Submission Opposing NorthConnex Project

NorthConnex Application Number: SSI 13_6136

My name is [redacted]. I am a specialist anaesthetist. I live 450 meters from the proposed site of the northern ventilation stack. I work at the Sydney Adventist hospital which is located in the same suburb as the stack. I am the author of the doctors petition letter that featured in the Sydney Morning Herald on Monday September 1st. 260 doctors signed the petition opposing the placement of a ventilation stack in residential Wahroonga. Radio interviews with 2GB and ABC, as well as a story in the 7:30 report followed the release of the letter and petition.

I **oppose** the current design of the NorthConnex project.

My concerns are outlined below:

1. Health Impacts

2. Financial impacts on health and burden on tax payer

3. Psychosocial impacts on community

4. Surrounding Schools

5. Air quality modelling

6. Meteorological data

7. Terrain data

8. Ambient Air quality data

9. Entry Portal Locations

10.Current best Practice

11.Economic impacts

12.Alternative options

13.Endorsed submissions

14.Conclusion

15.Appendix

1. Health impacts

I am opposed to the current design of the NorthConnex tunnel due to overwhelming health concerns.
I have based my concerns on a review of the medical and scientific literature that is available to date. My views and findings of the scientific knowledge, together with the fact that the proposal to place a single ventilation stack in the middle of an education precinct at the northern site, are supported by approximately 260 fellow doctors. These doctors live over the greater metropolitan area and include a variety of different medical specialties, including Paediatricians, Respiratory physicians, Cardiologists, Surgeons, Anaesthetists and General Practitioners.Together we oppose the current design as its location makes neither medical sense, nor does it adopt a precautionary principle approach.

A local study by Cowie et al looking at health effects of the Lane Cove tunnel in Sydney, NSW studied participants before and after the opening of the tunnel. The study found that residents living within 650m of the tunnel ventilation stack reported more upper and lower respiratory symptoms and **had lower lung volumes i**n the first 2 years after the tunnel opened. There was also, unfortunately, no consistent evidence of improvement in respiratory health in residents living along the bypassed main road, despite a reduction in traffic from 90,000 to 45,000 vehicles per day.
Gauderman et al followed school children from the age of 10 for 8 years to observe the effects of air pollution on lung development. He showed that lung development is significantly affected through **reductions in lung volumes** such as FVC, FEV1 and MMEF, as would be expected of the children had been exposed to maternal smoking.

Exposure to particulate pollution is associated with **reduced lung function growth in children**, and even children relocating from high to low pollution areas (or vice versa) were shown to experience changes in lung function growth that mirrored changes in exposure to particulate matter, ie the **changes in their lung function growth was permanent**.

The following facts regarding air pollution are also researched and documented in the scientific literature:

There is an increased risk of death in people exposed to particulate matter, even when exposure is within concentration ranges well below the present European standards.

Air pollution causes Lung Cancer and is associated with Bladder cancer.

In 2010, 223,000 deaths from lung cancer worldwide resulted from air pollution according to the World Health Organisation (WHO)

WHO classifies diesel exhaust fumes as a *carcinogen (cancer causing)*, belonging in the “same deadly category as asbestos, arsenic and mustard gas”

Ultrafine particles (median diameter <0·1 micrometers) are more toxic when inhaled than other measurable particles. They are greatly absorbed into tissues and the circulation and are important factors in determining *cardiopulmonary toxicity.*

Both short- and long-term exposures to particulate matter are associated with a host of *cardiovascular diseases, including heart attacks, arrhythmias, strokes and increased risk of death* from the above cardiovascular causes

Children show *reduced lung function* growth which persist later into life, even when exposure stops, i.e. the damage for growing lungs is permanent.

Children have been found to suffer from symptoms of *bronchitis* following exposure

Residents living around tunnel ventilation stacks report more upper and lower respiratory symptoms and have lower lung volumes.

Low birth weights are more common in pregnant women exposed to traffic pollution.

Exposure to traffic-related air pollution during pregnancy and during the first year of life is associated with *autism.*

Higher levels of long-term pollution are associated with significantly faster cognitive decline i.e development of *dementia*

Outdoor pollutant levels correlate with those measured indoors in houses exposed to air traffic pollution.

The NHMRC (National Health and Medical Research Council) states that the great advantage of tunnels is that their portals and stacks can be *deliberately sited away from residential areas.* These recommendations are also found internationally.

International air pollution experts state that there is no safety threshold to the amount of air pollution causing health impacts, hence *there is no “safe level”*. The smallest amount of air pollution will have a corresponding amount of health impact. Even low dose exposures to particulate matter have been demonstrated to have significant health risks.

Traffic emissions contain substances that are not accounted for in standard pollution modelling. These include ultrafine particles and other *unmeasured substances.* Dozens of compounds can be detected in vehicle exhaust. While the adverse effects of these exhausts have been extensively studied surrounding open roadways, the hazards to

local residents and commuters resulting from the presence of ultrafine particles are less well known. *It is these ultrafine particles and unknown substances that potentially pose a great health risk.*

We are very concerned that any modelling of air quality and drawing conclusions on their resultant health impacts drawn from this modelling prior to construction will be inaccurate, *as little scientific evidence exists for long term health impacts of unmeasured particles.* Please refer to the section on Air quality for further details.

As health professionals, we strongly oppose the construction of a major source of air pollution at the proposed site. This is a residential neighbourhood. We are of the opinion that there will inevitably be negative long and short term health impacts in the surrounding area.

Our concerns are therefore validated by the existing medical data which suggests that lung damage to children is permanent when due to air pollution. We have seen this happen locally by Cowie, and even though measurable particles did not significantly increase in the studied areas, health impacts occurred. This heightens our concerns that it is unmeasured particles, such as ultrafine PMs, which contribute to these adverse health impacts.

The NorthConnex EIS includes a human health impacts assessment.

The impacts outlined in this section of the EIS are directly calculated from the air quality data derived from the Air quality section of the EIS.

Hence, the health impacts are directly linked to the air quality calculations.

I am of the overwhelming opinion that the air quality calculations in the EIS show major flaws and hence the health impacts thus derived are rendered INVALID.

Please see sections on air quality in this submission.

Transurban cannot present the current EIS to politicians with a guarantee that there will be negligible health impacts based on flawed calculations.

Solution:

1. The project must not be approved in its current design state.

2. As the medical and scientific knowledge of these toxins is evolving, the government needs to adopt the approach of using **precautionary principles t**o avoid long term harm to the affected community and thereby enforce its **duty of care** to the surrounding population. Our knowledge of these pollutants suggests that there are no safe exposure thresholds, similar to substances like asbestos or cigarette smoke.

3. Application of the precautionary principle is best achieved by **relocation** of the northern ventilation stack away from a densely populated area. Please see section on alternate options as well as current practise.

4. Alternatively the stacks need to be **filtered** with the utilisation of the filtration systems being enforced by an independent overseer. This would avoid inappropriate disuse by the tunnel operator.

5. Another option must include assessment of alternative surface options, such as orbital roads. These assessments need to be made by an independent body. As the EIS is prepared by the proprietor, it is hardly surprising that alternative options were not adequately discussed.

6. Transurban need to repeat the air quality assessment and recalculate the resultant health impacts, taking into account the local topography, stack height, local meterology and true total emission values in various traffic situations.

Please find attached in the appendix section, a detailed review of the literature, outlining the medical evidence for serious potential health impacts of such a project. Also attached are signatures from health care professionals from a multitude of specialties.

2. Financial impacts on health and burden on tax payer

A recent study by the OECD has found that Australia is amongst only 14 out of 34 developed countries in the world where deaths from air pollution have increased in the past 5 years. In between 2005 and 2010, the number of deaths from air pollution in Australia increased by 68 per cent. Evidence suggested that road transport was probably responsible for about half of all deaths from air pollution. The economic cost for Australia was about $5.8 billion in 2010, up from $2.9 billion just five years earlier.

In addition to the scientific arguments there are strong economic arguments to mitigate health risk. The review of the NEPM guidelines states “Any reduction in exposure to particle pollution will have public health benefits. The health cost of particle air pollution in the NSW Greater Metropolitan is estimated to be around $4.7 billion per year (NSW DEC 2005; Jalaludin et al. 2011). The greatest proportion (>99%) of the health costs accrue from avoiding premature deaths due to long-term exposure to PM2.5”

As we have recently seen, Transurban has managed to avoid contributing to the public coffers despite staggering profits.

Australia's monopoly toll road operator Transurban paid $3 million tax last year despite racking up $1 billion in tolls from motorists.

Actual income tax paid was just $3 million, down from $12 million last year.

The tax paid was less than Transurban chief executive Scott Charlton was paid – $4.9 million. Directors and top management were paid $17 million last year and $21 million the year before.

Ref: http://www.smh.com.au/business/transurban-pays-just-3-million-tax-despite-collecting-1-billion-in-tolls-20140805-100le8.html#ixzz3BMBetPBQ

However, the health costs will be absorbed by the state and federal governments and ultimately the tax payer.

Solution:

1. Construction of major permanent infrastructure projects need to be designed with minimal health impacts based on a precautionary principle. I strongly feel that this has not occurred in the design of the NorthConnex project.

2. Major infrastructure projects need to have transparent and thorough cost benefit analysis performed prior to commencement of the approval processes. This needs to be displayed in any associated EIS.
NorthConnex needs to undergo such a process as part of its EIS review process. This needs to be transparent and accessible to the general public.

3. Psychosocial impacts on the community

As a doctor, I am gravely concerned about the resultant psychosocial health impacts on the local communities affected by the construction and maintenence of the NorthConnex tunnel and associated stacks.

There are numerous vulnerable groups living near construction zones and ventilation stacks.
These include the frail, elderly residents of Aged care facilities, nursing homes and palliative care hospitals, as well as elderly residents living in their own homes near to construction zones. There are also approximately 9000 school children within a kilometer of construction and the northern stack.
I am concerned that ongoing noise from construction will have psychological impacts on these people.
Exposure to noise constitutes a health risk. There is sufficient scientific evidence that noise exposure can induce hearing impairment, hypertension and ischemic heart disease, annoyance, sleep disturbance, and decreased school performance.
Combined with the stress of loss in property values (see section on Economic impacts) and changes in the surrounding suburb, I fear that this will lead to a substantial psychosocial health impacts in the area. This further strains the health system and adds to the economic cost of this project.

Solution:

Consider alternative options which carry less impact on the local population such as orbital roads or optimisation of existing infrastructure.

4. Surrounding Schools and Aged Care facilities

Below is a list of schools surrounding the proposed northern ventilation stack and the distances to the stack.

Abbotsleigh Early Learning Centre (452m)

Abbotsleigh School for Girls (452m)

Accent Coaching & Lang. School (1991m)

Adventist Aged Care Wahroonga (2744m)

B'nai B'rth Retirement Village (597m)

Balamara Preschool (633m)

Barker College (1291m)

Belvedere Aged Care Facility (947m)

Bowden Brae Retirement Village (1506m)

Bright Horizons Early Learning Centre (1056m)

Centacare Broken Bay Waitara Childrens Services Long Day Care (1089m)

City Centre Child Care (1844m)

Explore & Develop Preschool (686m)

Greenwood Aged Care (1562m)

Hornsby Child Early Learning (1036m)

Hornsby Girls High (1420m)

Hornsby Hospital (893m)

Hornsby Kuring-Gai Hosp. Child Care (919m)

Hornsby South Public School (1836m)

Hornsby TAFE (2114m)

Hornsby TAFE Children's Centre (1565m)

Kids Academy Hornsby (1330m)

Kids Academy Hornsby (1361m)

Knox Grammar School (1229m)

Knox Prepatory School (851m)

KU Fox Valley Preschool (1409m)

KU Fox Valley Preschool (2273m)

KU Wahroonga Preschool (486m)

Little Learning School Hornsby (1082m)

Little Learning School Wahroonga (1170m)

Loreto Normanhurst (2217m)

Neringah Hospital, Wahroonga (674m)

Netherby Aged Care Facility (817m)

Next Generation Preschool (933m)

Normanhurst Boys High School (1654m)

Normanhurst Long Day Care Centre (1864m)

Normanhurst Public School (2464m)

Normanhurst West Pre-School (2616m)

Our Lady of Rosary Cath. School (1002m)

Peter Rabbit Preschool (802m)

Prouille Catholic College (777m)

Prouille Catholic Prim. School (777m)

Pymble Turra. Kindergarten (2698m)

Redleaf Serviced Apartments, Retirement Village, Wahroonga (1149m)

Retaval Prepatory School (2162m)

St Edmund’s School (1115m)

St Leo’s Catholic College (1048m)

St Lucy’s School (781m)

St Stephens Pre School (2397m)

Sydney Adventist Hospital (2535m)

Tallwoods Corner Aged Care Service (508m)

Thomas & Rosetta Aged Care Service (1001m)

Turramurra Beehive Preschool (1834m)

Twinkle Tots Cottage (1012m)

Wahroonga After School Care (1209m)

Wahroonga Beehive

Pre-School (1618m)

Wahroonga Long Day Care Centre (1467m)

Wahroonga Nursing Home (726m)

Wahroonga Park (513m)

Wahroonga Prepatory School (409m)

Wahroonga Public School (1201m)

Waitara Public School (473m)

Warawee Public School (2061m)

It is clear from the above list that the northern ventilation stack will be placed in the centre of Sydney's schooling capital. There are also a large proportion of aged care facilities in the area. This amounts to a high density of vulnerable people which will be adversely affected by the effects of air pollution.

