and tunnelling.

The EIS proposed a range of site management strategies and requirements to mitigate against likely impacts on the indigenous heritage items and the two areas identified as having potential archaeological deposits (PADS). The Department is cognisant of the potential impacts of vibration and has recommended vibration limits to minimise impacts on the surrounding environment. While these limits are focussed primarily on minimising damage to property, these would equally minimise impacts on the natural environment.

Non-Indigenous Heritage

Up to 12 items could be affected during construction of the Proposal. These include the Artarmon Conservation Area, Stringybark Creek, Chicago Starch Mill and the sandstone drain in Moore Street. Impacts on Moore Street are discussed in more detail in Section 8.1, however the Department has recommended further archaeological investigation prior to commencement of construction at this site in Recommended Condition 254. Notwithstanding, Recommended Condition 100 requires the preparation of an Archaeology and Heritage Sub Plan for all sites which would outline measures to be implemented to minimise impacts on heritage items.

## 9.7 Water Quality, Erosion and Sediment Control

### 9.7.1 Background

The Proposal lies within the catchments of Gore Creek, Lane Cove River, Stringybark Creek and Flat Rock Creek.

The EIS and Representations Report did not assess Gore Creek as only small flows from Epping Road pass to this watercourse and the potential for impacts were assessed as being minor compared with the other watercourses.

Existing water quality of the three assessed water courses is poor. Water quality in Flat Rock Creek fails to meet ANZECC Guideline criteria. The EIS proposes a range of standard erosion and sediment control measures including sediment and silt fencing, plantings, in tunnel drainage systems and use of sediment basins which will mitigate any impacts otherwise created by the Proposal.

### 9.7.2 Issues Raised in Representations

Issues raised in representations to the EIS include:

- questions on the quality of data and extent of additional data gathering undertaken;
- concerns regarding the potential impacts to the aquatic ecosystem;
- depth of fill and sediment/erosion control measures at the Moore Street compound;
- potential pollutants during construction and operation; and
- disturbance of acid sulfate soils.

### 9.7.3 Consideration of Issues

Quality of Data

Concern was raised in some representations that the assessment undertaken with inadequate data. The Proponent considers that in general, the level of information was adequate and where additional information was required, it was obtained. The Department considers that the level of information, and the methodology used to obtain the additional data, was adequate for the assessment and will provide the Proponent and its contractors with adequate baseline information to develop the range of Management Plans required by the recommended conditions of approval.

Potential Impacts on aquatic ecosystems

The potential impacts that reduced water quality may have upon the aquatic ecosystems in the three assessed catchments is an issue which would require ongoing management and monitoring. The RTA proposes extensive management measures to ensure that the quality of water discharged (*i.e.* downstream) from any compound or worksite is no worse than the water quality upstream from the site. The Department concurs with this approach.

Depth of Fill/Erosion Control at the Moore Street Compound

The use of the Moore Street compound and its impact upon the Stringybark Creek and Lane Cove catchments is a matter which has been addressed in detail in section 8 of this report. Special conditions have been recommended for the Moore Street compound to ensure that impacts on these catchments are mitigated and managed.

Potential pollutants during construction and operation

The EIS and Representations Report (including the environmental protection measures in section 7 of the Representations Report) detail how potential pollutants will be managed during the construction and operational phases. In addition to these commitments, the Proponent would be required to prepare a Water Management Sub Plan for construction and operation which would incorporate detailed measures for water treatment, sediment and erosion control, and detention systems for spill containment.

Disturbance of Acid Sulfate Soils

There is potential for acid sulfate soils (ASS) to be disturbed during the construction phase, particularly in Proposal areas close to Lane Cove River. No field assessment was undertaken in the EIS. Therefore the Department recommends a detailed testing program in selected locations prior to construction to determine the likelihood of encountering ASS during construction. Depending on the

outcomes of testing, Conditions 206 and 207 would be relevant which require preparation of either a contingency plan or ASS management sub plan.

### 9.7.4 Conclusion

The Proposal has the potential to impact water quality in the three catchments examined. The management and mitigation measures proposed in the EIS and Representations Report, and the additional measures required by the recommended conditions of approval would ensure that any impact on water quality is mitigated as far as practicable. This will be further strengthened by the requirements of the Environmental Protection Licence issued by the EPA which would be relevant during construction.

## 9.8 Energy Use and Greenhouse Gas Emissions

### 9.8.1 Background

The EIS estimated that during construction, 47 GWhrs of electrical power would be required (primarily as a result of road header tunnel construction) and it was estimated 1.5 million litres of fuel would be used during construction. During operation, the EIS estimated that the Proposal would result in a reduction of 56 million litres of fuel per annum in 2006 and 80 million litres of fuel per annum in 2016. Such a reduction in fuel usage would result in comparative reductions in greenhouse gas emissions. The EIS estimated that the power required for the tunnel ventilation system would be approximately 48 GWhrs per annum. The revised ventilation system design (as detailed in Chapter 4) would lead to an increase in energy requirements. It has been estimated that the power required could be up to 89 GWhrs per annum.

### 9.8.2 Key Issues Raised

Concerns were raised in representations about issues associated with the energy use and greenhouse gas emissions including:

- need for further assessment of operational energy requirements of the Proposal and consideration of renewable energy sources; and
- use of electrostatic precipitators (ESPs) to reduce energy use.

### 9.8.3 Consideration of Key Issues Raised

In response of the concerns raised the RTA stated that investigations would be undertaken to investigate the potential use of 'green' energy for tunnel operation.

The Department has calculated that if the ventilation system used 89 GWhrs per annum this would result in an annual emission of 36,401 tonnes of $CO_2$ (using a factor of 0.409kg of $CO_2$ per KWhr from a coal fired power station). Although it is predicted that the tunnel itself would lead to a more efficient traffic network and lead to reduced overall $CO_2$ emissions this assumes that there would not be induced traffic as a result of the Proposal.

In recognition of the potential greenhouse gas implications that such a large increase in energy use would lead to and mindful of recent NSW Government commitments to reducing greenhouse gas emissions it is recommended that Condition of Approval No. 144 is included requiring that at 50% of the electrical energy used for the Proposal during construction and operation shall be sourced from renewable green energy sources. In recognition of RTA concerns the recommended Condition allows

for this green energy component to be reduced to a minimum of 25% should it be demonstrated that higher levels are not available due to supply constraints.

The RTA did not clarify in the Representations Report what change in energy use could result from the use of ESPs. The Department believes that any positive change, if any is likely to be relatively small. Refer to Section 5.1 for further discussion of ESPs.

### 9.8.4 Conclusions

The Department notes that the RTA predicts that the Proposal would result in substantial improvements in fuel efficiency and greenhouse gas emissions. However, it is noted that such predictions are based on traffic modelling and the assumption that the Proposal would not result in induced traffic. The operation of the ventilation system would result in considerable energy use and if sources from traditional coal-fired power supplies would result in considerable greenhouse gas emissions. The Department has therefore recommended that "green power" be purchased for 50% of electrical energy requirements during construction and twice the Government Energy Management Policy for operations.

# 10 CONCLUSIONS AND RECOMMENDATIONS

## 10.1 Strategic Justification

The objectives of the Proposal as stated in the EIS (refer to Section 2.2) are related to improving road-base transport, both private and public, along an east-west corridor incorporating Epping Road. In addition, the objectives refer to improvements to local amenity, pedestrian and cyclist access and to the natural environment.

The stated benefits pf the Proposal would be realised in the form or road user benefits (travel time savings, improved safety, reduced operating costs, better public transport) and local community improvements (improved air and noise environment, improved access to facilities, safer and more amenable environment). Justification for the Proposal derives from transport, social, environmental and economic considerations and the Government's commitment to the Proposal in *Action for Transport 2010* and *Action for Air*.

### 10.1.1 Strategic Policy Objectives

The NSW Government's *Action for Transport 2010* and *Action for Air* policies outline a number of objectives with regard to integrated transport planning and infrastructure initiatives, including the need to:

- achieve more effectives us of existing and proposed transport infrastructure;
- improve air quality;
- reduce car dependency;
- meet the needs for urban transport services and usage;
- ensure new urban developments are provided with equitable access to economic and social opportunities;
- improve facilities for cyclists and pedestrians;
- reduce road accidents;
- move movement of freight more efficient; and
- provide value for money.

Overall, it must be appreciated that the strategic transport objectives would, by necessity, apply to a program of projects rather than to individual projects such as the Lane Cove Tunnel and Associated Road Improvements. In this regard, it is not expected that each project in isolation would necessarily address all objectives, but rather cumulatively, all projects should address or support a majority of the objectives. Notwithstanding, there would be an expectation that no individual project should result in a significant detrimental impact on any of the strategic objectives.

The ability of the proposed Lane Cove Tunnel and Associated Road Improvements to meet these broader strategic policy objectives is considered in the context of the specific proposal objectives below.

### 10.1.2 Strategic Proposal Objectives

*To improve the efficiency of east-west travel along the corridor for road-based transport modes through a reduction in congestion and improved travel times*

The EIS states that North-West Sydney is served by four (4) east-west arterial corridors/routes which concentrate movements along routes across the North Shore. Any traffic wishing to access the Gore Hill Freeway is captive to Epping Road, this corridor becomes highly congested such that traffic spreads to a number of lower order routes along the Pacific Highway between Crows Nest and Lindfield that are unsuitable for arterial traffic. The Proposal will provide additional road capacity with the construction of the tunnel. The EIS estimated that the Proposal would lead to travel time reductions of around 50% between the North-West sector and the North Shore/CBD during peak period as well as significant time reductions for trips to Chatswood and Artarmon. Improvements to bus travel times were also predicted through the corridor largely due to the provision of dedicated bus lanes on Epping Road and the Pacific Highway.

It is also stated that traffic reduction in the corridor due to mode shift to the Parramatta Chatswood Rail Link would contribute to meeting the project objectives, though this is unlikely to be sufficient to negate the need for the road upgrade

*To improve air quality and reduce traffic noise, particularly along the arterial road network through a reduction in surface traffic volumes and congestion*

Overall, the Proposal would lead to improved air quality and reduced traffic noise. Air quality along Epping Road is expected to improve significantly due to removal of a large proportion of traffic from the surface road and redirected into the tunnel. Improved traffic flows through the larger corridor would also contribute to regional air quality improvements due to more efficient vehicle operation. Further long term improvements to air quality in general could be anticipated over time with improvements to vehicle fleet emissions.

Similarly, operational noise reductions are anticipated along Epping Road, east of Mowbray Road West, with the downgrading of the surface route. However significant construction and small, incremental increases in operational traffic noise would occur west of Mowbray Road West and more significant increases along the Gore Hill Freeway due to increased traffic levels. The Department is cognisant that it would be problematic to meet relevant construction noise guideline levels. However, construction would be scheduled to occur predominantly during normal day time hours and with the inclusion of best practice mitigation and community consultation impacts would be reduced. Operational traffic noise would be minimised by the use of open graded asphalt pavement and the installation of noise barriers. Architectural treatment of other dwellings such as elevated receptors would further reduce impacts.

*To improved the amenity of the local community and businesses*

The significant reduction in traffic on Epping Road, estimated as up to 62%, would significantly improve the amenity of residents and businesses along this thoroughfare. The traffic reduction on Epping Road, while in itself provides improved amenity, also provides further opportunities to enhance the corridor by downgrading the function of the road, installing a pedestrian/cycle path, undertake significant landscaping of the roadway to reflect the downgraded road function and create a "boulevard" feel to the area. Access to the Lane Cove Industrial Estate, which is a key trip destination to the area would be improved.

*To improve the operation of road-based public transport for people in north-western Sydney and along the corridor through an improvement in bus priority through the corridor*

The Proposal as stated in the EIS included provision for dedicated bus lanes in each direction along Epping Road and T2 transit lanes on the Gore Hill Freeway. Bus travel time improvements with the

Proposal were predicted between 17% and 32% in 2005 and 10% to 25% in 2016. In addition, the stated in the Representations Report that it proposes to construct a bus interchange on the north-eastern corner of the Longueville/Epping Road intersection which will facilitate route changes and bus travel times through this section. Further improvements identified in the Representations Report included conversion of the existing T2 transit lanes on the Pacific Highway south of the Gore Hill Freeway to dedicated bus lanes which would be anticipated to improve the high number of services using the highway before turning westwards onto Longueville Road.

The Department identified further public transport enhancements which should be incorporated into the Proposal. These included installation of T3 lanes eastbound between Delhi Road and Mowbray Road West as well as bus priority measures at Mowbray Road West, Pittwater Road and Delhi Road. Installation of these measures would further strengthen the RTA's commitment to improved operation of road-based transport.

*To minimise impacts on the natural environment during both the construction and operation phases of the project*

The EIS and Representations Report have considered the impacts of the construction and operation of the Proposal on the surrounding environment. Whilst there would be impacts on the natural environment, these are anticipated to be limited and could be largely controlled with the implementation of mitigation measures. The Department has undertaken a thorough assessment of the residual impacts and considers that these are unlikely to be significant. The RTA has committed to preparing Construction and Operation Environmental Management Plans to set a framework for managing the anticipated impacts in a consistent manner across the project.

*To provide for cyclists along the corridor*

The incorporation of a pedestrian/cycleway along the length of the Proposal would provide a significant piece of infrastructure for non-motorised transport modes and is aimed at both commuter and recreational cyclists. The path would be shared with pedestrians for some sections while being a dedicated cycleway in other sections. The cycleway would be designed to take into account existing and regional cycleway connections wherever possible, including connections to the Sydney Harbour Bridge and North-West Sydney, thereby contributing to reduced car dependency. The Department believes that the RTA has sufficiently demonstrated that the project meets the pedestrian and cyclist objectives as outlined in the EIS.

*To provide the benefits of the project to the community at least cost to the Government*

The RTA has stated that several surface road options have been previously developed to improve traffic flow along Epping Road. These options were cheaper however, they did not meet the objectives of the Proposal, primarily improved amenity, local environment and access for the Lane Cove community. The changed scope of the Proposal during its development has resulted in increased costs to those originally estimated. The Proposal is to be constructed as a toll road with funding provided by the private sector. Under this arrangement, the private sector would be responsible for design, finance, construction, maintenance and operation of the Proposal. This would enable Government funding to be spent in other prioritised areas.

### 10.1.3 Conclusion

The Proposed Lane Cove Tunnel and Associated Road Improvements would provide the "missing link" in the Sydney Orbital road system identified by the Government in *Action for Transport 2010*. The Proposal would also provide substantial improvements to east-west travel across northern Sydney, between the North-West sector and the North Shore. It also has strategic importance in terms of catering for future connections between the F3 and Sydney Orbital.

The construction of the Lane Cove Tunnel would remove a significant proportion of the traffic currently using Epping Road and surrounding roads. However, the Proposal would result in an overall increase in road capacity as well as increasing traffic on a number of other roads.

The RTA has sought to maximise the sustainability of the Proposal by capturing some of the additional road space created and using this for public transport, pedestrian and cyclist access. The Department supports these measures and investigations into additional public transport priority are embodied in the Recommended Conditions of Approval. Further, extensive monitoring and local area traffic management measures would minimise the potential for "rat runs" to occur through local roads as a result of induced traffic and/or toll avoidance.

Significant impacts are anticipated as a result of construction activities particularly at the Moore Street compound site. The RTA has stated that the availability of the Moore Street site provides significant flexibility which is integral to construction of the Proposal. The Department is cognisant of the likely impacts and supports further investigation of alternative compound options. To this end, the Department recommends thorough consideration of any alternative compound locations or methods of construction identified during the tender process which may avoid the need for the Moore Street site. If no suitable options are identified, the Department would accept the use of Moore Street, provided activities complied with the stringent and transparent conditions recommended.

In order to achieve the desired long term and strategic outcomes, the Department has, in particular, placed significant emphasis on maximising public transport enhancement opportunities, ensuring net improvement to regional air quality and the downgrading of Epping Road. The Department's assessment has concluded that the Proposal would of be long term benefit to the community if supplemented by the recommended air quality, regional and local traffic, and Moore Street construction conditions, and that all residual impacts could be appropriately managed.

Other issues of relevance to the Proposal are assessed in Chapters 5 to 9, the key ones include noise and vibration, spoil and waste management, groundwater and settlement, urban design and visual impacts, cyclists and pedestrians and ecological impacts. The assessment concludes that all such impacts can be managed and would not, subject to conditions, result in long term adverse or irreversible effects.

### 10.1.4 Recommendations

It is recommended that, should the proposal proceed, it would be essential for extensive and comprehensive conditions to be imposed so as to ensure, to the greatest extent practicable, its long term benefits. Section 12 of this Report lists all the recommended conditions of approval, the key ones include:

- the most stringent in-tunnel carbon monoxide standards in the world (CO of 50 ppm for 30-minutes);
- requirement for community based air quality monitoring stations for each of the ventilation stacks;

- provision for the retro-fitting of pollution control systems subject to air quality impacts and technological improvements in treatment of gases;
- highly prescriptive and transparent conditions related to noise, air quality, transport, water quality and site rehabilitation should the Proponent decide to pursue the Moore Street compound site;
- creation of 1.3 km of new T3 transit lanes between Mowbray Road and Delhi Road and conversion of 0.65 km of transit lane to bus lanes and establishment of 0.45 km of new bus lanes;
- requirement to investigate further opportunities for bus lanes, bus priority or high occupancy vehicle lanes on the Warringah Expressway, Falcon Street and Pacific Highway;
- monitoring or traffic after opening to verify predictions in the EIS and to determine the level of induced traffic as a result of the Proposal and implementation of measures where induced traffic is realised;
- strategic assessment of traffic access to Chatswood to reduce impacts on roads in Artarmon including Reserve Road;
- installation of LATM measures for key locations likely to experience increased traffic volumes;
- preparation of a detailed cycleway and pedestrian plans and a review of the cycleway route in the vicinity of residences in Naremburn;
- development of a community education program regarding the appropriate action to be taken in the event of incidents and emergencies in the tunnel;
- commitment to supply electrical energy from "green power" for 50% of construction electrical energy requirements and double the Government Energy Management Policy for operations;
- a number of construction related environmental management measures to minimise impacts.

# 11 REFERENCES

Roads and Traffic Authority (1994). *Epping Road Options Study*. Prepared by Sinclair Knight Merz.

Roads and Traffic Authority (1995). *Road Development Strategy – M2 Motorway to Warringah Freeway*. Prepared by Connell Wagner.

Roads and Traffic Authority (1997). *Tunnel Financial and Feasibility Study*. Prepared by Hyder Consulting.

Roads and Traffic Authority (2001). *Lane Cove Tunnel and Associated Road Improvements. Environmental Impact Statement*. Prepared by Sinclair Knight Merz.

Roads and Traffic Authority (2001). *Lane Cove Tunnel. Pre-tender Geotechnical Investigation. Geotechnical Interpretation Report*. Prepared by Coffey Geosciences.

Roads and Traffic Authority (2002a). *Lane Cove Tunnel EIS. Assessment of Western Vent Stack Site Options*. Prepared by Sinclair Knight Merz.

