

General Purpose Standing Committee No 5

Report on Inquiry into Northside Storage Tunnel - Scotts Creek Vent

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Report on Inquiry into Northside Storage Tunnel – Scotts Creek Vent

Chair: The Hon Richard Jones MLC

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Terms of Reference

- 1)** In relation to venting of the Northside Storage Tunnel at Scotts Creek, the Committee consider and report on:
 - a) the health and odour risks to the community, their scientific quantification and application of the Precautionary Principle;
 - b) the ability for the vent to meet ambient air quality standards and licence requirements during operation under all circumstances;
 - c) the roles and responsibilities of bodies accountable for community health impacts and monitoring and maintaining ambient air quality standards;
 - d) the appropriateness, measurability and reliability of licence conditions associated with venting; and
 - e) interim alternative options to venting at Scotts Creek.

- 2)** To consider and report on permanent alternative options to venting at Scotts Creek.

- 3)** To consider and report on the implementation of recommendations from previous parliamentary inquiries and reports on the Northside Storage Tunnel.

- 4)** That the Committee present a report by 8 September 2000.

These Terms of Reference were adopted by the Committee at a meeting of the Committee held on 12 July 2000.

Committee Membership

The Hon Richard Jones MLC (Chair)	Independent
The Hon Jan Burnswoods MLC ¹	Australian Labor Party
The Hon John Jobling MLC	Liberal Party
The Hon John Johnson MLC	Australian Labor Party
The Hon Malcolm Jones MLC ²	Outdoor Recreation Party
The Hon Andy Manson MLC ³	Australian Labor Party
The Hon John Ryan MLC ⁴	Liberal Party

Committee Secretariat

Ms Anna McNicol	Director
Mr Robert Stefanic	Senior Project Officer
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¹ The Hon Jan Burnswoods MLC was represented by the Hon Amanda Fazio MLC at the hearing on 9 October 2000.

² The Hon Malcolm Jones MLC was represented by the Hon Peter Breen MLC at the hearing on 9 August 2000.

³ The Hon Andy Manson MLC represented the Hon Ron Dyer MLC for the purposes of this inquiry until his resignation as a Member of the Legislative Council on 27 October 2000.

⁴ The Hon John Ryan MLC represented the Hon Richard Bull MLC, resigned (to 29 August 2000), the Hon Patricia Forsythe MLC (from 6 September 2000 to 9 October 2000) and the Hon Richard Colless MLC (from 9 October 2000) for the purposes of this inquiry.

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Chair's Foreword

On 12 July 2000, the Committee self-referred an inquiry into the Scotts Creek ventilation facilities of the Northside Storage Tunnel due to the overwhelming concern of the Scotts Creek community groups with potential health risks posed by the vent. Of particular concern to the community groups is the proximity of the vent to the Glenaeon Rudolph Steiner School. Accordingly, the terms of reference for the inquiry related to not only the potential health risks posed by the vent, but also to odour issues, the ability of the vent to meet ambient air quality standards and licence requirements during operation, the responsibilities of bodies accountable for monitoring and maintaining air quality standards and consideration of alternative options to the proposed venting arrangements at Scotts Creek.

The Committee received 1,399 submissions, which is the largest number of submissions received by a Legislative Council Standing Committee. Three public hearings were held to take evidence from a number of Government departments and agencies in addition to community groups and health experts.

Both Sydney Water and NSW Health took action in relation to a number of issues during the inquiry. NSW Health convened a panel of health experts to examine the potential threat of Legionella and other pathogens from vent emissions. Sydney Water signed an agreement with the Lane Cove River West community for the installation of a high efficiency particle arrestor (HEPA) filter and repeated its offer to install an equivalent measure as part of the Scotts Creek ventilation facility.

This inquiry has been valuable for several reasons. The submissions and evidence received by the Committee revealed a critical breakdown in relations between the Northside Storage Tunnel proponents and the Scotts Creek community groups. The inquiry has provided both sides with an effective medium in which to communicate their concerns and expert opinions. The Committee has sought to provide recommendations which will provide a constructive outcome.

The key recommendation, to install a vent pipe from Tunks Park to North Head, if accepted, would substantially reduce the volume of emissions at Scotts Creek and Lane Cove but would cause a very small relative increase in emissions at North Head. Sydney Water believe the existing chemical scrubber plant at North Head is highly effective in treating emissions.

The second key recommendation to install a final filter at Scotts Creek as an interim measure, if accepted, should also substantially reduce the concerns of the local community.

I wish to extend my gratitude to all those who made submissions to the inquiry. The balanced discussion provided in this report is a reflection upon the valuable submissions received from both government agencies and from the community during the Inquiry process.

Finally I would like to thank my fellow Members of the Committee and the Committee secretariat for their involvement during the Inquiry and in preparing this report. I particularly note the efforts of the Committee Director, Anna McNicol, Senior Project Officer, Robert Stefanic, Committee Officer, Phaedra Parkins and Parliamentary Clerical Officer, Ashley Nguyen for their research, analysis and administrative support.

The Hon Richard Jones MLC

Chairman

Summary of Recommendations

Recommendation 1 *Page 15*

The Committee recommends that, the independent post-construction audit report required under NST operation conditions, be tabled by the relevant Minister in each House.

Recommendation 2 *Page 28*

In the event the Scotts Creek vent commences operation, the Committee recommends that Sydney Water engage an independent consultant to conduct random monitoring and verification of hydrogen sulphide emissions.

Recommendation 3 *Page 28*

The Committee recommends that Sydney Water and the EPA investigate the potential problem that hydrogen sulphide monitoring equipment may be rendered inoperative through saturation and report the results to the House.

Recommendation 4 *Page 37*

The Committee recommends that NSW Health immediately prepare appropriate testing protocols to regularly evaluate the potential public health risks from *Legionella* and other pathogenic micro-organisms that may survive and proliferate in the Northside Storage Tunnel.

Recommendation 5 *Page 51*

The Committee recommends that Sydney Water and NSW Health undertake research into the effectiveness of activated carbon filters to capture micro-organisms. The Committee suggests that pilot scale trials be implemented to simulate operating conditions of the vent filtering mechanisms. The simulation should ascertain:

- the permeability of the filters for aerosols;
- under what conditions aerosols could permeate the filters;
- what types of bioaerosols can permeate the filters; and
- what percentage of bio-aerosols are being captured by the filters.

Recommendation 6 *Page 51*

The Committee recommends that Sydney Water and the NSW Health conduct detailed investigations into:

- whether it is possible for *Legionella* to remain viable and breed in activated carbon filters; and
- if it is found that it is possible for *Legionella* to remain viable and breed in activated carbon filters, whether public health risks could result from transfer of *Legionella* from the filter into the atmosphere.

Recommendation 7 *Page 59*

The Committee recommends that, if the Scotts Creek ventilation facility becomes operational, a full health study should be conducted on the long-term effects of exposure to emissions from the vent by residents and the school children of the Glenaeon Rudolph Steiner School.

Recommendation 8 *Page 70*

The Committee recommends that Sydney Water install a final filter, at least 95% efficient on 0.3 micron Hot DOP particles, in addition to the pre-filter and impregnated granulated activated carbon filter, as a means to alleviate concerns raised by the community.

Recommendation 9 *Page 70*

The Committee recommends that as a permanent measure, Sydney Water construct a return exhaust line from Tunks Park to the North Head STP.

Glossary

ARI	Average Recurrence Interval
CLC	Community Liaison Committee
DUAP	Department of Urban Affairs and Planning
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plans
EMS	Environmental Management System
EPA	Environment Protection Authority
ESD	Ecologically Sustainable Development
GAC	Granulated Activated Carbon Filter
HEPA	High Efficiency Particle Arrestor
NSOOS	Northern Suburbs Ocean Outfall Sewer
NST	Northside Storage Tunnel
OEMP	Operational Environmental Management Plan
ppb	parts per billion
ppm	parts per million
REF	Review of Environmental Factors
STP	Sewage Treatment Plant
WAP	Waterways Advisory Panel

Chapter 1 Introduction

Background to this inquiry

- 1.1** On 12 July 2000, General Purpose Standing Committee No. 5 resolved, in accordance with its powers under paragraphs 3 & 4 of the resolution establishing the Committee, to adopt terms of reference for an inquiry into and report on Sydney Water's Northside Storage Tunnel at Scotts Creek, and in particular:
- the health and odour risks to the community, their scientific quantification and the application of the Precautionary Principle;
 - the ability for the vent to meet ambient air quality standards and licence requirements during operation under all circumstances;
 - the roles and responsibilities of bodies accountable for community health impacts, and monitoring and maintaining ambient air quality standards;
 - the appropriateness, measurability and reliability of licence conditions associated with venting;
 - interim alternative options to venting at Scotts Creek;
 - permanent alternative options to venting at Scotts Creek; and
 - to consider and report on the implementation of recommendations from previous parliamentary inquiries and reports on the Northside Storage Tunnel.
- 1.2** The Committee resolved on a reporting date of 8 September 2000.