Solution:

Locate the northern ventilation stack away from Sydney's densest schooling area.

5. Air Quality Modelling

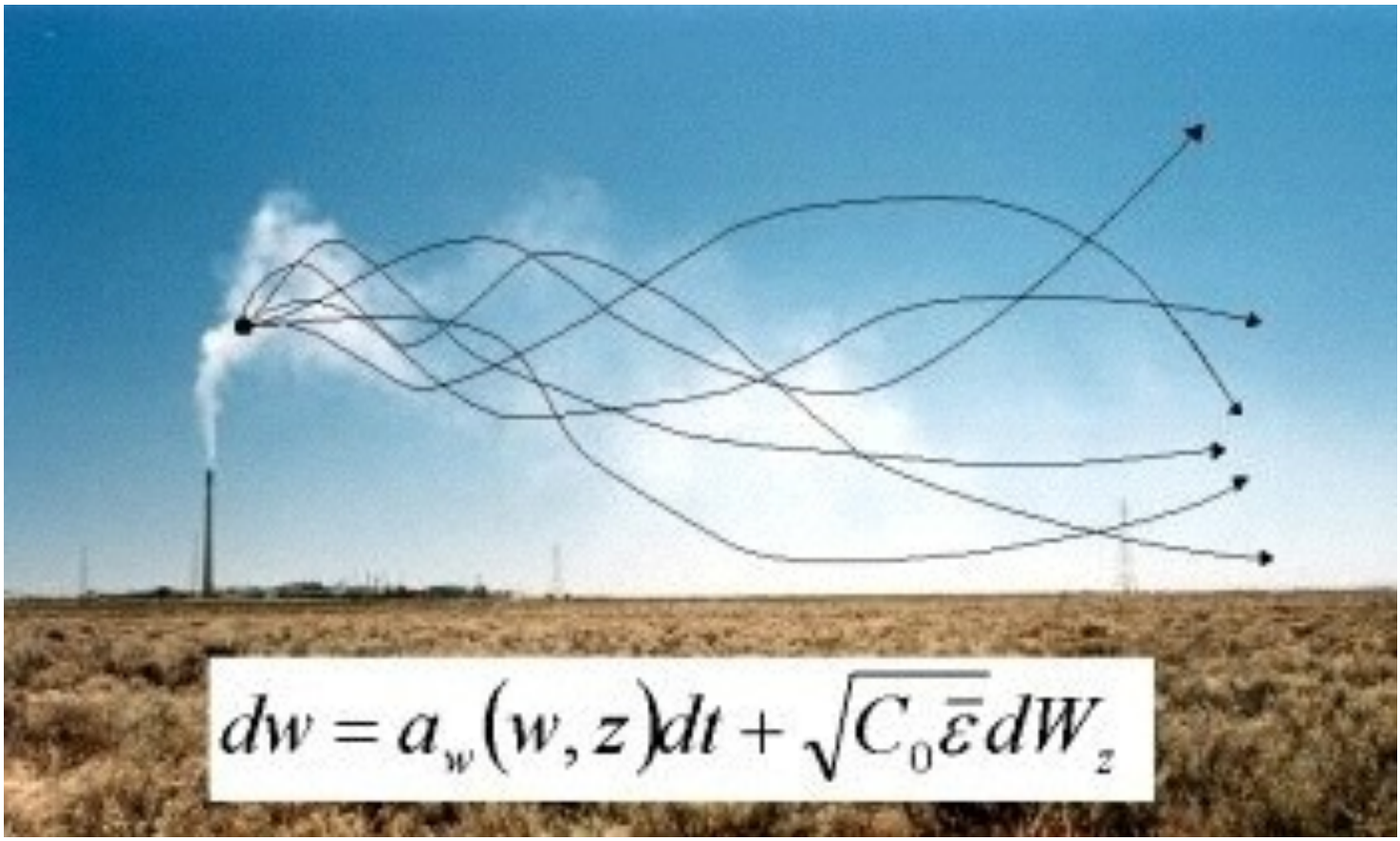
The issues with the air quality modelling fall into two basic categories

The use of poor quality data as inputs into the modelling – such as the meteorological, ambient air quality and terrain data. This is especially of concern at the northern stack location as the stack is only 15 m in height, is in a middle of residential area and is located in a valley with its own microclimate.

The failure to model aspects of the project that may result in significantly higher pollutant concentrations in the intake air at the entry portals. This in turn may result in significantly higher pollutant levels discharged from the stacks than has been currently modeled.

There is an underestimation of the concentrations of pollutants from heavy freight diesel emissions, and hence underestimation of emissions from stacks and health risks have been deemed negligible. This underestimation is a key flaw in the modeling assumptions by Transurban.

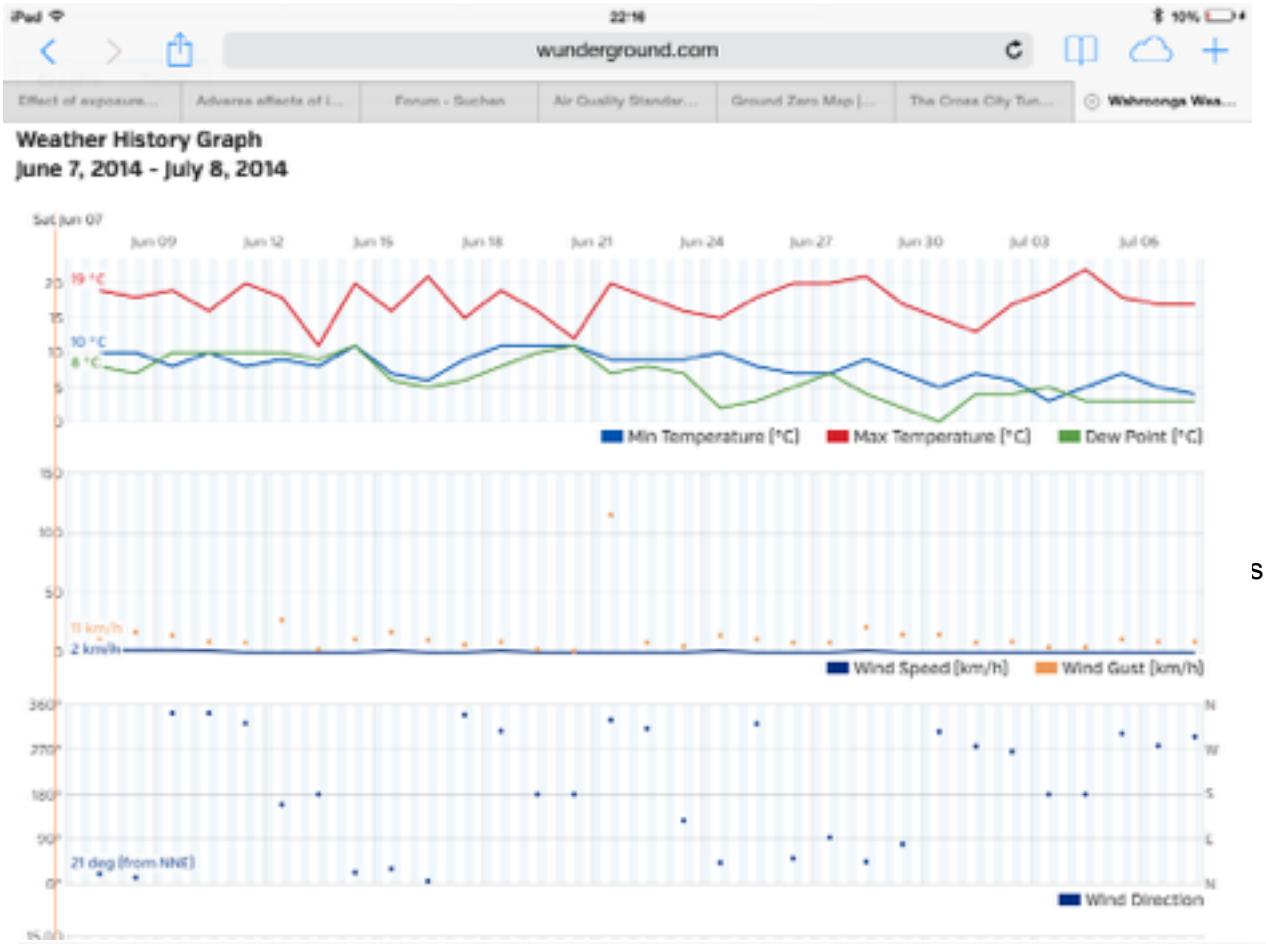
At this point I would like to endorse the submission made by Kuring gai council. I would like to also specifically refer to the independent air quality assessment made by Shane Lakmaker for Jacobs Group Ltd Pty.



The image above demonstrates plume dispersion from a CSIRO model.

This clearly demonstrates a very tall stack which is forcing exhausts into the atmosphere. The NorthConnex stack will be only 23 metres tall, therefore ground strikes as seen above will occur earlier, more frequently and closer to the stack site according to this model.

The surrounding terrain is very flat, unlike for the proposed NorthConnex ventilation stacks. These are situated in valleys and will entrap and retain the emissions that are forced onto the ground.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Jul 03
Jul 06
19 °C
10 °C
8 °C
Min Temperature (°C)
Max Temperature (°C)
Dew Point (°C)
11 km/h
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Wind Speed (km/h)
Wind Gust (km/h)
21 deg (from NNE)
Wind Direction

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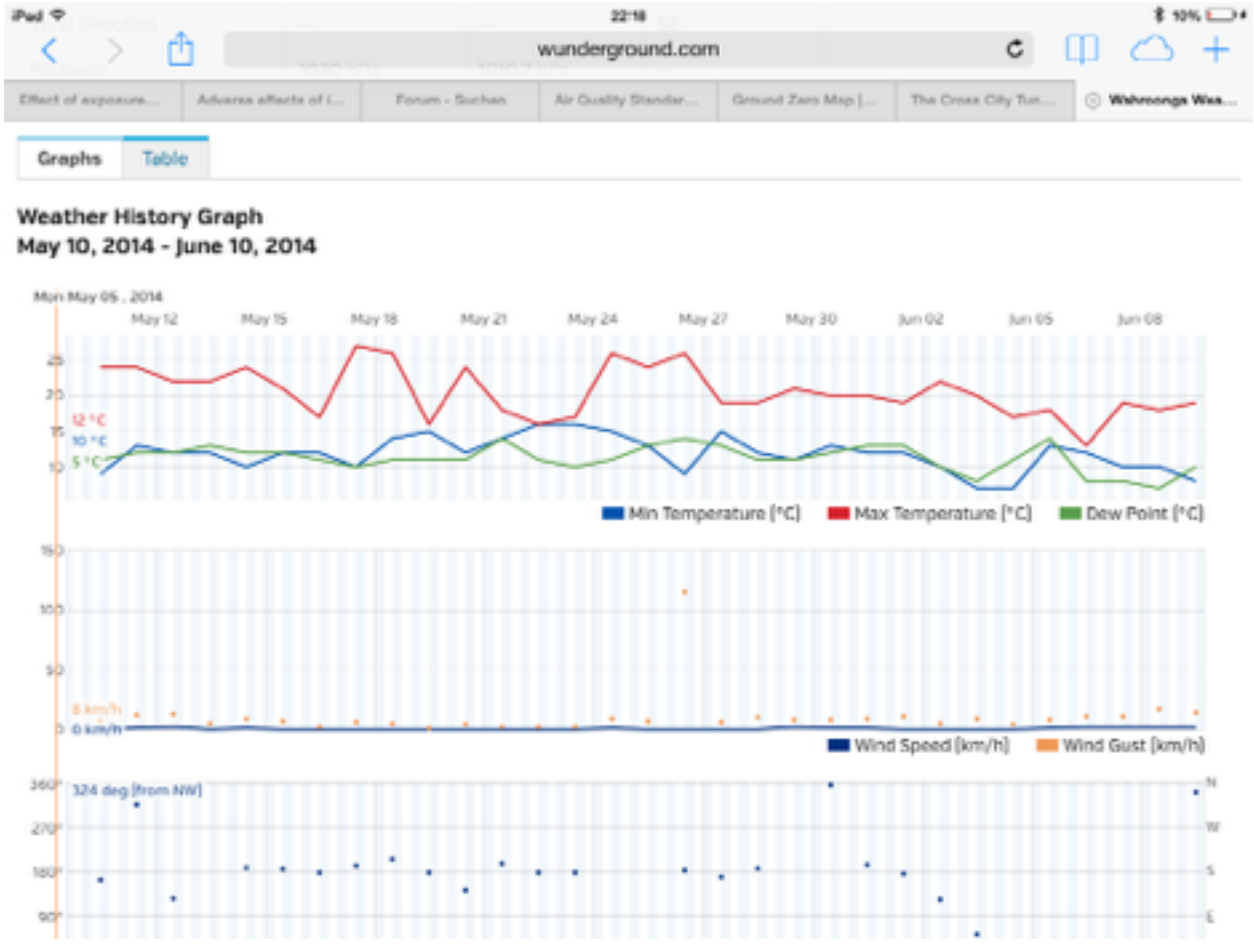
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Jun 08
12 °C
10 °C
5 °C
Min Temperature (°C)
Max Temperature (°C)
Dew Point (°C)
8 km/h
0 km/h
Wind Speed (km/h)
Wind Gust (km/h)
324 deg (from NW)

Below are pictured two typical months for local weather in Wahroonga. Please note the dark blue lines showing extremely low wind speeds.