# 12 RECOMMENDED CONDITIONS OF APPROVAL

*This section provides the Department's Recommended Conditions of Approval for the Proposal under Section 115B(2) of the EP&A Act. These are based on the Department's assessment of the EIS, the representations made to the RTA and supplementary information and advice provided.*

*It is noted that the EIS and Representations Report contain extensive information on procedures and mitigation strategies to be implemented to ameliorate the impacts of the Proposal. The recommended conditions of approval should therefore be implemented in conjunction with those procedures and mitigation measures specified in the EIS and the Representations Report. Where there is an inconsistency with the recommendations in the EIS or Representations Report, the Recommended Conditions will prevail.*

*The following acronyms and abbreviations are used in this section:*

| | |
|---|---|
| AQCCC | Air Quality Community Consultative Committee |
| ARI | Average Recurrence Interval |
| ASS | Acid Sulfate Soils |
| CBMS | Community Based Monitoring Station |
| CIP | Community Involvement Plan |
| CMS | Construction Method Statements |
| CLG | Community Liaison Group |
| The Company | The contractor awarded the concession by the Roads and Traffic Authority to construct and operate the Project |
| Department, the | Department of Planning |
| Director-General, the | Director-General of the Department of Planning or delegate |
| Director-General's Report | the report of the Director-General of the Department of Planning |
| DLWC | NSW Department of Land and Water Conservation |
| DoH | NSW Department of Health |
| DoP | NSW Department of Planning (PlanningNSW) |
| EIS | The *Lane Cove Tunnel and Associated Road Improvements Environmental Impact Statement* prepared for the RTA by Sinclair Knight Merz, dated October 2001. |
| EMP | Environmental Management Plan |
| EMR | Environmental Management Representative |
| EP& A Act | *Environmental Planning and Assessment Act 1979* |
| EPA | NSW Environment Protection Authority |
| ESD | Ecologically Sustainable Development |
| Feasible noise mitigation | For operational noise mitigation, feasible relates to engineering considerations and what is practical to build |
| ICLR | Independent Community Liaison Representative |
| LATM | Local Area Traffic Management |
| LALC | Local Aboriginal Land Council |
| LCC | Lane Cove Council |
| LCT | Lane Cove Tunnel and Associated Road Improvements |
| $L_{Aeq(9\ hour)}$ | Equivalent continuous (constant) sound pressure level over a 9 hour period from 10pm to 7am |
| $L_{Aeq(15\ hour)}$ | Equivalent continuous (constant) sound pressure level over a 15 hour period from 7am to 10pm |
| $L_{Aeq\ (15\ mins)}$ | Equivalent continuous (constant) sound pressure level over a 15 minute interval |
| $L_{A1(1\ minute)}$ | Sound pressure level exceeded for 1 per cent of the time measured over a 1 minute interval |
| $L_{A10\ (15\ mins)}$ | Sound pressure level exceeded for 10 per cent of the time over a 15 minute period |
| Minister, the | Minister for Planning |

| | |
|---|---|
| NATA | National Association of Testing Authorities |
| NEPC | National Environment Protection Council |
| NEPM | National Environment Protection Measure |
| NH&MRC | National Health and Medical Research Council |
| NPWS | NSW National Parks and Wildlife Service |
| PC | personal computer |
| PMF | Probable Maximum Flood |
| $PM_{10}$ | Particulate matter with an aerodynamic diameter of less than or equal to 10 microns |
| $PM_{2.5}$ | Particulate matter with an aerodynamic diameter of less than or equal to 2.5 microns |
| Public Transport | Refers to road-based public transport |
| PTC | Public Transport Committee |
| Proponent | Roads and Traffic Authority NSW |
| Reasonable noise mitigation | Relates to the application of judgement in arriving at a decision taking into account:<br>▪ Noise mitigation benefits (noise reduction provided, no. of people protected)<br>▪ Mitigation cost (cost versus benefit provided)<br>▪ Community views (aesthetic impacts and community wishes); and<br>▪ Noise levels for affected land uses (existing and future levels and changes in noise levels) |
| Relevant Councils | Any one or more of the following Councils as applicable: North Sydney Council, Willoughby City Council, Lane Cove Council, Ryde City Council |
| Representations Report | The report and appendices prepared by the *Lane Cove Tunnel and Associated Road Improvements Volumes I-III* dated June 2002. |
| RTA | Roads and Traffic Authority NSW |
| Sensitive Receptor | Residential, nursing home, hospital or similar |
| STA | State Transit Authority |
| Substantial construction | Does not include survey, acquisitions, fencing, test drilling/test excavations, building/road dilapidation surveys, minor surveys, minor clearing except where endangered ecological communities or threatened flora and fauna species would be impacted, establishment of site compounds in generally cleared, highly disturbed or non environmentally sensitive areas, minor access roads, minor adjustments to services/utilities, noise mitigation measures and other minimal environmental/community impact activities |
| Supplementary information | To be defined following submission of all outstanding information from RTA |
| SWC | Sydney Water Corporation |
| TSP | Total suspended particulates |
| TEOM | Tapered element oscillating microbalance analyser |
| TNSW | Transport NSW (NSW Department of Transport) |
| Tunnel | That component of the Project underground between the western portal at Mowbray Road West and the eastern portal to the east of the Pacific Highway interchange, any entrance/exit ramps from the main underground tunnel to the surface used for either construction and/or operation and any excavations required for ventilation including emission and intake. |
| VOCs | Volatile Organic Compounds |
| WHO | World Health Organisation |

## COMMENCEMENT, COMPLIANCE AND CONSULTATION

### General

1. The Project shall be carried out in accordance with the Proposal as described in the Environmental Impact Statement (EIS), and as modified by the Representations Report and where relevant:

   (a) the Director-General's Report; and
   (b) the Conditions of this Approval imposed by the Minister.

   Despite the above, in the event of any inconsistency with the Project as described in the EIS, Representations Report, supplementary information and the Conditions of Approval, the Conditions of Approval imposed by the Minister shall prevail.

   These conditions do not relieve the Proponent of the obligation to obtain all other approvals and licences from all relevant authorities required under any other Act. Without affecting the generality of the foregoing, the Proponent shall comply with the terms and conditions of such approvals and licences.

   It shall be the ultimate responsibility of the Proponent to ensure that the Project is carried out in accordance with the EIS and as modified by the Representations Report and supplementary information, and that full compliance with all Conditions of Approval granted by the Minister is achieved.

2. The Proponent shall notify the Director-General and all relevant authorities in writing of Project commencement both in terms of 'construction', 'substantial construction' and opening of the Project to traffic at least four (4) weeks prior to the relevant commencement date.

3. The Tunnel, Falcon Street ramps and Gore Hill Freeway widening shall be opened to traffic concurrently.

### Compliance

*General*

4. The Proponent shall comply with, or ensure compliance with, all requirements of the Director-General in respect of the implementation of any measures arising from the conditions of this approval. The Proponent shall bring to the attention of the Director-General any matter that may require further investigation and the issuing of instructions from the Director-General. The Proponent shall ensure that these instructions are implemented to the satisfaction of the Director-General within such time as the Director-General may specify.

*Pre-Construction Compliance Report*

5. The Proponent shall submit a compliance report detailing compliance with all relevant conditions that apply prior to commencement of substantial construction. The report shall be submitted to the Director-General for approval at least one (1) month prior to commencement of substantial construction. The Pre-construction compliance report shall address:

   (a) the dates of submissions of the various studies and/or requirements of various relevant conditions, and their approval and terms of approval; and
   (b) action taken and/or proposed to implement the recommendations made in terms of approvals and/or studies.

*Pre-Operation Compliance Report*

6. At least one (1) month prior to commencement of operation of the Project, the Proponent shall submit to the Director-General a compliance report detailing compliance with all relevant conditions that apply prior to commencement of operation and shall include:

   (a) results of environmental monitoring during construction required under this Approval including interpretation and discussion by a suitably qualified person;
   (b) a record of all complaints and the action taken to mitigate all such complaints;
   (c) recommendations in regard to compliance issues; and
   (d) action taken and/or proposed to implement the recommendations made in terms of approvals and/or studies.

   The period of one (1) month referred to in this condition above may be altered as agreed by the Director-General.

> *Note: The Director-General shall provide a response to Conditions 5 and 6 within one (1) month of receipt of all relevant information from the Proponent assuming receipt of adequate and sufficient information. If a request is made by the Director-General for additional information, the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the Director-General shall not be taken into account in the 1 month period referred to. Any requests for additional information shall be made by the Director-General within 2 weeks of receipt of all relevant information from the Proponent.*

*Environmental Impact Audit Report*

7. An Environmental Impact Audit Report shall be submitted to the Director-General, one (1) year, five (5) years from opening of the Project to traffic or at any time as requested by the Director-General within the first ten (10) years of operation. The environmental impact audit report shall be prepared by an independent person(s) or organisation approved by the Director-General and paid for by the Proponent. The Report shall assess the key impact predictions made in the EIS, Representations Report and supplementary information and detail the extent to which actual impacts reflect the predictions during the first 12 months of operation and any other periods as required. The Report shall provide details on actual versus predicted impacts for all key issues identified in the EIS. The suitability of implemented mitigation measures and safeguards shall also be assessed. The Report shall also assess compliance with the Operational EMP.

   The Report shall discuss results of consultation with the local community in terms of feedback/complaints on the construction and operation phases of the Project and any issues of concern raised and shall be made available to any member of the public upon request. The Proponent shall comply with all reasonable requirements of the Director-General or any determining authority with respect to any reasonable measure arising from, or recommendations in, the report.

**Dispute Resolution and Complaints Procedures**

8. The Proponent shall endeavour to resolve any dispute between or with relevant public authorities arising out of the implementation of these conditions of approval. Any matters which cannot be resolved shall be referred firstly to the Chief Executives and Directors of the agencies involved. If the matter cannot be resolved then it shall be referred to the Minister for resolution. The Minister's resolution of the disagreement shall be final and binding on all parties.

   Nothing in this condition shall prevent, limit or restrict any statutory requirements under any legislation.

9. Prior to the commencement of construction, the Proponent shall establish and publicise a 24 hour toll-free complaints contact telephone number. The aim of the complaints line is to enable any member of the general public to reach a person who can arrange appropriate response/corrective action to the complaint within two hours during all times construction activities occur.

10. The Proponent shall record details of all complaints received during construction and ensure that at least a verbal response on the action(s) to be taken is provided to the complainant within 2 hours during all times construction activities occur (unless the complainant agrees otherwise) and a detailed written response within seven (7) calendar days. Information on all complaints received and response times shall be made available to the EMR daily and on request to the Director-General and relevant government agencies. The Proponent shall nominate an appropriate person(s) to receive, log, track and respond to complaints within the specified timeframe. The name and contact details of this person(s) shall be provided to the relevant Council(s), the Director-General and relevant agencies upon appointment and at least one week prior to the commencement of substantial construction or upon any changes to the appointment.

**Communication and Consultation**

*Advertisement of Activities*

11. As soon as practicable from the date of this approval, the Proponent shall inform all relevant residents and businesses by way of brochure of any physical changes to the concept design of the Project made since the exhibition of the PAR including the potential locations of the air intake and changes at the intersection with Willoughby Road

    At least one month prior to substantial construction the Proponent shall inform all relevant residents and businesses of the final location for air intakes or physical changes to the Project.

12. Prior to the commencement of construction, and then at three-monthly intervals, the Proponent shall advertise in relevant local newspapers, the nature of works proposed for the forthcoming three (3) months, the areas in which these works are proposed to occur, the hours of operation and a contact telephone number.

    The Proponent shall ensure that the local community, businesses and public transport operators are kept informed (by appropriate means such as: local newsletters, leaflets, newspaper advertisements, community notice boards and the Project internet site to be established in accordance with Condition 13 of the progress of the Project, including any traffic disruptions and controls, construction of temporary detours and work required outside the standard construction hours, including noisy works, prior to such works being undertaken.

13. The Proponent shall establish a Project internet site prior to the commencement of construction and maintain the internet site until at least 12 months after commencement of operation of the Project or as long as required for updating operational air quality and traffic monitoring results. The internet site shall as a minimum contain monthly work progress and consultation activities updates, including but not limited to:

    (a) a description of relevant approval authorities and their areas of responsibility;
    (b) a list of environmental management reports that are publicly available and the executive summaries of those reports;
    (c) minutes of Community Liaison Group(s) meetings (refer to Condition 14);
    (d) bi-monthly newsletters consistent with Condition 12;

(e) contact names and phone numbers of Project communications staff;
(f) 24 hour toll-free complaints contact telephone number, established in accordance with Condition of Approval No. 9;
(g) reporting of complaint management details including nature of complaints and how the complaint was addressed, analysis of complaints over time;
(h) a means of lodging complaints over the internet; and
(i) a means of asking questions for feedback

Work progress, construction activities and planned work schedule shall be provided and updated more frequently where significant changes in noise impacts are expected.

*Note:*
*The intent of this condition is to ensure that information about the project is provided on the Internet and can be accessed by the general public. The Internet site could be established as a link from the Proponent's existing website or as a project specific site.*

*Community Liaison Groups*

14. The Proponent shall establish appropriate representative Community Liaison Group(s) to the satisfaction of the Director-General and in accordance with the Community Involvement Plan required under Condition 15, having considered the Guidelines for the Establishment of the Community Liaison Group(s) (see Attachment 1). The number of groups to be established shall consider the various construction stages and sections of the Project as applicable. The Proponent shall:

(a) ensure that the first meeting is held prior to substantial construction;
(b) allow the Group(s) to make comments and recommendations about construction progress and implementation and the environmental management plan and sub plans, monitor compliance with these conditions of approval and other matters relevant to the operation of the Project;
(c) ensure that the Group(s) have access to the necessary plans and information for such purposes;
(d) consider the recommendations and comments of the Group(s) and provide a response to the Groups and Director-General;
(e) ensure that the Community Liaison Group(s) and the Air Quality Community Consultative Committee required by Condition 158 shall be appropriately co-ordinated in terms of nominees, issues covered by each committee and updates from the Air Quality Community Consultative Committee to the Community Liaison Group(s);

The Proponent shall bear all costs associated with the establishment and ongoing function of the Group(s).

*Community Involvement Plan*

15. The Proponent shall prepare a Community Involvement Plan for the construction period, to be initiated by commencement of construction. The Community Involvement Plan shall set out the community consultation procedures for the Project, which shall comply with the obligations under the approval from the Minister, these Conditions, other approvals, licences and permits. The Community Involvement Plan shall also include:

(a) identification of the local community likely to be affected by the Project, including identification of residences, businesses and other sensitive land uses;
(b) procedures for the establishment and functioning of the Community Liaison Groups in accordance with Condition 14;

(c) procedures for informing affected road network users of planned traffic arrangements including temporary traffic switches;
(d) procedures for informing the local community of planned investigation and construction activities;
(e) provisions for dealing with complaints (particularly night time) and response requirements as specified in Conditions 9 and 10.
(f) provision for the Proponent's attendance and participation in all groups and public meetings forming part of the Community Involvement Plan; and
(g) the provision of training for all employees and sub-contractors on the requirements of the Community Involvement Plan.

*Independent Community Liaison Representative*

16. The Proponent shall nominate a person(s), to be approved by the Director-General, to serve as the Independent Community Liaison Representative(s) (ICLR). The role of the ICLR shall include but not be limited to:

(a) attending and chairing Community Liaison Group meetings;
(b) consulting with the Proponent with regard to consultation strategies;
(c) being available for direct contact by the community during standard construction hours and periods of significant noise generating activities as outlined in the Construction Noise and Vibration Management Sub Plan (Condition 57); and,
(d) to the greatest extent practicable, resolve community complaints.

The ICLR shall:
(a) be experienced in mediating disputes; and
(b) contact the EMR immediately if, in the opinion of the ICLR, an unacceptable noise or other impact is being generated.

The Proponent shall bear the cost of employment of the ICLR.

*Display Centres*

17. At least one (1) display centre shall be established, staffed and maintained at least until opening of the LCT to traffic. The ICLR shall be based at a display centres. The display centre(s) shall be open at least between 10:00 am and 6:00 pm on business days and between 10:00 am and 1:00 pm on Saturdays. Up-to-date photographs, diagrams, engineering drawings, technical reports, samples and other suitable material shall be provided at each display centre, covering at least:

(a) noise and retaining wall locations, details and finishes;
(b) landscape concept, cross section treatments, perspective views and details;
(c) buildings;
(d) bridges;
(e) tunnels;
(f) overall architectural and landscape design theme;
(g) ventilation technology and ventilation stack design; and
(h) temporary works affecting businesses, residences, pedestrians and public transport users.

A dedicated PC internet access point to the Project internet site shall be provided at each display centre. A phone line shall be provided from one display centre to the centre where the ICLR is based if more than one display centre is established.

## ENVIRONMENTAL MANAGEMENT AND MONITORING

### Environmental Management Representative

18. The Proponent shall nominate a person(s) to serve as the Environmental Management Representative (EMR) for the Director-General's approval at least three (3) months prior to substantial construction. In considering the appointment, the Director-General shall take into account:

(a) the qualifications and experience of the EMR including demonstration of understanding and application of AS/NZS ISO 14012:1996 Guidelines for Environmental Auditing : Qualification Criteria for Environmental Auditors;
(b) the role and responsibility of the EMR; and,
(c) the authority and independence of the EMR from the Company or any construction contractor, including details of the Proponent's and or the Company's internal reporting structure. This shall include the authority to stop work immediately if, in the view of the EMR, an unacceptable impact is occurring and/or likely to occur or to require other reasonable steps to be taken to avoid or minimise any adverse impacts.

The EMR shall have responsibility for:

(i) considering and advising the Company and/or Proponent on matters specified in the Conditions of Approval and compliance with such;
(ii) certifying the environmental/community impacts as minor for all activities defined by the Proponent as not constituting substantial construction;
(iii) reviewing and approving the Project induction and training program for all persons involved in construction activities and monitoring implementation;
(iv) periodically monitoring the Proponent's environmental activities to evaluate the implementation, effectiveness and level of compliance of on-site construction activities with the EMP and associated plans and procedures, including carrying out site inspections at least fortnightly at all active sites;
(v) providing monthly project construction updates to the Department;
(vi) certify audits in accordance with Condition 23 and undertake informal audits/checks to ensure adequacy of environmental management measures;
(vii) recording and providing a written report to the Proponent of non-conformances with the EMP and requiring the Proponent to implement mitigation measures to avoid or minimise any adverse impacts on the environment or reporting required changes to the EMP;
(viii) requiring the Proponent to take all steps necessary to avoid or minimise an unacceptable impact on the environment such as an immediate halt to work in the vicinity of the impact and/or the implementation of mitigation measures;
(ix) reviewing corrective and preventative actions to ensure the implementation of recommendations made from the audits and site inspections;
(x) reviewing revisions to the EMP and CMS;
(xi) providing reports to the Department on matters relevant to the carrying out of the EMR role as necessary including notifying the Director-General of any stop work notices; and
(xii) certify the Construction and Operational EMPs in accordance with Conditions 20 and 24 respectively.

The EMR shall immediately advise the Proponent and the Director-General concurrently of any major issues resulting from the construction of the Project.

The EMR shall be available for contact during all time construction activities are occurring at the site(s) and be present on-site during any critical construction activities as defined in the relevant Environmental Management Plan (EMP), Sub Plans or Construction Method Statements (CMSs).

**Environmental Management System**

19. The Proponent shall appoint construction and/or operation head contractors (the Company) that have an Environmental Management System prepared in accordance with the AS/NZS ISO 14000 series or BS7750-1994 certified by an accredited certifier and/or have a proven environmental management performance record.

**Construction Framework Environmental Management Plan**

20. At least one (1) month prior to the commencement of substantial construction, a Construction Framework Environmental Management Plan (EMP) shall be prepared, following consultation with the EPA, DoH, DLWC, STA, relevant councils and all relevant utility/service providers. The Construction Framework EMP shall be prepared in accordance with the conditions of this approval, all relevant Acts and Regulations and accepted best practice management Sub Plans.

The Construction Framework EMP shall require approval by the Director-General prior to the commencement of substantial construction or within such time as otherwise agreed to by the Director-General. The Construction Framework EMP shall be certified by the EMR as being in accordance with these Conditions of Approval and all undertakings made in the EIS and Representations Report, prior to seeking the approval of the Director-General.

*Note: The Director-General shall provide a response to the Construction Framework EMP within one (1) month of receipt of all relevant information from the Proponent assuming receipt of adequate and sufficient information. If a request is made by the Director-General for additional information, the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the Director-General shall not be taken into account in the 1 month period referred to.*

The Construction Framework EMP shall include, but not be limited to:

(a) reference and proposed timeframes for all Sub Plans required under this Approval;
(b) the role of the EMR;
(c) details of the ICLR and interaction of the EMP with the Community Involvement Plan required in Condition 15;
(d) definition of the role, responsibility, authority, accountability and reporting of personnel relevant to compliance with the Construction Framework EMP;
(e) a matrix of Construction Method Statements (CMSs) required to construct the Project, including an assessment of the predicted level of environmental risk and potential level of community concern posed by each CMS and indicative timeframes for completion; and,
(f) propose a response timeframe for all CMSs to be approved by the Director-General.

The Construction Framework EMP shall be made available to any member of the public upon request.

**Construction Method Statements**

21. The Proponent shall prepare Construction Method Statements (CMS) in accordance with the Construction Framework EMP required by Condition 20 and in consultation with relevant government agencies and CLGs. The Director-General shall nominate the CMSs that shall be submitted by the Proponent for approval. Those CMSs not requiring the Director-General's approval shall require the certification of the EMR as being in accordance with the Conditions of Approval and all undertakings made in the EIS and Representations Report. Any CMS to be approved by the Director-General shall be submitted to the Department following certification by the EMR and no less than one (1) month prior to the proposed commencement of the relevant construction activities.

Each CMS shall include, but not be limited to:

(a) construction activities and processes associated with the relevant construction site(s), including staging and timing of the proposed works;
(b) specific hours of operation for all key elements including off-site movements;
(c) specific environmental management objectives and strategies for the main environmental system elements and include as applicable, but not be limited to: noise and vibration; air quality; water quality; erosion and sedimentation; access and traffic including public transport changes; property acquisition and/or adjustments; indigenous and non indigenous heritage; groundwater; acid sulfate soils, spoil stockpiling and disposal; waste/resource management; weed management; flooding and stormwater control; geotechnical issues; visual screening, landscaping and rehabilitation; hazards and risks; energy use, resource use and recycling; and utilities; and
(d) address, but not be limited to:
    (i) identification of the statutory and other obligations which the Proponent is required to fulfil during Project construction, including all approvals and consultations/agreements required from other authorities and stakeholders, and key legislation and policies which control the Proponent's construction of the Project;
    (ii) measures to avoid and/or control the occurrence of environmental impacts;
    (iii) measures (where practicable and cost effective) to provide positive environmental offsets to unavoidable environmental impacts;
    (iv) definition of the role, responsibility, authority, accountability and reporting of personnel relevant to compliance with the CMS;
    (v) site specific environmental management techniques and processes for all construction processes which are important for the quality of the environment in respect of permanent and/or temporary works;
    (vi) site specific monitoring, inspection and test plans for all activities and environmental qualities which are important to the environmental management of the Project, including performance criteria, tests, and protocols (*e.g*. frequency and location);
    (vii) identification of affected residents and consultation/notification requirements;
    (viii) locational details of important elements such as temporary noise barriers; sedimentation basins and facilities; detention basins; portable offices and amenities; truck, plant and materials storage; access locations; provision of site hoardings etc;
    (ix) environmental management instructions for all complex environmental control processes which do not follow common practice or where the absence of such instructions could be potentially detrimental to the environment;
    (x) steps the Proponent intends to take to ensure that all Plans and Sub Plans are being complied with;
    (xi) consultation requirements with relevant government agencies; and

(xii) community consultation and notification strategy (including local community, businesses, relevant government agencies, public transport operators and all relevant Councils), and complaint handling procedures.

Specific requirements of the main environmental system elements referred to in (c) shall be as required under the conditions of this approval and/or as required under any licence or approval. All CMSs shall be publicly available upon request.