Conduct of the inquiry

- 1.3** At its meeting on 12 July 2000, the Committee decided to advertise in the North Shore Times and the Manly Daily newspapers calling for submissions with a closing date of Friday, 4 August 2000.
- 1.4** The Committee received 1,399 submissions in response to its call for submissions. The overwhelming majority of submissions were received from residents of the areas surrounding the Scotts Creek valley expressing opposition to the operation of the proposed Scotts Creek vent. The authors of the submissions received are listed in Appendix 1.
- 1.5** On 26 July 2000, the Committee inspected the site of the Scotts Creek vent in Castle Cove, with a number of officials from Sydney Water and the Northside Storage Tunnel Alliance (Alliance). The Committee also inspected the location of the Glenaeon Rudolph Steiner School to examine its proximity to the vent and met with a number of representatives of the school and the Scotts Creek Community Liaison Committee. The Committee members then proceeded to North Head Sewage Treatment Plant to inspect the Northside Storage Tunnel with officials from Sydney Water and the Alliance.

- 1.6** The Committee held public hearings on 9 and 10 August 2000 at Parliament House, Sydney. The 32 witnesses who gave evidence during the course of those two hearing days are listed in Appendix Two.
- 1.7** On 9 August 2000, the Committee resolved to order papers from NSW Health, requesting documents relating to any matter that had been referred to in relation to any health assessment of the Northside Storage Tunnel, Scotts Creek Vent. The documents were delivered to the Committee on Friday, 18 August 2000, in accordance with the Committee's resolution.
- 1.8** The Committee met on 6 September 2000 to deliberate on the Chair's draft report for the inquiry. At that meeting, the Committee considered correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer of NSW Health, dated 31 August 2000.⁵ The correspondence indicated that, on 23 August 2000, Dr Wilson had convened a meeting of an expert panel of microbiologists and public health physicians to advise him on possible health problems related to the commissioning of the Scotts Creek and Lane Cove vents (further details of this meeting are considered at Chapter 6). After considering this correspondence, the Committee decided to conduct an additional public hearing on 9 October 2000 to obtain further evidence in relation to health impacts from the expert panel and other expert witnesses. Consequently, the Committee resolved to extend the reporting date for the inquiry until 17 November 2000 and later to 24 November 2000.
- 1.9** The Committee adopted its report at a deliberative meeting held on 23 November 2000.

Structure of this report

- 1.10** Chapter Two of this report provides background information relating to the operation of the existing Northern Suburbs Ocean Outfall Sewer overflows at Scotts Creek, the proposed operation of the Northside Storage Tunnel, the Scotts Creek arm of the tunnel and the Scotts Creek vent. The Chapter also provides information about a previous parliamentary inquiry by the Select Committee on the Proposed Duplication of the North Head Sewerage Tunnel.
- 1.11** Chapter Three considers regulatory issues relating to the tunnel construction including, the Environmental Impact Statement for the Northside Storage Tunnel and the Review of Environmental Factors, which resulted in significant changes to the Northside Storage Tunnel's operation in respect of the Scotts Creek area. Responses by the community to the Review of Environmental Factors are summarised as well as the conditions for consent imposed on the revised project by the Department of Urban Affairs and Planning.
- 1.12** Chapter Four outlines the various stages of community consultation which occurred during the project's planning and construction with particular focus on issues which concerned the community in mediation following the publication of the Review of Environmental Factors.

⁵ Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 30 August 2000.

- 1.13** Chapter Five examines issues relating to the possibility of emissions and control of odours.
- 1.14** Chapter Six contains a discussion and findings relating to health concerns to the vent.
- 1.15** Chapter Seven considers the feasibility of alternative options to the Scotts Creek vent facility and concludes with the Committee's recommendations in this regard.

Chapter 2 Background information

Scotts Creek

2.1 Scotts Creek flows from a valley in the suburb of Castle Cove into Castle Cove, Middle Harbour. There is a pre-existing 20-metre long sewer aqueduct across Scotts Creek which is accessed from Deepwater Road, via an existing track that winds through surrounding bushland. A section of a popular walking track (the North Arm Walk) traverses part of the access track.

The existing Northern Suburbs Ocean Outfall Sewer overflow

2.2 The Northern Suburbs Ocean Outfall Sewer (NSOOS) comprises a number of sub-systems each consisting of sewer sub-mains and carriers. These systems all have the potential to experience capacity or blockage problems during heavy rainfall events which necessitates the inclusion of overflow structures as emergency pressure relief points. One of the largest overflow volumes from the NSOOS occurs at Scotts Creek where there are two overflows points.

2.3 The first of these two overflows crosses the Creek in an aboveground aqueduct. Flows that exceed the capacity of the pipe are released via a triangular shaped hinged lid in the top of the aqueduct. Currently, wet weather sewage overflow sprays over the aqueduct and drops into Scotts Creek which in turn flows into Castle Cove, Middle Harbour. This overflow site is located approximately 40 metres from the Glenaeon Rudolph Steiner School. The Environmental Impact Statement (EIS), released by Sydney Water in September 1997, includes modelling results indicating that during a one in 10 year average recurrence interval (ARI) rainfall event, the overflow discharges at a peak rate of 3,594 litres per second.⁶

2.4 The second overflow point discharges into the Creek via a pipe from a sewer access chamber. Modelling at the time of the EIS indicated that during a one in 10-year ARI rainfall event, the overflow discharges at a peak rate of 1,060 litres per second.⁷ Monitoring of the Scotts Creek system by Sydney Water indicated an average of 20 overflows per year that results in approximately 2,000 megalitres of diluted raw sewage flowing into local waterways each year.⁸

2.5 The most visible problem of the existing NSOOS overflow is the paper and other waste that is frequently caught on vegetation in Scotts Creek after an overflow event. In addition, the waterfall effect of the overflow and the residue left after the storm often creates an offensive odour in addition to environmental and public health risks.⁹

⁶ Sydney Water Corporation, *Environmental Impact Statement, The Northside Storage Tunnel*, September 1997, p.47.

⁷ Sydney Water Corporation, *Environmental Impact Statement, The Northside Storage Tunnel*, September 1997, p.47.

⁸ Submission No. 158, Sydney Water Corporation, p.7.

⁹ Submission No. 158, Sydney Water Corporation p.7.

Northside Storage Tunnel

2.6 As part of Sydney Water's Water Plan 21 policy for sustainable waste water management across Sydney Harbour, Sydney Water commissioned construction of the Northside Storage Tunnel (NST) to reduce wet weather sewage overflows into Sydney Harbour and improve water quality.¹⁰ The tunnel is being constructed under an "Alliance Agreement" between Sydney Water, Transfield, Connell Wagner and Montgomery Watson (the Alliance). Reduction of overflows into Sydney Harbour is intended to:

- reduce the amount of faecal coliforms which prevent swimming in some areas;
- reduce nutrient loads which promote algal growth; and
- improve the public health outcome for residents and recreational users of areas near current overflow points.

Functions of the Northside Storage Tunnel

2.7 The NST is primarily designed to capture wet weather sewage overflows from the four major overflow points affecting Sydney Harbour at Lane Cove River, Quakers Hat Bay, Tunks Park and Scotts Creek. The tunnel will reduce the extent of wet weather sewage entering the Harbour from a forecasted average of 6,145 megalitres per year to 955 megalitres per year¹¹ and convey the overflows to North Head Sewage Treatment Plant (STP) for processing. When the diluted sewage inflow to the tunnel exceeds the capacity of the STP to process it, the diluted sewage will be stored in the tunnel for processing as soon as the STP capacity allows.

2.8 The NST consists of a main tunnel extending from Lane Cove River West at a depth of 43 metres below sea level to North Head at a depth of 97.5 metres below sea level. The main tunnel is 16 kilometres long with a branch extending 3.5 kilometres from Tunks Park to Scotts Creek.

2.9 The tunnel is designed to have an operating capacity of approximately 500 megalitres. The tunnel will be emptied by drawing sewage up the shaft at the North Head STP. The pumping system has the capacity to empty a full tunnel in one and a half days.

2.10 In addition to overflow capture, the tunnel is intended to provide for emergency storage of sewage at times when operations at the North Head STP are interrupted and discharge of treated effluent through the deepwater ocean outfall is not possible. The tunnel could also provide a temporary by-pass of the main Northern Suburbs Ocean Outfall Sewer in the event of major maintenance works being necessary on the sewer between Lane Cove River West and North Head.¹²

¹⁰ Submission No. 158, Sydney Water Corporation p.6.

¹¹ Submission No. 158, Sydney Water Corporation p.15.

¹² Submission No. 158, Sydney Water Corporation p.13.