	High	Low	Average
Temperature	24.5 °C	6.8 °C	13.9 °C
Dew Point	14.2 °C	4 °C	8.1 °C
Humidity	99%	38%	69.7%
Precipitation	0.8 mm	--	--

	High	Low	Average
Wind Speed	12.2 km/h	--	1.6 km/h
Wind Gust	27 km/h	--	--
Wind Direction	--	--	West
Pressure	1026 hPa	1018.5 hPa	--

This table shows the average wind speed of 1.6km/h.

Wind speeds of 5km/h and above are required for adequate dispersion of pollution.

Suboptimal data has been used to carry out the vital air quality assessment in the NorthConnex EIS.

It is on this data that health impacts have been calculated.

The resultant assumption that there will be "negligible" health impacts based on this data are hence flawed and misleading.

Meteorological data – years used for assessment

Issue: The years selected for modelling and assessment of air quality were years when extreme climatic events occurred.

The three years used in the air quality assessment were 2009, 2010 and 2011. In 2009 an El Nino event was influencing climate, whereas in 2010 and 2011, the strongest ever La Nina event was recorded. Using these years is highly inappropriate for the modelling and they can not be considered as representative of normal conditions. No meaningful assessment was undertaken to determine whether these years were appropriate for use in modelling.

Solution:

1. The department of planning must not approve this project in its current state.
2. Transurban must collect **local meteorological data** and repeat its air quality assessment. This data needs to be collected onsite and needs to be obtained over a reasonable length of time reflecting adequately the local microclimate. A data collection period of 3 years would seem appropriate for a project of this magnitude.
3. An independent body needs to be involved and responsible for overseeing that this process is carried out in a non-biased and acceptable manner.
4. Repeat the modelling using meteorological data from years that are more representative of a range of climatic conditions including typical years.

7. Terrain data

Issue: The data used the develop the Digital Elevation Model (DEM) was not sufficiently accurate to be used in air quality modelling around the pollution stacks

NorthConnex used Shuttle Radar Topography Mission (SRTM) data to develop the Digital Elevation Model. While this dataset may be appropriate for assessing far field modelling impacts, it is unsuitable for assessing near field impacts especially given its significant limitations such as absolute and relative height errors of 6 metres and 4.7 metres. This is especially of concern as the stacks are only 15m high and the topography either side of the northern pollution stack is relatively steep. Therefore the inaccuracy in the DEM could be 40% of the stack height. An inaccurate DEM may affect both the estimated site specific meteorological conditions at the stack locations using the CALMET and TAPM modules as well as affecting the CALPUFF modelling - so it can have a compounding impact.

Some other limitations include:

"Man-made objects, such as large buildings, roads, towers, and bridges are often problematic targets for radar imaging. Reflections, shadows, and smooth surfaces in built-up areas can often lead to severe layover, shadowing, and multipath artifacts. Given the 30-90 m posting of the SRTM data, only the largest man-made features are resolved, but the height of any urban SRTM pixel will be affected by the buildings within that pixel"

"SRTM did not always map the true ground surface. Instead it measured an effective height determined by the phase of the complex vector sum of all the returned signals from within the pixel being imaged. If the pixel contained bare ground, the phase reflected the height of the surface. If the ground was covered with vegetation, the return was influenced by the vegetation height, structure, and density. If the vegetation was dense enough, little or no signal returned from the ground below."

For a full discussion of the limitations of the data please go to the following link

http://www2.jpl.nasa..gov/srtm/srtmBibliography.html

The use of this data is extremely disappointing given that there are other readily available DEM data sets with relative height errors of about 0.1m and a much greater resolution than the 30m x 30m SRTM data. While it would not be reasonable to develop a more accurate DEM model for the whole of Sydney (for the CALMET and TAPM model runs), it would be reasonable to expect NorthConnex to develop more accurate DEM model especially around the stack locations and particularly at the northern stack as it is located within a valley. With such a coarse DEM the nearfield impacts can not be accurately predicted.

The below survey shows that the stack is located at a height of 182 meters and that the maximum valley height is at 206 meters.

This means that the stack height will not clear the valley and at a height of 23 meters it falls short by 1 meter.

This clearly impacts on plume dispersion and pollutants will remain trapped inside the valley.

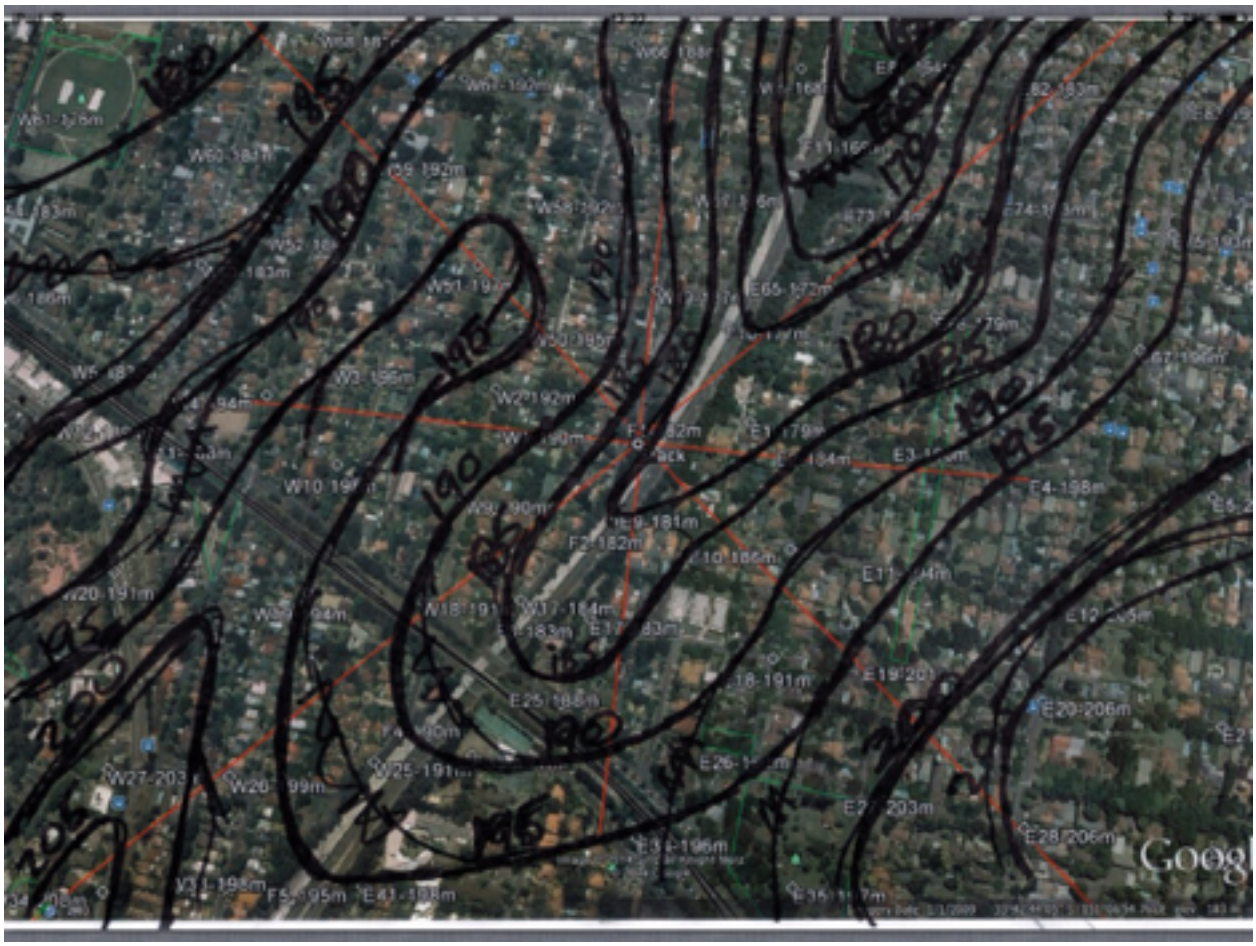


Figure 2.1 : Comparison of assumed SRTM data resolutions

The above image is from Jacobs Group (Australia) Pty Ltd, independent air quality assessors.

It shows the local terrain for the northern ventilation stack site in three different resolutions (lines).

Black is actual terrain to 50m resolution

Green is CALPUFF predictions

Yellow is CALMET .

From the image it can be seen that difference in terrain height estimations have occurred between the "actual" (resolution 50m) and the modelled CALMET (250m resolution) terrains.

At points the difference is 5 to 10 meters.

This has major significance when the stack height is only 23 meters.

Solution:

1. **The project must not be approved with its current design.**
2. **Confirm any groundtruthing undertaken to calibrate or test DEM.**
3. **A more detailed DEM should be developed for the terrain around the stacks and the air quality modelling repeated.**
3. **An alternate location for the stack must be sought.**

8. Ambient air quality data

Issue: The background air quality estimates especially at the northern portal push the boundaries of modelling, do not pass the commonsense test and cannot be trusted as representative of the air quality in the Wahroonga area.

Two air quality monitoring stations were used to establish ambient air quality for the modelling, one at Lindfield and the other Prospect. These air quality monitoring stations are both south of NorthConnex and are 9.7 km and 11 km, respectively from the southern portal, and 9km and 21 km, respectively from the northern portal. The stations are also located at 60 metres AHD whereas the northern stack is at 180 metres AHD. Both monitoring stations are also located in residential areas.

While it is recognised that the methodology for the estimation of background ambient air concentrations complied with Standard Methods (EPA 2005), because of the difference in the distance, location, landuse context and height of these stations, the use of data from these air quality stations can not be considered representative of airsheds in Wahroonga and Pennant Hills – especially for pollutants emitted in high concentrations by vehicles such as NO_2 and $PM_{2.5}$.

Also $PM_{2.5}$, a WHO Class 1A carcinogen is not measured at either air quality monitoring stations and had to be estimated from the PM10 concentrations. The Lindfield air quality monitoring station also does not meet the current Australian and international standards for the siting of air quality and meteorological monitoring stations.

Due to these issues, the ambient air quality data used in the modelling can not be guaranteed to be representative of actual air quality. For a 9km longitudinally ventilated tunnel such as NorthConnex, ambient air quality at either end of a tunnel is important as the local airsheds and associated air quality can be very different.

It is truly astonishing that a $3 billion project and the largest road tunnel in Australia which proposes to locate unfiltered ventilation stacks in residential areas does not have actual air quality data in those locations and is relying on incomplete data from 10+ kms away. It is even more astonishing that the air quality assessment is not based on one actual measurement of $PM_{2.5}$ – all the $PM_{2.5}$ concentrations have been estimated or modelled.

Solution:

Collect sufficient site specific ambient air quality information for at least one year (as per the EPA's 2005 Standard Methods) and repeat air quality modelling.

Undertake longer term ambient air quality monitoring at key project locations.

Monitoring programs should be developed in consultation with the community to ensure their confidence in the design and implementation of the programs.

9. Entry portal locations and impact on tunnel air quality

Issue: Inadequate modelling/monitoring of the quality of "fresh" air entering the northbound entry tunnel portals at the Pennant Hills/M2 interchange

It is unclear what data or assumptions NorthConnex has used for the quality of the "fresh air" entering the tunnel at the M2/Pennant Hills entry portals for the northbound tunnel. Despite numerous requests for clarifications on this issue, NorthConnex have provided conflicting and unclear answers. Some NorthConnex project team members have stated that it was based only upon OEH data from Prospect and Lindfield – while other team members have said the data has been modified to account for the close proximity of the portals to Pennant Hills Road/M2 – but have been unable to provide any details on how the data has been modified.

The quality of "fresh air" entering the northbound tunnel at the Pennant Hills Road and M2 Interchange entry portals has been based upon the air quality monitoring undertaken in residential areas in Prospect and Lindfield (See Section 5.2.3). The reality of the situation is that both entry portals to the northbound tunnel are located in close proximity to the southern ventilation stack and in the road corridor of the Pennant Hills/M2 interchange which has currently has over 160000 Annual Average Daily Traffic (AADT) movements – and is predicted to have over 200000 AADT by 2029. The influence of these two sources of pollution are likely to significantly influence the background air quality in this location – and therefore the "fresh air" entering the tunnel. This is especially the case for pollutants that are largely vehicle generated such as NO_2 and to a lesser extent $PM_{2.5}$.