**Environmental Monitoring – Construction**

22. The Proponent shall submit to the Director-General a report(s) in respect of the environmental performance of the construction works and compliance with the Construction Framework EMP, all relevant CMSs and any other relevant conditions of this approval. The reports shall be prepared six (6) months after the start of substantial construction and thereafter at six (6) monthly intervals or any other period as requested by the Director-General to ensure adequate environmental performance over the duration of the construction works. The reports shall be submitted not more than four (4) weeks after the preceding six (6) month period. The report(s) shall include, but not be limited to, the following information:

(a) applications for consents, licences and approvals, and responses from relevant authorities;
(b) implementation and effectiveness of environmental controls and conditions relating to the work undertaken;
(c) identification of construction impact predictions made in the EIS and any supplementary studies and details of the extent to which actual impacts reflected the predictions;
(d) details and analysis of environmental monitoring results;
(e) number and details of any complaints, including summary of main areas and issues of complaint, action taken, response given and intended strategies to reduce complaints of a similar nature; and
(f) any other matter relating to the Proponent's compliance with the conditions of this approval or as requested by the Director-General.

The report(s) shall be provided to the EPA, relevant Councils and any other relevant government agency nominated by the Director-General. The report(s) shall also be made publicly available.

23. The Proponent shall ensure that it has an internal compliance audit system and that internal audits are undertaken monthly and certified by the EMR every three (3) months to ensure compliance with the EMP, the conditions of this approval and all other relevant licences and approvals. Each audit must be completed and provided to the Director-General within four (4) weeks of the end of the preceding three (3) month period.

**Operational Environmental Management Plan**

24. An Operational Environmental Management Plan (OEMP) shall be prepared prior to the commencement of operation. The Plan shall be prepared in consultation with the EPA, DLWC, DoH, STA, relevant Councils, and any other relevant government agency nominated by the Director-General. The Plan shall be prepared in accordance with the conditions of this approval, all relevant Acts and Regulations and accepted best practice management Sub Plans.

The OEMP shall be submitted to the Director-General for approval a minimum of one (1) month prior to opening of the Project to traffic or within such time as otherwise agreed to by the Director-General. The OEMP shall be certified by the EMR as being in accordance with the Conditions of Approval prior to seeking approval of the Director-General. Opening of the

Project to traffic shall not be permitted prior to the approval of the OEMP unless otherwise agreed by the Director-General.

> *Note: The Director-General shall provide a response to the Operational EMP within one (1) month of receipt of all relevant information from the Proponent, assuming receipt of adequate and sufficient information. If a request is made by the Director-General for additional information, the period of time that elapses between the date on which the Proponent receives the request and the date on which the additional information is provided to the Director-General shall not be taken into account in the 1 month period referred to.*

The OEMP shall address at least the following issues:

(a) identification of the statutory and other obligations which the Proponent is required to fulfil, including all licences/approvals and consultations/agreements required from authorities and other stakeholders, and key legislation and policies which control the Proponent's operation of the Project;
(b) sampling strategies and protocols to ensure the quality of the monitoring program, including the specific requirements of DLWC, relevant Australian Standards and relevant EPA Guidelines;
(c) monitoring, inspection and test plans for all activities and environmental qualities which are important to the environmental performance of the Project during its operation, including a description of potential site impacts, performance criteria, specific tests and monitoring requirements, protocols (*e.g.* frequency and location) and procedures to follow;
(d) steps the Proponent intends to take to ensure compliance with all plans and procedures;
(e) consultation requirements, including relevant government agencies, the local community and Council(s), and complaints handling procedures; and
(f) strategies for the main environmental system elements including, but not limited to: noise; water quality; erosion and sedimentation; access and traffic; groundwater; settlement; waste/resource management/removal/disposal; hydrology and flooding; visual screening, landscaping and rehabilitation; hazards and risks; and energy use, resource use and recycling.

Specific requirements for some of the main environmental system elements referred to in (f) shall be as detailed under the conditions of this approval and/or as required under any licence or approval.

The OEMP shall be made available to the public upon request.

25. All sampling strategies and protocols undertaken in accordance with the Operational EMP shall include a quality assurance/quality control plan and shall be approved by an independent auditor to ensure the effectiveness and quality of the monitoring program. Laboratories to be used for any individual analysis must be accredited by NATA (or other accreditation body as appropriate) for that analysis.

## ENVIRONMENTAL, ECONOMIC AND SOCIAL ISSUES

### Construction Traffic

26. A road dilapidation report shall be prepared prior to commencement of substantial construction and after construction is complete for all non-arterial roads likely to be used by construction traffic. A copy of the report shall be provided to relevant Councils. Any damage resulting from the construction of the Project, aside from that resulting from normal wear and tear shall be repaired at the cost of the Proponent.

27. The Proponent shall consult with relevant Councils to develop management techniques for construction traffic on local roads, prior to commencement of construction. The Proponent shall monitor the use of local roads by construction heavy vehicle traffic in consultation with relevant Councils and shall consult with relevant Councils to develop measures to minimise and/or restrict use of local roads by heavy vehicle traffic.

> *Note: Nothing in Conditions 26 or Condition 27 shall be taken as restricting the Proponent from negotiating an alternative payment for damage to local roads with relevant Councils, subject to the agreement of relevant Councils.*

Construction Stage

28. The Proponent shall ensure that access to all properties is maintained during construction and following opening of the Project to traffic. The Proponent shall ensure that any access affected by the Project is reinstated to an equivalent standard or that adequate compensation is negotiated with the relevant landowner(s).

29. The Proponent shall prepare a Framework Construction Traffic Management Plan for overall traffic arrangements during the full construction period. The Plan shall include, with respect to the Project as a whole:

    (a) cumulative impacts of multiple construction sites and other major construction including the Parramatta Rail Link;
    (b) measures to manage traffic flows through and surrounding the Project and spoil disposal sites, including regulatory and direction signposting, line marking and variable message signs; and
    (c) identify any mitigation measures to improve the efficiency of traffic conditions.

    The Plan shall take into account both local and regional traffic impacts and shall at all stages maintain existing priority and running times to public transport, bicycles and pedestrian movements. The Plan shall be prepared by an experienced traffic/transport planner in consultation with the TNSW, PTC, STA, relevant councils and shall be approved by the RTA (Transport Management Centre) prior to substantial construction commencement.

30. The Proponent shall prepare individual Traffic Management Plans (TMPs) for each construction site in accordance with the Framework Construction Traffic Management Plan required by Condition 29, and in consultation with relevant local councils and other agencies, prior to commencement of substantial construction affecting that area. The individual TMPs shall be incorporated into the relevant Construction Method Statements required under Condition 21. The individual TMPs shall include, but not be limited to:

    (a) impacts on all existing traffic (including pedestrians, public transport, vehicles, cyclists and disabled persons), including the staging of construction works to minimise road closures

and delay or detours to traffic;
(b) access to construction sites and site compounds, including minimising the disruption from construction vehicles entering and leaving construction sites and site compounds;
(c) provision of staff parking within compounds wherever possible;
(d) any changes to existing number and width of traffic lanes;
(e) maximum and average truck volumes and expected hourly distribution;
(f) truck ingress and egress routes;
(g) entry/exit locations;
(h) nature of loads and materials;
(i) road safety audits for all construction access routes;
(j) temporary traffic arrangements, including the identification and advertisement of alternative routes;
(k) minimise heavy vehicle queuing and parking on public roads during standard construction hours and no queuing or parking outside standard construction hours as defined in Condition 61;
(l) provision of barriers between working and trafficked areas;
(m) the impact on pedestrian and bicycle facilities, including measures to ensure safe pedestrian and cycle routes and access at all times, and the provision of alternative facilities and locations for pedestrians and cyclists;
(n) the provision of safe and convenient access to all bus stops;
(o) signposting;
(p) access to side streets;
(q) access to adjoining properties, which would be maintained at all times wherever practicable;
(r) road or lane closures;
(s) the use of cranes on public roads;
(t) deliveries to construction sites and site compounds;
(u) a response plan which sets out the proposed response to any traffic, construction or other incident; and
(v) appropriate review and amendment mechanisms.

TMPs shall be certified by an experienced traffic/transport planner engaged in accordance with Condition 31 and approved by the RTA Transport Management Centre and the relevant Council traffic management committees.

31. The Proponent shall engage an experienced traffic/transport planner who shall be engaged throughout the construction stage on an "as needs" basis to advise on implementation issues and amendments and as a key liaison contact for the relevant local Councils and public transport operators.

32. The Proponent shall investigate the provision of bus pick-up and drop-offs from a central location(s) for each shift and car-pooling mechanisms to minimise worker traffic generation and parking requirements during construction. The Proponent shall incorporate any recommendations for this investigation into the relevant TMPs.

*Regional Traffic*

33. The Proponent shall ensure adequate monitoring of the local and regional road network is conducted prior to the opening of the Project to provide an appropriate baseline for measuring any future impacts resulting from the operation of the Project as part of the impact verification required under Condition 77. Key impact verification shall include traffic volumes on approach and departure routes, Reserve Road (north and south of the Gore Hill Freeway), Falcon

Street/Military Road, Ernest Street, Pacific Highway, Longueville Road/Epping Road (surface), Mowbray Road West and East, Pittwater Road, Badajoz Road, Wicks Road and all other roads where substantial increases or decreases were predicted in the EIS and/or Representations Report. Impacts on bus travel times on these roads (where relevant) shall also be monitored. The Proponent shall consult with and take into account comments from relevant Council(s) and bus operators regarding the methodology and timing of the study.

Twelve (12) months after opening, the Proponent shall monitor morning and evening peak hour traffic levels for a period of one (1) week. Should monitoring indicate traffic intrusion on these roads/streets 10% or greater than that predicted in the EIS and Representations Report as a result of the operation of the Project, the Proponent shall also prepare and implement additional traffic management measures consistent with Condition of Approval No. 37 to mitigate the impacts of intrusive traffic in the affected areas following consultation and agreement with the relevant Council(s) and consultation with the local communities and the STA.

34. As a specific requirement under Condition 33, the Proponent shall also investigate measures to improve vehicular access to Chatswood by arterial roads such as the Pacific Highway and to discourage use of Reserve Road and other local roads through Artarmon, particularly where LATM measures are already in place. The investigations shall be undertaken in consultation with Willoughby City Council, Parramatta Rail Link, STA and the relevant CLG. Recommendations as a result of investigations shall require the approval of the Director-General.

35. The Proponent shall monitor morning and evening peak hour traffic levels for a period of one (1) week (outside of school holiday periods), 12 months after opening and then every two (2) years for ten (10) years or for a shorter period as agreed to by the Director-General should monitoring indicate traffic levels close to those predicted. The monitoring shall occur across the western and eastern screenlines, as defined in Working Paper 4 of the EIS, and in the Lane Cove Tunnel. The results of this monitoring shall be compared to levels predicted in the model used for the EIS and forwarded to the Department and PTC within one (1) month of monitoring and made publicly available.

36. Should the monitoring required as part of Condition 35 indicate peak hour traffic levels across the western or eastern screenlines 5% or higher than predicted AND peak hour traffic levels in the tunnel 10% or higher than predictions made in the EIS, the Proponent shall prepare a report in consultation with the PTC, or in the absence of the PTC, in consultation with the Director-General, on the impacts of additional traffic and consistency with what was assessed in the EIS. Should impacts be found to be inconsistent with the assessment and substantially attributable to the Project, the Proponent shall examine and address the impacts to the satisfaction of the Director-General, including consideration of physical and/or operational traffic management measures, public transport improvements and/or the use of a toll levy applied to existing Project tolls. The report and mitigation measures shall demonstrate how the objectives of minimising induced traffic and achieving the stated project benefits would be realised. The report shall be forwarded to the Department within 3 months of the monitoring required in Condition of Approval 35 and all appropriate measures shall be implemented by the Proponent to the satisfaction of the Director-General. The report shall be advertised and made publicly available for comment for a period of no less than 30 days.

> *Note: The intention of Conditions 35 and 36 is to ensure that the key project objectives are met and are not significantly reduced through induced traffic.*

*Local Traffic*

37. The Proponent shall prepare a Local Area Traffic Management (LATM) Plan(s) at least six (6) months prior to the opening of the Project to traffic for the approval of the Director-General. The LATM Plan shall be prepared in consultation with the TNSW, STA, NSW Police, Emergency Services, relevant local Councils (including traffic management committees), bicycle groups and affected communities and businesses. The objectives of the LATM Plan shall be to:

    (a) Identify reasonable measures to mitigate the impact of significant increases in traffic on local roads that result from the operation of the Lane Cove Tunnel. The LATM shall particularly address the following areas, as identified in EIS Working Paper 4:

        (i) Lane Cove including Mowbray Road West and Centennial Avenue north;
        (ii) North Ryde including Pittwater Road, Badajoz Road and Wicks Road;
        (iii) Artarmon, including Reserve Road, Jersey Road, Hampden Road and Barton Road, and
        (iv) Crows Nest and St Leonards including key connecting roads to the Pacific Highway.

    (b) Identify reasonable measures to maintain and enhance the benefits of significant reductions in traffic volumes on Mowbray Road West and other local roads directly influenced by the opening of the Project. These measures may be designed to benefit all road users, including pedestrians, cyclists, public transport as well as general traffic.

    The installation of the identified measures shall be fully funded by the Proponent.

38. Prior to the operator collecting any toll, the Proponent shall have in place, to the greatest extent practicable, an implementation program for the necessary LATM measures referred to in Condition 37. Despite the above, the implementation of such measures including any associated construction works shall be fully completed within 12 months of commencement of toll collection. Any extension of time for the full implementation of the LATM Plan shall specifically require the approval of the Director-General following consultation by the Proponent with the relevant local councils.

39. The Proponent shall undertake Road Safety Audits during both detailed design of the Project and prior to opening (*i.e*. 2 audits).

**Pedestrian and Cyclist Access**

40. The Proponent shall maintain safe pedestrian and cyclist access to the fullest extent possible during construction. In circumstances where pedestrian access around construction sites is not possible due to construction activities, the Proponent shall ensure that a satisfactory alternate route is provided and signposted.

41. The Proponent shall in consultation with the PTC develop measurable performance indicators for pedestrian walk times at key pedestrian crossing locations (e.g. Delhi Road/Epping Road, Longueville Road/Epping Road intersection including Little Street, Centennial Avenue, Mowbray Road and Merlin Street) occurring as a result of the Project. The performance indicators at these crossing locations shall be reviewed one (1) and two (2) years after opening of the Project to traffic. The Proponent shall, at its own expense, implement any measures as reasonably required by the PTC.

42. A safe, high quality and contiguous cyclist/pedestrian path(s) shall be provided for recreational and commuter cyclists and for pedestrians for the length of the Project. Details of the provisions for cyclists shall be developed through the preparation of a detailed Cycleway and

Pedestrian Plan which shall be prepared in consultation with Bicycle NSW, local councils, relevant bicycle user groups, NSW Health and the CLGs.

The Cycleway and Pedestrian Plan shall also include:

(a) a detailed description of the proposed design including all connections to surrounding roads, streets and paths;
(b) lighting, where appropriate;
(c) safety including safe crossings for pedestrians and those accessing bus stops and security;
(d) linemarking and signage to separate cyclists from pedestrians in accordance with signposting directions from the RTA in relation to all shared paths;
(e) maintenance;
(f) consideration of links to existing and future planned cycle networks, roads and paths and potential linkages; and
(g) landscaping in accordance with the Urban Design and Landscape plan to be prepared in accordance with Condition 86 and 87.

The Cycleway and Pedestrian Plan shall be submitted to the Director-General and require the approval of the Director-General within an appropriate timeframe to ensure that the approved cycleway and pedestrian path is opened to cyclists and pedestrians no later than completion of works on Epping Road.

43. All cycleway/pedestrian path elements resulting from the Cycleway and Pedestrian Plan shall be designed and constructed in accordance with Austroads *Guide to Traffic Engineering Practice Part 14 – Bicycles* and other relevant reference documents.

**Air Quality – Construction Dust Management**

44. A detailed Construction Dust Management Sub Plan shall be prepared in consultation with the EPA. The Sub Plan shall detail the procedures for the management of dust emissions from the Project. The Sub Plan shall include, but not be limited to:

(a) identification of potential sources of dust deposition;
(b) monitoring (by sampling and obtaining result by analysis);
(c) details of mitigation measures to be implemented during normal operations and during periods of extreme climatic conditions where high level dust episodes are likely to occur;
(d) establishment of a protocol for handling dust complaints that includes recording, reporting and acting on complaints; and
(e) a reactive management program detailing how and when operations are to be modified to minimise the potential for dust emissions, should emission levels exceed the criteria.

Except in the case of Moore Street, as specified in Conditions 251 and 252, the maximum acceptable increase over existing dust deposition is 2 $g/m^2$/month annual average. Monitoring shall be carried out during the construction phase of the Project to assess compliance with goals for dust concentration and deposition rates.

45. Prior to construction commencing, dust sensitive land uses/industries shall be identified and consulted and mitigation measures implemented in accordance with Construction Dust Management Sub Plan. Background monitoring of dust and TSP shall be undertaken prior to commencement of substantial construction.

46. The Proponent shall undertake a regular dust monitoring program in accordance with the Construction Dust Management Sub Plan.

47. Wheel wash facilities or equivalent shall be constructed at exit points of all unsealed construction sites/compounds to ensure that any vehicles leaving the sites do not track materials onto public roads.

48. No open burning or incineration shall be permitted at any construction site.

**Public Transport Enhancement Measures**

49. Three (3) months prior to substantial construction the Proponent shall establish a Lane Cove Tunnel Public Transport Committee (PTC) to be chaired by TNSW.

The PTC shall invite representatives from, but not limited to, the RTA, NSW Police Service, STA, relevant private bus operators and TNSW. The PTC shall also consult with the relevant council(s).
The Proponent shall provide appropriate financial and administrative assistance to ensure appropriate resourcing of the PTC and the implementation of any measures as determined by the PTC.
The PTC shall continue for at least two (2) years after the opening of the Project unless otherwise agreed by the Director-General. Prior to the dissolution of the PTC, the Proponent in consultation with the TNSW shall identify the appropriate transfer of its function.
The key role of the PTC shall be to:

(a) co-ordinate the concerns and interests of the local and state road-based public transport agencies relating to the Project;
(b) ensure adverse impacts of the construction and operation of the Project on public transport are minimised;
(c) develop plans and strategies for maximising short and long term public transport opportunities during construction and operation within the study area, including but not limited to:
    (i) information programs for the public and affected businesses;
    (ii) public transport improvements beyond those already identified as part of these Conditions of Approval but related to the Project, including but not limited to:
        – bus signals;
        – bus priority lanes;
        – enhanced bus services;
    (iii) giving due consideration to pedestrians and cyclists and other users of the study area; and
(d) ensure that any plans and strategies are implemented to ensure that potential benefits to public transport are captured and maintained throughout the construction and operational life of the project.

50. The PTC shall consider the following specific matters as they relate to the study area:

(a) oversee provision of bus priority measures proposed by the RTA in the EIS and Representations Report ;
(b) assessment of the potential bus stop requirements on the Gore Hill Freeway (to provide access to the Artarmon Industrial Area);
(c) bus priority measures on Falcon Street, east of Pacific Highway;
(d) pedestrian access across Epping Road to Delhi Road;
(e) potential for bus priority measures at Pittwater Road, Longueville Road to the Pacific Highway southbound and from Epping Road to Mowbray Road West;
(f) appropriate signage and marking of proposed bus lanes ;
(g) bus and transit lane enforcement measures;

(h) further opportunities for improved bus priority on the Pacific Highway including rationalisation of 'S' lane extensions to proposed bus lanes, need for parking restrictions and treatment of right turns;
(i) review the effectiveness of the T2 lane on the Gore Hill Freeway with a view to upgrading to T3 or bus lanes at 6 months and then every two years after opening
(j) potential for real time bus information at bus stops.

51. The Proponent shall prepare an annual report to the Director-General on the progress and outcomes of the PTC process, including result of communications with relevant local Council(s) and the application of these Conditions of Approval and shall make the report available to the public upon request. The PTC shall take into account any comments/requirements raised by the Director-General.

52. The Proponent shall, in consultation with the PTC, develop measurable performance indicators for bus efficiencies (including consideration of bus timetables), occurring as a result of the Project taking into account existing performance and predictions made in the EIS and Representations Report.

53. The Proponent shall, in consultation with the PTC, monitor and review bus performance against the indicators developed in Condition 52 (including bus timetables) at six (6) months after opening, then after one (1) and two (2) years of operation for key bus services and routes. The monitoring shall include bus services using the Gore Hill Freeway, Epping Road, Pacific Highway and Willoughby Road. The results of the monitoring shall be forwarded to the Director-General. If bus performance does not meet the indicator targets, the Proponent shall initiate, at its own expense, any actions as reasonably required by the PTC or TNSW.

54. Prior to the commencement of substantial construction, a Construction Stage Public Transport Management Plan(s) shall be prepared as part of the Framework Traffic Management Plan in consultation with the STA, and private bus operators and to the satisfaction of the PTC. The Plan shall address the potential impact of construction activities on public transport. The objective of the Plan shall be to achieve at least pre-construction level of service for buses and high occupancy vehicles.

**Toll**

55. A tolling system shall be implemented which:

(a) is compatible with the existing standard for electronic tolling adopted throughout Sydney and Australia; and
(b) makes adequate provision for casual users.

The Proponent shall install appropriate signs to indicate the toll to be charged for the Tunnel and Falcon Street ramps. These signs shall be placed to allow a motorist to choose an alternative to using the Tunnel and/or Falcon Street ramps after having been advised through the sign(s) referred to above.

56. All buses (including school buses) providing scheduled public passenger transport services, emergency service vehicles responding to emergencies and bicycles shall be exempt from all Project tolls.