Tunnel operating modes

2.11 The Northside Storage Tunnel will function at several operating modes. These will be determined by prevailing environmental and health considerations. The modes are:

- Tunnel Stand-By Mode;
- Tunnel Normal Operating Mode;
- Tunnel Maintenance Mode;
- Emergency Bypass at North Head STP Mode; and
- Maintenance of the NSOOS Mode.

2.12 For most of the year, during stand-by and tunnel maintenance modes, the tunnel will be continuously vented by drawing air in through vents at Lane Cove River West and Scotts Creek and exhausting through a chemical scrubber¹³ at North Head.

Tunnel operation during an overflow event

2.13 Correspondence provided to the Committee by Sydney Water provides a detailed explanation of the tunnel operation during an overflow event:

- When the level in the sewer at Scotts Creek reaches a level that indicates that an overflow to Scotts Creek is imminent, the penstocks commence to lower to allow the excess flow to be diverted into the tunnel. Note that the sewer remains “full” and only the excess flow is diverted.
- When the flow reaches North Head STP the tunnel pumps are started and pump at a rate of 350 ML/day until the tunnel is empty. At this stage the air is still being exhausted through North Head.
- If the rate of inflow rate from all overflow sites (Scotts Creek, Lane Cove River West, Tunks Park, and Quakers Hat Bay) exceeds 350 ML/day, the tunnel starts to fill.
- When the volume in the tunnel reaches 80 ML, the air cannot reach North Head STP and the vent systems at Scotts Creek and Lane Cove River West are started. In 75% of the overflow events, the storage level in the tunnel never reaches 80 ML, and the air continues to vent through North Head STP.
- The facilities at Scotts Creek and Lane Cove River West vent the air displaced by the increasing volume in the tunnel. The rate of venting is controlled by the rate of dilute sewage overflows into the tunnel. The fans at Scotts Creek and Lane Cove River West simply ensure that the flow can pass through the filter system. All displaced air passes through the prefilter and the activated carbon filter.
- As the tunnel approaches full capacity, overflow sites progressively shut off the overflowing dilute sewage. The sites shut in the following sequence – Quakers Hat Bay, Tunks Park, Lane Cove River West and Scotts Creek.

¹³ A chemical scrubber is a facility designed to remove odorous compounds from air.

- When the tunnel is “Full” the overflow to the tunnel is shut off, and any excess flow is diverted to the harbour via the existing overflows.
- Current modelling indicates that an overflow to Scotts Creek in the vicinity of the aqueduct (via the revised overflow entry pipe) will occur only 1 to 2 times per year, on average.
- Under the current operating plans, Scotts Creek is the last of the Overflow Facilities to [be] closed and when Scotts Creek overflow to the tunnel is closed there is no air venting. The venting of air from the Scotts Creek facility and the overflow of dilute sewage into Scotts Creek never occur at the same time.
- After Scotts Creek overflows to the tunnel are shut off, the tunnel level starts to fall, and fresh air is drawn in at Scotts Creek. When the tunnel level falls to about 95% full, any excess sewer flow at Scotts Creek is diverted to the tunnel, thus minimising overflow to the environment.
- The maximum overflow rate at Scotts Creek is slightly higher than the maximum pump out rate at North Head. If the overflow rate is at maximum after overflow to the tunnel has recommenced, air will again vent from Scotts Creek, but at a maximum rate of about 1 m³/sec. This is because only Scotts Creek overflow is operating at this stage.
- If the overflow rate at Scotts Creek is less than the pump out rate at North Head the level in the tunnel will continue to fall and fresh air will be drawn in at Scotts Creek to replace the displaced dilute sewage.
- As the level in the tunnel falls, the other overflow facilities are reconnected to the tunnel, if the NSOOS is still overflowing to the environment at those locations. The reconnection sequence is the reverse of the shutdown sequence above. This usually occurs at the end of a storm and the total overflow rates will be declining. If the total overflow rate into the tunnel is less than 350 ML/day, the airflow will be into the tunnel at Scotts Creek and Lane Cove River West, and no air will be vented.
- If the total flow exceeds 350 ML/day, then air will commence to be vented at Scotts Creek and Lane Cove River West, but this will generally be at low flow rates and the air will be fresh air that has only recently been drawn into the tunnel and has had minimal contact time with very dilute sewage.
- When the tunnel is emptying (total sewage inflow less than 350 ML/day), air will be drawn into the tunnel. When the level falls below 80 ML this air will be exhausted through North Head STP.¹⁴

The Scotts Creek facility

2.14 When the NST is operational, Sydney Water estimates that it will reduce frequency of overflow events at Scotts Creek from approximately 20 per year to approximately two per year.¹⁵ During most storm events, the sewage that would previously overflow into Scotts Creek will now enter the NST through a drop shaft. As part of the project, the existing

¹⁴ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 3 p.6.

¹⁵ Submission No. 158, Sydney Water Corporation p.7.

hinged lid on the aqueduct will be permanently closed and replaced by a new overflow point has been relocated through a pipe to the creek.¹⁶

2.15 In its submission to the Committee, Sydney Water indicated that venting is expected to occur on approximately five or six occasions per year, over a total period of 20 to 30 days each year.¹⁷ In evidence to the Committee, Mr Alec Dietsch of the Alliance advised the Committee that this figure is likely to be lower with the tunnel venting, on average, 15 to 20 days per year.¹⁸ Sydney Water advised in evidence that the vent is not necessarily operating for the whole day on the days which record Scotts Creek being “in use”. For most of this time, additional air is being drawn into the tunnel. Actual venting time is expected to be less than 150 hours per year.¹⁹

2.16 The vent will be fitted with a “contaminant control system” consisting of a pre-filter to remove particulate matter, variable speed flow fans and an activated carbon bed filter. Exhaust gases will exit through the vent stack at Scotts Creek at a variable rate of up to 8.0m³ per second which is the speed of air being displaced from inside the tunnel during an overflow event. The average flow rate when venting is estimated to be 2.0m³. The maximum discharge flow rate of 8.0m³ per second is estimated to occur for about four to 8 hours in an average year.

Flow of sewage at Scotts Creek

2.17 Sydney Water have provided the following explanation of the engineering mechanisms which guide sewage as it enters the dropshaft during an overflow event:

- When overflows are initially diverted to the tunnel, dilute sewage flows down the vortex channel and enters the vortex. This impacts a centrifugal motion to the overflowing dilute sewage, to dissipate the energy of the flowing stream and to prevent air “plugs” from forming in the dropshaft.
- The dilute sewage “spirals” down the dropshaft to the de-aeration chamber about 50 metres below. The vortex motion draws in air equal to 25 to 50% of the overflow volume. This could be up to 5 m³/sec. As this amount of sewer gas is not available, due to the NSOOS being nearly full with dilute sewage, fresh air is drawn in to balance the flow demand.
- At the same time of initial overflows at Scotts Creek approximately 20 m³/sec of air is being drawn in at Scotts Creek (and 10 m³/sec at Lane Cove River West) to balance the 30 m³/sec being drawn out at North Head. As only a maximum of 5 m³/sec is drawn in with the overflowing dilute sewage, the balance of 15 to 20 m³/sec of fresh air is drawn in from the atmosphere through the Scotts Creek facility, and down the ventshaft to the tunnel.

¹⁶ Submission No. 158, Sydney Water Corporation p.33.

¹⁷ Submission No. 158, Sydney Water Corporation, p.32.

¹⁸ Evidence of Mr Alec Dietsch, Engineering Manager, Northside Storage Tunnel Alliance, 9 August 2000, p.14.

¹⁹ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, p.42.

- The dilute sewage (and entrained air) from the dropshaft enters the de-aeration chamber and the air and dilute sewage are “separated”. The separated air, including any entrained sewer gas, mixes with the 15 to 20 m³/sec of fresh air coming down the ventshaft and is drawn to North Head and exhausted.²⁰

Capture of airstream contaminants

- 2.18** To minimise the possibility of offensive odours emanating from air discharge during a filling event, the vent will be fitted with a two-stage filter system. The first is a honeycomb pre-filter designed to remove grease, larger particulates and other materials that may block the second filter. The second filter is a multi-bed activated carbon filter, filled with Calgon GHS 4x6 activated carbon with a mesh size of 3-6mm. The 3-6 mm mesh size refers to the nominal size of the activated carbon pellets used in the filter. The activated carbon consists of irregular sized granules generally in the range of 3 mm to 6 mm that are randomly compacted into the bed.
- 2.19** Sydney Water informed the Committee that, at the average vent rate of 2 m³ per second the vented airstream will take approximately 12 seconds to travel through the activated carbon bed. At the maximum vent rate of 8 m³ per second, the water surface and the air in the tunnel are moving at less than 1 kilometre per hour. At the average vent rate of 2 m³ per second, the air/liquid is moving at one metre every 15 seconds.²¹
- 2.20** GHS carbon is chemically treated with Sodium Hydroxide to ensure optimum performance at high humidities. The GHS carbon has enhanced capacity to remove hydrogen sulphide and mercaptans as well as being effective in adsorbing other organic odorants and volatile organic compounds.²² The filter contains approximately 15 tonnes of activated carbon in three parallel beds with an individual bed depth of 750mm with a face surface area of 12 square metres.²³ The performance guarantee for the filter has been specified as a hydrogen sulphide removal efficiency greater than 99% at 80% bed saturation and mercaptan removal efficiency greater than 99% at 70% bed saturation. The filter bed is designed to operate in the range 60%-100% relative humidity.²⁴

Select Committee on the Proposed Duplication of North Head Sewerage Tunnel

- 2.21** On 24 September 1997, considerable Parliamentary and public debate resulted in the Legislative Council establishing a Select Committee to inquire into and report on the Proposed Duplication of North Head Sewerage Tunnel. The Select Committee reported on

²⁰ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 3 p.7.