The modelling of improvements in air quality adjacent to Pennant Hills Road in the NorthConnex EIS show that by removing approximately 25% of the vehicles (by 2029), there would an improvement of 11.8 ug/m^3 in peak daily PM2.5 concentrations and about 40 ug/m^3 peak hourly NO_2 concentrations (Table 37 – Air quality assessment). Using these figures and the current AADT along Pennant Hills Road of about 4 times the traffic removed, peak contributions of road traffic to daily PM2.5 and hourly NO2 levels in the road corridor could be as high as 47.2 ug/m3 and 160 ug/m3, respectively. When background air quality is added to these road generated pollutant concentrations, peak concentrations of pollutants in the "fresh air" entering the tunnel could be extremely high. Also as one of the NO2 guidelines is based on hourly exposure, peaks in traffic levels are likely to significantly increase the chance of exceeding guideline levels.

Clearly using the Prospect and Lindfield air quality monitoring stations to establish the "fresh air" quality entering the northbound tunnel at Pennant Hills Road/M2 interchange would significantly underestimate pollutant concentrations. The reality is that the polluted air from Pennant Hills/ M2 interchange is going to be transferred to Wahroonga and with the vehicle emissions from the 9km of tunnel, be discharged via the vent stack in Wahroonga. This has not been modelled in the air quality assessment for the NorthConnex EIS.

Even if the "fresh air" data has been modified to account for the close proximity of the portals to Pennant Hills Road/M2 interchange, it does not appear that the relative increases in pollutant levels from the northern stack have included the contribution of the polluted air from the Pennant Hills Road/M2 interchange.

Solution:

This air quality at Pennant Hills needs to be remodelled to include emissions from the southern vent stack and surface emissions from the M2 and Pennant Hills Road. This then should be used as the "fresh air" entering the tunnel and the project contribution and air impacts from the discharge of the ventilation stack at Wahroonga re-assessed.

Impact of entry portal air intake on dispersion of tunnel air at stacks

Issue: The entry portals and the stacks are in close proximity and the extraction of air at the entry tunnel may adversely impact the dispersion of polluted tunnel from the stack.

Some entry portals are in close proximity to the ventilation stacks. This is especially the case for the M2 Northbound entry portal which is less than 20 metres away from the southern ventilation stack (Figure 5-17) and to a lesser extent the M1 southbound entry portal which is about 80 metres away from the stack.

At all entry portals there will be significant negative pressure (i.e the surrounding air will be sucked into entry portal). Based on information in the EIS the volume of air entering each of the entry portals would be large – about a maximum 350m^3 per second (assuming the maximum discharge is 700m^3 and there are two entry portals). Because of the close proximity of these high volume air intakes to the stacks, this may significantly affect the plume from the ventilation stacks – and would tend to drag the plume downwards and in the direction of the entry portals. There may also be short circuiting – where the plume is dragged into the entry portal, compounding the pollution of the tunnel air. Given that the stacks are only 15 metres high this is a very real possibly.

The NorthConnex EIS has not assessed this potential impact and is silent on the potential impacts of locating the stacks and entry in such close proximity. This has not been an issue on other Sydney tunnels because the stacks and portals have had sufficient separation – or the stacks are significantly higher and above the influence of the intake entry portal air.

Solution:

Detailed near-field modelling should be undertaken to assess whether the intake air at the entry portals influence the dispersion plume behavior from the stacks. If there is shown to be an influence either design needs to modified and/or the overall dispersion modelling needs to be repeated.

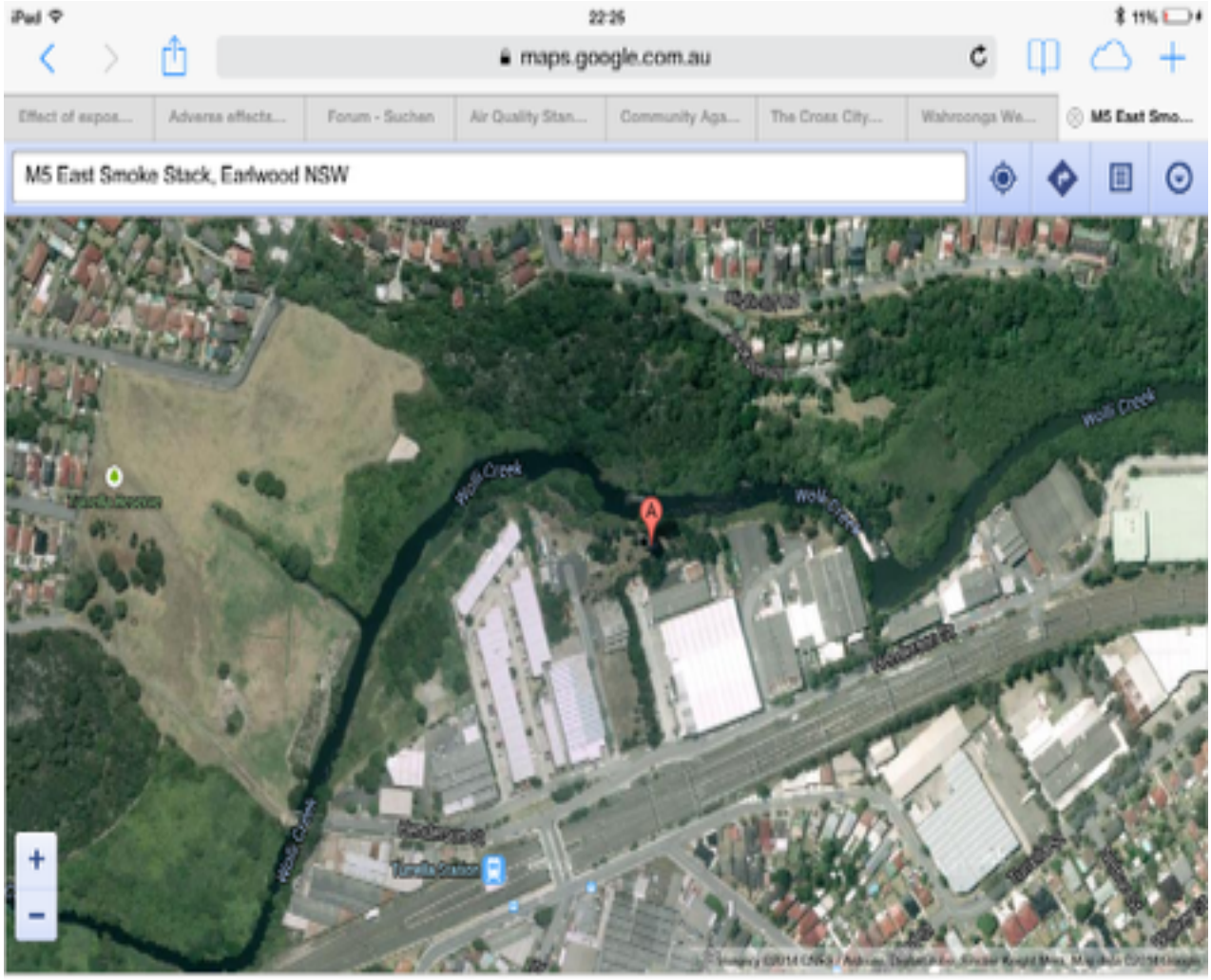
9. Current Practice

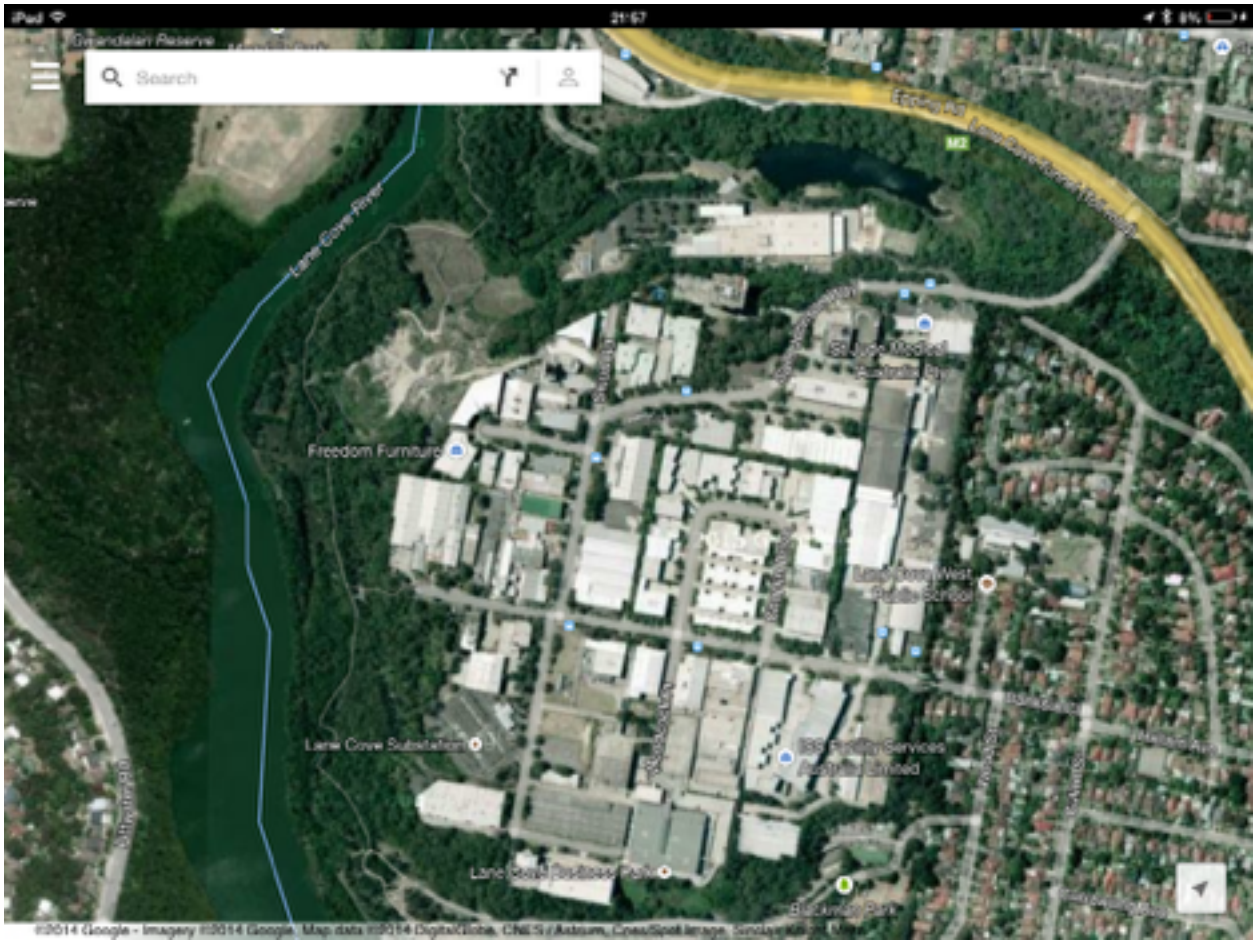
There are no other ventilation stacks currently in a comparable residential area, either locally or overseas. The major differences are in:

1. Tunnel length -No other tunnels will accumulate 9km worth of exhaust fumes. All other tunnels are shorter.
2. Stack location - no other tunnel has the same, dense population adjacent to its stack. Other tunnels exist in industrial/commercial areas near to residential areas.