*Note: The intent of this condition is to ensure that local and regional passenger services, including State Transit Authority services and those provided by private bus operators, providing public transport services are not required to pay the toll. This condition is not intended to include long haul intra and interstate coach services. Refer to the Passenger Transport Act 1990 for definitions.*

**Noise and Vibration – General**

Construction Noise and Vibration Management Sub Plan

57. A detailed Construction Noise and Vibration Management Sub Plan shall be prepared as part of the Construction Framework EMP to the satisfaction of the Director-General and following consultation with the EPA, Council(s) and the CLGs. The Sub Plan shall provide details of noise and vibration control measures to be undertaken during the construction and operation stages, sufficient to address the technical requirements for any EPA approvals/licences. The Sub Plan shall include, but not be limited to:

(a) tests for ascertaining acoustic parameters;
(b) identification of sensitive receivers particularly residents and sensitive equipment.
(c) identification of all noise and vibration generating tasks, duration and predicted airborne noise and vibration levels;
(d) impacts from site compounds/construction depots;
(e) location, type and timing of erection of temporary and permanent noise barriers and/or other noise and vibration mitigation measures;
(f) specific physical and managerial measures for controlling noise and vibration demonstrating how activities would be managed so that relevant EPA guidelines and the conditions of approval are complied with;
(g) a pro-active and reactive strategy for dealing with complaints including compliance with Condition 10, particularly with regard to verbal and written responses;
(h) the need for respite periods;
(i) noise and vibration monitoring, reporting and response procedures;
(j) internal compliance audits of all plant and equipment;
(k) construction timetabling, in particular works outside standard hours, to minimise noise impacts;
(l) procedures for notifying residents of construction activities likely to affect their noise and vibration amenity;
(m) contingency plans to be implemented in the event of non-compliances and/or noise complaints; and
(n) the urban design issues relating to noise and vibration control measures.

With respect to (d) above, the Proponent shall consider the use of a range of structural and non-structural measures during construction including barriers, acoustic treatment of residences, scheduling of construction activities to minimise impacts and temporary relocation of affected residents.

Construction Noise Impact Statements

58. Specific Construction Noise Impact Statements shall be prepared in consultation with relevant government agencies, relevant Councils, CLGs for specific stages of construction consistent with the Construction Noise and Vibration Management Sub Plan and the relevant CMS and shall specifically address each of the major construction sites. The statements shall include:

(a) a description of the proposed processes and activities;
(b) assessment of potential noise from the proposed construction methods including noise from construction vehicles and noise impacts from required traffic diversions;
(c) examination of alternative methods that would potentially reduce noise if the potential noise exceeds the relevant criteria;
(d) description and commitment to work practices which limit noise;

(e) description of specific noise mitigation treatments and time restrictions including respite periods, duration, and frequency (where possible programming of night works over consecutive nights in the same locality shall be avoided);
(f) justification for any activities outside the normal hours specified in Condition of Approval 61;
(g) extent of noise monitoring;
(h) internal noise audit systems including recording of daily hours of construction, progressive impact assessments as work proceeds, conducting informal checks by the EMR, providing active and continuous communication links to relevant Councils, residents etc.;
(i) community consultation and notification;
(j) all feasible measures including adopting the least noisy available construction methods, systems and equipment;
(k) assessment and examination of potential feasible offsite mitigation measures for traffic noise; and,
(l) additional noise mitigation measures as negotiated with affected residents and other sensitive receptors.

Operational Noise Management Sub Plan

59. A detailed Operational Noise Management Sub Plan shall be prepared as part of the Operational EMP, to the satisfaction of the Director-General. The Sub Plan shall provide details of noise and vibration control measures to be implemented during operation which are sufficient to address the requirements of the NSW Government's Environmental Criteria for Road Traffic Noise, the NSW Government's Industrial Noise Policy and the RTA's Environmental Noise Management Manual. The Sub Plan shall include, but not be limited to:

(a) identification of the appropriate operational noise criteria;
(b) tests for ascertaining acoustic parameters;
(c) predicted noise levels at all affected residential, recreational, commercial and industrial land uses;
(d) location, type and timing of erection of permanent noise barriers and/or other noise mitigation measures demonstrating all reasonable and feasible noise mitigation including silencers and building treatments for associated plant rooms and enclosures for exposed plant;
(e) specific physical and managerial measures for controlling noise;
(f) noise monitoring, reporting and response procedures including the monitoring on surrounding roads which experience significantly increased traffic volumes as a result of the Project; and
(g) the urban design issues relating to noise control measures.

60. Monitoring of operational noise shall be undertaken in accordance with the Operational Noise Management Sub Plan prepared in accordance with Condition 59. The Proponent shall, to the satisfaction of the Director-General and in consultation with the EPA, assess the adequacy of the traffic noise and ventilation noise mitigation measures after one (1) year from opening of the Project to traffic and having regard to the criteria specified in the Operational Noise Management Sub Plan. Should assessment indicate a clear trend in traffic noise levels on surrounding roads which exceed the Operational Noise Management Sub Plan defined noise design goals prepared in accordance with the RTA's Environmental Noise Control Manual, the Proponent shall implement further reasonable and feasible mitigation measures in consultation with affected landowners and/or occupiers.

Construction Hours

61. All construction activities, including transportation of spoil, shall be restricted to the hours of 7:00 am to 6:00 pm (Monday to Friday); 8:00 am to 1:00 pm (Saturday) and at no time on Sundays and public holidays.

Works outside these hours that may be permitted except as explicitly specified in other conditions include:

(a) any works which do not cause noise emissions to be audible at any sensitive receptor;
(b) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
(c) emergency work to avoid the loss of lives, property and/or to prevent environmental harm;
(d) tunnel excavation and other sub-surface activities providing the criteria in Conditions 58 and 62, and regenerated noise criteria in Condition 186 can be met; and
(e) any other work as agreed by the EPA through licence conditions, the Construction Noise and Vibration Management Sub Plan or Construction Noise Impact Statement process provided local residents are informed of the timing and duration at least 48 hours prior to commencement of the work.

Construction Noise Criteria – General

62. Without limiting any specific site requirements as specified elsewhere in these Conditions of Approval, the Proponent shall ensure that noise from construction activities is limited such that the $L_{A10(15\ min)}$ level does not exceed the background level by more than 5dB(A) at any residence or other sensitive receiver unless specified in the Construction Noise Impact Statement prepared in accordance with Condition 58.

For the purposes of the noise criteria for this condition, 5dB(A) must be added to the measured level if the noise from the activity is substantially tonal or impulsive in nature in accordance with Chapter 4 of the *NSW Industrial Noise Policy*.

Construction Noise Management

63. The Proponent shall apply best practice, innovative noise mitigation measures, where practicable, including:

(a) maximising the offset distance between noisy plant items and nearby noise sensitive receivers;
(b) avoiding the co-incidence of noisy plant working simultaneously close together and adjacent to sensitive receivers;
(c) minimising consecutive night time works in the same locality;
(d) orienting equipment away from sensitive areas;
(e) carrying out loading and unloading away from noise sensitive areas; and,
(f) selecting site access points and roads as far as possible away from sensitive receivers.

64. Construction noise levels shall be monitored to verify compliance with the Construction Noise and Vibration Management Sub Plan and Construction Noise Impact Statements. Should monitoring indicate exceedances of the criteria stated in the Construction Noise Impact Statements, the Proponent shall consult with the EPA and implement all reasonable and feasible mitigation measures to the satisfaction of the EPA.

65. The Proponent shall ensure that rock breaking, rock hammering, sheet piling, pile driving and any other activities which result in impulsive or tonal noise generation are only scheduled between the following hours unless otherwise permitted under the EPA environment protection licence:

    (a) 8 am to 12 pm, Monday to Friday;
    (b) 2 pm to 5 pm Monday to Friday; and
    (c) 8 am to 12 pm Saturday.

    Where these activities are undertaken for a continuous three (3) hour period and are audible to noise sensitive receptors, a minimum respite period of at least one (1) hour shall be scheduled before activities recommence.

66. The Proponent shall ensure that no public address systems are used at any construction sites outside the standard working hours detailed in Condition 61. Any public address system shall be designed to minimise noise spillage off the site. Speakers shall be installed with their pointing axis directed away from residential buildings and sensitive receptors unless otherwise specified in the Construction Noise Impact Statement referred to in Condition 58.

67. The Proponent shall consult with relevant Council(s) and where practicable, erect operational noise mitigation measures prior to the commencement of construction in order to minimise noise impacts during construction.

68. The Proponent shall use only dampened rock hammers and/or "city" rock hammers to minimise the impacts associated with rock-breaking works.

69. The Proponent shall investigate and apply all feasible noise source controls to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks. Examples of appropriate noise source controls could include efficient silencers, low noise mufflers and alternatives to reversing alarms.

70. The Proponent shall ensure that the noisiest activities associated with night time works are scheduled wherever possible to be completed before midnight.

Vibration (and Blasting) Criteria

71. The Proponent shall ensure that vibration, including that generated by any proposed blasting, resulting from construction of the Project is limited to:

    (a) German Standard DIN 4150 and BS 7385: Part 2 – 1993 for structural damage vibration; and,
    (b) British Standard BS 6472 and AS2670 for human exposure to vibration.

    Where there is an inconsistency between these standards, the more stringent criteria shall apply.

72. The Proponent shall ensure that overpressure level resulting from any proposed blasting is limited to 95 dBLin.

73. Unless otherwise agreed by the Director-General, following consultation with the EPA, vibration levels shall not exceed 3 mm/s at the building foundation of heritage buildings and sensitive structures.

74. Prior to commencement of construction activities likely to result in high vibration levels, the Proponent shall identify potential highly sensitive facilities, including scientific equipment, measuring equipment, printing press and the like, where the criteria in Condition 71 may not be adequate. Should such cases arise, the Proponent shall consult with the potentially affected owners and develop appropriate mitigation measures to ensure impacts are acceptable.

**Property Matters**

Pre-construction

75. The Proponent shall identify all properties to be affected by land acquisition and negotiate with landholders prior to construction commencement and in accordance with the RTA's Land Acquisition Policy. Where a mutually acceptable arrangement cannot be made using this method, the Proponent shall ensure that the acquisition of any land shall be in a responsive and sensitive manner and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. The Proponent shall consult affected landowners prior to and during the property acquisition process in accordance with the requirements of Condition 77. Where compensation is payable the Proponent shall pay for independent valuation and legal advice if so requested.

76. Prior to the commencement of construction, the Proponent shall consult all owners of land affected by acquisition regarding any practicable and cost-effective measures which may be implemented to minimise impacts. These measures shall be completed prior to the commencement of construction or within such time as agreed with the relevant landowner. Access, car parking and safety issues are to be provided particular consideration during this process.

77. The Proponent shall consult, through notification, the owner of any property that is to be adjusted, acquired or from which an easement is to be obtained. This notice shall contain sufficient details to identify the land of interest being adjusted/acquired and is to include dimensions, location with respect to boundaries and any other information necessary to enable the identification of the land in relation to the development. This notification shall be given in adequate advanced time prior to access for construction purposes.

78. Building condition surveys shall be completed on the following buildings/structures at least one (1) month prior to commencement of excavation construction works or may be subject to major vibration or settlement inducing construction activities in the vicinity of such buildings/structures (including basements) subject to the relevant owner or occupier providing access:

    (a) all buildings/ structures on solid rock within 50 metres of the construction works or within a plan distance equal to twice the invert depth from the edge of the tunnel and/or excavation works unless otherwise determined following geotechnical and vibration analysis as certified by a qualified geotechnical engineer as not likely to be adversely affected; and
    (b) any heritage buildings as identified in the Heritage and Archaeology Management Sub Plan required by Condition 100 or other sensitive structures within 100 metres from the edge of the tunnel and/or excavation works unless otherwise determined following geotechnical and vibration analysis as certified by a qualified geotechnical engineer as not likely to be adversely affected.

79. The Proponent shall advise all property owners of buildings to be surveyed, as defined in Condition 78, what the survey will entail and of the process for making a claim regarding property damage prior the commencement of building condition surveys. A copy of the survey shall be given to each affected owner. A register of all properties surveyed shall be maintained by the Proponent and provided to the Director-General upon request.

Construction

80. Prior to substantial construction commencement, the Proponent shall establish an Independent Property Impact Assessment Panel to be approved by the Director-General. Either the affected property owner or the Proponent may refer any unresolved disputes arising from potential and/or actual property impacts to the Panel for resolution. All costs incurred in establishing and implementing the Panel shall be borne by the Proponent.

81. Prior to the placement of appropriate temporary soil anchors and/or permanent rock anchors, the Proponent shall notify all affected property owners of the need for placement of temporary soil anchors and shall provide sufficient detail to determine the precise location of such anchors relative to existing buildings. The Proponent shall instigate, if necessary, adjustments to construction methods at no cost to the property owner, to ensure that the placement of any temporary soil anchors or any other such construction stage measure does not impose any restrictions on development (existing or proposed) unless otherwise agreed to by the landowner or where acquisition of easement(s) is undertaken in accordance with the *Land Acquisition (Just Terms) Compensation Act 1991.*

82. All temporary soil anchors shall be disconnected and made obsolete as soon as practicable after tunnel construction is completed.

83. Any damage to buildings, structures, lawns, trees, sheds, gardens, bus stops etc. caused by construction activities shall be fully rectified by the Proponent at no cost to the owner(s).

84. Construction activities undertaken within private property shall be sympathetic to the specific needs of individual property owners particularly in terms of requirements for temporary facilities such as fencing, access to footpaths/ driveways/garages etc.

85. Each construction compound shall be reinstated to at least its pre-construction state following completion of construction works for which an individual compound associated with that site are completed. Rehabilitation shall be in accordance with the Framework Urban Design and Landscape Management Plan and any relevant Sub Plans required in accordance with Conditions 86 and 87. Site decommissioning shall include removal of any temporary fencing or temporary noise barriers, construction access and wheel washes etc. not required for safety or any other operational aspect of the Project.

**Urban Design and Landscaping**

86. A Framework Urban Design and Landscape Plan shall be prepared for inclusion in the Construction Framework EMP for the entire Project. It shall be prepared in consultation with relevant Councils, STA, and other relevant authorities and to the satisfaction of the Director-General prior to construction of Project elements subject to urban design considerations. The Plan shall be prepared by a suitably qualified urban designer. The Plan shall present an integrated urban design proposal.

    The Plan shall include, but not be limited to:

    (a) be presented as an integrated proposal with the final design;
    (b) apply design principles established in the EIS, working paper, Representations Report and supplementary information;
    (c) be in consultation with all relevant land owners, Councils and the local community to the satisfaction of the Director-General; and
    (d) consist of a report with accompanying annotated plans, sections and perspective sketches at a scale and level of detail which is adequate to convey the specific features of the Project.

87. Detailed Urban Design and Landscape Sub Plans shall be prepared by a qualified urban designer, at least one (1) month prior to commencement of construction, or as otherwise agreed by the Director-General, to the satisfaction of the Director-General, for the following sections of the Project:

(a) Epping Road between the western side of the Lane Cove River to Wicks Road;
(b) Western portal and Epping Road between the western side of the Lane Cove River and west of Mowbray Road West, including the western tunnel portal;
(c) Epping Road/Longueville Road between Mowbray Road West and the Pacific Highway, including the bus interchange;
(d) Gore Hill Freeway between the Pacific Highway and Reserve Road, including the eastern tunnel portal;
(e) Pacific Highway between Norton Lane and Hotham Road, including the entry and exit ramps and portals;
(f) Gore Hill Freeway between Reserve Road and Meremburn Road, including Willoughby Road underpass with particular reference to the pedestrian/cycleway;
(g) Falcon Street ramps and cantilever pedestrian pathway; and
(h) ventilation stacks, tunnel control facilities and associated infrastructure.

Each Sub Plan shall include consideration of the following (as relevant) in accordance with the Framework Urban Design and Landscape Plan:

(i) built elements including tunnel portals, bridges and other structures, retaining walls, noise walls, toll infrastructure, control buildings, substations;
(ii) motorway and road furniture including safety barriers, kerbs, paving, signage, lighting, medians, emergency phones and breakdown facilities;
(iii) pedestrian and cycle elements including footpaths and paving, pedestrian crossings, street furniture and fixtures (i.e. tree guards, seating, lighting, fencing and signage);
(iv) landscape elements including proposed treatments, finishes and materials of exposed surfaces (including colour specifications and samples);
(v) proposals for community art to be integrated into the Project;
(vi) timing and staging of works, methodology, monitoring and maintenance; and
(vii) impacts on bus stop operations and passenger access.

The Sub Plan(s) shall consist of a report with accompanying annotated plans, sections and perspective sketches, photo montages and other illustrative material at a scale and level of detail which is adequate to convey the specific aspects of the Project as required.

Specific Urban Design Aspects

88. Where practicable, directional signs for the Project shall be accommodated on existing signage.

89. No advertising shall be permitted within the lease area for the Project during construction or operation except at bus stops.

90. A report shall be prepared during detailed design which investigates the location for electronic tolling facilities for both the tunnel and Falcon Street ramps and the use of variable messaging signage for the complete Project. The report shall consider the location, integration, visual impact, urban design features and installation of such facilities and be submitted to the Director-General for approval.

## Flora and Fauna

Pre-Construction

91. A detailed Tree Protection Plan shall be prepared to manage construction impacts on any existing trees, including those to be retained with particular regard to Turrumbarra Park and Tantallon Oval and the proposed Moore Street Compound. This plan shall identify any significant trees, based on species or age/size which may be affected during construction and detail appropriate management and impact mitigation measures. Measures to be considered shall include, but not be limited to, fencing, ongoing maintenance, pruning, tree relocation *etc*.

92. Construction footprints at each construction site and compound shall be surveyed and marked using poly-web fencing or other such measures, prior to the commencement of vegetation clearing. Vegetation clearing shall be limited to within the surveyed construction footprint. No access to construction equipment or personnel shall be permitted outside the surveyed area(s). Fencing (or other alternative measures) shall remain in place until the risk of accidental clearing from construction activity is removed.

93. Cleared vegetation must be reused or recycled on site to the greatest extent practicable. Alternative reuse opportunities shall be sought where material is not required for reuse within the Project and included in the Flora and Fauna Management Sub-Plan as required in Condition 95. No burning of cleared vegetation shall be permitted.

94. Wherever possible, seed of locally native species shall be collected prior to the commencement and/or during construction to provide seed stock for revegetation purposes to the satisfaction of a qualified bushland regenerator. The bushland regenerator shall be used to advise the Proponent on the degree of weed infestation and the suitability of topsoil for regeneration. Where weed infestation deems topsoil unsuitable for regeneration, the material shall be disposed of in an appropriate manner in accordance with the Spoil Management Sub Plan in Condition 120 and be outlined in the Flora and Fauna Management Sub Plan referred to in Condition 95.

95. As part of the Framework Construction EMP, the Proponent shall prepare a detailed Flora and Fauna Management Sub Plan in consultation with the DLWC and NPWS, with particular reference to areas proximal to Lane Cove National Park. The Sub Plan shall be prepared prior to construction and shall include but not be limited to:

    (a) requirements for seed collection;
    (b) strategies for minimising vegetation clearance and protection of vegetated areas outside the direct impact zone;
    (c) maps identifying all native vegetation clearing associated with all construction works
    (d) handling of any fauna;
    (e) controlling impacts due to spills, spread of debris and refuse;
    (f) movement and storage of materials and equipment,
    (g) maps and strategies outlining rehabilitation and revegetation plans for disturbed/cleared areas;
    (h) weed control within the construction site(s) and managing spread of weeds to other areas; and
    (i) ongoing maintenance.

Construction

96. A suitably qualified tree surgeon or arborist shall be present for the duration of excavation works within the vicinity of any significant trees as identified in the Tree Protection Plan required under Condition 91 that are not to be removed or relocated and to undertake any root pruning required. The Proponent shall ensure that the condition of any affected trees is monitored throughout the construction period and for 18 months after opening of the Project to traffic. Any measures necessary to ensure the survival of the trees (*e.g*. fencing, watering, fertilising) shall be undertaken by a suitably qualified person in accordance with the recommendations of the Tree Protection Plan.

97. Maintenance of all landscaping works provided under the Urban Design and Landscape Plan referred to in Condition 86 and 87 (including the health of all trees) shall be provided for at least two (2) years from the date of opening of the Project to traffic unless alternative arrangements are negotiated with the relevant Council(s).

98. The Proponent shall consult with the relevant council(s)/landowners regarding replacement of any trees identified in the Tree Protection Plan (Condition 91) that are lost due to either direct or indirect impacts during construction or within 18 months of opening of the Project to traffic. Where practicable, replacements shall be specimens of similar species and similar maturity unless otherwise agreed with the relevant Council(s)/landholder.

99. If, during the course of construction (including vegetation clearing) the Proponent becomes aware of the presence of any threatened flora and fauna species which are likely to be significantly affected, the Proponent shall immediately cease those construction activities that are likely to affect the threatened species and consult with the DoP, NPWS and/or NSW Fisheries as appropriate. Following this consultation, the Proponent shall meet all requirements as directed by the Director-General prior to recommencement of any works likely to affect any threatened species.

**Indigenous and Non-Indigenous Heritage**

100. As part of the Construction Framework and Operational EMPs, the Proponent shall prepare and implement a Heritage and Archaeology Management Sub Plan in consultation with the, NSW Heritage Office and relevant Councils to manage heritage items and archaeological resources located within the area affected by the Project. The Sub Plan shall include:

(a) an assessment of the significance of effects on heritage and archaeological items including demolition, relocation, removal, damage and physical intrusion into conservation areas;
(b) a Contingency Protocol to be implemented in the event of discovery of relics including provision for significance assessment, consideration of management options and, where destruction or removal is proposed documentation and recording for archival purposes in accordance with How to Prepare Archival Records of Heritage Items and Guidelines for Photographic Recording of Heritage Sites, Buildings and Structures (DoP/NSW Heritage Council);
(c) a conservation management strategy including management measures for all identified features; and
(d) an independent conflict resolution process.