²¹ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 5 p.30.

²² Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.18-19.

²³ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 5 p.30.

²⁴ AWN Consultants, Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents, June 1999, p.21.

the Waterways Advisory Panel's report on the Sydney Water tunnel proposal and continued outfall to the Pacific Ocean. The terms of reference of the Select Committee also required it consider the extent to which the Sydney 2000 Olympics timetable influenced the decision and consequently whether this timetable precluded proper consideration of alternative or more appropriate methods of achieving a cleaner harbour. Other issues investigated included whether the scheme would produce better water quality in the harbour, whether the \$375 million budget could be spent more effectively and the efficacy of the contract process.²⁵

2.22 The Select Committee tabled its report in the Legislative Council on 5 December 1997. Three recommendations of the Select Committee specifically related to the Northside Storage Tunnel. The remaining recommendations related to other aspects of wastewater management by Sydney Water. The recommendations of the Select Committee relating specifically to the Northside Storage Tunnel are detailed in Appendix 3, along with information provided by Sydney Water about implementation of the recommendations.

²⁵ Select Committee on the Proposed Duplication of the North Head Storage Tunnel, Report, December 1997, pp.1-2.

Chapter 3 Environmental regulatory issues

1997 Environmental Impact Statement

- 3.1** Sydney Water publicly exhibited the Environmental Impact Statement (EIS) for the Northside Storage Tunnel project in September and October 1997. On 22 December 1997, the Minister for Urban Affairs and Planning approved the Northside Storage Tunnel, subject to 128 conditions. These conditions were modified by the Minister on 28 July 1998 and 17 August 1998, to permit changes for works at North Head STP, Little Manly Point and Tunks Park.
- 3.2** The original EIS proposal is examined in detail in the Report of the Select Committee on the Proposed Duplication of the North Head Sewerage Tunnel.²⁶

1999 Review of Environmental Factors

- 3.3** Subsequent to the EIS, and in accordance with section 115BA of the Environmental Planning and Assessment Act 1979 (EP&A Act), Sydney Water sought modifications to the Minister's approval in relation to the tunnel configuration and for construction works at Lane Cove West and Scotts Creek. The details of the proposed modifications were contained in a Review of Environmental Factors (REF) prepared by Sydney Water and publicly exhibited from 6 May to 20 May 1999. The period for the receipt of representations closed on 27 May 1999. The REF contended that, as the proposed modifications were not likely to have a significant effect on the environment, another EIS was not required.

Objectives of the changes

- 3.4** The specific objectives of the proposed changes contained in the REF were:
- to improve the tunnel's hydraulic performance;
 - to improve the capture of overflow events upstream of the Lane Cove River West site;
 - to complete the Northside Storage tunnel prior to the Sydney 2000 Olympic Games;
 - to reduce the overall environmental impact of the construction of the project;
 - to continue to provide for pipeline and services in the tunnel; and
 - to contain the cost of the project.²⁷

²⁶ Select Committee on the Proposed Duplication of the North Head Storage Tunnel, Report, December 1997, pp.4-19, 50.

²⁷ Sydney Water Corporation, *Northside Storage Tunnel Review of Environmental Factors for Proposed Changes to Approved Project – Tunnel Configuration and Construction at the Lane Cove and Scotts Creek Sites*, May 1999, p.3.

Proposed modifications affecting Scotts Creek

3.5 The key proposed modifications relevant to Scotts Creek included:²⁸

- Increasing the diameter of the branch tunnel between Tunks Park and Scotts Creek from four metres to six metres;
- Reducing the diameter of the drop shaft from 2.1 metres to 1.5 metres;
- Reducing the diameter of the ventilation shaft from four metres to three metres;
- Changing the method of construction of the two shafts from raised boring to surface downwards;
- Increasing the duration of surface construction works from six months to between 13 and 16 months;
- Increasing the volume of spoil removed from the site by truck;
- Removing the concrete invert and the tunnel lining except where geological or hydraulic conditions require it;
- Increasing the volume of air vented at Scotts Creek and correspondingly decreasing the volume at Lane Cove River West;
- Relocating the overflow at Scotts Creek to creek level; and
- Reducing the dimensions of the odour control building from 14m x 14m x 4m to 6m x 8m x 3m and partial undergrounding of the building.

Community response

3.6 Over 500 representations were received in response to the exhibition of the REF by Sydney Water. Significant concerns were raised about the proposed modifications, particularly in relation to:

- air quality and venting from the tunnel;
- odour and health issues;
- safety concerns about the proposal to excavate the shafts by the use of explosives;
- noise, vibration and dust impacts from the extended period of construction on the surface; and
- construction traffic.

Other issues raised included impacts on flora and fauna, visual impacts and community consultation.²⁹

²⁸ Sydney Water Corporation, *Northside Storage Tunnel Review of Environmental Factors for Proposed Changes to Approved Project – Tunnel Configuration and Construction at the Lane Cove and Scotts Creek Sites*, May 1999, pp.13-20.

Department of Urban Affairs and Planning consent

3.7 Under section 115C of the EP&A Act, the Director-General of the Department of Urban Affairs and Planning (DUAP) is required to make a report to the Minister prior to making a decision on an REF approval. The Director-General's report released in July 1999 included several findings and conclusions relating to air quality, venting and health issues.

3.8 To assist with its investigations, the Department of Urban Affairs and Planning sought an independent assessment of the potential air quality impacts from Mr Frank Flear of AWN Consultants. In citing the AWN Consultants report, the Director-General's report stated:

The assessment concluded that the proposed modified activities would not create an unacceptable adverse impact on the adjoining communities in terms of air quality, odour or health impacts. The Department does however recommend that specific comprehensive monitoring and mitigative measures are installed to ensure that the specific concerns of the community are addressed on an on-going basis.³⁰

3.9 Based on the consultants report and community concerns, DUAP recommended that the modifications proceed subject to safeguards and additional conditions of approval. The Minister subsequently approved the following safeguards:

- The installation, operation and maintenance of appropriate air pollution control equipment at Lane Cove River West and Scotts Creek to ensure that, under all operating conditions and meteorological conditions, discharges from the vent do not result in offensive odours;
- A remote monitoring system shall be established to provide an audible and visible alarm at a Sydney Water 24 hour Operations Centre should the hydrogen sulphide concentrations exceed EPA requirements;
- Odour emission sampling and analysis be undertaken to the satisfaction of the EPA;
- For the first year of operation, on a quarterly basis, the activated carbon shall be analysed for hydrogen sulphide adsorptive capacity, subject to approval by the EPA;
- An Odour Complaints Management Plan be implemented in consultation with the EPA;
- Two impregnated activated carbon filter beds be installed and designed to hydrogen sulphide efficiency greater than 99% at 80% bed saturation, based on

²⁹ Department of Urban Affairs and Planning, *Northside Storage Tunnel Proposed Modifications to Tunnel Configuration and Construction Works at Lane Cove and Scotts Creek*, Director-General's Report, July 1999, p.x.

³⁰ Department of Urban Affairs and Planning, *Northside Storage Tunnel Proposed Modifications to Tunnel Configuration and Construction Works at Lane Cove and Scotts Creek*, Director-General's Report, July 1999, p.x.

vent gases having a relative humidity range of 60-100%, and mercaptan removal efficiency greater than 99% at 70% bed-saturation;

- Design of the filter beds be based on an anticipated venting rate of 8m³/sec at Scotts Creek;
- A weather station be established;
- If there is evidence that the system is not performing to expectation, that additional plume dispersion modelling be conducted at the request of the Director-General.³¹

3.10 Granulated activated carbon filters were examined in the EIS in 1997. Mr Callaghan advised the Committee at the public hearing that “the original EIS that was prepared by Sydney Water nominated activated carbon filters as the appropriate technology.³² Selection of granulated activated carbon filtering as supported in the AWN Consultants’ report, which considered a number of alternative types of pollution control methods. The selection of the most appropriate technology was based on criteria of capital expenditure, on-going operating costs, minimum odour removal efficiency and odour contaminants. The alternatives considered were:

- Absorption (Wet Chemical Scrubbing);
- Biological Treatment (Biofiltration);
- Incineration; and
- Adsorption (Activated Carbon).³³

3.11 In evaluating these alternative processes, the consultant concluded the following:

Biofiltration is not considered an appropriate control option. The period required for bacterial population adjustment (several days) precludes its use with such an intermittent operation.