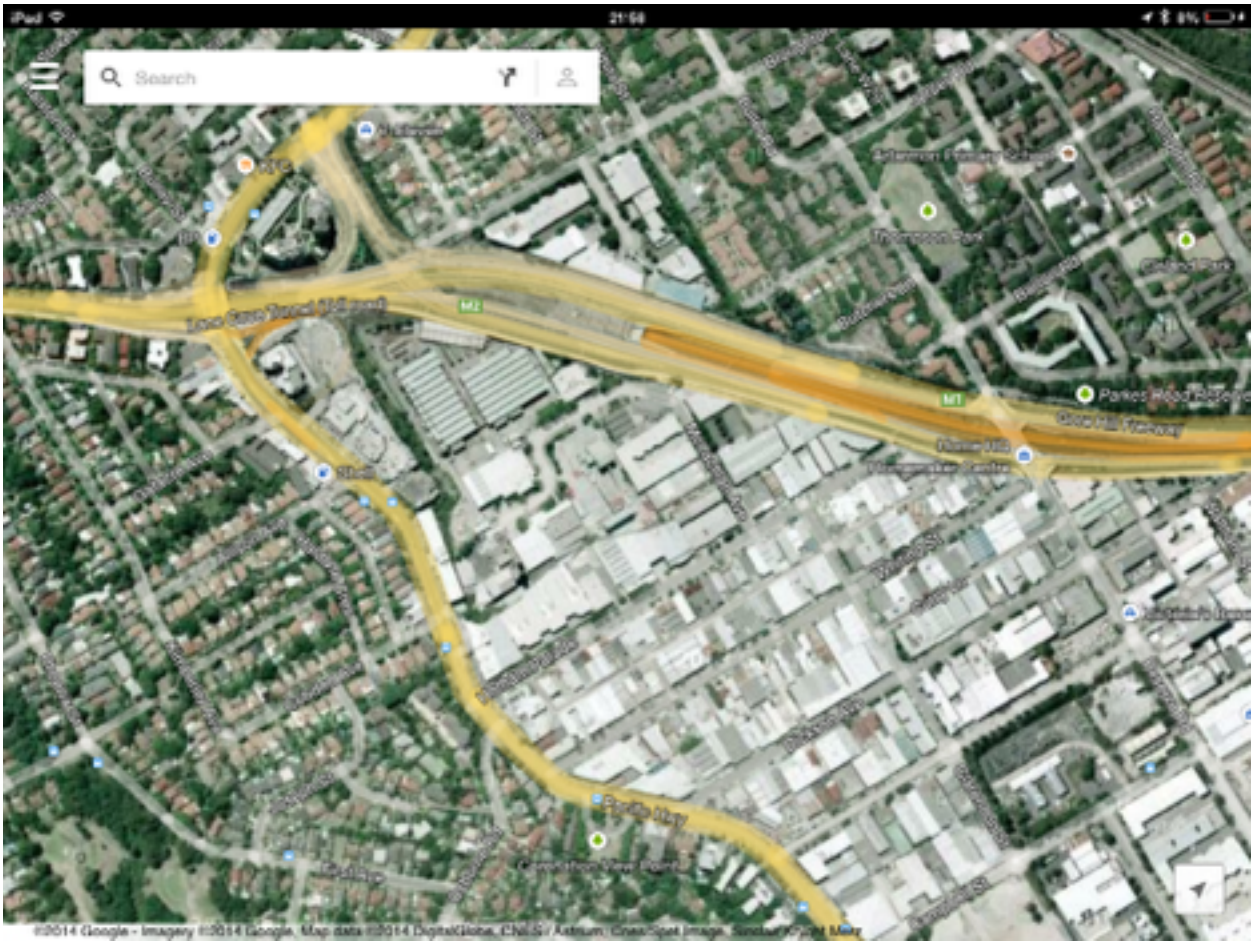
Location of cross city stack. Commercial area.

Location of M5 East stack in Turrella. Industrial area adjacent to bushland.

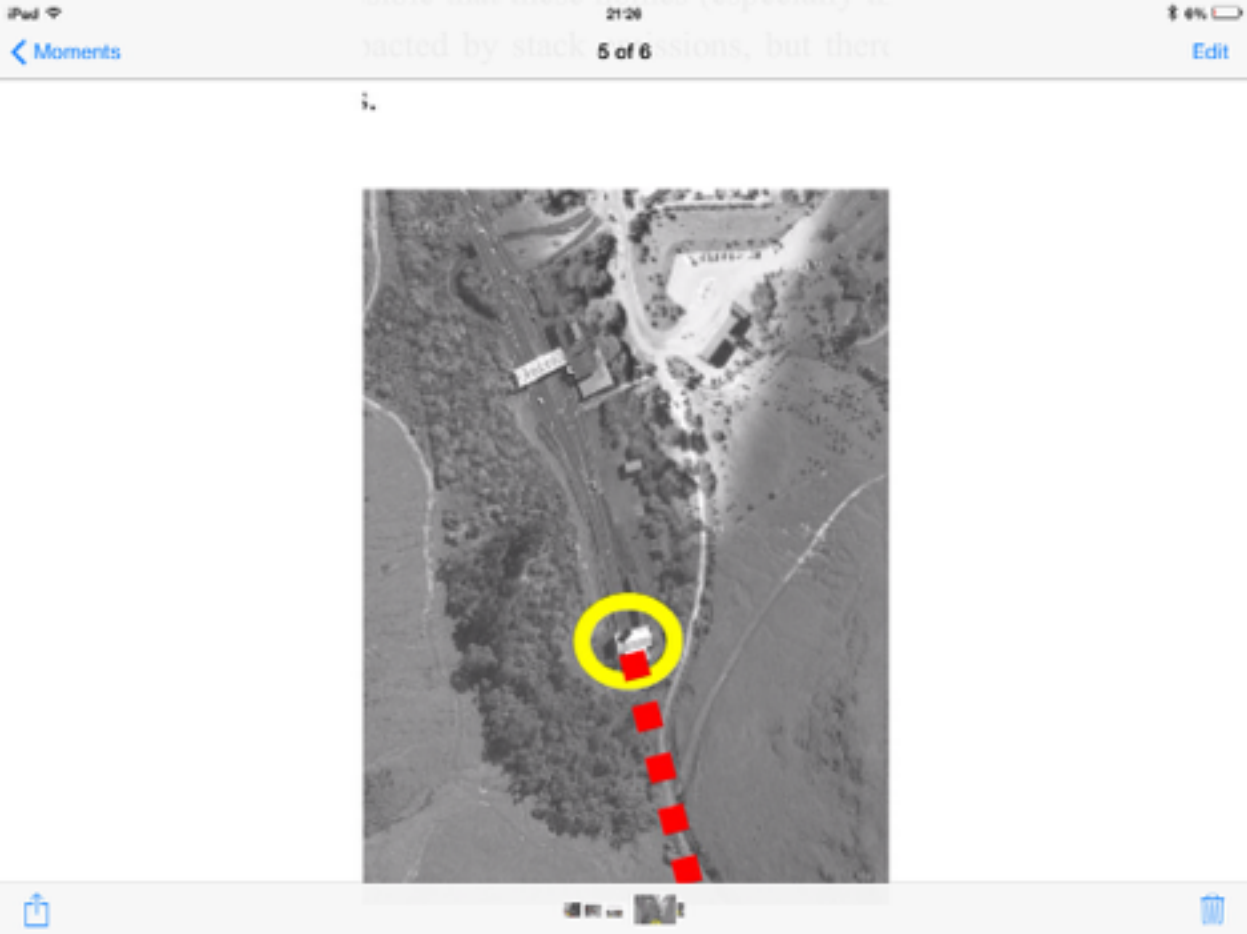




Location of Lane cove tunnel stack on Orion Rd in industrial area near bushland.



Location of Lane cove tunnel stack in industrial area on Marden Street



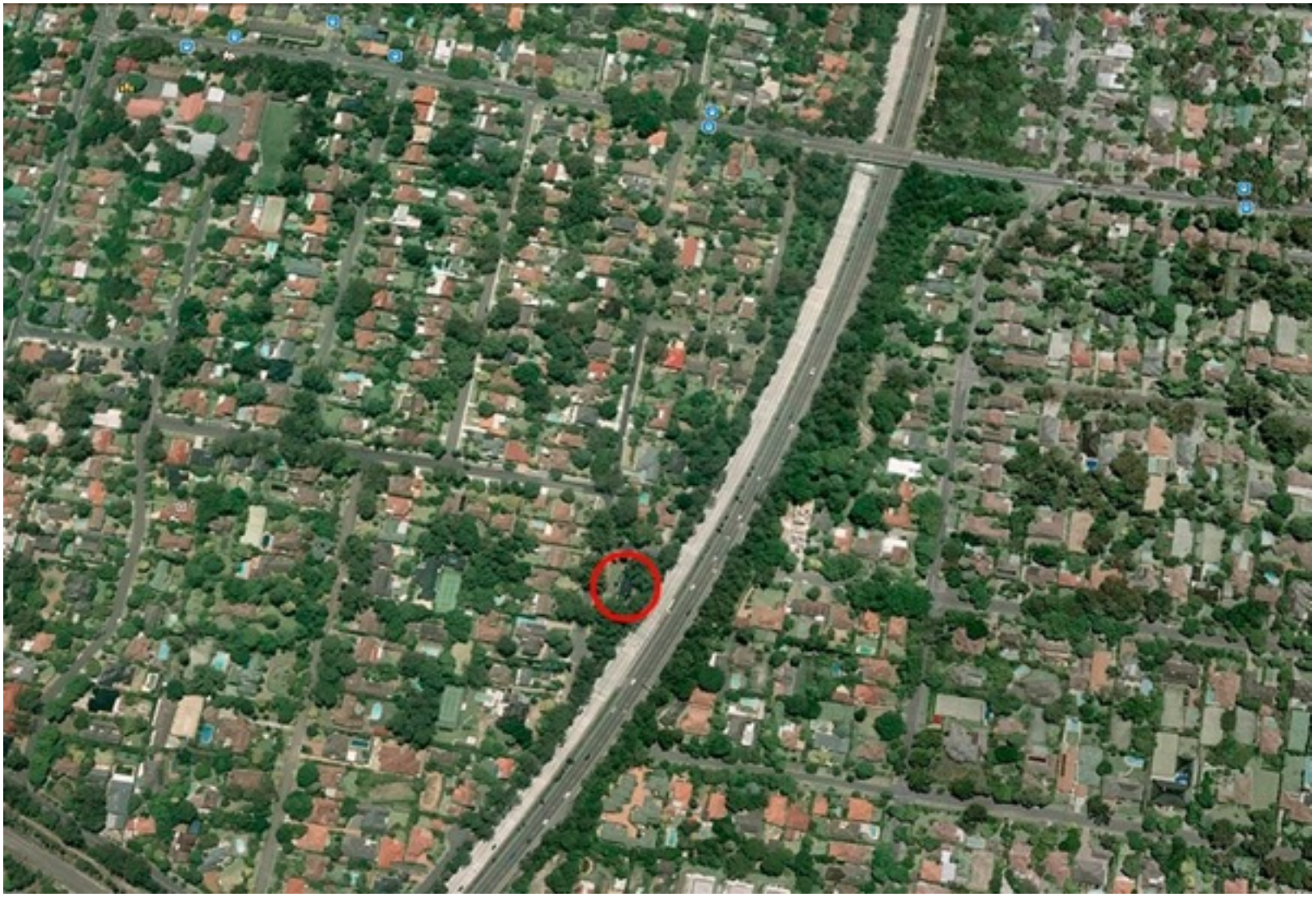
Location of Tunnel stack for Lyttleton tunnel in New Zealand. The southern portal and stack are located at approx. 28 m above sea level.

NIWA
Taihoro Nukurangi

Detail of the eastern end of the Mt Victoria Tunnel. The yellow circle marks the eastern fan house. The blue rectangle is Hataitai Kindergarten. The area north-east of the portal is residential. To the south is Hataitai Park, where an athletics track and tennis courts can be seen.

Adverse impacts from the fan houses on local residences are unlikely due to the substantial height difference and favourable prevailing wind directions.

Mt Victoria tunnel and stack in NZ.



Location of proposed northern stack.
High density residential and large numbers of schools in immediate area.

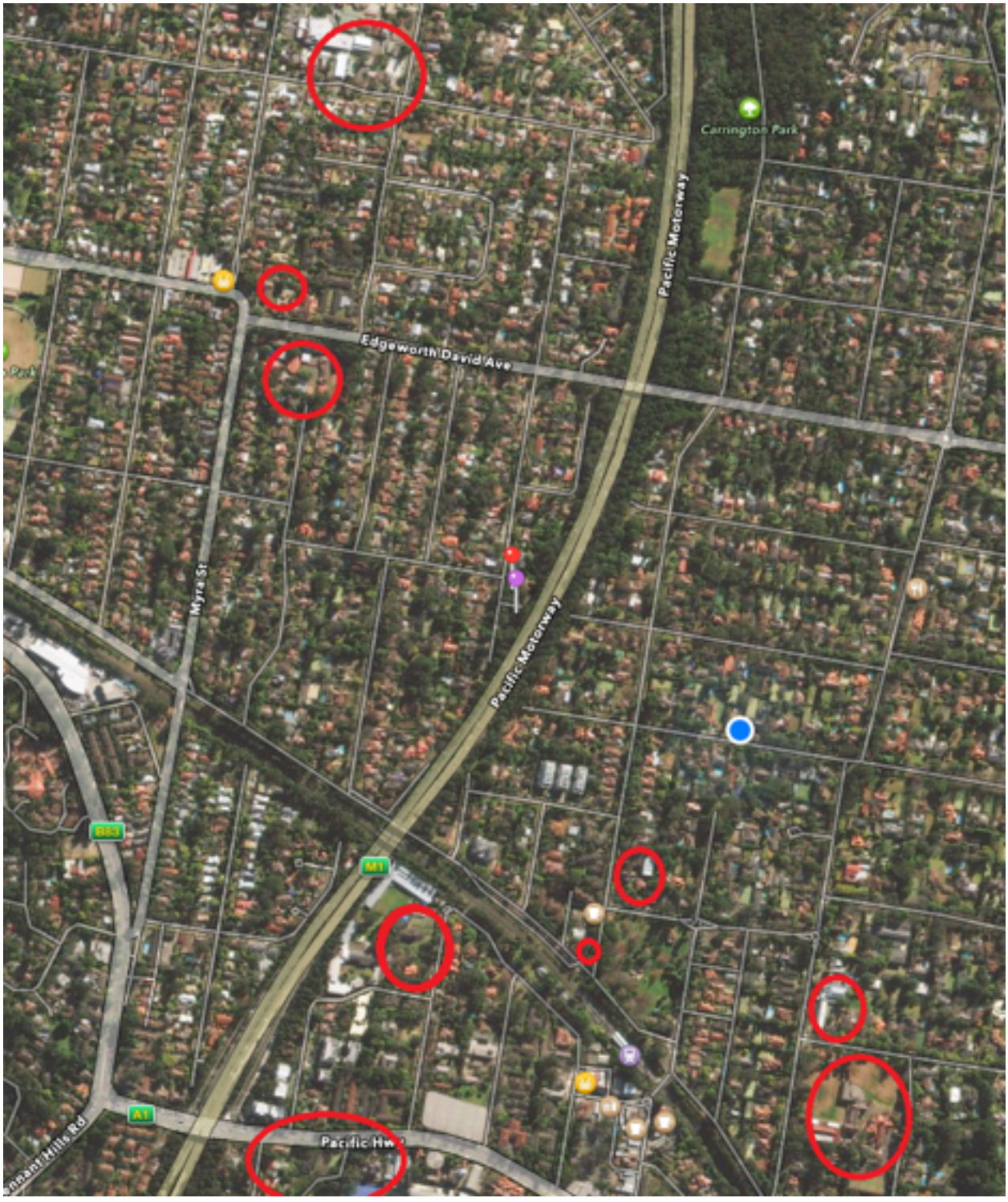


Image showing location of stack by pins. Schools and Hornsby hospital are circled in red.