101. A suitably qualified archaeologist and a representative of the Metropolitan Local Aboriginal Land Council shall be on-site during initial ground clearing and preliminary works in the vicinity of known or potential archaeological sites.

102. During construction, temporary protective fencing shall be place around sites considered to be archaeologically sensitive and for which Consent to Destroy Permits have not been obtained.

103. Plans of Management shall be prepared prior to construction commencement for any historically significant items potentially affected by the Project. Any Plans of Management shall be prepared in consultation with the relevant local Council and NSW Heritage Office.

104. If during the course of construction the Proponent becomes aware of any heritage items or archaeological material, all work likely to affect the site(s) shall cease immediately and the relevant authorities, including NPWS, NSW Heritage Council and/or the relevant Local Aboriginal Land Council(s) shall be consulted to determine an appropriate course of action prior to the re-commencement of work at that site in accordance with the requirements of the Contingency Protocol to be prepared as part of Condition 100.

**Water Management**

*Construction Water Management Sub Plan*

105. As part of the Construction Framework EMP, a detailed Construction Water Management Sub Plan shall be prepared following consultation with the EPA, DLWC, SWC and relevant councils. The Sub Plan shall be prepared in accordance with the Department of Housing's guideline *Managing Urban Stormwater – Soils and Construction* (3rd edition) to manage the cumulative impacts of the development on the quality and quantity of surface and groundwater, including stormwater in storage, sedimentation dams and flooding impacts. The Sub Plan shall contain, but not be limited to:

(a) preparation of a catchment analysis in consultation with the relevant Councils and Sydney Water to determine the capacity of existing drainage systems and capacity, changes resulting from the construction of the Project and implications of pumping load and detention requirements;
(b) details of short and long term measures to be employed to minimise soil erosion and the discharge of sediment to land and/or waters including the exact locations and capacities of sedimentation basins;
(c) identification of all potential sources of water pollution and a detailed description of the remedial action to be taken or management systems to be implemented to minimise emissions of these pollutants from all sources within the subject site;
(d) measures to handle, treat, re-use and dispose of stormwater, contaminated water and soil;
(e) measures for the use of water reclaimed or recycled on-site;
(f) detailed description of water quality monitoring to be undertaken including base line monitoring, identification of locations where monitoring would be carried out and procedures for analysing the degree of contamination of potentially contaminated water;
(g) contingency plans to be implemented in the event of fuel or chemical spills or turbid water discharge from the site; and
(h) program for reporting on the effectiveness of the sediment and erosion control system against performance goals.

106. The Proponent shall prepare a detailed Flooding and Drainage Management Sub Plan(s) as part of the Construction Framework EMP in consultation with local councils. The Sub Plan(s) shall address all drainage catchments affected by the construction and operation of the Project. The objective of the Sub Plan(s) shall be to identify the measures to be implemented such that there is no increase in inundation levels or durations in any areas sensitive to flooding at or above the critical flood event.

Pre-Construction

107. The Proponent shall ensure that construction and operational water management systems for the Project are designed and implemented to include the management measures identified in the EIS and Representations Report and meet the performance objectives unless otherwise agreed through the preparation of the Construction Water Management Sub-Plan.

108. Prior to finalisation of detailed drainage design, the Proponent shall undertake and incorporate all required management measures into the final drainage design. As a minimum the tunnel drainage design must provide capacity to deal with at least a 100 year ARI storm for tunnel carriageway and ramp approaches. The Proponent shall also consider the implications of a PMF event in accordance with the *Floodplain Management Manual: the management of flood liable land* and in consultation with DLWC.

109. The Proponent shall undertake monitoring of water quality both upstream and downstream of construction sites and compounds to determine any change attributable to construction activities. Where there is deterioration in water quality attributable to construction activities for the Project, the Proponent shall implement all reasonable and practicable measures to minimise impacts on water quality.

Construction

110. The Proponent shall ensure that all appropriate soil, erosion and sediment control works are completed and in place prior to the commencement of any works that may have the potential to generate soil erosion or sediment.

111. All water collected during construction, including water drained from tunnel excavations (portal entry, groundwater influx) and from dewatering of major cuts, which is likely to be contaminated shall be tested, treated and handled consistent with any licence obtained from the EPA.

112. No disposal of water shall be allowed to the sewer or the stormwater system without prior agreement from Sydney Water as applicable.

Soil and Water Quality Management Plan(s)

113. As part of the Construction Method Statements and Operational EMPs, detailed Soil and Water Quality Management Plan(s) shall be prepared in consultation with the EPA, DLWC, SWC NSW Fisheries, NPWS (where relevant), relevant catchment management trusts and Councils. The Plan(s) shall be prepared in accordance with the Department of Housing's guideline *Managing Urban Stormwater – Soils and Construction, 1998* (3rd Edition) and the RTA's *Guidelines for the Control of Erosion and Sedimentation in Roadworks*. The Plan(s) shall be prepared prior to construction or operation as appropriate. The Soil and Water Quality Management Plan(s) shall contain, but not be limited to:

    (a) management of the cumulative impacts of the development on the quality and quantity of surface and groundwater, including stormwater in storage, sedimentation dams and flooding impacts;
    (b) details of short and long term measures to be employed to minimise soil erosion and the discharge of sediment to land and/or waters including the exact locations and capacities of sedimentation basins;
    (c) identification of all potential sources of water pollution and a detailed description of the remedial action to be taken or management systems to be implemented to minimise emissions of these pollutants from all sources within the subject site;

(d) detailed description of water quality monitoring to be undertaken during the pre-construction, construction and operation stages of the Project, including baseline monitoring, identification of locations where monitoring would be carried out and procedures for analysing the degree of contamination of potentially contaminated water;
(e) measures to handle and dispose of stormwater, effluent and contaminated water and soil including incident management structures;
(f) a process for the disposal of water from sedimentation basins;
(g) measures for the use of water reclaimed or recycled on site; and
(h) contingency plans to be implemented in the event of fuel spills or turbid water discharge from the site(s).

Operational Water Management

114. All operational stormwater and wastewater systems of the Project, including stormwater drainage, erosion, sedimentation and water pollution control systems and facilities of the Project shall be located, designed, constructed, operated and maintained to meet the requirements of the relevant authorities including the EPA, NSW Fisheries, DLWC and relevant Councils. All facilities including gross pollutant traps and sedimentation basins shall be inspected regularly and maintained in a functional condition for the life of the project.

115. As part of the Operations EMP a detailed Operational Stormwater Management Sub Plan shall be prepared in consultation with EPA, DLWC, SWC, and the relevant Councils to the satisfaction of the Director-General. The Sub Plan shall provide details on catchment analysis (including localised flooding as recognised by the relevant local Councils), existing drainage systems and capacity, drainage changes resulting from the Project, potential reuse and implications for the system including total pumping load to drainage systems, detention requirements, possible reuse of wastewater (such as water recycling for park irrigation) and the associated environmental impacts.

116. Provision shall be made for retention and treatment of fire water in accordance with the Government's *Best Practice Guidelines for Contaminated Water Retention and Treatment Systems*.

**Spoil and Waste Management**

Spoil Disposal

117. The Proponent shall ensure that transportation of spoil (and where possible, all other construction vehicles) is only by the routes shown in Figure 5.7 of the Director General's Report.

118. Spoil transportation from all construction sites, except for the Marden Street compound, shall be in accordance with the standard construction hours stated in Condition 61.

119. A detailed geotechnical/soil analysis assessment shall be undertaken during detailed design to ascertain the quality of material to be excavated and the potential for it to be used for construction or other such higher value purpose. The beneficial use of all excavated material shall be in accordance with the waste hierarchy outlined in Condition 125. Disposal of spoil to landfill shall not be permitted where other such higher value purposes are economically viable.

120. As part of the Construction Framework EMP, the Proponent shall prepare a Spoil Management Sub Plan in consultation with Resources NSW, EPA, DoP and relevant Council(s). The Sub Plan shall be prepared and approved by the Director-General prior to the commencement of construction at relevant sites. This Sub Plan shall address:

(a) measures to handle, stockpile, reuse and dispose of spoil;
(b) the reuse or recycling of all clean and/or treated spoil where possible, including EMR certification that:
  (i) use of spoil generated from construction activities is maximised in preference to any import of fill; and
  (ii) where practicable all clean excavated natural material is either reused on the Project or otherwise made available for reuse elsewhere in preference to disposal to landfill
(c) spoil transport options and routes, including potential use of barge and rail;
(d) noise and local amenity;
(e) dust mitigation;
(f) drainage;
(g) contaminated material (including procedures for dealing with the unanticipated discovery of contaminated material during the course of construction) including:
  (i) disposal only to a EPA approved landfills;
  (ii) integration with the Contamination Investigation Report required in Condition 122 and waste management procedures in Condition 125;
(h) full integration with the Transport Management Plans.

The Sub Plan shall also assess the cumulative impacts and opportunities for non-road based transport of spoil and/or reuse associated with other Projects such as the Parramatta Rail Link, Western Sydney Orbital, South Windsor Flood Relief Route and Cross City Tunnel.

121. Prior to commencement of construction at various relevant sites where spoil is to be generated the Proponent shall ensure that Resources NSW, the EPA and any other relevant authority are provided with spoil disposal/reuse details. The Proponent shall also assess the environmental impacts of the disposal in accordance with the EP&A Act and obtain any necessary approvals.

*Contamination*

122. The Proponent shall prepare a Contamination Investigation Report to the satisfaction of an EPA accredited contaminated site auditor as part of the Spoil Management Sub Plan to determine the nature, extent and degree of contamination. The Report shall detail the results of site investigations and the assessment of potential risks posed by contaminants to health and the environment and indicate whether remediation is required.

Should the Contamination Investigation Report indicate that remediation is necessary to reduce or remove risks posed by contaminants in particular locations, the land shall be remediated in accordance with a Remedial Action Plan to be incorporated into the relevant CMS(s) required by Condition 21. The Plan(s) shall be prepared in accordance with relevant guidelines and in consultation with relevant Council(s) and should be subject to independent review by an EPA accredited site auditor.

123. In the event of discovering previously unidentified area(s) of potentially contaminated material, the Proponent shall cease work in the vicinity of the discovery. Work shall not recommence until the extent of contamination has been assessed and a Remedial Action Plan has been prepared and implemented in accordance with Condition 122 if required.

124. Where remediation is required, the treatment options should consider and be consistent with the ANZECC and NH&MRC site remediation hierarchy as published in the EPA's guidelines for the NSW Site Auditor's Scheme.

Waste Management and Recycling

125. A detailed Waste Management and Reuse Sub Plan shall be prepared in consultation with the EPA as part of the construction framework and operational EMPs. The Sub Plan shall address the management of wastes during the construction and operation stages respectively. It shall be prepared prior to construction, and shall identify requirements for the waste hierarchy as follows:

(a) waste avoidance;
(b) reduction;
(c) reuse; and
(d) recycling,

and provide details of requirements for:

(e) handling;
(f) stockpiling;
(g) waste disposal: specifically contaminated soil or water, concrete, demolition material, cleared vegetation, oils, grease, lubricants, sanitary wastes, timber, glass, metal, etc.; and
(h) identifying final disposal site(s) for any waste material and remedial works required at the identified disposal site(s) before accepting the material.

This Sub Plan shall include but not be limited to:

(i) management of all waste generated as part of the Project;
(ii) an outline of comprehensive plans of action for key waste streams;
(iii) implementation of the waste hierarchy by seeking to avoid waste generation as a priority, the reuse, recycling or reprocessing of waste and, as a last resort, disposal of waste;
(iv) the need for environmental safeguards and the adoption of environmentally sensitive work practices to minimise waste and advance the values of ecologically sustainable development;
(v) arrangements for waste which cannot be re-used, recycled or reprocessed to be disposed of at a licensed waste disposal facility;
(vi) procedures for separating excavation and demolition waste and for identifying destinations for the material;
(vii) procedures for classifying waste in accordance with the EPA's Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes;
(viii) installation of segregated bins for recyclable materials and provision for material to be reused or recycled wherever possible;
(ix) except where a sewer is available, sewage discharge of from site amenities to holding tanks for removal by tankers;
(x) the provision of rubbish skips at all construction sites and site compounds and their regular removal or emptying;
(xi) erecting signs within construction sites and site compounds encouraging employees to reduce, re-use, or recycle wherever possible;

(xii) the disposal of solid (including fuel and lubricant containers) and liquid wastes in accordance with relevant guidelines;
(xiii) the disposal of chemical wastes in accordance with manufacturers' instructions;
(xiv) appropriate induction and training of all employees and sub-contractors in the waste hierarchy and the requirements of the Waste Management and Reuse Sub Plan;
(xv) a schedule for undertaking regular audits of waste management procedures; and
(xvi) keeping of a waste management register of all significant waste collected from construction sites and site compounds for disposal, including amounts, date and time and details and locations of disposal.

As part of the Sub Plan, an Action Plan shall be prepared to promote the use of recycled materials, including construction and landscape materials. The Plan shall detail how the Project gives consideration and support to the Government's Waste Reduction and Purchasing Policy. The Plan shall also include details on measures to implement energy conservation best practice.

126. Water demand for construction activities shall be kept to a minimum. The Project shall incorporate water reduction initiatives including water reuse and recycling to the maximum extent practicably possible.

**Hazards and Risks**

127. At least 6 months prior to Project opening, the proponent shall conduct a road safety audit on Centennial Avenue between Penrose Street and Mowbray Road West. A revised preliminary hazard analysis shall be prepared based on the results of these investigations and all recommended measures adopted as appropriate to the satisfaction of the Director-General.

Dangerous Goods

128. The Proponent shall not store or handle a quantity of goods defined as dangerous under the Australian Dangerous Goods Code, at any location associated with the Project, whether during the construction or the operation of the Project. This Condition does not include diesel fuel, to which Condition 132 applies.

Security and Crime

129. The final design of bus stations/stops, pedestrian and cyclist access routes and ancillary structures of the Project shall be in accordance with the DoP/NSW Police Service's *Safer By Design* safety guidelines.

130. The Proponent shall prepare and implement a Security and Crime Management Strategy for each of the construction and operation phases of the Project. The aim of the strategy shall be to prevent unauthorised access to the Project and to minimise the potential for crime in the vicinity of infrastructure (e.g. vandalism, loitering, illegal dumping etc). The Strategy shall be generally in accordance with the principles outlined in the joint Department and Police Service publication Crime Prevention and the Assessment of Development Applications, and be developed in consultation with the NSW Police Service and relevant councils. The Strategy shall include, but not necessarily be limited to:

(a) details of security arrangements to prevent unauthorised access to the Project, including physical exclusion measures, detection devices and management mechanisms;
(b) policies and procedures for addressing security issues, should they arise;

(c) specific design features to discourage the incidence of crime at and in the immediate vicinity of the bus interchange, access points and cycleways;
(d) lighting considerations, including light intensity, direction and hours of operation at and in the immediate vicinity of the bus interchange, access points and cycleways, with the aim of minimising areas that may encourage crime;
(e) policies and procedures for the management and removal of graffiti, amelioration of vandalism, should it occur at or on any component of the; and
(f) policies and procedures for the management and removal of illegal or inappropriate bill-posting and illegally dumped materials, should it occur at or on any component of the.

The Security and Crime Management Strategy shall be submitted for the approval of the Director-General no later than one (1) month prior to the commencement of substantial construction or opening of the Project to traffic as applicable, or within such period as otherwise agreed by the Director-General.

Pre-Construction

131. An Emergency Response Sub Plan shall be prepared as part of the Construction Framework EMP. The Sub Plan shall include, but not be limited to:

(a) the provision of adequate emergency procedures and equipment for the response to and management of any environmental pollution events;
(b) a program for training all staff;
(c) a protocol for notifying the appropriate authorities in the case of an emergency;
(d) procedures to ensure compliance with all legislative and industry standard requirements for safe handling and storage of hazardous substances; and,
(e) undertaking hazardous activities such as washing out of concrete delivery vehicles, washing down of construction plant etc. only at appropriate locations that have appropriate environmental protection controls.

Construction Hazards

132. The Proponent may seek the approval of the Director-General for the temporary storage of diesel fuel to permit continuous operation of equipment during the construction of the Project. In seeking the Director-General's approval, the Proponent shall provide:

(a) details of the location(s), stored volume(s) and storage method(s) for the diesel fuel;
(b) the maximum length of time diesel storage will be required;
(c) assessment of the potential environmental and risk impacts associated with the storage of diesel at the locations required; and
(d) details of the mitigation measures proposed to address potential environmental and risk impacts from diesel storage including bunding of storage area(s).

133. The Proponent shall not locate any quantity of diesel fuel at any location associated with the Project without the prior written approval of the Director-General. The Proponent shall implement all measures required by the Director-General to mitigate environmental and risk impacts identified through the information listed from (a) to (d) above, within such period as the Director-General may agree.

*Note: Diesel fuel is a combustible liquid and not defined as a dangerous good under the Australia Dangerous Goods Code.*

134. The Proponent shall prepare and implement a Construction Safety Study for the approval of the Director-General prior to the commencement of construction of the Project. The Study shall address all safety-related matters relevant to the construction of the Project and shall have regard to the principles outlined in the Department's publication *Hazardous Industry Planning Advisory Paper No. 7 – Construction Safety Study Guidelines*.

Operational Hazards

135. At least six months prior to the opening of the Project, the Proponent shall prepare an Emergency Response Plan , in consultation with the NSW Fire Brigades, the Police Service and State Emergency Services and be submitted to the Director-General for approval. The Plan shall include, but not necessarily be limited to:

(a) protocols and procedures to be followed during emergency situations associated with the operation of the Project including vehicle collisions, fires and explosions;
(b) details of traffic management measures to be implemented during emergencies, where appropriate, to minimise the potential for escalation of the emergency;
(c) management and infrastructure measures to address the potential environmental impacts of an emergency situation, including measures for containment of contaminated firefighting water, fuel spills and gaseous combustion products; and
(d) a training and testing program to ensure that all operational staff are familiar with the Plan and coordination with the Fire Brigades, Police and Emergency Services is regularly rehearsed.

A rehearsed emergency response in accordance with the approved Emergency Response Plan, including the Proponent, NSW Fire Brigades, the NSW Police Service and State Emergency Services, shall be undertaken on at least one (1) occasion prior to the opening of the Project to traffic.

136. The Proponent shall undertake an annual Hazard Review of the Project and hazardous incidents that have occurred during the preceding twelve-month period for the first five years of operation. The first Review shall be undertaken no later than twelve months after the opening of the Project to traffic. A report outlining the results of the Hazard Review, and any proposed additional safety measures to be implemented in response to the findings of the Review, shall be submitted to the Director-General within one month of completion of the Review. The Proponent shall meet the Director-General's requirements in relation to the findings of the Review, within such time as may be agreed by the Director-General. The Director-General may direct the Proponent to undertake further hazard review following any major incident in the tunnel.

**Project Utilities and Services**

Pre-Construction

137. Prior to the commencement of construction the Proponent shall identify the services potentially affected by construction activities to determine requirements for diversion, protection and/or support. This shall be undertaken in consultation with the relevant service provider(s).

138. During the detailed design process the Proponent shall consult with relevant utility and service authorities to determine potential co-location opportunities for services with the construction of the Project.

Construction

139. Any alterations to utilities and services shall be carried out to the satisfaction of the relevant service provider(s), and unless otherwise agreed to, at no cost to the service/utility provider(s).

> *Note: Nothing in Condition No. 139 shall be taken as requiring the Proponent to meet the cost of any alterations should any prior agreements or protocols be in place between the Proponent and service provider(s) for such alterations.*

140. The Proponent shall ensure that disruption to services resulting from the Project are minimised and shall be responsible (with the approval of the relevant service provider) for advising local residents and businesses affected at least 48 hours prior to any disruption of service.

141. The Proponent shall prepare dilapidation surveys and reports in consultation with relevant infrastructure/service providers. The Proponent shall carry out rectification work at the Proponent's expense and to the satisfaction of the owners, except where Condition of Approval No. 139 applies.

**Energy and Greenhouse Gases**

142. The Proponent shall promote the reduction of greenhouse gases by adopting energy efficient work practices including, but not limited to:

(a) developing and implementing procedures to minimise energy waste in accordance with Conditions 125;
(b) conducting awareness programs as part of induction for all site personnel regarding energy conservation methods; and,
(c) conducting an energy audit prior to construction and regular energy audits during the Project to identify and address energy wastage.

143. No rainforest timbers shall be used in any construction activities.

144. SEDA accredited 'Green Power' shall be purchased for the supply of 50% of the electrical energy requirements for the construction phase of the Project. During operations, SEDA accredited 'Green Power' shall be purchased for all operational electrical energy requirements to a minimum level of twice the amount specified by the Government Energy Management Policy (currently 6%), to a maximum of 100%.

**SITE SPECIFIC ISSUES**

**Tunnel**

*Fire Safety*

145. The Proponent shall develop a scope of works (Fire and Smoke Management Plan) to address fire safety in the tunnel. The Plan shall outline fire protection systems and other tunnel equipment and systems and operation protocols required for fire and smoke management.

The Proponent shall undertake a detailed fire engineering study in accordance with the Australian Building Codes Board, Fire Safety Engineering Guidelines. The study must also take into consideration the following current relevant international studies including:

(a) French Inter-ministry Circular No. 200 – 63 of August 2000 Relating to Safety in Tunnels in the National Highway Network;
(b) PIARC – Fire and Smoke Control in Road Tunnels; and

(c) US NFPA 502 Standard for Road Tunnels and other Limited Access Highways, 2001 Edition.