Time delays in the effectiveness of wet chemical scrubbing and incineration would occur due to; the dosing of chemicals to aim scrubbing liquor concentrations, in the case of scrubbing; in achieving the design combustion chamber temperature, in the case of incineration.

This could be overcome through commencing equipment operation prior to the flooding of the Tunks Park tunnel junction (when venting at Lane Cove and Scotts Creek is required), however, for safety reasons, neither option is considered acceptable. Scrubbing would require delivery and storage of concentrated sodium

³¹ Conditions 51B – 51N; Department of Urban Affairs and Planning, Modification of an approval granted under section 115B of the *Environmental Planning and Assessment Act 1979*, 31 August 1999, pp.3-6.

³² Evidence of Mr John Callaghan, Senior Associate, Connell Wagner Pty Ltd, and Design Manager, Northside Storage Tunnel Alliance, 9 August 2000, p.6.

³³ AWN Consultants, *Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents*, June 1999, pp.10-14.

hypochlorite and sodium hydroxide solutions. Incineration involves the discharge of high temperature exhaust gases, even with heat recovery.

Given the isolated nature of the vent locations, and the absence of on-site operating personnel, these are considered unacceptable risks.

Activated carbon adsorption, on this basis, would therefore be the preferred odour control technology.³⁴

Recommendation 1

The Committee recommends that, the independent post-construction audit report required under NST operation conditions, be tabled by the relevant Minister in each House.

³⁴ AWN Consultants, *Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents*, June 1999, pp.14-15.

Chapter 4 Community Consultation

Environmental Impact Statement consultation

4.1 In its submission to the Committee, Sydney Water indicated that Community Liaison Committees (CLCs) were established at the beginning of the NST project with all of the communities affected by the construction of the tunnel. As part of this community liaison, more than 330 meetings, as well as regular newsletters, letterbox drops and mediation, were used to inform the community and to facilitate opportunities to raise concerns. Outcomes from consultation relating to the 1997 EIS included design modifications such as burying part of the ventilation infrastructure underground to maintain visual amenity, relocation of construction sites, noise reduction and controls, traffic management, changed working hours and re-vegetation plans.³⁵

Review of Environmental Factors consultation

4.2 Statutory consultation also occurred during the 1999 REF process. On 21 June 1999, Sydney Water sought approval for the project in a letter to the Department of Urban Affairs and Planning. The letter was accompanied by a Representations Report, which addressed issues raised in representations from the public exhibition of the REF.³⁶ In making a decision on the REF, the Minister assessed the issues raised in the Representation Report.

4.3 Particular issues addressing the vent at Scotts Creek detailed in the Representations Report, related to potential odour and health impacts and the choice of odour control equipment. Key issues raised by the Scotts Creek community were:³⁷

- the decision not to implement proposed alternatives to a vent at Scotts Creek, on the grounds of cost (see Chapter 7 for discussion of alternative proposals);
- the removal of the vents at Tunks Park resulting in a significant increase in size of the Scotts Creek vent and volume of air vented;
- a need for the vent at Scotts Creek to be on higher ground to avoid thermal inversion;
- modelling at Scotts Creek not taking account of specific meteorological conditions;
- the need to independently cost alternative vent options;

³⁵ Submission No. 158, Sydney Water Corporation, p.34.

³⁶ Department of Urban Affairs and Planning, *Northside Storage Tunnel Proposed Modifications to Tunnel Configuration and Construction Works at Lane Cove and Scotts Creek*, Director-General's Report, July 1999, p.iii.

³⁷ Department of Urban Affairs and Planning, *Northside Storage Tunnel Proposed Modifications to Tunnel Configuration and Construction Works at Lane Cove and Scotts Creek*, Director-General's Report, July 1999, pp.12, 15-16.

- apparent dismissal of the return vent line to North Head on the grounds that it would delay completion of the project;
- a need for advice and information about the operating efficiency of filters, including their operation at high humidity levels;
- the need for more information about backup or mitigative measures in the event of a failure of the granulated carbon filters;
- the need for a study to be completed on proposed method of odour control;
- the modelling assumed a venting rate of 6m³ per second however the actual rate is 8m³ per second;
- the proposed vents would be a health risk to the residents of a nearby aged care facility and school students; and
- concern about whether the proposed filters will remove pathogens in aerosol solutions.

Mediation

4.4 Due to ongoing concern of the Scotts Creek community regarding the proposed ventilation shaft, potential adverse health effects and consultation process that had irretrievably broken down, the community asked the Minister for Urban Affairs and Planning to enter into formal mediation with Sydney Water.³⁸ In August 1999, an independent consultant was selected by the Scotts Creek community and agreed to by Sydney Water to mediate between the parties. During the mediation process, it was agreed that advice would be sought from experts in health, air quality and engineering (the mediation Experts Panel).³⁹

The Mediation Experts Panel

4.5 The members of the Mediation Experts Panel who were nominated by the Alliance and community representatives, were requested to focus on health issues related to the impact of the vent on the Scotts Creek environs. The Members of the Mediation Experts Panel included the following people:

- Dr Terry Bellair, Environmental Scientist, Agricultural Scientist and Biochemist, Consulting Environmental Engineers;
- Dr Steven Corbett, Manager, Environmental Health Branch, NSW Health;
- Dr Mark Donohoe, Environmental Medical Specialist, Medico-Legal Adviser and Researcher;
- Dr Kerry Holmes, Air Quality and Odour Consultant, Holmes Air Sciences;

³⁸ Evidence of Mr Brian Moran, President of the Parents Association of Glenaeon Rudolf Steiner School, 9 August 2000, p.32.

³⁹ Submission No. 158, Sydney Water Corporation, p.36.

- Prof Charles Kerr, Professor of Preventative and Social Medicine, Department of Public and Community Health, University of Sydney; and
- Terry Schulz, Air Quality and Odour Consultant, Chemical Engineer, CH2Mhill Consultants.⁴⁰

4.6 Prior to the Panel meeting, the mediators had agreed that should the experts indicate there was a health risk associated with the proposed vent or lack of consensus on whether such a risk exists, the mediators would proceed to investigate alternatives to venting the tunnel at Scotts Creek.⁴¹

4.7 The Mediation Experts Panel was unable to reach a consensus on the public health impacts of the proposed vent configuration:

One expert has abstained as he considers that the issue of health impacts is outside his area of expertise. The remaining five experts agree that the health impacts are difficult to quantify, but will not be of epidemic proportions. However, three consider that the public health impacts will be minimal and the other two consider that there is a risk of some discernible impact.⁴²

Outcome of mediation

4.8 Consequently, the mediating parties proceeded to examine other options for venting the tunnel. After five months of mediation, it was acknowledged by all participants that there had been no consensus reached and, in fact, no agreed or preferred outcome.

In conclusion, it was agreed by all parties that there was no way forward in terms of a mutually acceptable, single solution to the dispute between the parties and no possibility that a recommendation could be made as to a mutually acceptable solution.⁴³

Waterways Advisory Panel – Second Report

4.9 The Waterways Advisory Panel (WAP) was reconvened from July 1999, by the Hon. Kim Yeadon MP, Minister for Information Technology, Minister for Energy, Minister for Forestry and Minister for Western Sydney, to assess progress of the tunnel and report on a number of construction issues including community consultation. The WAP published its findings in March 2000 and made the following assessment of the community consultation conducted by Sydney Water and the Alliance:

⁴⁰ *Final Report on Mediation between Sydney Water and the Community of the Scotts Creek Area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment*, March 2000, p.9.

⁴¹ Submission No. 158, Sydney Water Corporation, p.36.

⁴² Advice from Expert Panel, *Final report on Mediation between Sydney Water and the Community of the Scotts Creek area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment*, March 2000.

⁴³ *Final report on Mediation between Sydney Water and the Community of the Scotts Creek area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment*, March 2000, p.34.

Sydney Water can significantly improve the way in which it responds to the concerns of communities. It is clear to the Advisory Panel that Sydney Water remains an organisation that is largely driven by engineering objectives and finds it difficult to take the initiative in interacting with the community. Sydney Water and the Alliance communicated through CLCs, but they failed to comprehend the concerns of members of the community, which relate to their social and environmental priorities.

...