Artists impression of the 23 meter tall northern stack. Located on edge of valley.

Cross city tunnel stack 65 meters tall. Commercial area near harbour and coast.

City link tunnel stack in melbourne. Taller than 23 meters.

Lane cove tunnel stack. Taller than 23 meters?

Lane cove tunnel stack. Taller than 23 meters.

The Governments own NHMRC document for Air Quality in and Around Tunnels 2008 (p69) following the M5East tunnel clearly states that:

“From the point of view of the local neighbourhood, it is at the tunnel openings that the air-quality impact of the tunnel is most keenly felt. This is the zone within which the road tunnel will inevitably worsen local air quality in comparison to an equivalent road without a tunnel.”

If it is considered that the impact on the local environment is too high, the tunnel air can be vented elsewhere, at a ventilation station and possibly via a tall stack. In some cases, this stack is some distance from the tunnel so that tunnel air may be vented into the atmosphere in a nonresidential location.

One of the great advantages of road tunnels is the opportunity to deliberately site portals (or stacks) away from sensitive receptors so that road transport emissions may be removed from dense residential areas, improving local air quality.

Issue:

The proposed tunneland stack design do not conform with current practice for location or height of emission stacks.

Solution:

- Do not approve NorthConnex project in its current design.
- Transurban needs to show compliance with current best practice by altering the location and design of the ventilation stacks.
- See Alternate Options section.

10. Economic impact:

I am concerned about the impact that this project will have on local property values. **Below is a picture of the house which will be demolished and replaced with a 23 meter stack.**

This is the street around the proposed stack and the house opposite the 23m ventilation facility.

It is needless to say that the above house and neighbouring dwellings will suffer a staggering fall in their value, as they will be across the road from a 23 meter ventilation stack.
Dozens of other properties nearby will be rendered virtually unsellable.
This will have a flow on effect in the whole neighbourhood.
Properties with views of the stack will also suffer in value.
These problems have occurred around the M5 east stack in Turrella, as well as Lane Cove.

Personally, my house has been valued for its current value and with a "stack" value.
The difference is in the order of 30%.

These effects result in psychosocial stresses, which have previously been mentioned.
For residents who are unable to sell their house, this means a loss of their financial independence as the family home is usually ones' most valuable asset.This feeling of entrapment and loss of control adds to the risk factors for depression.
Again, this ultimately carries a burden on State government, as depression related health visits account for 40% of all GP visits.
Furthermore, the loss of property values is a direct loss to the state government in lost revenue from stamp duty.

Solution:

1. Site the northern portal away from sensitive residential areas and schools.
2. Site the northern emission stack away from sensitive residential areas and schools
3. Apply filtration to the stack when it is placed near the Hornsby industrial area. Transurban needs to finance the prevention of adverse health impacts as opposed to the government and tax payers carrying the costs of the associated health burden if Transurban wishes to collect revenue for its shareholders.

Schools:

There are several major public and private schools within close proximity of the proposed northern ventilation stack.
Private schools are one of the major economies impacted upon by the NorthConnex project.
There are many reports of parents intending to change schools for their children and enroling them in schools further away from the stack.
This is also my personal intention.
Overall, this may potentially threaten the viability of well established schools like Abbotsleigh or Knox. There is already a large amount of parental concern at these schools. Once construction commences and a stack becomes visible in the near proximity, parents may well chose to move their children to cleaner environments.

Solution:

1. Resite the northern ventilation stack further north in the Hornsby industrial area and vent the stack into adjacent bushland using available technology in the form of filtration.

Wear and Tear of local roads.

With the creation of large staff carparks and a continuous fux of shift workers in and out of the suburb, the local infrastructure will be placed under a large amount of strain. Access to building sites carries with it associated spoils and pollution, and as heavy vehicle movements increase, local roads will be degraded. This is again at the expense of tax payers and local government.

Solution:

1. Do not approve the current NorthConnex project as it is proposed.
2. Resite the northern stack and associated work sites in the Hornsby industrial area where the local infrastructure is used to stresses of heavy vehicle movements.

11. Alternative options

Background

(As per Professor Richard Chard)

I would like to endorse Professor Chard's submission at this point.

Director General requirements is an analysis of alternatives/options considered having regard to the project objectives (including an assessment of the environmental costs and benefits of the project relative to alternatives and the consequences of not carrying out the project), and the provision of a clear discussion of the route development and selection process, the suitability of the chosen alignment and whether or not the project is in the public interest.

Three broad corridor options were explored:

Type A – directly from Wahroonga to M2

Type B – from Berowra to M7/Windsor Road

Type C – from Calga to M7/west of Blacktown

Selection of the preferred option

Despite the requirement above that analysis of the alternatives be provided no credible analysis is contained within the EIS sections, Chapter 4, Sections 4.1 on.

The document is essentially a statement of opinion with attribution to several reports :

(F3 to Sydney ORBITAL LINK STUDY) (SKM2004).

The Pearlman Review 2007 –

neither of which studies appear to have provided detailed analysis of the real environmental impact of construction of one of the world's 5 longest road tunnels with a longitudinal ventilation system compared with a B corridor largely surface road going through less heavily inhabited areas.

No mention is made of the severe limitations of tunnel developments, namely that

NO DANGEROUS GOODS ARE PERMITTED within the tunnel and therefore at least 20% of heavy transport will continue to use the unimproved surface road (Pennant Hills Road).

Dangerous goods classification is easily “gamed” by the trucking industry to avoid tolls.

Traffic speed in a tunnel would be significantly less than a surface road. According to recent announcements by the Transport Minister appropriate motorways could have up to a 130kph limit versus 80kph in a tunnel (as are all road tunnels in Sydney at present)

High vehicle speeds in the sensorily deprived environment of a long tunnel would be dangerous.

Emergency services are far more easily delivered on a surface road

Sensory deprivation may contribute to accidents within the tunnel.

Tunnels are inherently more hazardous in the event of accidents particularly fire – emergency services are far more easily and safely delivered on a surface road.

There is no practical way to adequately police the presence of dangerous goods within any tunnel.

The high energy consumption to provide ventilation.

The environmental impact of converting a linear source of road traffic pollution into 2 point sources concentrating the pollution at either end in a heavily populated residential and educational area with inadequate provisions for dispersion.

The EIS contains no serious discussion of any surface road alternative but is essentially a statement of opinion and advocacy of NorthConnex’s design.

Uncorroborated statements about “community consultation” with regard to the 2004 and 2007 reports are made in relation to support for NorthConnex’s position. It is extremely unlikely that the true implications of a massive tunnel development both construction and operation were presented to the “communities” in a way that would allow a meaningful choice to be made by those consulted.

NorthConnex should be required to provide a comprehensive analysis of Type B Corridor alternatives in the light of the true advantages and disadvantages of a predominant surface road alternative versus a tunnel twice as long as any other in Australia.

Assessment of alternatives in EIS

No assessment of alternatives is provided in the EIS. There are brief statements which are essentially dismissive of a variety of alternatives. NO analysis is provided.

The document contains statements of opinion as though the previous reports on the subject were relevant to current conditions and were made in the knowledge of the actual consequences in relation to the environment and potential improvement of traffic problems.

Detailed analysis of all alternatives with appropriate validated data comparisons of all aspects and issues needs to be provided by NorthConnex to justify their claims that their preferred alternative is superior.

The whole process needs to be independently supervised including dominant community input.

That this project has reached this stage demonstrates the fundamental failure of the Department of Planning and the political process to arrive at a valid solution to the problem.

They have uncritically accepted the numerous limitations listed above, in addition the design of the Pacific Highway/Pennant Hills Road interchange is likely to make for slow and cumbersome truck movements (which will ensure all traffic is slow). The Southern interchange feeds into a very busy traffic area with feeder and distributor roads already frequently blocked in both directions.

The tunnel is highly likely to become congested frequently, despite this the cheapest and least effective ventilation system has been selected. It is designed on false principles, such as the Piston effect which does not work significantly in road tunnels, it is for rail tunnels. They give their game away with the passionate denunciation of filtration, even though it works in many overseas locations. Cost is no excuse for inadequate safeguards to health.

The Northern Portal location has been selected because it is the cheapest option, with no credible model for dispersion of the pollutants and setting a precedent of polluting an established residential area.

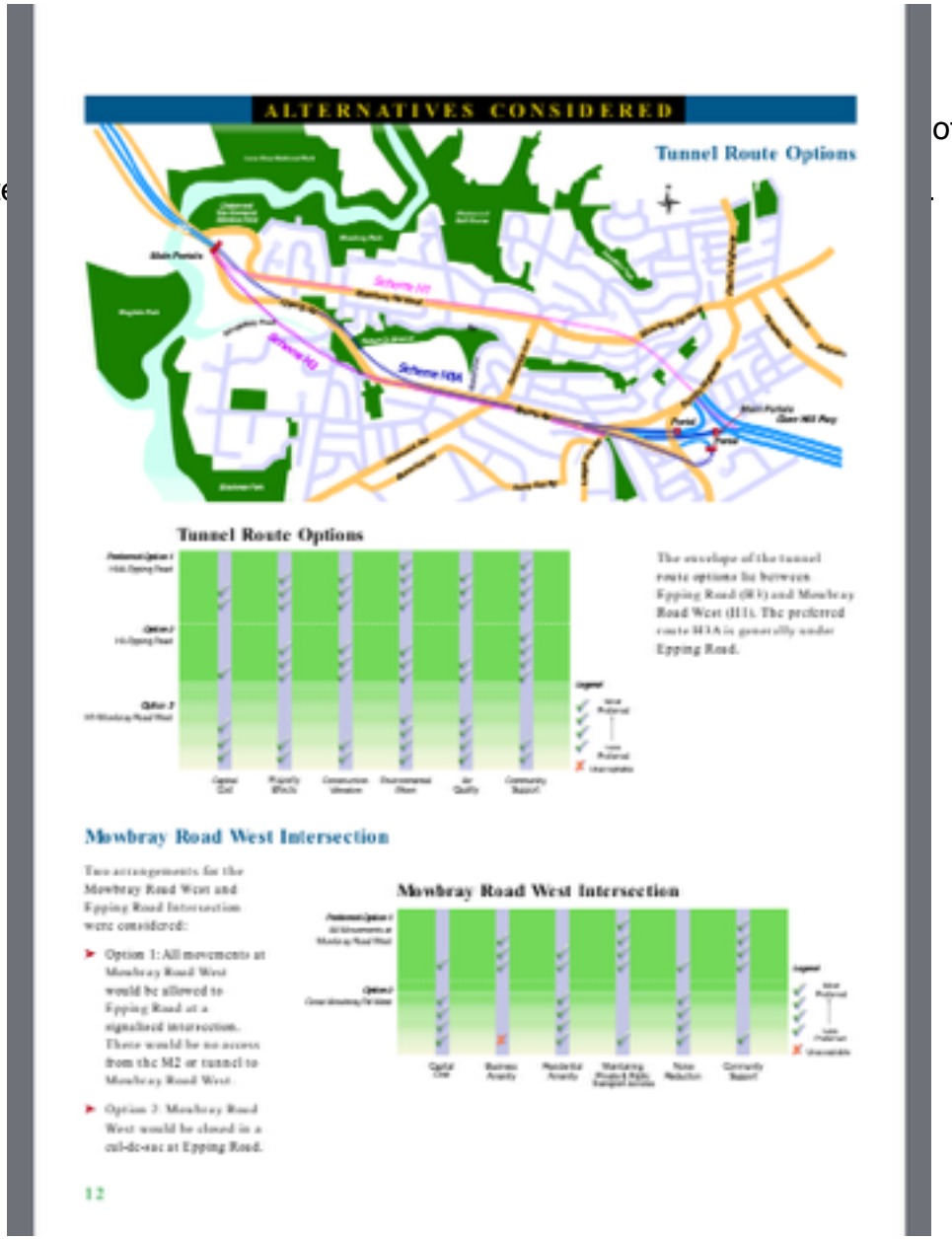
The scenario is that the Department of Planning had no credible solution to the problem, despite two enquiries. That lack of expertise is then presented with an unsolicited proposal with serious flaws by the dominant provider of Toll roads in the state. They know that the only way to fund the project is cross subsidy from their existing toll roads, which will cement their monopoly position and secure their assets. It allows them to get away with saddling the NSW community with a $3billion dollar lemon that will at most transiently contribute to solving the traffic congestion problems.