Detailed design of the tunnel shall incorporate the design and operational measures outlined in the scope of works to minimise the potential for and impact of fire in the tunnel. The scope of works shall be developed in consultation with and to the satisfaction of the NSW Fire Brigades. The final design of the tunnel in relation to the fire safety shall be approved by the Director-General and verified against the scope of works to the satisfaction of the NSW Fire Brigades by an independent person/organisation.

146. Prior to the opening of the Project to traffic, a full audit of the fire safety system as defined by the scope of works developed in Condition 145 shall be undertaken by an independent person(s)/organisation to be paid for by the Proponent. The objective of the audit shall be to ensure that all design and operational measures outlined in the scope of works have been installed and are operational and achieves the required design criteria. The results of the safety audit shall be made available to the NSW Fire Brigade and the Director-General for review prior to opening of the Project to traffic. The Proponent shall comply with any requirements resulting from the NSW Fire Brigade.

147. Fire simulation and smoke testing shall be undertaken as part of the rehearsed emergency response to be staged prior to opening of the Project to traffic as required in Condition 135.

148. A maintenance testing program outlining the methods of testing fire safety facilities and schedule for implementation shall be developed to the satisfaction of the NSW Fire Brigade prior to opening of the Project to traffic. Maintenance testing of fire safety facilities shall be undertaken at least annually or any other interval as required by the NSW Fire Brigade. Results of maintenance testing shall be made available to the NSW Fire Brigade for review and the Proponent shall comply with any requirements to ensure the fire safety systems operate adequately.

149. The Proponent shall develop a community education program for the general public and bus operators regarding the potential implications of incidents and emergencies in the Lane Cove Tunnel prior to opening of the Project to traffic. The program shall outline the actions that should be taken by drivers and passengers in the tunnel during such incidents/emergencies to minimise the potential for serious injury or loss of life.

The Proponent shall consider implementation of the education program by methods such as pamphlets to be disseminated with licence/registration renewals, inclusion in the Learner Driver Handbook and test and/or any other appropriate method.

The program shall be prepared in consultation with the relevant NSW emergency services, NSW Health and DoP.

*Air Quality*

Physical Requirements

150. One (1) ventilation stack shall be constructed at each of the following locations: 5 Sirius Road, Lane Cove West Industrial Estate and 6 Marden Street, Artarmon Industrial Area as shown Attachment 2), with the top of the ventilation stacks at a minimum height of 62 m and 134 m AHD respectively.

151. Prior to finalising the ventilation stack design, the Proponent shall in consultation with relevant Councils, demonstrate to the satisfaction of the Director-General, that potential opportunities to incorporate the ventilation stack within an existing, proposed or newly constructed building have been appropriately considered through the selected proposal invitation and final design process.

152. The tunnel ventilation system shall be designed, constructed and operated to avoid emissions of tunnel air from the portals. Portal emissions are not permitted except in the following circumstances:

(a) emergency situations and/or where emergency personnel are involved,
(b) accidents and genuine breakdowns inside the tunnel;
(c) major maintenance periods where it can be demonstrated that the in-tunnel CO requirements specified in Table 2 cannot be met; and
(d) any other situation approved by the Director-General in consultation with the DoH, EPA and the AQCCC.

If portal emissions are required as a result of any of the above events occurring, all practicable measures shall be taken to minimise duration of portal emissions and from such emissions.

153. The tunnel shall be designed and constructed so as to make provision for future installation of an appropriate pollution control system to treat air emissions from the tunnel as may be required by the Director-General. The Proponent shall provide evidence to this effect during the design and construction phases to the satisfaction of the Director-General.

154. All plant and equipment associated with the ventilation stack including possible pollution control systems shall be located below the existing surface level unless incorporated into an existing, proposed or newly constructed building as identified in Condition of Approval No. 151 or otherwise agreed by the Director-General following consultation with the relevant local Councils.

155. The Proponent shall install stack emission sampling points and associated safe access thereto, during construction of each ventilation stack in accordance with Condition 154. The sampling points shall be designed and located in accordance with TM-1 of the EPA's *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW, 2001.*

156. The Proponent shall develop a Pre-commissioning Tunnel Ventilation, Incident Response and Traffic Management Systems Integration Protocol in consultation with the RTA's Traffic Management Centre. The Protocol must be reviewed by an appropriate experienced person/firm to confirm to the satisfaction of the Director-General, before the tunnel is open to traffic, that the systems would operate together to ensure that the primary objective of satisfying Conditions 161 and 162. The Protocol should include a pre-commissioning procedure to be completed before the tunnel is opened to traffic.

> *Note: Tunnel ventilation design and operation, incident response triggers and procedures, and traffic management, should be fully integrated in accordance with the primary objective of ensuring the safety of tunnel users, tunnel workers and emergency services personnel under all conditions.*

157. The Proponent shall install appropriate traffic management devices upstream and downstream of the tunnel entrances and exits to regulate traffic flow in the tunnel in addition to the ventilation system, as required to ensure compliance with air quality goals. Traffic management devices shall include ramp metering and/or tunnel closure devices as appropriate. Monitoring devices to measure traffic speeds inside the tunnel shall be installed and operated.

Unless otherwise agreed by the Director-General, stop signals (including advance signals) must be installed at least 50 metres (or at another distance as agreed by the Director-General) from the front of each entrance and incorporated into the overall traffic management system for the route on which the tunnel is located. Where practical this shall also enable tunnel users to be diverted to other routes well before the entrance. The stop signals must be supplemented by a remote-controlled physical closure device and by a variable message panel, which will inform users of the reason for the closure.

Air Quality Community Consultative Committee

158. An Air Quality Community Consultative Committee (AQCCC) shall be established by the Proponent. Representatives from relevant Councils and local community representatives with interests in tunnel ventilation shall be invited to participate on the Committee. The AQCCC must be established prior to the commencement of substantial construction. The Committee's role shall be defined in a detailed terms of reference document to be submitted for approval by the Director-General within three (3) months before commencement of construction or within any other time as agreed by the Director-General. The terms of reference shall include providing community feedback on air quality monitoring and reporting during the design, construction and operational phases of the project, accessing and disseminating monitoring results and other information on air quality issues. The functions and conduct of the AQCCC shall be in accordance with the terms of reference approved by the Director-General.

Air Quality – In-Tunnel

- Monitoring of In-Tunnel Air Quality

159. Within the Tunnel, the Proponent must monitor (by sampling and obtaining results by analysis) the pollutants, specified in Table 1. The Proponent must use the sampling method, units of measurement and sample at the frequency specified opposite in the other columns. The number and siting of the monitoring stations inside the tunnel must be independently verified in accordance with the EPA's Approved Methods for the Sampling and Analysis of Air Pollutants in NSW, 2001 to the satisfaction of the Director-General. Each sampling point established under this condition shall be audited prior to its commencement of monitoring for compliance with the requirements set out in Table 1. Verification and compliance auditing is to be undertaken by an independent person(s) or organisation(s) approved by the Director-General and paid for by the Proponent.

**Table 1 – In-Tunnel CO Monitoring Methodology**

| Pollutant | Units of measure | Frequency | Method[1] |
|---|---|---|---|
| CO | ppm | Continuous | AM-6 |

Note: [1]NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales

- In-Tunnel Air Quality Limits

160. The tunnel ventilation system must be operated so that the concentration of carbon-monoxide (CO) for exposure to any motorist inside the Tunnel must not exceed the concentration limits specified for that pollutant in Table 2 under all conditions (including fully congested conditions).

**Table 2– In-Tunnel CO Individual Exposure Limits**

| Pollutant | Units of measurement | Averaging period | Limit |
|---|---|---|---|
| CO | ppm | Rolling 30–minute | 50 |
| CO | ppm | Rolling 15-minute | 87 |

For the purposes of interpreting compliance with the rolling average periods specified in Table 2, the Proponent shall install appropriate systems to the satisfaction of the Director-General in consultation with NSW Health and the EPA, to enable as accurate as possible estimate of time spent inside the tunnel by any motorist or any emergency services, Proponent or Company personnel and corresponding CO levels. The Proponent must justify that the measuring points present an accurate representation of the CO profile and shall provide data/evidence including appropriate modelling to support that justification. The pollution concentrations outside the vehicle cabin shall be assumed to be equivalent to the pollution concentration within the cabin for the purposes of interpreting compliance.

161. The tunnel ventilation system must be operated so that the concentration of carbon-monoxide (CO) as measured at any single point in the tunnel must not exceed the concentration limit specified for that pollutant in Table 3 under all conditions (including fully congested conditions).

**Table 3 – In-Tunnel CO Single Point Limits**

| Pollutant | Units of measurement | Averaging period | Limit |
|---|---|---|---|
| CO | ppm | Rolling 3-minute | 200 |

- Notification of In-Tunnel Air Quality

162. In addition to the general reporting requirements specified in Condition 178, the Proponent shall notify the Director-General, EPA and DoH within 24 hours of the Proponent becoming aware of any single monitoring point CO recording above the limits specified in Condition 160 and/or 161.

> *Note: The requirement to report on any single point recording above the limits for Condition 162 is for information and reporting purposes only.*

- Air Quality Compliance

163. If the air quality limits specified in Conditions 160 and/or 161 are exceeded, the Director-General may direct the Proponent to expend an amount, which is to be calculated as the aggregate of $50,000 (CPI adjusted) for each day on which any one (1) or more of the air quality limits specified in Conditions 160 and/or 161 are exceeded, for the implementation of the strategy.

In the event that the Proponent is directed to expend any amount as required under this condition, it shall, within 3 months, prepare a strategy in consultation with the AQCCC and approved by the Director-General, on how any money shall be spent, including options of improvements to in-tunnel and external air quality in the area affected by the Project.

Nothing in this condition shall prevent, limit or restrict any statutory requirements under any legislation, nor shall it limit any action being taken under the EP&A Act.

## Ambient Air Quality

- Monitoring of Ambient Air Quality

164. The Proponent shall monitor (by sampling and obtaining results by analysis) the pollutants and parameters specified in Column 1 of Table 4 at the following four (4) locations as a minimum:

(a) One (1) ground level receptor near the eastern vent stack and one ground level receptor near the western vent stack;
(b) At the air conditioning intake nearest to the top of building 18-20 Orion Road (Compaq building); and
(c) At the air conditioning intake nearest to the top of building 401 Pacific Highway (Corinthian building).

All monitoring stations shall be established subject to the land owner's agreement. The Proponent must use the sampling method, units of measure, and sampling frequency specified in Table 4. The Proponent shall commence monitoring within 18 months of this approval or ensure monitoring occurs for at least 12 continuous months prior to opening of the tunnel. The establishment and operation of the stations is to be undertaken in accordance with recognised Australian standards and undertaken by an organisation accredited by NATA for this purpose and approved by the Director-General. The quality of the monitoring results shall be assured through a NATA accredited process prior to the data being considered as a basis for compliance/auditing purposes.

**Table 4 – Ambient Air Quality Monitoring Methodologies**

| **Pollutant** | **Units of measurement** | **Averaging Period** | **Frequency** | **Method1** |
|---|---|---|---|---|
| NO | pphm | 1-hour | Continuous | AM-12 |
| $NO_2$ | pphm | 1-hour | Continuous | AM-12 |
| $NO_x$ | pphm | 1-hour | Continuous | AM-12 |
| $PM_{10}$ | $\mu g/m^3$ | 24-hour | Continuous | AM-18[1] or AS3580.9.8-2001[2] |
| $PM_{2.5}$[4] | $ug/m^3$ | 24-hour | Continuous | AM-18[1] or AS3580.9.8-2001[2] or method approved by EPA's chief scientist[2] |
| CO | ppm | 1-hour, 8-hour | Continuous | AM-6 |
| **Parameter[3],** | **Units of measurement** | **Averaging Period** | **Frequency** | **Method1** |
| Wind Speed @ 10 m | m/s | 1-hour | Continuous | AM-2 & AM-4 |
| Wind Direction @ 10 m | ° | 1-hour | Continuous | AM-2 & AM-4 |
| Sigma Theta @ 10 m | ° | 1-hour | Continuous | AM-2 & AM-4 |
| Temperature @ 2 m | K | 1-hour | Continuous | AM-4 |
| Temperature @ 10 m | K | 1-hour | Continuous | AM-4 |
| Total Solar Radiation @ 10 m | W/m2 | 1-hour | Continuous | AM-4 |
| **Other** | **Units of measurement** | **Averaging Period** | **Frequency** | **Method1** |
| Siting | NA | NA | NA | AM-1 & AM-4 |

Note: [1]NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales
[2] Standards Australia, 2001, AS3580.9.8-2001, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – $PM_{10}$ Continuous Direct Mass Method using Tapered Element Oscillating Microbalance Analyser.
[3] Location for meteorological monitoring at Compaq/Corinthian station to be at the top of the building.
[4]. Appropriately modified to include size selective inlet for PM2.5 or as otherwise approved by the Director-General

- Operation Stage Monitoring Stations – Community Based Monitoring Station

165. The Proponent shall establish one (1) community based monitoring station (CBMS) associated with each ventilation stack to monitor ambient air quality consistent with the requirements in Table 4, the locations to be agreed to by the AQCCC, at least two (2) years prior to the opening of the Project to traffic. The Proponent shall meet all operating costs associated with the stations.

    The CBMSs shall be operated independently of the Proponent and all other authorities and its establishment and operation shall be overseen by the AQCCC on behalf of the community. The establishment and operation of the stations is to be undertaken in accordance with recognised Australian standards and undertaken by a consultant accredited by NATA for this purpose. The quality of the monitoring results shall be assured through a NATA accredited process prior to the data being considered as a basis for compliance/auditing purposes.

    Monitoring results shall be made publicly available and shall be subject to audit at 6 monthly intervals or at a longer interval if approved by the Director-General by an independent auditor agreed by the AQCCC, whose report shall be directly provided to the Proponent and the AQCCC.

    The Proponent, following consultation with the AQCCC, shall review the need for the continuation of the CBMS after a period of three (3) years after the Project is opened to traffic. Any recommendation to close the CBMS shall require the approval of the Director-General in consultation with the EPA. The Director-General shall approve the independent operator.

- Operation Stage Monitoring Stations – 18-20 Orion Road (Compaq Building) and 401 Pacific Highway (Corinthian Building)

166. The Proponent shall install monitoring stations at the top of the building at 18-20 Orion Road and 401 Pacific Highway, in accordance with Condition of Approval No. 164 to monitor for pollutants identified in Table 4. Monitoring shall be undertaken over a period of at least 12 months from opening of the Project to traffic to correlate and verify impacts with the air quality modelling predictions. The results of the monitoring program shall be made available to the owners of 18-20 Orion Road and 401 Pacific Highway and the AQCCC.

- Operation Stage Monitoring Stations – Residents Living at Ground Level

167. The Proponent shall install two (2) ground level monitoring stations, in accordance with Condition 164 to assess ambient ground level impacts. The location of the stations and pollutants to be monitored shall be developed in consultation with the AQCCC and be approved by the Director-General and shall include the pollutants specified in Table 4 unless otherwise agreed by the Director-General in consultation with the EPA. The location of the ground level monitoring stations shall meet the siting requirements for a background ambient monitoring station in accordance with AS2922-1987.

    The monitoring reports must be made available at six (6) monthly intervals from the date the Project commences operation. The reports must be made available to the Director-General, the EPA, relevant Council(s) and the AQCCC, and must be made publicly available. The total duration of the monitoring shall be for at least three (3) years unless otherwise requested by the Director-General. Any closure of the monitoring station shall be approved by the Director-General in consultation with the EPA at least three (3) months prior to closure.

- Verification of Air Quality Assessment

168. The Proponent shall validate the ambient air quality assessment undertaken for tunnel ventilation system as assessed in the Environmental Assessment for the Revised Ventilation Design for Lane Cove Tunnel (RTA, undated as submitted to DoP 25/10/02) for the Project utilising actual monitoring data recorded by the Proponent following 12 months of operation of the Project. Validation shall be to the satisfaction of the Director-General in consultation with the EPA.

- Air Quality Goals – Ambient Air

169. Should ambient monitoring of air pollutants exceed the following goals, the provisions of Condition 170 shall apply:

(a) CO – 8 hour rolling average of 9.0 ppm (NEPM);
(b) $NO_2$ – One hour average of 0.12 ppm (245 $\mu g/m^3$)(NEPM); and
(c) $PM_{10}$ – 24 hour average of 50 $\mu g/m^3$ (NEPM).

Only monitoring station(s) that meet the requirements for ambient monitoring stations in Australian Standard AS2922 – 1987, shall be used for the purposes of assessing compliance with the ambient goals specified in this condition unless otherwise agreed by the Director-General.

170. Should the results of monitoring required under Condition 165, 166 and 167 show that any of the goals specified in Condition 169 have been exceeded for any given event (excluding extra-ordinary events such as bushfires, dust storms etc as to be defined in a Protocol), the Proponent shall immediately notify the DoP, EPA and NSW Health. The Protocol shall be approved by the Director-General in consultation with the EPA, DoH and the AQCCC.

The notification shall be followed up with a detailed report within 10 working days which shall be prepared by an independent person/organisation to the Director-General on the cause and major contributor of the exceedance and the options available to prevent recurrence. The Director-General shall approve the independent person/organisation. This report must include consideration of improvements to the installed systems such as ventilation, and traffic management measures to address ambient air and/or the option of installing pollution control systems. If the Report does not propose the installation of pollution control systems then this recommendation must be justified. The Proponent shall comply with any requirements of the Director-General's review of the Report.

- Public Access to Monitoring Results

171. Results of hourly updated real-time ambient monitoring of $PM_{10}$, $PM_{2.5}$, $NO_2$, and CO at the approved ground level monitoring locations, in-tunnel CO and relevant meteorological data shall be provided on the Internet site and made publicly available each month in hard form in an easy to interpret format. These data shall be preliminary until a quality assurance check has been undertaken by a person or organisation accredited by NATA for this purpose. The availability of these data shall be conveyed to the local community by way of newsletter (including translation into common non-English speaking languages in the area) and newspaper advertisement at least one (1) month prior to the opening of the Project to traffic.

Ventilation Stacks

- Monitoring

172. The Proponent shall install monitoring equipment to monitor pollutants inside the ventilation stack. Pollutant monitoring inside the ventilation stack (by sampling and obtaining results by analysis) shall be for the pollutants and parameters specified in Column 1 of Table 5. The Proponent must use the sampling method, units of measures and sample at the frequency specified in the other columns. Monitoring equipment installed under this condition is to be independently audited prior to its commencement of monitoring for compliance with the requirements set out in Table 5. Auditing is to be undertaken by an independent person(s) or organisation(s) approved by the Director-General and paid by the Proponent.

**Table 5 – Stack Emission Monitoring Methodologies**

| Pollutant | Units of measure | Frequency | Method[1] |
|---|---|---|---|
| NO | $mg/m^3$ | Continuous | CEM-2 |
| $NO_2$ | $mg/m^3$ | Continuous | CEM-2 |
| $NO_x$ (as $NO_2$) | $mg/m^3$ | Continuous | CEM-2 |
| $PM_{10}$ | $\mu g/m^3$ | Continuous | AS3580.9.8-2001, AM18 or method approved by EPA's chief scientist[2] |
| $PM_{2.5}$[5] | $\mu g/m^3$ | Continuous | AS3580.9.8-2001, AM18 or method approved by EPA's Chief Scientist[2] |
| Solid Particles | $\mu g/m^3$ | quarterly | TM15 |
| $PM_{10}$ | $\mu g/m^3$ | quarterly | OM-5 |
| $PM_{2.5}$[5] | $\mu g/m^3$ | quarterly | OM-5 |
| CO | $mg/m^3$ | Continuous | CEM-4 |
| VOC | $mg/m^3$ | Continuous | CEM-8 |
| Speciated VOC[3] | $mg/m^3$ | Annual | OM-2 |
| PAH[4] | $\mu g/m^3$ | Annual | OM-6 |
| Parameter | Units of measure | Frequency | Method[1] |
| Flow rate | $m^3/s$ | Continuous | CEM-6 |
| Moisture | % | Continuous | TM-22 |
| Temperature | K | Continuous | TM-2 |
| Other | Units of measure | Frequency | Method[1] |
| Sampling locations | NA | NA | TM-1 |

Note:
1 NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales
2 Standards Australia, 2001, AS3580.9.8-2001, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – $PM_{10}$ Continuous Direct Mass Method using Tapered Element Oscillating Microbalance Analyser
3 Must include, but not limited to; Benzene, Toluene, Xylenes, 1,3-Butadiene, Formaldehyde and Acetaldehyde
4 Must include, but not limited to; 16 USEPA priority PAHs, namely; Naphthalene, Phenanthrene, Benz(a)anthracene, Benzo(a)pyrene, Acenapthylene, Anthracene, Chrysene, Indeno(1,2,3-cd)pyrene, Acenaphthene, Fluoranthene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Fluorene, Pyrene, Benzo(k)fluoranhtene, Benzo(g,h,i)perylene.
5 Appropriately modified to include size selective inlet for PM2.5 or as otherwise approved by the Director-General.

- Ventilation Stack Limits

173. The concentration and mass of pollutants discharged from the ventilation stack(s) referred to in Table 6 must not exceed the respective limits specified for that pollutant.