The community of Scotts Creek catchment has also been distressed by the behaviour of Sydney Water and the Alliance. It has taken considerable effort from these two organisations to recover the trust of the community that was lost through their early dealings. The mediation process has been beneficial in this respect.⁴⁴

⁴⁴ Waterways Advisory Panel, *Second Report to the NSW Government on the Proposal by the Sydney Water Corporation for Sewage Overflow Abatement in Sydney Harbour*, March 2000, pp.8-9.

Chapter 5 Issues concerning odour

Much of the community concern raised during the course of the inquiry is related to the uncertain nature of the types and quantities of odorants and pathogenic (disease causing) micro-organisms in aerosols that may be emitted from the tunnel environment. This chapter considers issues relating to odour. Issues relating to health are discussed in the following chapter.

Gaseous odorants

5.1 Analysis of sewage odour in NSW and Victoria indicates that the major odorants emitted are sulphur containing compounds, which in descending order of significance are:

- Hydrogen sulphide;
- Methyl mercaptan;
- Dimethyl sulphide; and
- Dimethyl disulphide.

5.2 Identified odours of lesser significance such as reduced nitrogen and volatile organic compounds are listed in Appendix 4.

Regulatory bodies

5.3 The Environment Protection Authority (EPA) is an environmental regulator for the construction and operation of the NST under the *Protection of the Environment Operations Act 1997* (POEO Act). The role of the EPA is to advise the planning consent authority on appropriate environmental requirements for the project and to issue a licence consistent with consent conditions.

5.4 DUAP is the determining or planning consent authority for the NST development in accordance with powers under the *Environmental Planning and Assessment Act 1979*.

Regulatory requirements and licencing conditions

5.5 Stringent licence conditions have been imposed by the EPA and DUAP to regulate air emissions from the Northside Storage Tunnel. A key condition of approval imposed by DUAP with respect to air quality is:

The Proponent shall install, operate and maintain appropriate air pollution control equipment at Lane Cove River West and Scotts Creek to ensure that under all operating and meteorological conditions, discharges from the vent do not result in an offensive odour or air quality impact at or beyond the boundary of the premises of any sensitive receptors, or other locations(s) agreed by the EPA.⁴⁵

⁴⁵ Department of Urban Affairs and Planning, *Northside Storage Tunnel Proposed Modifications to Tunnel Configuration and Construction Works at Lane Cove and Scotts Creek*, Director-General's Report, July

- 5.6** Conditions E 3.1.1 and O 8.1 of the licence issued by the EPA for the construction and operation of the NST project impose conditions consistent with the DUAP consent. Further, section 129 of the POEO Act requires that Sydney Water must not allow the emission of any offensive odour from the premises to which the licence applies.
- 5.7** In addition to the licence requirements, there are also requirements under the *Clean Air (Plant and Equipment) Regulation 1997*. The clean air regulations require that emissions of hydrogen sulphide do not exceed 0.005 grams of hydrogen sulphide per cubic metre.

Monitoring of compliance with licence conditions

- 5.8** During the inquiry process, a concern was raised with respect to quantitative measures placed on odour for “ambient” air and air from “emissions”. By definition, ambient air refers to air quality from the surrounding or circulating air, which for example, would include odours detected from a property boundary. However, emissions will refer specifically to odour detected from air discharges from a direct source, in this case the Scotts Creek vent.
- 5.9** In its submission to the Committee, the EPA highlighted the absence of ambient air standards for hydrogen sulphide in NSW and explained how odour performance goals were determined:

...an odour performance criterion and design ground level concentration criterion of 2 odour units per cubic metre and 3 micrograms per cubic metre respectively were used by Sydney Water's consultants to determine the required emission rates of odour and hydrogen sulphide from the vent stack...The EPA understands that the hydrogen sulphide dispersion modelling indicated that the design ground level concentration criterion could be met.⁴⁶

- 5.10** The EPA licence does not make reference to ambient air quality standards for odour and hydrogen sulphide, however ambient air quality objectives are used by the EPA as a regional assessment and reporting tool. In relation to this objective the EPA stated:

They are not used by the EPA to specify the maximum concentrations that can be discharged at the point of emission from individual premises. The reason for adopting this approach is that a pollutant present in ambient air may be emitted from a variety of sources.⁴⁷

- 5.11** When asked how the EPA will determine whether compliance with licence condition 3.1.1 was being achieved, given there are no quantitative limits on hydrogen sulphide and odour concentrations at the point of emission, Mr Joe Woodward, Acting Assistant Director General of the EPA indicated:

The EPA licence will require continuous monitoring of the temperature, flowrate and hydrogen sulphide concentration in the emissions from the vent. Within six

1999, p.36, imposed as Condition 51B in the modification to the approval granted under s115B of the EP&A Act.

⁴⁶ Submission No. 173, Environment Protection Authority, p.2.

⁴⁷ Submission No. 173, Environment Protection Authority, p.2.

months of commencement and during a filling event, further detailed monitoring will be required including odour concentrations. This information will be used to check the predictions used in the original modelling of the proposal. All this information must be submitted to the EPA and will also be available to the public.⁴⁸

5.12 With respect to the vent being able to meet ambient air quality goals set for the project by NSW EPA, Dr Kerry Holmes of Holmes Air Sciences, stated:

... the assessment that I did was very conservative. It certainly took account of worst case dispersion conditions, which would certainly occur in the valley, but it also assumed that the vents would be emitting continuously, and the goal that the New South Wales EPA set for odour was a frequency-based goal. It was a goal which said that two odour units, which is a measure of odour level, should not be exceeded more than one per cent of the time throughout a year, but in the modelling that I undertook I assumed that the vent was emitting continuously every hour of the day throughout the whole year.⁴⁹

5.13 The Committee requested information as to what safeguards will be put in place to ensure proper control and monitoring of the licence requirements. Sydney Water provided the following information to the Committee:

Stringent licence conditions have been imposed by the EPA and DUAP to ensure that controls to the Scotts Creek filtered vent are fully implemented and maintained.

Sydney Water proposes a rigorous inspection and maintenance program to be carried out on the granulated activated carbon filters on a regular basis. The activated carbon filters installed have been specified with a five-year operating life. Nevertheless appropriate tests will be carried out to ensure that they remain viable and are changed before they reach 80 per cent saturation.

Samples of activated carbon will be collected from the 30 per cent, 50 per cent and 80 per cent locations in the bed on a quarterly basis in the first year of operation and analysed for H₂S adsorptive capacity. The results of testing in the first year will provide Sydney Water with information necessary to forecast the operating life of the activated carbon bed.

Thereafter, testing will be carried out on a regular basis with sampling frequency and sampling and analytical methods approved by the EPA. Testing will include total sulphur and volatile organic compound adsorptive capacity.

The exit stream (vented air) will be continuously measured for H₂S, flow rate and temperature. This information is continuously monitored at Sydney Water's Strategic Operating Centre, with appropriate alarms and data recording.

Odour emissions sampling and analysis will be undertaken. This will be carried out on air being discharged from the Scotts Creek filtered vent during an overflow

⁴⁸ Correspondence from Mr Joe Woodward, Acting Assistant Director General, NSW Environment Protection Authority, dated 21 August 2000, p.3.

⁴⁹ Evidence of Dr Kerry Holmes, Air Quality Consultant, Holmes Air Sciences, 9 August 2000, p.79.

event and the sampling and analysis program must be approved by the EPA. The following information will be collected:

- Discharge velocity (m/s)
- Discharge temperature (deg C)
- Discharge rate wet and dry basis (m³/min)
- Moisture content (%)
- Odour concentration.

A weather station is being installed at Scotts Creek to collect local data for temperature, wind speed and wind direction. In future, additional plume dispersion modelling may be required and the data collected from the weather station will be used in the analysis.

The Scotts Creek vent has a high level of redundancy built into its operating systems. It has a spare ventilation fan, back up power for all instrumentation and critical control functions.

The average non-use period for the tunnel (length of time between overflows) is at least 20 days, leaving plenty of time for any required maintenance. The replacement of the activated carbon from all three beds will take 3–4 days, and will be required no more often than every 5 years. The multiple parallel beds in the Scotts Creek activated carbon filter allow single beds to be replaced progressively.

Additionally, Sydney Water will operate the Northside Storage Tunnel in accordance with the OEMP, which specifies the environmental requirements for the operation of the tunnel. The OEMP is being prepared to the satisfaction of the Director-General of DUAP, following the consideration of community and stakeholder input and consultation with the relevant approval/consent authorities.