The process should have been that the Dept of Planning actually has the expertise to devise a solution to the problem, it outlines the alternatives including community consultation and political input. The process is public and transparent.

A solution is arrived at and tenders are called for with detailed specifications.

If the ot occur.

The te .



ALTERNATIVES CONSIDERED

Tunnel Route Options

Tunnel Route Options

The envelope of the tunnel route options lie between Epping Road (R1) and Mowbray Road West (I11). The preferred route M1A is generally under Epping Road.

Mowbray Road West Intersection

Two arrangements for the Mowbray Road West and Epping Road Intersection were considered:

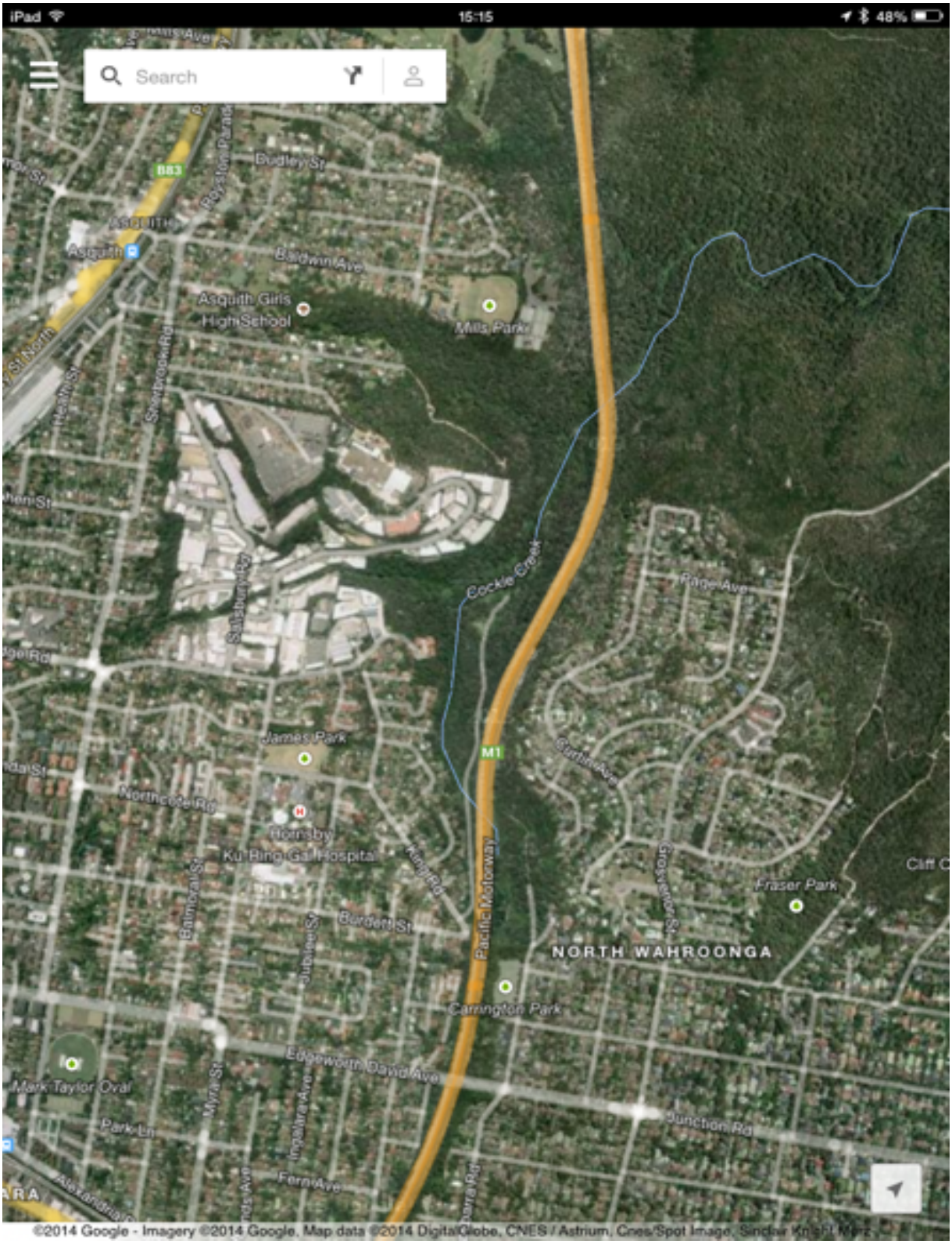
- Option 1: All movements at Mowbray Road West would be allowed to Epping Road at a signalised intersection. There would be no access from the M2 or tunnel to Mowbray Road West.
- Option 2: Mowbray Road West would be closed in a cul-de-sac at Epping Road.

Mowbray Road West Intersection

12

This is an example of the level of research that went into exploring and then presenting alternative options for theLane Cove tunnel.

The NorthConnex assessement of alternatives falls well and truly short of the benchmark set above.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James Park
Hornsby Ku-Ring-Gai Hospital
Fraser Park
NORTH WAHROONGA
Carrington Park
Mark Taylor Oval
Edgeworth David Ave
Junction Rd
Fern Ave
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The above satellite image demonstrates the unique opportunity in resiting the northern ventilation stack to an industrial area with adjacent bushland and surrounding residential area which is less densely populated.
These images look similar to what has been done in the Lane Cove and M5 east stack placement and appear more in accord with current practice.
The ventilation stack should be fitted with efficient filtration systems and vented into the bush land using state of the art filtration as there are still residential areas nearby.
The portal for the north bound tunnel should also be sited in the vicinity of the industrial area as future portal emissions have not been excluded in the EIS.
The cost of extending the tunnel to this location is something that Transurban has protested in the past. They have quoted the estimated cost at $400m. However,as we have realised from earlier statements, Transurban has an extremely profitable foothold on Sydney's toll roads already and would quite easily be able to pay for this extension. With last years revenues equalling $1 bn from toll roads, and a tax bill of $1 million, the maths is self explanatory.

Level Tunnel

The North bound tunnel should have a level grade with minimal inclines to minimise pollution from acceleration to overcome these grades. Ventilation stacks and portals (also a source of pollution) should be as far as possible from residential areas on the North portal.

This would mean opposite the Hornsby industrial area and into the adjacent bushland.

Use of the Lin Ma plan for a covered tunnel would provide a cost effective method of extending the tunnel away from highly populated residential and educational areas. It employs a “cut and cover” approach to extend the tunnel in a more financially efficient way, yet at the same time transporting harmful emissions away from Sydney’s schooling capital and densly inhabited residential areas.

12. Endorsed submissions:

I would like to endorse the following submissions in my own personal submission:

1. Ku ring gai council Submission
2. CAPS group submission
3. Mr. Lin Ma's submission – civil engineer
4. Public Health Association of Australia submission
5. Professor Richard Chard
6. Dr Kirthana Sharma
7. Mr Jonas Ball
8. Dr Helen Nassar (Ward)
9. SAN hospital submission

13. Conclusion:

This submission has outlined the following critical points:

- There are numerous medical and scientific trials which show, beyond any doubt, that air pollution poses serious health risks to populations exposed. Current air pollution guidelines are moving towards exposure minimisation approaches and away from traditional guidelines
- The particulate matter expelled from unfiltered ventilation stacks has no safe exposure threshold.
- Scientific evidence for impacts from ventilation stacks is evolving and there remain many unanswered questions about long term impacts from such stacks. As a result governments must demonstrate the use of precautionary principles and exclude any doubts via further long term studies
- Surrounding communities are at a greater risk of adverse health impacts from this proposal
- Dispersion modelling and air quality modelling performed in the EIS by NorthConnex is substandard for a project of this magnitude
- Inadequate data has been gathered to account for local meteorological and geographical factors which will have major influences on plume dispersion
- Calculations for air quality have shown major omissions in the NorthConnex EIS
- The NorthConnex health impacts assessment is based on the air quality assumptions and is therefore INVALID
- The proposed northern stack will be located in Syndey's schooling capital. There are also large numbers of vulnerable people living in the vicinity of the stack in Aged care facilities, nursing homes and in their own homes.
- The locations and heights of the stacks is inadequate to ensure dispersion. The Wahroonga stack is in a valley and is in an area with little to low wind speed at all times, prone to inversion phenomena.
- I feel the current design is NOT a Gold standard design.
- NHMRC recommendations have been ignored in the proposed design and choice in portal and stack placement.

- No other tunnels in Australia have stacks in similar and comparable locations.
- No other tunnels internationally, to my best knowledge, have stacks in comparable locations
- Alternative options have been poorly explored and assessed

Summary of suggestions:

- The NorthConnex proposal must not be approved in its current design

  Conclusion
- Air quality data needs to be collected from the stack site locations for a reasonable period of time to establish true future impacts from this project.
- In tunnel air quality needs to be remodeled as it needs to include polluted air from the tunnel entrances.
- In tunnel air quality needs to be remodeled to take into account a realistic level of emissions from large and very large cargo vehicles which are currently under estimated.
- Terrain data needs to be recollected at a higher quality, Suitable for a project of this magnitude.
- Local meteorological data needs to be collected for an appropriate amount of time. Low average wind speeds and frequent inversion phenomenae need to be acknowledged.
- Dispersion modelling needs to be repeated taking into account local weather and terrain data.
- The entire health impacts section needs to be repeated to take into account the above data which has been omitted. This data will substantially alter the health impacts for in tunnel users and communities surrounding the stacks and portals.
- Independent experts from countries which have a large amount of experience in tunnels such as Japan, Norway and Germany need to be consulted to give alternative design solutions. This needs to be an independent process.
- Economic impacts need to be assessed and a transparent cost benefit analysis of the NorthConnex project as well as alternative options needs to be performed.

- The location of the stacks need to be such that current best practice and national as well as international recommendations are followed. This means that they must not be sited in residential areas.
- State of the art air filtration systems need to be installed no matter where the ventilation stacks are sited. The operation and maintenance of these devices needs to be by an independent operator, not the tunnel operator.
- Continuous in tunnel air monitoring is needed. Exceedences in limits will require operators to activate a tunnel shut down scenario.
- Continuous air monitoring needs to occur at the tunnel portals to ensure that there are zero portal emissions. Exceedences in limits will require tunnel shut down.
- Government must apply the precautionary principle and err on the side of caution with regards to public health and not approve the current design of the NorthConnex project.
- A revised EIS period must be made available for public display and adequate time must be made to respond to the revisions.

14. Appendix:

Medical Evidence regarding adverse health effects of air pollution from tunnel portal and stack placement in residential suburb

There exists an overwhelming amount of medical evidence on the adverse health effects of air pollution, and as such, we have selected some of the most relevant and significant articles to present our concerns.

A recent study released in The Lancet, one of the most prestigious international medical journals, reported the adverse health effects in 367,251 people with long term exposure to air pollution. These people were followed for an average length of 13 years, during which 29,076 died.

The study found that there was a significantly increased risk of death in the participants exposed to particle matter. This risk was even found in individuals whose exposure was within concentration ranges well below the current European standard (1).

Another major study conducted by the American Cancer Society enrolled approximately 1.2 million adults in 1982 for an ongoing prospective mortality study.

Fine particulate and sulfur oxide--related pollution were associated with an increased risk of lung cancer and death from heart and lung diseases. Each 10-microg/m increase in fine particulate air pollution was associated with approximately a 4%, 6%, and 8% increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively (2).

A WHO press release in October 2012 stated that after thoroughly reviewing the latest available scientific literature, the world's leading experts concluded that there is sufficient evidence that exposure to outdoor air pollution causes lung cancer. They also noted a positive association with an increased risk of bladder cancer (3).

The most recent WHO data indicates that in 2010, 223,000 deaths from lung cancer resulted from air pollution (4).

Medical evidence is overwhelmingly clear that long term exposure to air pollution increases death rates.

A local study by Cowie et al looking at health effects of the Lane Cove tunnel in Sydney, NSW studied participants before and after the opening of the tunnel. The study found that residents living within 650m of the tunnel ventilation stack reported more upper and lower respiratory symptoms and had lower lung volumes in the first 2 years after the tunnel opened (5). There was also, unfortunately, no consistent evidence of improvement in respiratory health in residents living along the bypassed main road, despite a reduction in traffic from 90,000 to 45,000 vehicles per day.

A recent study using data from numerous international studies looked at dose response relationships for PM 2.5 (6). The results suggested a relatively steep exposure–response function at very low levels of exposure to PM 2.5 and a flattening out of cardiovascular risk at high exposure levels.