**Table 6 – Mass Pollutant Concentrations**

| | | Units of measurement | Averaging period | Total CO | Total $NO_x$ | Total $PM_{10}$ | Total VOC |
|---|---|---|---|---|---|---|---|
| **W Stack** | **Concentration limit** | $mg/m^3$ | 30 minutes | 62.5 | 32.8 | 1.6 | 6.3 |
| **E Stack** | **Concentration limit** | $mg/m^3$ | 30 minutes | 62.5 | 25.7 | 1.2 | 6.3 |
| **Combined Stacks** | **Combined Annual load limit** | t/annum | annual | 1530 | 229 | 14[1] | 153 |

1. or averaging period consistent with test method

An independent person or organisation, approved by the Director-General shall:

(a) verify that compliance with stack limits detailed in Table 6 will not result in air quality impacts greater than predicted in Appendix C (Environmental Assessment for Revised Tunnel Ventilation Design for the Lane Cove Tunnel) of the Director-General's report;
(b) undertake an appropriate assessment to the satisfaction of the Director General and in consultation with the EPA to indicate how stack discharge velocities have been optimised in consideration of energy requirements and air quality impacts at all sensitive receivers; and,
(c) validate recorded monitoring data and certify compliance with the stack limits.

The ventilation stack limits detailed in Table 6 shall be reviewed on a five (5) yearly basis and may be lowered (*i.e.* made more stringent), subject to improvements in vehicle fleet emissions, if the Proponent is directed to do so by the Director-General following consultation with the EPA.

- Exceedance of Stack Limits

174. Should the results of monitoring required under Condition 172 show that any of the stack limits specified in Condition 173 have been exceeded, the Proponent shall immediately notify the DoP, EPA and DoH. This notification shall be followed up with a detailed report within 10 working days to be prepared by an independent person/organisation to the Director-General on the cause and major contributor of the exceedance and the options available to ensure the prevention of a recurrence. The report must include consideration of additional traffic management measures to address air quality emissions and also the option of installing pollution control systems. If the Report does not propose the installation of pollution control systems then this recommendation must be justified. The Proponent shall comply with any requirements of the Director-General's review of the Report. Independent verification shall be undertaken by independent person(s) or organisation(s) approved by the Director-General.

- Emergency Discharge

175. Conditions 160, 161, 169 and 170, do not apply:

(a) in an emergency to prevent damage to life or limb other than an emergency arising from a negligent act or omission from the Proponent. The Proponent shall as soon as reasonably practicable, notify the Director-General and the EPA of any such discharge.
(b) as a result of an incident (not including congestion in the tunnel), which is beyond the control of the Proponent or the tunnel operator and could not have been prevented by taking those steps which a prudent, experienced and competent operator would have taken.

The Proponent shall, as soon as reasonably practicable, notify the Director-General and the EPA of any such discharge.

*Note: Any exceedance of the goals or limits in conditions 160, 169 and 170 which result from a negligent act by the Proponent/Company irrespective of potential damage to life or limb is a breach of these Conditions of Approval.*

Local and Sub-Regional Air Quality Improvements

176. The Proponent shall assist the relevant Councils in developing an air quality assessment process for inclusion in a Development Control Plan or other appropriate planning instrument, in considering planning and building approvals for new development in the area which would be within a potential three (3) dimensional zone of affectation (buffer volume). This process shall include procedures for identifying the width and height of buildings that are likely to be either affected by the plume from the ventilation stack or affect the dispersion of the plume from the ventilation stack through building wake effects. The Proponent shall meet all costs for the development of this process and any necessary amendments to the planning instrument(s) required to implement the process.

177. Prior to the opening of the Project to traffic, the Proponent shall investigate, in consultation with the EPA the measures for smoky vehicle enforcement in areas surrounding the Project, taking into consideration cost effectiveness. Any measures implemented as a result of investigation recommendations shall be in accordance with the Smoky Vehicle Enforcement Program. The Proponent shall report on the effectiveness of the smoky vehicle enforcement.

General Air Quality Reporting Auditing and Quality Assurance

- General Reporting

178. The Proponent must develop and implement a reporting system for in-tunnel, ambient and ventilation stack limits to the satisfaction of the Director-General in consultation with the EPA. The reporting system must be approved, fully implemented and operational prior to the commencement of tunnel operations. Minimum analytical reporting requirements for air pollution monitoring stations shall be as specified in Section 4 of the EPA's *Approved Methods of Modelling and Assessment of Air Pollutants in NSW, 2001.*

- Auditing/Quality Assurance

179. The provision, operation and maintenance (including all auditing and validation of data) of all air quality monitoring and reporting shall be funded by the Proponent.

180. The Proponent shall appoint an external auditor to conduct an audit of the air quality monitoring (in tunnel and external) at six (6) monthly intervals or at any longer interval if approved by the Director-General. Air quality audits shall commence six (6) months from opening of the Project to traffic. The auditor shall ensure that the operating procedures and equipment to acquire air monitoring, meteorological data and emission monitoring data and monitoring reporting comply with NATA (or equivalent) requirements and sound laboratory practice. The Proponent must document the results of the audit and make available all audit data for inspection by the Director-General upon request. A copy of the audit report shall also be issued to the Proponent and AQCCC.

181. The Proponent shall undertake appropriate quality assurance (QA) and quality control (QC) measures for air quality and ventilation stack emission monitoring data. This shall include, but not limited to: accreditation/quality systems, staff qualifications and training, auditing, monitoring procedures, service and maintenance, equipment or system malfunction and records/reporting. The QA/QC measures shall be approved by an independent expert approved by the Director-General prior to monitoring of air quality and ventilation stack emissions as appropriate.

Air Intake

182. Any air intake required for the tunnel ventilation system shall be located on the RTA owned land at 130-132 Epping Road or any other location as agreed by the Director-General following further assessment. The Proponent shall design the air intake to maximise the undergrounding of facilities in consultation with nearby residents and Lane Cove Council.

*Dangerous Goods*

183. The Proponent shall ensure that that all practicable measures are taken to prohibit any vehicle carrying any quantity of goods defined as dangerous under the Australian Dangerous Goods Code, from entering the Tunnel during either construction or operation.

184. The Proponent shall develop a program outlining measures to be implemented to restrict access of dangerous goods vehicles into the Tunnel in accordance with Condition of Approval No. 183. The program shall be submitted to and approved by the Director-General prior to the opening of the Project to traffic.

*Noise*

Regenerated Noise

185. The Proponent shall not undertake any excavation using rock hammers below ground during the night time (10pm to 7am).

186. Regenerated noise from construction works shall not exceed the following criteria as measured at the nearest sensitive receptor:

(a) LAeq(15 min) 40 dB(A) between the hours of 6:00 pm and 10:00 pm; and
(b) LAeq (15 min) 35 dB(A) between the hours of 10:00 pm and 7:00 am

If any exceedances are proposed they must be fully justified, prior to undertaking the work, through a detailed noise impact assessment report prepared by a qualified acoustic specialist. The noise impact assessment report shall be prepared in consultation with the EPA and the proposed works must not be commenced without the prior approval of the EPA.

*Operational Noise Management*

187. The Proponent shall ensure that noise emanating from the tunnel ventilation system does not exceed the noise limits at the nearest sensitive receptor as specified in Table 7 in accordance with the EPA's *Industrial Noise Policy*.

**Table 7 – Tunnel Ventilation System Operating Noise Limits**

| Noise Receivers | Day ($L_{eq\ (15\ minutes)}$) | Evening ($L_{eq\ (15\ minutes)}$) | Night ($L_{eq\ (15\ minutes)}$) |
|---|---|---|---|
| Portal Entrance near Pacific Highway | 54 dB(A) | 45 dB(A) | 40 dB(A) |
| Eastern Ventilation Stack | 54 dB(A) | 45 dB(A) | 40 dB(A) |
| Portal Entrance near Mowbray Road West | 60 dB(A) | 50 dB(A) | 42 dB(A) |
| Western Ventilation Stack | 39 dB(A) | 37 dB(A) | 36 dB(A) |
| Air intake at 130-132 Epping Road[1] | 45 dB(A) | 45 dB(A) | 45dB(A)[2] |

1. In accordance with Condition 182 if the air intake location changes limits will have to be revised and reset by the Director-General.
2. Limits can only be modified with the approval of the Director-General following a detailed noise assessment during the detailed design phase.

Daytime shall be defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays. Evening is defined as the period from 6pm to 10 pm. Nighttime is defined as the period 10pm to 7am Monday to Saturday and 10pm to 8 am Sundays and Public Holidays.

*Drainage*

188. The Proponent shall undertake further assessment of tunnel drainage including fire water management prior to construction and operation of the Tunnel to the satisfaction of the Director-General. The assessment shall include but not be limited to identification of anticipated runoff volumes, runoff treatment options and the potential impacts of runoff discharge into Stringybark Creek from a hydraulic/hydrological and environmental perspective.

*Settlement*

Dewatering Analysis

189. A detailed settlement study specific to all proposed construction stage dewatering shall be prepared to determine the potential extent of settlement and whether structures need to be protected through appropriate treatment. The study shall identify the implications and mitigation measures for buried services, roadways, buildings and other structures. The study shall investigate the proposed areas of dewatering operations and shall have particular reference to the following:

(a) entry and exit tunnels to/from the Pacific Highway;
(b) the area of the western vent stack exhaust tunnel, shall be conducted prior to commencement of tunnelling; and
(c) buildings on George Place, Artarmon.

Settlement Analysis

190. A detailed geotechnical model of representative geological conditions shall be prepared prior to commencement of tunnelling to identify and include significant geological structures. This model shall also include full details of existing and currently proposed excavations, basements and other sub-surface structures which may be impacted by the Project. The Proponent shall use this model to assess the predicted settlement and horizontal strain profiles caused by tunnelling.

191. Should the geotechnical model in Condition 190 indicate that exceedances of the criteria in Table 8 are likely, the Proponent shall implement mitigation measures such as appropriate support and stabilisation structures in consultation with the relevant land and/or infrastructure owners prior to the commencement of tunnelling to ensure where possible that underground services, infrastructure and adjacent buildings will not experience settlements exceeding the criteria Table 8.

**Table 8 Settlement Criteria for Specific Structures**

| Beneath Structure/Facility | Maximum Settlement | Maximum Angular Distortion |
|---|---|---|
| Buildings | | |
| Low or non sensitive buildings (i.e. ≤ 2 levels and carparks). | 30 mm | 1:350 |
| High or sensitive buildings (i.e. ≥ 3 levels and heritage buildings). | 20 mm | 1:500 |
| Roads and Parking areas | 40 mm | 1:250 |
| Parks | 50 mm | 1:250 |
| Identified Utilities | to be determined in consultation with the relevant authorities | to be determined in consultation with the relevant authorities |

The above criteria shall not remove any responsibility from the Proponent for the protection of existing structures or for rectifying any damages resulting from the Project.

192. Settlement criteria for individual sensitive utility structures including SWC services (*i.e.* brick sewers), gas, electricity and telecommunication services, shall be determined in consultation with the relevant authorities prior to the commencement of tunnelling.

Management

193. The Proponent shall install and monitor inclinometers and settlement monuments along the tunnel route throughout the construction period and for a period of not less than six (6) months after settlement has stabilised, with particular reference to risk areas identified in the building condition surveys required by Condition 78. If monitoring during construction indicates exceedance of the criteria then all work affecting settlement shall cease immediately and shall not resume until fully rectified or a revised method of work has been established that will ensure protection of affected structures.

Operation

194. The Proponent shall monitor settlement for any period as may be specified through the Independent Property Impact Assessment Panel referred to in Condition 80. The results of this monitoring shall be made available to the Director-General upon request.

*Groundwater Inflow*

195. Prior to commencement of construction, the Proponent shall undertake detailed geotechnical investigations to the satisfaction of the Director-General to identify risk areas for groundwater inflow where treatment may be required to prevent groundwater inflow into the Tunnel or groundwater induced settlement. Particular reference shall be made to those areas identified as "high risk" in the EIS. The investigation shall include but not be limited to:

(a) monitoring existing groundwater for quality and quantity;
(b) groundwater contamination potential (including site histories);
(c) identifying treatment that may be required to prevent significant influence on the local groundwater or the surface flow in Stringybark Creek;
(d) the impact of groundwater drawdown on structures supported on pile foundations; and
(e) an assessment of the impacts of any proposed treatments on the natural groundwater flow paths and any resultant effects on surrounding ecological communities.

Groundwater Management Sub Plan

196. A detailed Groundwater Management Sub Plan shall be prepared to meet the requirements of

DLWC and following consultation with the EPA and incorporated into the Construction Framework and Operation EMPs. The Sub Plan shall cover the complete tunnel and shall provide details of groundwater inflow and dewatering control measures to be undertaken during both the construction and operation stages respectively and include but not be limited to:

(a) impacts on nearby structures from potential settlement;
(b) groundwater inflow control, handling, treatment, reuse and disposal of contaminated groundwater;
(c) pre-construction and construction monitoring in accordance with the NSW EPA *Contaminated Sites: Sampling Design Guidelines* (NSW Environment Protection Authority 1995) to identify elevated concentrations of contaminants;
(d) auditing; and,
(e) procedures for mitigation through reinjection, grouting *etc.* identified in the dewatering analysis required by Condition 189, including:
    (i) detailed community consultation procedures;
    (ii) identification of sensitive structures requiring reinjection;
    (iii) identification of borehole spacing, borehole design, injection pipework, monitoring pipework and general system design and redevelopment; and,
    (iv) a detailed monitoring plan identifying piezometers locations and standards, construction details, monitoring frequency and analysis requirements; and
    (v) maximum allowable groundwater inflow.

Pre-Construction

197. Prior to substantial construction, the Proponent shall develop a program for implementation during construction, to monitor impacts of dewatering on groundwater before and during construction. The program shall include:

(a) identification of areas to be monitored;
(b) monitoring methods and equipment, data loggers for continuous groundwater level monitoring;
(c) the suitability for disposal of groundwater inflow/seepage into the tunnel; and
(d) frequency and duration of monitoring.

Construction Stage Dewatering

198. If dewatering is required at any stage during construction or operation, the impacts on groundwater users that could be affected by drawdown shall be identified and suitable mitigation measures proposed to the satisfaction of the DLWC. Any dewatering works required would need to be licensed by the DLWC for that purpose.

199. Probe ahead drilling shall be carried out beneath Stringybark Creek in conjunction with additional surface borehole investigations to protect against possibility that structural features in the rock link the tunnel with the creek waters, to confirm palaeochannel depth and infill composition and identify the need for pre-tunnel grouting. (Coffey report, November 2001, p. 45 & 57).

200. The ventilation tunnel to the vent stack at Sirius Road shall avoid the reservoir and dam embankment to reduce the risk of groundwater inflow and differential settlement respectively unless otherwise agreed to by the Director-General following further investigation.

201. Licensable groundwater works shall only be undertaken by drilling contractors who hold a current Drillers Licence issued by DLWC with appropriate endorsement for the nature of the work required.

202. A conventional spear point system shall be used to the satisfaction of DLWC for areas of the excavation where risks to structures are high and where it is desirable to install the system before excavation begins or desirable to locate the system outside the excavation for other reasons.

Operation Stage

203. The Proponent shall take all practicable measures to limit operational groundwater inflows to 3 litres/second/kilometre, or other such limit(s), established by the Proponent and agreed to by the Director General, based on detailed geotechnical investigations groundwater modelling and settlement analyses.

204. The Proponent shall monitor the quality of groundwater collected in the tunnel drainage system for a period of at least one (1) year after commissioning of the Project or any other such period as required by the Director-General and consistent with Condition 188. Seepage, spills, contaminated water, tunnel washing, fire fighting or other water in the tunnel which contains pollutant levels above the background concentrations of natural discharge points shall be directed into separate sumps with pump out facilities. This water shall not be discharged to the stormwater system.

*Acid Sulfate Soils*

205. A detailed acid sulfate soils testing program shall be undertaken prior to commencement of excavation works for the Project (between the eastern and western portals, including construction access tunnels and exit/entrance tunnels from the Pacific Highway and ventilation stack tunnels), in areas required for bridge works associated with the Lane Cove River crossing and the Mowbray Road West construction compound. The testing shall determine the class and volume of potential or actual acid sulphate soils likely to be disturbed during construction. The testing program shall be developed and implemented in consultation with the DLWC.

206. Should the testing required in Condition 205 identify that the likelihood of excavating acid sulfate soils will be high, a detailed Acid Sulfate Soil Management Sub Plan shall be prepared to the satisfaction of the DLWC and following consultation with EPA and incorporated into the Construction Framework EMP. The Sub Plan shall include reference to the water quality monitoring program contained in the Construction Water Management Sub Plan and shall be prepared in accordance with the Acid Sulfate Soils Manual (ASSMC, 1998).

207. If testing undertaken in accordance with Condition 205 indicates that the potential for encountering acid sulphate soils is low, the Proponent shall prepare an Acid Sulfate Soil Contingency Plan prior to commencement of construction and incorporated into the Construction Framework EMP. The contingency shall include measures for the unexpected discovery of actual or potential acid sulfate soils during construction. It shall be prepared in consultation with the DLWC. The ASS Contingency Plan shall be prepared in accordance with the Acid Sulfate Soils Manual (ASSMC, 1998).

*Urban Design*

208. A detailed Urban Design and Landscape Management Sub Plan(s) for the eastern and western vent stacks, air intake, tunnel control facilities and associated infrastructure shall be prepared in accordance with Condition 87 and the principles of the Framework Urban Landscape Plan. The plan(s) for any component shall be developed in consultation with relevant Councils for the approval of the Director-General prior to commencement of construction works. The Sub Plan(s) shall consider, but not be limited to the following:

(a) the requirements of Conditions of Approval Nos 150, 151, 153 and 154;
(b) proposed treatments, finishes and materials of exposed surfaces (including colour specifications and samples);
(c) final location of the stacks to consider the need to minimise visual impacts on surrounding areas
(d) where appropriate, integration of the finished form with the existing structures and surrounding environment in accordance with the requirements of Condition 151.

The final design shall be prepared in consultation with the AQCCC, local Councils and approved by the Director-General.

*Open Space*

209. If the air intake is located at 130-132 Epping Road (subject to Condition 182) any remaining land not required for the operation of the air intake shall be dedicated to the relevant Council for use as open space, otherwise this condition is deleted..

**Epping Road Surface Modifications**

*Bridge Construction*

210. The Proponent shall ensure that wherever practical, piling activities are undertaken using bored piles. If driven piles are required they shall only be installed after the completion of a detailed noise and vibration impact assessment and in accordance with Conditions 186 and 65. The noise and vibration impact assessment shall be prepared in consultation with the EPA and the proposed works shall not be commenced without the prior approval of the EPA.

211. A detailed Urban Design and Landscape Management Sub Plan for the Lane Cove River crossing shall be prepared in accordance with Condition 87 and the principles of the Framework Urban Landscape Plan. The Plan shall be developed in consultation with the DLWC and NPWS for approval by the Director-General prior to commencement of construction works for the bridge. The sub plan shall consider, but not be limited to the following:

(a) proposed treatments, finishes and materials of exposed surfaces (including colour specifications and samples);
(b) finished form to prevent obstruction of the main watercourse;
(c) minimisation of direct and indirect impacts, including measures to limit clearing requirements and long term shading of mangroves;
(d) integration of the finished form with the existing bridge structures and surrounding environment, including the Lane Cove National Park and Great North Walk; and
(e) abutment design and location to allow for pedestrian access, fauna movement and vegetation linkages.

*Public Transport*

212. No more than six (6) months after Project opening the Proponent shall install continuous 24 hour bus lanes in both directions on Epping Road/Longueville Road from Mowbray Road West to the commencement of the Gore Hill Freeway in consultation with the PTC.

213. No later than at the time of Project opening the Proponent shall install bus priority facilities for westbound traffic on Epping Road at Mowbray Road West, Pittwater Road and Delhi Road intersections in consultation with the PTC.

214. No later than at the time of Project opening the Proponent shall install a continuous AM peak T3 lane on Epping Road between Delhi Road and Mowbray Road West for eastbound traffic in consultation with the PTC.

215. No more than six (6) months after Project opening the Proponent shall install bus lane enforcement systems on Epping Road for both eastbound and westbound bus lanes in consultation with the STA, PTC and NSW Police Service.

*Pedestrian and Cycleway Access*

216. The Proponent shall ensure that at-grade pedestrian crossings are provided at the following locations to allow pedestrians to cross in a single uninterrupted stage across:

(a) Epping Road on the western side of the junction with Longueville Road (not including the slip lane from Longueville Road northbound to Epping Road westbound);
(b) Epping Road at the junction with Mowbray Road west

*Note: The intent of Condition 216 is to ensure that pedestrians are able to cross Epping Road in a single unbroken journey and are not required to wait on the median for a second pedestrian crossing phase and to ensure that pedestrians receive equal priority on the downgraded Epping Road surface route.*

217. The Proponent shall design the footpath next to the "Azalea Bed" display on Epping Road in consultation with Lane Cove Council and the relevant CLG.

*Property Impacts*

218. Prior to any construction works commencing on the Epping Road surface route, the Proponent shall prepare a Business Management Strategy in consultation with all businesses affected during the construction stage. The objective of the Strategy shall be to minimise impacts on local businesses through appropriate signage, maintaining vehicular and pedestrian access during business hours, minimising noise and dust impacts and retaining visibility of the business appropriate to its reliance on such. A draft Strategy shall be made available to all businesses and to relevant local Council(s) for comment for a period of no less than 21 days. The final Strategy shall indicate how any issues raised on the draft have been addressed in the final Strategy. The Strategy shall be made publicly available.

219. The design of the Project and the resultant acquisition (freehold, easement or other arrangement) of land from the BP service station on Epping Road must be undertaken in a way which ensures that the ability to operate the service station is protected. In particular, the Proponent must ensure that all necessary boundary and other setbacks to the storage tanks, associated dispensers and other critical components of the service station to satisfy the relevant Australian Standards and other safety related requirements. The Proponent shall bear the costs of any changes required to the Property.