In addition, the design of the Scotts Creek facility provides significant information on the status and performance of the filters and associated equipment. This includes:

- Inlet H₂S (continuous)
- Outlet H₂S (continuous)
- Vented Air Outlet Temperature
- Vented Air Outlet flow rate
- Air Inlet Temperature (to GAC Filter)
- Air Inlet Pressure
- Carbon Filter Differential Pressure
- Prefilter Differential Pressure
- Ventilation Fan Status (Duty/Standby, On/Off)
- Damper(s) Status
- Dilute Sewage Overflow Rate (to Tunnel)
- Penstock(s) Position

- NSOOS Flow and Pressure
- Overflow Flowrate to Scotts Creek (environmental overflow)
- Pressure Relief Valve Status
- Vacuum Breaker Valve Status
- Water Level in Tunnel
- Wind speed, direction and ambient temperature
- Ancillaries Status (ventilation, dewatering, security, fire protection, etc)
- Incoming Power Status
- Back-up Power Status

Most of this information is telemetered to the Sydney Water 24 hour staffed Strategic Operations Centre, all critical information is displayed and abnormal levels are alarmed for Operator response and action.⁵⁰

5.14 Mr Geoff Noonan, Director, Development and Infrastructure Assessment at DUAP, was asked how DUAP would ensure monitoring of the vent will be fully implemented and maintained. Mr Noonan stated that:

The conditions were specifically written to regard the Scotts Creek vent as a high risk circumstance. We have many approvals, but this one we classify as a high risk activity. Therefore, Sydney Water is required to prepare...an almost constant flow of data and reports on performance that we do send to other relevant agencies, in particular the air quality monitoring expertise in the EPA to review as well.

In other words, when we determine an activity to be higher risk, it then goes under our microscope and we have computer-based tracking systems that follow up within a week if those reports do not arrive on our desk. Those reports are public. Once they hit our desk they are available to the community to scrutinise as well.⁵¹

Operation of monitoring equipment in a humid environment

5.15 In evidence before the Committee, Mr Ralph Kaye, air pollution consultant to Glenaeon Rudolph Steiner School, indicated that from his own direct observations, hydrogen sulphide monitoring systems might be rendered ineffective through saturation as a result of humid tunnel environment:

That the monitoring lines become or the system becomes so wet and so much water is emitted from the system as aerosols that in fact it could fill the monitoring lines that are used to detect hydrogen sulphide in the emission and that that amount of water is sufficient to render that equipment inoperative.⁵²

⁵⁰ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.39-40.

⁵¹ Evidence of Mr Geoff Noonan, Director, Development and Infrastructure Assessment Branch, Department of Urban Affairs and Planning, 10 August 2000, p.17.

⁵² Evidence of Mr Ralph Kaye, Air Pollution Consultant, 10 August 2000, p.27.

- 5.16** In contrast, Sydney Water has advised that it is confident that the monitoring system for the Northside Storage Tunnel will not be rendered ineffective through saturation as a result of humid tunnel environment:

Sewage Pumping Station (SPS) 138 at Padstow and SPS 630 at Hoxton Park have activated carbon filters installed for odour control. Both filters commenced operation in January 1999 and are envisaged to have a 5 year operational life before requiring replacement of the activated carbon bed.

No quantitative odour monitoring has been carried out on either activated carbon filter.

However, both filters have been effective in reducing odours as measured by the reduction in odour complaints received from the community. In fact, since the installation of both filters, only one (1) odour complaint has been received relating to SPS 138. This complaint occurred when the activated carbon filter had been turned off to enable painting at SPS 138.

...

An inspection of the filter at SPS 138 in December 1999 (11 months after operation commenced) indicated the carbon bed was only 20 per cent spent. This indicates that the activated carbon filters will be effective in removing odours for several more years before the activated carbon requires replacing.⁵³

Effectiveness of activated carbon filters

- 5.17** During the course of the inquiry, the Committee sought to determine whether the granular activated carbon filters are an appropriate and effective device for controlling odour.
- 5.18** In response to a question about whether the activated carbon filters were the appropriate choice for the vent, Mr John Callaghan from Connell Wagner, a member of the Alliance stated:

The original EIS that was prepared by Sydney Water nominated activated carbon filters as the appropriate technology. The Alliance project team then undertook its own assessment of what was an appropriate technology to filter the air at the vents at Lane Cove and Scotts Creek and also at the other sites, including North Head.

We also took specialist advice from Kerry Holmes and from Terry Schultz of CH2MHill, who are renowned odour specialists, and we formulated what we considered appropriate technology, looking at the various options available and also how the tunnel operates, the fact that it is intermittent by nature, it does not operate very often and so it needs a particular type of technology that best suits that approach.

⁵³ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, p.32.

We selected impregnated granulated activated carbon as the appropriate technology, based on all of that advice. That happened to be endorsed by DUAP's independent expert, Frank Flerer, in a report that he provided to DUAP at the time, and we also took advice from Sydney Water.

So, based on all of that design approach, independent advice looking at what was world's best practice and appropriate technology, we selected the impregnated activated carbon filters for Scotts Creek.⁵⁴

5.19 Dr Holmes was asked whether the Scotts Creek filter will always emit odour concentrations containing 50 odour units or less. Dr Holmes responded:

...I would note that the EPA criteria relate to an environmental outcome. They are not prescriptive about the way in which that outcome should be met. The goal is based on compliance with 2 odour units for 99% of the time. One way would be for the vent to emit continuously at 50 odour units or less. Other ways would be to have zero emissions for a larger proportion of the time and higher than 50 odour units on some occasions.

In summary, it is not necessary for the Scotts Creek vent to emit less than 50 odour units all the time. Given that it will have effectively zero emissions for about 95% of the time, some excursions over 50 odour units could occur and compliance still [be]achieved.⁵⁵

5.20 Mr Ralph Kaye, contended that Sydney Water would not be able to meet its 50 odour units air quality goal. Mr Kaye cites information contained in a Sydney Water report showing that hydrogen sulphide emissions at North Head exceeded 5 ppm. He submitted that the report:

...plainly shows that hydrogen sulphide routinely and substantially exceed 5 ppm. In total, hydrogen sulphide concentrations exceeded 5 ppm during 87 days for the 1998/1999 licensing year. Maximum hydrogen sulphide concentrations exceeded 21 ppm.⁵⁶

5.21 Further he expressed that the air quality goals established for operation of the Scotts Creek vent will be technically difficult to achieve:

There are no design modifications to the vent stack or to the activated carbon filter that could make the emission comply. Furthermore, the EPA's air quality goal could not be achieved with any known odour treatment technology. I think you only have to look at the design specification for the North Head chemical scrubber for confirmation of that.⁵⁷

⁵⁴ Evidence of Mr John Callaghan, Senior Associate, Connell Wagner Pty Limited, and Design Manager, Northside Storage Tunnel Alliance, 9 August 2000, p.6.

⁵⁵ Correspondence from Dr Kerry Holmes, Air Quality Consultant, Holmes Air Sciences, dated 21 August 2000, p.4.

⁵⁶ Submission No.97, Mr Ralph Kaye, Air Pollution Consultant, p.9.

⁵⁷ Evidence of Mr Ralph Kaye, Air Pollution Consultant, 10 August 2000, p.25.

5.22 In response to Mr Kaye's contention, Sydney Water advised the Committee that the information quoted by Mr Kaye regarding hydrogen sulphide concentrations at North Head was not comparable with respect to Scotts Creek:

... the H₂S concentration levels he quoted were for dry weather flows...[and] the H₂S levels during wet weather flows (when the tunnel operates) are much lower and the typical level for wet weather flows is 1–2 ppm, with a maximum of 3.8 ppm in the 1998/99 period quoted.⁵⁸

5.23 In its submission to the Committee, Sydney Water further argued that emissions from ventilation stacks on its major sewers that ventilate the raw sewage upstream from sewage treatment plants could not be compared with sewage in the NST. The submission states that the vented air of the stacks on major sewers contain:

...far higher concentrations of odorous contaminants, principally hydrogen sulphide, than is likely for the vents on the storage tunnel because of the highly diluted nature of sewage overflow in wet weather.⁵⁹

5.24 To demonstrate that activated carbon filters may be effective in controlling odour, Sydney Water referred to its Hoxton Park and Padstow sewage pumping stations as examples. The submission from Sydney Water stated that activated carbon filter units were installed in response to complaints from residents. Sydney Water argues that odour problems at the pumping stations have abated as demonstrated by no further complaints from residents.⁶⁰

5.25 During the REF process, concerns were raised in a number of community submissions about the effectiveness of activated carbon systems in high humidity situations. The report by AWN Consultants addressed these concerns and stated:

The adsorptive capacity of standard activated carbon decreases with increasing temperature and increasing relative humidity. For increasing contaminant concentration and increasing pressure, the adsorptive capacity is increased. For impregnated carbons, however, increasing relative humidity actually enhances chemisorption of the reduced sulphur compounds.⁶¹

5.26 In evidence, the Committee also asked Dr Holmes to verify whether the activated carbon filter will work correctly in a wet environment. Dr Holmes responded that the granular activated carbon would certainly remove hydrogen sulphide in a high humidity environment.⁶²

⁵⁸ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, p.29.

⁵⁹ Submission No. 158, Sydney Water Corporation p.42.