At very low levels of exposure excess mortality risks are similar for lung cancer and CVD mortality. A relative risk of 1.3 was found for cardiopulmonary disease secondary to PM2.5 levels of 24.5 micrograms/m3.

Current air quality modelling guidelines consider a level of less than 50 micrograms/m3 to be safe. This is equivalent to the risks associated with exposures to moderate to high levels of second hand cigarette smoke.

A potential explanation regarding the steep exposure–response for CVD mortality at low levels of exposure and the levelling off at high exposures is a saturation phenomenon whereby relatively low levels of exposure are capable of activating relevant biological pathways.

There is substantial and growing evidence that long-term exposures to $PM_{2.5}$ from cigarette smoke, ambient air pollution, or both affect multiple physiologic pathways. Even low levels of exposure to PM 2.5 from second hand smoke and ambient air pollution have been associated with pulmonary and systemic oxidative stress, inflammatory vascular dysfunction, increased platelet activation and blood viscosity, atherosclerosis, IHD, and altered cardiac autonomic function

In eight different communities in Switzerland, lung function in adults was negatively associated with PM10, nitrogen dioxide, and sulphur dioxide all of which are pollutants arising from vehicle exhausts (7). The pollutants also increased symptoms of bronchitis

(8). In children from ten Swiss communities, the same pollutants were found to be associated with symptoms of bronchitis (9).

In children living in 24 communities in Canada and the USA, significant associations were reported between exposure to fine particles and lung function and symptoms of bronchitis (10-12).

Exposure to particulate pollution is associated with reduced lung function growth in children (13), and even children relocating from high to low pollution areas (or vice versa) were shown to experience changes in lung function growth that mirrored changes in exposure to particulate matter (14).

Gauderman et al followed school children from the age of 10 for 8 years to observe the effects of air pollution on lung development. He showed that lung development is significantly affected through reductions in FVC, FEV1 and MMEF, as would be expected of the children had been exposed to maternal smoking(15).

Studies from across the world have consistently shown that both short- and long-term exposures to particulate matter are associated with a host of cardiovascular diseases, including heart attack, heart failure, abnormalities of heart rhythm, strokes and increased death from cardiovascular causes (16).

Evidence from cellular/toxicological experiments, controlled animal and human exposures and human panel studies have demonstrated several mechanisms by which particle exposure may both trigger acute events as well as prompt the chronic development of cardiovascular diseases. Particulate matter inhaled into the pulmonary tree may instigate remote cardiovascular health effects via three general pathways: instigation of systemic inflammation and/or oxidative stress, alterations in autonomic balance, and potentially by direct actions upon the vasculature of particle constituents capable of reaching the systemic circulation. In turn, these responses have been shown to trigger acute arterial vasoconstriction, endothelial dysfunction, arrhythmias and pro-coagulant/thrombotic actions (17).

In both short-term and long-term studies, air pollution has an effect on cardiac deaths and hospital admissions in addition to respiratory effects. Plasma viscosity, as well as

heart rate and concentrations of C-reactive protein, were increased (18-20), all of which can contribute to an increased risk of cardiovascular events.

Studies in Boston, MA, USA, showed that nitrogen dioxide and PM2·5 were associated with life-threatening arrhythmia leading to therapeutic interventions by an implanted cardioverter defibrillator (21), and that PM2·5 concentrations were higher

in the hours and days before onset of myocardial infarction in a large group of patients (22).

Hoffman et al found that long-term residential exposure to high traffic is associated with the degree of coronary atherosclerosis. Participants living within 50m of a busy road had an odds ratio of 1.63 for developing coronary artery calcification compared with a control group (23).

Older subjects (greater than or equal to 60 years of age) and women were found by Künzli et al, to have a 15.7% stronger association between particle matter exposure and carotid intimal thickening, ie the risk of stroke. (24)

In a study of 1,705 Boston-area patients admitted to hospital with strokes, the risk of stroke was increased by 34 percent on days when traffic pollutants were classified by federal regulators as "moderate," which is defined as a minimal danger to health. These results suggest that exposure to $PM_{2.5}$ concentration generally considered safe by the US EPA increase the risk of stroke onset within hours of exposure (25).

One of the most commonly measured chemicals arising from car emissions is nitrogen dioxide. Associations between natural-cause and respiratory mortality have been found to be statistically significant for NO_2 and black smoke (26).

Giulia et al studied the effects of long-term exposure to both fine particulate matter (≤ 2.5 μm; $PM_{2.5}$) and nitrogen dioxide (NO_2) on risk of death (27). This large study of over 1.2 million subjects strongly supports that long-term exposure to NO_2 and $PM_{2.5}$ increases risk of death, especially from cardiovascular causes.

Traffic emissions contain substances that can be measured and that cannot be measured or are accounted for in standard pollution modelling.

Dozens of volatile and semivolatile organic compounds can be detected in vehicle exhaust, along with numerous metals and oxides of sulfur, nitrogen, and carbon. While the adverse effects of these chemicals have been extensively studied surrounding open roadways, the hazards to local residents and commuters resulting from the presence of tunnel emission chemicals are less well known (28).

It is the unknown substances that potentially pose a great health risk in themselves.

The recognition that ultrafine particles (mass median diameter <0·1 _m) are more toxic when inhaled than PM10 suggests that their ability to be absorbed into tissues and the circulation, and their greatly increased surface area, might be important factors in determining cardiopulmonary toxicity (29).

In the local study by Cowie et al, which looked at the health impacts on locals living near the Lane Cove Tunnel Stack, the study found that there was an increase in the number of adverse health effects among residents living around the stack. It also went on to suggest that these effects may have occurred due to unmeasured pollutants. (5)

Diesel particulates and ozone have been shown to increase the synthesis of the allergic antibody IgE in animals (30), and human beings (31), which would increase sensitisation to common allergens (32). By interacting together and with other environmental factors, particulates and gaseous air pollutants can have long-term effects on allergic individuals.

Short term and long term health impacts have been well studied internationally.

The findings of increased airway inflammation and symptoms in subjects after only 2 hours exposure at a heavily trafficked location indicate that even short-term exposures to traffic-related air pollution has adverse health effects (33).

Fischer et al found that outdoor pollutant levels correlated with those measured indoors in 36 houses exposed to air traffic pollution. A substantially larger contrast (about a factor two) was found for outdoor concentration of the particulate components BaP, total polycyclic aromatic hydrocarbons, absorption coefficient (`soot') and the gas-phase components benzene and total volatile organic compounds. The contrasts for these pollutants were substantially larger than the estimated contrast in average NO_2 (22%). (34)

Pregnant women exposed to sulphur dioxide from traffic pollution are more likely to give birth to low birth-weight babies. (35)

Exposure to traffic-related air pollution, nitrogen dioxide, $PM_{2.5}$, and PM_{10} during pregnancy and during the first year of life is associated with autism (36).

Effects on the elderly:

Higher levels of long-term exposure to both $PM_{2.5-10}$ and $PM_{2.5}$ are associated with significantly faster cognitive decline, i.e. can accelerate the development of dementia. (37).

A study of 137 Brisbane school children at 25 schools by Mazaheri (38) analyzing alveolar concentrations of ultrafine particles concluded that children's exposure during school hours was more strongly influenced by urban background particles than traffic near the school. The study also found that the highest dose intensity occurred during outdoor times at school and when children were more active.
There are large numbers of children in the immediate area surrounding the stack, attending schools.
These background levels of ultrafine particles could be significantly affected by an unfiltered exhaust stack within close proximity of multiple schools.

Buonanno et al (39) studied particle concentrations at schools in several different urban locations. In general, children attend school during day time hours on weekdays when traffic intensity is high.
It has been proven, that outdoor pollutants are able to penetrate inside the buildings, influencing indoor concentration levels on the basis of traffic, meteo-climatic and urban characteristics with regard to airborne particles. Indeed, indoor pollutants were found to explain a number of health effects even at concentrations significantly lower than outdoors.

In a separate study, Buoanno et al (40) looks at the health effects of dose related particle exposure on children. Significant differences were found for asthmatics, children with allergic rhinitis and sensitive to allergens compared to healthy subjects.
At present, it is not known which particle size, morphology or chemical components are most strongly related to the negative effects on human health and further research in this field is required.
These effects have received more attention in relation to children, because they inhale a higher dose of airborne particles relative to lung size when compared with adults.
Nevertheless, the major difficulty facing epidemiological studies of ultra fine particles is mostly related to the estimation of individual exposure levels. The most common current approach assumes that each person in a given region has the same exposure level, which is often obtained from a few air quality monitors and reflects the mean concentrations in the entire urban area or community.
This approach could lead to significant errors in the estimation of individual exposure to air pollutants because the actual exposure is strongly related to the time activity of the individuals. Furthermore, the use of mean air pollution levels smoothes peak air pollution concentrations and thus, may result in unreliable estimates of exposure (Manigrasso et al., 2013).

Furthermore, several authors have suggested that short term fluctuations in aerosol concentrations of particles increase morbidity and mortality (Brugge et al., 2007; Strak et al.,)

A recent study by the OECD has found that Australia is amongst only 14 out of 34 developed countries in the world where deaths from air pollution have increased in the past 5 years. In between 2005 and 2010, the number of deaths from air pollution in Australia increased by 68 per cent. Evidence suggested that road transport was probably responsible for about half of all deaths from air pollution. The economic cost for Australia was about $5.8 billion in 2010, up from $2.9 billion just five years earlier (41).

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Letter of Medical Evidence opposing NorthConnex tunnel portal and stack placement in residential suburb

We are writing to you regarding the planned NorthConnex tunnel and associated northern ventilation stack, proposed for the densely populated *residential suburb* of Wahroonga, NSW. This project will emit *unfiltered* exhaust fumes from approximately 5000 trucks and 9000 cars per day into an area which has a high density of schools, hospitals and aged care facilities, and will be less than 50 metres to the nearest house.

As health professionals, we feel that this project will have a *major negative impact on the health of the surrounding community.*

The NHMRC (National Health and Medical Research Council) states that the great advantage of tunnels is that their portals and stacks can be *deliberately sited away from residential areas.* These recommendations are also found internationally.

International air pollution experts state that there is no safety threshold to the amount of air pollution causing health impacts, hence *there is no "safe level"*. The smallest amount of air pollution will have a corresponding amount of health impact. Even low dose exposures to particulate matter have been demonstrated to have significant health risks.

There are numerous, well documented health risks associated with air pollution exposure, as found around tunnel portals, tunnel stacks and associated on-ramps. As such we would like to raise our concerns regarding this proposal.

The following facts regarding air pollution are researched and documented in the scientific literature:

16. There is an increased *risk of death in people* exposed to particulate matter*, even when exposure is within concentration ranges well below the present European standards.*
- Air pollution causes *Lung Cancer and is associated with Bladder cancer.*
4. In 2010, 223,000 deaths from lung cancer worldwide resulted from air pollution according to the World Health Organisation (WHO)
4. WHO classifies diesel exhaust fumes as a *carcinogen (cancer causing)*, belonging in the "same deadly category as asbestos, arsenic and mustard gas"
5. *Ultrafine particles* (median diameter <0·1 micrometers) are more toxic when inhaled than other measurable particles. They are greatly absorbed into tissues and the circulation and are important factors in determining *cardiopulmonary toxicity.*
    1. Both short- and long-term exposures to particulate matter are associated with a host of *cardiovascular diseases, including heart attacks, arrhythmias, strokes and increased risk of death* from the above cardiovascular causes
1. Children show *reduced lung function* growth which persist later into life, even when exposure stops, i.e. the damage for growing lungs is permanent.
2. Children have been found to suffer from symptoms of *bronchitis* following exposure

3. Residents living around tunnel ventilation stacks report more *upper and lower respiratory symptoms and have lower lung volumes.*

- *Low birth weights* are more common in pregnant women exposed to traffic pollution.
- Exposure to traffic-related air pollution during pregnancy and during the first year of life is associated with *autism.*
- Higher levels of long-term pollution are associated with significantly faster cognitive decline i.e development of *dementia*

- Outdoor pollutant levels correlate with those measured indoors in houses exposed to air traffic pollution.

Traffic emissions contain substances that are not accounted for in standard pollution modelling. These include ultrafine particles and other *unmeasured substances.* Dozens of compounds can be detected in vehicle exhaust. While the adverse effects of these exhausts have been extensively studied surrounding open roadways, the hazards to local residents and commuters resulting from the presence of ultrafine particles are less well known. *It is these ultrafine particles and unknown substances that potentially pose a great health risk.*

We are very concerned that any modelling of air quality and drawing conclusions on their resultant health impacts drawn from this modelling prior to construction will be inaccurate, *as little scientific evidence exists for long term health impacts of unmeasured particles.*

As health professionals, we strongly oppose the construction of a major source of air pollution at the proposed site. This is a residential neighbourhood. We are of the opinion that there will inevitably be negative long and short term health impacts in the surrounding area.

We strongly feel that an alternative solution needs to be found.

Please find attached a detailed review of the literature, outlining the medical evidence for serious potential health impacts of such a project. Also attached are signatures from health care professionals from a multitude of specialties.

Yours faithfully,

[redacted]