220. The Proponent shall ensure that all businesses affected by altered traffic arrangements are consulted at least 10 days prior to any affectation and shall endeavour where practicable to maintain access at all times.

*Urban Design and Landscaping*

221. The Urban Design and Landscape Sub Plan for the Epping Road corridor between Mowbray Road West and the Pacific Highway prepared in accordance with Condition 87 shall be prepared in consultation with the local community, the CLG, Lane Cove, Willoughby and Ryde councils, PTC and the Director-General. The Sub Plan shall be based on the landscape plans prepared by Hassell Pty Ltd dated February 2002 titled "Epping Road Additional Planting Opportunities (Moore Street to Centennial Avenue)" and "Epping Road Planting Opportunities (Centennial Avenue to Parklands Avenue)" and shall include, but not be limited to:

(a) sections and perspective sketches;
(b) methodology of landscaping works;
(c) built elements including bridges and other structures, retaining walls, noise walls and toll infrastructure;
(d) road furniture including safety barriers, kerbs, paving, signage, lighting and medians;
(e) consideration of undergrounding electricity transmission lines;
(f) pedestrian and cycle elements including footpaths and paving, pedestrian crossings/overpasses and fixtures (i.e. tree guards, seating, lighting, fencing and signage);
(g) public transport facilities;
(h) landscape elements including proposed treatments, finishes and materials of exposed surfaces (including colour specifications and samples);
(i) timing and staging of works, methodology, monitoring and maintenance;
(j) location and identification of existing and proposed vegetation including use of locally native species and target survival rates for plantings; and
(k) specific measures to maintain the "azalea display" on Epping Road.

The Urban Design and Landscape Sub Plan shall consist of a report with accompanying annotated plans, sections and perspective sketches, photomontages and other illustrative material at a scale and level of detail which is adequate to convey the Project.

222. The Proponent shall prepare a specific Urban Design and Landscape Management Sub Plan for the Longueville Road bus interchange and pedestrian overbridge which is consistent with the urban design and landscape features identified for the Epping Road corridor in Condition 221. The Sub Plan shall include consideration of, but not be limited to:

(a) the role of this intersection as the eastern "gateway" to Epping Road and beyond;
(b) proposed treatments, finishes and materials of exposed surfaces (including colour specifications and samples);
(c) integration of the finished form with the existing structures and surrounding environment;
(d) the landscape plan by Hassell dated February 2002 titled "Epping Road Planting Opportunities (Centennial Avenue to Parklands Avenue) and "Epping Road Master Plan (Parklands Avenue to Pacific Highway);
(e) pedestrian safety and visibility;
(f) the adequacy of footpaths to accommodate passengers and the general public, incorporating the required abutments;
(g) appropriate shelter and seating;
(h) help point phones; and
(i) safe access to and from the interchange.

The final design of the bus interchange shall be to the satisfaction of the STA in consultation with Lane Cove Council and the PTC. Ownership and maintenance of the bus interchange and overbridge shall be determined in consultation with Lane Cove Council and the STA at least six months prior to opening.

223. On completion of the pedestrian overbridge at Longueville Road and Epping Road, the existing pedestrian bridge at Kimberley Avenue shall be removed and the immediate area be rehabilitated in accordance with the Urban Design and Landscaping Management Sub Plan required in Condition 87.

224. Additional investigations to determine the likely success or otherwise of transplanting the fig tree on the southern side of Epping Road near the Lane Cove River shall be undertaken by a qualified arborist. In the event that transplantation is unlikely to be successful, alternative mitigation measures shall be identified and implemented as required.

**Gore Hill Freeway**

*Noise and Vibration*

225. Operational noise mitigation measures shall be installed consistent with those described in Appendix M of the Representations Report, the ECRTN and RTA's Environmental Noise Management Manual. Prior to installation of these mitigation measures the Proponent shall consult with the community affected and with the EPA. The approval of the Director-General is required for any changes to proposed noise mitigation measures.

*Cycleway*

226. The cycleway through the Willoughby Road/Naremburn shops area shall be designed consistent with Figure 4.8 of the Director-General's report to avoid potential conflicts with traffic and pedestrians and to maximise free flow of traffic. The Proponent shall consult with Bicycle NSW, relevant bicycle groups, Willoughby Council and the relevant CLG in developing the final design.

*Traffic*

227. The Proponent shall ensure that one lane in each direction on the entire length of the Gore Hill Freeway is a dedicated 24 hour T2 lane.

228. The Proponent shall ensure that the design ensures priority for eastbound buses in the merge between the Longueville Road bus lane and the Gore Hill Freeway transit lane to the satisfaction of the PTC.

229. The Proponent shall investigate the installation of a bus lane or other suitable bus priority measures for southbound traffic between the end of the T2 lane on the Gore Hill Freeway and the existing southbound bus lane on the Warringah Expressway. The Proponent shall implement recommendations of the investigation to the satisfaction of the Director-General following consultation with the PTC within 1 month of opening of the Project to traffic unless otherwise agreed to by the PTC.

230. The Proponent shall investigate alternative procedures and/or facilities, including an alternative bus layover to manage bus movements to the City along the Warringah Expressway. Any alternative procedures and/or facilities shall be prepared in consultation with and to the satisfaction of the PTC, STA and relevant private bus operators. Any procedures and/or facilities shall be in place and operational prior to the commencement of construction of the north-facing Falcon Street ramps.

231. Prior to Project opening, the Proponent shall install transit lane enforcement bays on the Gore Hill Freeway and bus lane enforcement required on the Pacific Highway in consultation with the NSW Police Service, STA and the PTC.

*Pedestrians and Cyclists*

232. Unless otherwise agreed by the Director-General, the Proponent shall install pedestrian crossing(s) across Reserve Road in the vicinity of the Gore Hill Freeway in consultation with Willoughby City Council.

233. During the detailed design stage, the proponent shall investigate options for the location of the proposed cycleway away from the rear of properties on Olympia Road, Naremburn in consultation with Willoughby City Council, BicycleNSW and the relevant CLG. This shall include at least the option of putting the cycleway on areas adjacent to the Gore Hill Freeway. The objectives of the investigations shall be to ensure the best level of service for cyclists whilst maximising the privacy of residents to the greatest extent practicable. The final proposed design for the cycleway in this location shall require the approval of the Director-General.

*Hydrology*

234. The Proponent shall undertake further hydrological assessment of the Flat Rock Creek catchment prior to commencement of substantial construction to the satisfaction of the Director-General. The assessment shall include, but not be limited to:

(a) confirmation of predicted increases in peak surface water levels and peak discharge;
(b) identification of affected properties and the critical flood event at which affected properties become inundated and how these would be affected by the Project;
(c) extent of inundation for affected properties at and above the critical flood event with the Project in place; and
(d) comparison of the options available to ensure that flooding impacts are no greater than those currently experienced within the catchment, including a cost effectiveness comparison.

**Falcon Street Ramps**

*Traffic and Access*

235. The Proponent shall ensure that at grade pedestrian access is maintained across Falcon Street and Military Road from Merlin Street south to Merlin Street north unless otherwise agreed to by the Director-General.

236. The Proponent shall consult with North Sydney City Council during the detailed design stage of the Falcon Street ramps and revised traffic movements around the residential island on Falcon Street with regard to the masterplanning process for that area. Where practicable the Proponent shall incorporate any relevant recommendations of the masterplanning process area into the final design.

237. A continuous bus lane shall be provided on Falcon Street/Military Road (eastbound) from the Warringah Expressway northbound exit ramp to Big Bear Shopping Centre unless otherwise agreed to by the Director-General.

238. The Proponent shall install a bus indent bay on Military Road to the east of Merlin Street north. The location and design of the bay shall be to the satisfaction of the State Transit Authority.

239. The Proponent shall investigate installation of a 24 hour bus lane in the westbound direction on Falcon Street between the Warringah Expressway and Miller Street in consultation with the PTC. Any installation of bus lanes resulting from these investigations shall be completed within one (1) month of opening of the Project

240. Additional to Condition 239 the Proponent shall investigate measures to "capture" additional road capacity created by reduced traffic levels on Falcon Street between the Pacific Highway and Warringah Expressway for approval by the Director-General. Such measures may include installation of T2 lanes or other public transport enhancement measures. These investigations shall be carried out in consultation with the PTC and the recommendations shall be forwarded to the Director-General. The Proponent shall implement recommendations of the investigation to the satisfaction of the Director-General within 6 months of opening of the Project to traffic unless otherwise agreed by the Director-General.

*Noise and Vibration*

241. The Proponent shall install noise mitigation measures for traffic noise on the southbound Falcon Street ramp in accordance with the Environmental Criteria for Road Traffic Noise (ECRTN) and the RTA's Environmental Noise Management Manual only after consultation with affected residents and the EPA, and detailed consideration of visual impacts. Installation of noise mitigation measures shall be to the satisfaction of the Director-General.

*Urban Design and Visual*

242. The Proponent shall prepare an Urban Design and Landscaping Sub Plan for the Falcon Street ramps and pedestrian overbridge in accordance with Condition of Approval No. 87 which shall consider:

(a) noise barriers on the eastern side of the Warringah Expressway;
(b) road furniture including safety barriers, kerbs, paving, signage, lighting and medians
(c) pedestrian and cycle elements including footpaths and paving, pedestrian crossings/overpasses and fixtures (i.e. tree guards, seating, lighting, fencing and signage);
(d) public transport facilities in consultation with the PTC;
(e) proposed treatments, finishes and materials of exposed surfaces (including colour specifications and samples);
(f) integration of the finished form with the existing structures and surrounding environment; and
(g) pedestrian safety and visibility, with reference to the DoP/NSW Police Service publication *Safer by Design*.

**Moore Street Compound**

*General*

243. Prior to any works at the proposed Moore Street compound site, the Proponent shall investigate alternative sites and alternative construction compound designs to address the potential environmental impacts. The assessment shall include as a minimum:

(a) detailed comparative assessment of all viable alternative sites and justification for use of this site and implications for the Project of not using it;
(b) results of consultation with affected residents, EPA, DLWC and Lane Cove Council;
(c) alternative construction compound designs, including locations of spoil stockpile, truck wheel wash, site access etc.;
(d) traffic management, with particular attention to management of access to Moore Street during peak periods;
(e) alternative means of spoil disposal to eliminate heavy vehicle traffic from Moore Street;
(f) all feasible options for noise and dust/air quality mitigation measures including cost effectiveness of the options considered;
(g) consideration of alternative means of operating the site including works scheduling, maintenance requirements etc.;
(h) impacts on vegetation and measures to minimise impacts for the alternative designs considered; and
(i) visual impacts for surrounding residents and options for screening to minimise those impacts.

The primary objective of the consideration of alternative designs and methods of operation shall be to minimise environmental impacts on local residents.
The assessment shall nominate a final site and construction compound design which shall require the approval of the Director-General at least one (1) month prior to the commencement of any works at Moore Street compound site.

244. Should the Proponent obtain approval for the Moore Street Compound under Condition 243, Conditions 245 to 259 apply, otherwise Condition 245 to 259 are deleted.

245. Any non compliance with the requirements of Conditions 246 to 256 inclusive may be identified by the Department as a breach of this condition. The Director-General may direct the Proponent to provide a report within two (2) working days outlining the cause of the non-compliance and measures implemented or to be implemented to prevent recurrence. If the Proponent fails to implement the required actions within a period specified by the Director-General, or the nature of the non-compliance is of high impact significance, the Director-General may direct the Proponent to expend an amount, which is to be calculated as the aggregate of $10,000 (CPI adjusted) for each day on which any one or more of the non-compliances occurs or remains outstanding.

In the event that the Proponent is directed to expend any amount as required under this Condition, it shall, within 3 months, prepare a strategy in consultation with local residents and Lane Cove Council and approved by the Director-General on how any money shall be spent.

246. All external surface construction activities at Moore Street, including transportation of spoil, shall be restricted to the hours of 7:00 am to 6:00 pm (Monday to Friday); 8:00 am to 1:00 pm (Saturday) and at no time on Sundays and public holidays.

Works outside these hours that may be permitted include:
(a) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
(b) emergency work to avoid the loss of lives, property and/or to prevent environmental harm; and
(c) any other work as agreed by the EPA through licence conditions, provided local residents are informed of the timing and duration at least 48 hours prior to commencement of the work.

247. The Proponent shall prepare a Construction Method Statement (CMS) specifically for the Moore Street compound. The CMS shall contain a detailed assessment of the following as a minimum:

(a) Noise and vibration;
(b) construction and residential traffic management;
(c) air quality and dust management;
(d) flora and fauna;
(e) water quality;
(f) heritage; and
(g) site rehabilitation and revegetation.

*Traffic*

248. Construction vehicle access and egress to Moore Street shall be directly to/from Epping Road only. Construction vehicle access to/from Epping Road shall be left in left out only during peak periods (6:00 am to 10:00am and 3:00 pm to 7:00 pm). Right hand turns into Moore Street from Epping Road shall only be permitted outside peak periods. Right hand turns from Moore Street to Epping Road shall not be permitted at any time.

249. A truck wheel wash shall be installed in accordance with the outcomes of Condition 243 to be utilised by all trucks and machinery leaving the site such that no material is tracked onto public roads.

*Air Quality and Dust Management*

250. The proposed construction works at the Moore Street compound must satisfy the following dust management objectives at the most sensitive receptor:

(a) 4g/$m^2$/month annual average for dust deposition (insoluble solids); and
(b) 90µg/$m^3$ annual average for TSP.

The monitoring shall be in accordance with the requirements of Table 9 as specified in Condition 251.

*Note: The intent of Condition 250 is to provide objectives to be achieved in managing dust generated at the site. The stated TSP concentration provides a trigger for action rather than being a compliance goal. If the 1 hour average of 180 µg/$m^3$ stated in Condition 251 is not exceeded, it is unlikely that the annual average goals would be exceeded.*

251. The Proponent shall develop a reactive dust management plan to ensure compliance with Condition 251. The reactive dust management plan shall be triggered at a TSP concentration level of 180 µg/$m^3$ as a 1-hour average or as otherwise agreed to by the Director-General. The monitoring shall be conducted at the most sensitive receptor and in accordance with the requirements of Table 9. The dust management plan shall be developed following consultation with the EPA for the approval of the Director General.

**Table 9 – Moore Street Compound Ambient Dust Monitoring**

| Pollutant | Units of measure | Frequency | Method[1] |
|---|---|---|---|
| Dust deposition rate | g/m²/month | Continuous | AM-19 |
| $TSP_0$ | µg/m³ | Continuous | AS3580.9.8-2001[2] |
| **Pollutant** | **Units of measure** | **Frequency** | **Method[1]** |
| Siting | - | - | AM-1 |

Note: [1]NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales
2 Without size selective PM10 inlet or as otherwise agreed to by the Director-General.

*Noise*

252. Noise emanating from the operation of the Moore Street construction compound must not exceed the following sound pressure levels at the nearest sensitive receptor unless otherwise approved by the EPA under an Environment Protection Licence for the Project:

(a) 68 dB(A) $L_{A10\ (15\ minute)}$ between 7:00am and 6:00pm Monday to Friday and 8:00am to 1:00pm Saturday;
(b) 58 dB(A) $L_{A10(15\ minute)}$ between 6:00pm and 10:00pm on any day;
(c) 44 dB(A) $L_{A10(15\ minute)}$ between 10:00pm and 7:00am on any day and between 1:00pm and 6:00pm on Saturday;
(d) 54 dB(A) $L_{A(1\ minute)}$ between 10:00pm and 7:00am on any day.

The modification factors presented in Section 4 of the *NSW Industrial Noise Policy* shall also be applied to the measured or computed noise levels where applicable.

*Note: Noise from the premises is to be measured at the most affected point on or within the residential property boundary of the most sensitive receptor to determine compliance with the $L_{A10(15\ min)}$ levels. Noise from the premises is to be measured at one (1) metre from the dwelling façade of the most sensitive receptor to determine compliance with the $L_{A1(1\ minute)}$ levels.*

*Water Quality*

253. The Proponent shall ensure that all appropriate soil and erosion and sediment control works are completed and in place prior to commencement of any works that may have the potential to generate soil erosion or sediment. Erosion and sediment protection measures shall also be in place before the commencement of any stockpiling activity. These controls shall be maintained until all ground surfaces are stabilised and revegetated.

*Heritage*

254. An archaeological investigation shall be undertaken at the Moore Street compound prior to substantial construction at the compound. The investigation shall be conducted by an archaeologist and accompanied by a representative of the Metropolitan Local Aboriginal Land Council. Results and recommendations of the investigation shall be included and considered in the preparation of the Heritage and Archaeology Management Sub Plan required in Condition 100.

*Site Rehabilitation*

255. Prior to commencement of substantial construction at Moore Street compound, the Proponent shall consult with the Lane Cove Council, affected Moore Street community and the relevant CLG regarding rehabilitation of the site following construction. The Proponent shall rehabilitate the Moore Street compound site footprint to native bushland using locally native species in consultation with NPWS and in accordance with the Site Rehabilitation and Revegetation

Management Sub Plan required in Condition 256. Additional areas to be rehabilitated at a minimum ratio of 2:1 (for the area affected at Moore Street), shall include but not limited to reinstatement of bushland corridors along the Stringybark Creek and Lane Cove River corridor. Additional areas, including any bushland corridors along the Stringybark Creek and Lane Cove River corridor to be rehabilitated shall be identified in consultation with Lane Cove Council and subject to agreement with the landholder(s). The bushland rehabilitation proposal shall be approved by the Director-General prior to completion of construction at the Moore Street compound site.

256. A detailed Site Rehabilitation and Revegetation Management Sub Plan shall be prepared at least six (6) months prior to completion of construction activities at Moore Street and site decommissioning as part of the Construction Framework EMP. The long term objective of the plan shall be to rehabilitate the Moore Street compound site and any other areas identified under Condition 255 for revegetation, particularly where opportunities to reinstate fauna movement corridors are available. The Plan shall include but not be limited to the following:

(a) consideration of completion of construction and site withdrawal activities;
(b) outcomes of consultation with Lane Cove Council, DLWC, NPWS, affected residents and the CLG;
(c) consideration of existing native species on site and likely vegetation prior to the construction of Epping Road;
(d) consideration of the final landform of the site and the locally native species most likely to succeed following revegetation;
(e) water quality and hydrology prior to site filling;
(f) condition of upstream and adjacent bushland areas and any measures required to be implemented to maximise success of site rehabilitation and revegetation;
(g) defined targets for all actions proposed, including but not limited to anticipated success rates and/or other suitable performance measures;
(h) initial establishment and maintenance programs for a minimum of five (5) years from site decommissioning; and
(i) ongoing management of the site.

The Plan shall be submitted to the Director-General for approval.

257. Any failure to achieve the actions and or/targets identified in the Site Rehabilitation and Revegetation Management Sub Plan required in Condition 256 or non-compliance with Conditions 258 or 259 within the specified timeframe may be identified by the Department as a breach of this condition. The Director-General may direct the Proponent to implement such actions as to achieve the desired outcomes and/or targets within 30 days. If the Proponent fails to implement the required actions within the specified period, the Director-General may direct the Proponent to expend an amount, which is to be calculated as the aggregate of $10,000 (CPI adjusted) for each day on which any one or more of the actions and/or targets specified in the Site Rehabilitation and Management Sub Plan remain outstanding. Any money required to be expended shall be used for additional bushland revegetation works determined in consultation with Lane Cove Council and approved by the Director-General.

*Note: Nothing in this Condition shall prevent, limit or restrict any statutory requirements under any legislation nor shall it limit any action being undertaken under the EP&A Act.*

258. Rehabilitation of the Moore Street Construction compound and any other areas identified in Condition 256 shall be in accordance with the approved Site Rehabilitation and Revegetation Management Sub Plan.

259. Fill material imported to the Moore Street Compound site shall be removed following completion of works and decommissioning of the site unless otherwise agreed to by the Director-General and relevant Council in accordance with the Site Rehabilitation Management Sub-Plan.

**ATTACHMENT 1**

## Guidelines for the Establishment of the Community Liaison Group

The proponent shall consider the following when establishing a Community Liaison Group:

1. The Group shall comprise at least two (2) representatives of the Proponent (including the Environmental Management Representative), at least one (1) representative of Council, at least two (2) community representatives and one (1) business representative (where relevant).

2. At its first meeting, the Group shall consider its interrelationship with any existing community liaison/ consultative groups of adjoining or interrelated developments.

3. Representatives from relevant government agencies or other individuals may be invited to attend meetings as required by the Chair.

4. Minutes shall be taken for each meeting and be agreed to by the Group prior to commencement of the following meeting

5. The Proponent shall, at its own expense:

- nominate two (2) representatives to attend all meetings of the Committee;
- provide to the Group regular information on the progress of work and monitoring results;
- promptly provide to the Group such other information as the Chair of the Group may reasonably request concerning the environmental performance of the development;
- provide access for site inspections by the Group; and
- provide meeting facilities for the Group, and take minutes of Group meetings. These minutes, once endorsed by the Chair, shall be available for public inspection at Council within 14 days of the meeting.
- The Proponent shall ensure that minutes from Community Liaison Group meetings, annual reports and other public reports required by this approval, and results and interpretation of monitoring required by this Consent are placed on the Internet for public information within 14 days after they are available. The Internet address is to be made publicly available.
- Where reasonably required the Proponent shall meet all reasonable costs to engage independent consultants to interpret relevant technical information and tasks of a similar nature as agreed by the relevant CLG. In the circumstance of any disagreement, the Director-General's decision shall be final.

## ATTACHMENT 2

## Plans of Eastern and Western Vent Stack Locations