⁶⁰ Submission No. 158, Sydney Water Corporation p.42.

⁶¹ AWN Consultants, *Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents*, June 1999, pp.20; citing personal communication with Carbon Link Corporation, dated 8 June, 1999.

⁶² Evidence of Dr Kerry Holmes, Air Quality Consultant, Holmes Air Sciences, 9 August 2000, p.79.

Conclusion

- 5.27** The Committee notes there is disagreement about the concentration of hydrogen sulphide emissions which may emanate from the Scotts Creek vent. Further, there is a suggestion that monitoring equipment may be impaired during operation of the vent. The Committee has however, been assured by Sydney Water that close monitoring of hydrogen sulphide will occur and that data collected will be made publicly available.
- 5.28** It is the Committee's view that in order to restore public confidence, it is imperative that independent monitoring of emissions and verification of results be permitted on the Scotts Creek vent site.

Recommendation 2

In the event the Scotts Creek vent commences operation, the Committee recommends that Sydney Water engage an independent consultant to conduct random monitoring and verification of hydrogen sulphide emissions.

Recommendation 3

The Committee recommends that Sydney Water and the EPA investigate the potential problem that hydrogen sulphide monitoring equipment may be rendered inoperative through saturation and report the results to the House.

Chapter 6 Issues concerning health

The most significant issue raised in this inquiry was the concern expressed by of the Scotts Creek community groups in relation to health risks associated with operation of the Scotts Creek vent. A member of the Scotts Creek Community Liaison Council, Mrs Wendy Norton, expressed this concern in evidence before the Committee:

Matters which have been of grave concern to us and are still not satisfactorily resolved include the lack of application of the precautionary principle to the venting at Scotts Creek. It is apparent that the notion of possible health effects of the venting was not considered by the Alliance until they were raised by CLC members. Also, absence of evidence that the vent will be safe. There has been a steadfast refusal to address our concerns regarding health.⁶³

Despite concerns expressed by the Scotts Creek community, Sydney Water expressed a firm view that no significant health risks are posed by the Scotts Creek vent:

Sydney Water and the Alliance have undertaken and commissioned extensive research into the potential health and odour risks associated with the Scotts Creek vent. Numerous studies in the vicinity of STPs have shown no significant health effects, either to workers or to the communities (including schools) who live and work around the plants. There is absolutely no evidence to suggest that there will be emissions of unidentified toxic compounds that will affect the health of residents or schoolchildren in the neighbourhood of the vents.⁶⁴

NSW Health expert panel

6.1 On 31 August 2000, one week prior to the original reporting date for the inquiry, the Committee received correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer of NSW Health, indicating that on 23 August 2000 he had

⁶³ Evidence of Mrs Wendy Norton, Scotts Creek Community Liaison Committee, 9 August 2000, p.31.

⁶⁴ Submission No. 158, Sydney Water Corporation, p.8; Sydney Water provided the following list of studies relating to potential health and odour impact: CH2MHill (Terry Schulz) – *Tunnel Ventilation Odour Impact Assessment* (May 1999); CH2MHill (Terry Schulz) – *Letter to the Alliance re Odour Responses* (2 June 1999); Holmes Air Sciences (Dr Kerry Holmes) – *Appraisal of Odour Issues for Northside Tunnel Storage Tunnel Vents* (May 1999); Holmes Air Sciences (Dr Kerry Holmes) – *Northside Storage Tunnel: Odour and Health Impacts of Vent Operation at Scotts Creek and Lane Cove River West* (September 1999); Professor Charles Kerr (University of Sydney) – *Northside Storage Tunnel Project: Public Health Risk* (June 1999); Dr Stephen Corbett (NSW Health Department) – *Letter to Northside Storage Tunnel Project Alliance Attn: Andrew Wild* (4 June 1999); Odour and Corrosion Technology Consultants, Inc (J Joyce) – *Health Effects of Exposure to Raw Wastewater Aerosols* (1999); Foundation for Water Research – *Health Hazards at Wastewater Treatment Works – The Implications of the COSHH Regulations* (June 1994); Waterways Advisory Panel – *Second Report to the NSW Government on the Proposal by the Sydney Water Corporation for Sewage Overflow Abatement in Sydney Harbour* (March 2000); *Final Report on Mediation Between Sydney Water and the Community of the Scotts Creek Area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment* (March 2000); Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.4-5.

convened a meeting of an expert panel of microbiologists and public health physicians to advise him on potential health problems related to the commissioning of the Scotts Creek and Lane Cove vents.⁶⁵ The members of the Chief Health Officer's expert panel convened were:

- Prof Lynn Gilbert – Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital;
- Prof Adrian Lee – Pro Vice-Chancellor (Education) University of NSW (Former Head of Microbiology and Immunology, University of NSW);
- Prof Tania Sorrell – Professor of Clinical Infectious Diseases, University of Sydney and Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital;
- Dr Dominic Dwyer – Medical Virologist, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital;
- Dr David Cuncliffe – Microbiologist, Department of Human Services, South Australia;
- Dr Jeremy McAnulty – Medical Epidemiologist, NSW Health;
- Dr Stephen Corbett – Public Health Physician, NSW Health.

6.2 At this most recent meeting of the Chief Health Officer's expert panel⁶⁶, Assoc Prof Ray Kearney, from the Department of Infectious Diseases, University of Sydney, was invited to present his scientific opinion to the assembled group. Notwithstanding conflicting evidence presented by Assoc Prof Kearney, the expert panel concluded it was satisfied the Scotts Creek vent would not pose an increased public health risk for the surrounding community.⁶⁷

6.3 In order to further consider matters raised by Dr Wilson, the Committee resolved to extend the reporting date of the inquiry and conduct an additional public hearing on 9 October 2000 to obtain further evidence from the Chief Health Officer's expert panel members and Assoc Prof Kearney.

6.4 At the hearing on 9 October 2000, Prof Lyn Gilbert and Dr Dominic Dwyer from the expert panel appeared alongside Dr Wilson, the Chief Health Officer. The Committee questioned Dr Wilson as to why this expert information was not available prior to the earlier Committee hearings. In response, Dr Wilson stated:

⁶⁵ Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 30 August 2000.

⁶⁶ The expert panel was first convened to brief the Chief Health Officer on the Northside Storage Tunnel project in late July 2000: Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 20 October 2000, p.2.

⁶⁷ Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 30 August 2000.

The advice you have received is from the expert panel which was convened as soon as I was able to do so for the purposes of informing this Committee. It may have been unfortunate that it was not available to you at that time, but as soon as I became aware that this information would be useful to you I convened the committee as soon as I could.

...

I was concerned that as well as that advice the Committee should have some independent advice from people with international reputations. I believe that what we were giving you was additional information of some substance in that regard.⁶⁸

Micro-organisms in sewage

6.5 The major health concerns centred on risks associated with the various types of pathogens that might be emitted from the Scotts Creek vent including:

- the types of pathogens in sewage that may pose a risk;
- the risk of pathogen transfer from the tunnel to the vent;
- the effectiveness of the vent filter to minimise the emission of pathogens;
- the potential of the filter to be a growth medium for *Legionella*; and
- risks of harm to human health if pathogens are emitted from the vent.

6.6 The various types of pathogenic micro-organisms that can be found in raw sewage include bacteria, protozoa, helminths and viruses.⁶⁹

6.7 Professor Charles Kerr, stated that:

...any pathogenic organisms in sewage diluted by rainfall will be at such low concentrations in the emitted aerosol that the chances of harmful effects arising from their ingestion are negligible.⁷⁰

6.8 A contrary view was presented by Assoc Prof Kearney, who stated that recent studies have shown there are many organisms that exist in sewage that have not been tested for pathogenicity:

...the organisms in sewage have not yet all been cultured—perhaps only one per cent of them have been cultured. We do not know what we have got in there and all we can do is culture what is culturable and what will grow under those conditions. It was not so long ago when today the most common cause of gastritis

⁶⁸ Evidence of Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, 9 October 2000, p.3.

⁶⁹ AWN Consultants, *Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents*, June 1999, pp.8-9; citing AM Brown, *Wastewater Treatment Works and Health (Report to Hunter Water Corporation)*, Discipline of Environmental and Occupational Health, Faculty of Medicine, The University of Newcastle, May 1993.

⁷⁰ Prof Charles Kerr, *Northside Storage Tunnel Project: Public Health Risk*, June 1999, p.1.

in the Sydney area caused by *Campylobacter jejuni* was isolated and grown. My point is that there are organisms in there that you can see when you stain a smear but when you try to culture from that medium you only get a few.

...

We can only assess the pathogenicity of what we can culture. The rest of it is a black box...⁷¹

Conditions for pathogen presence in the tunnel

6.9 During the course of the inquiry, the Committee sought to establish whether tunnel conditions would be conducive to the proliferation of pathogenic micro-organisms. The Committee was particularly interested in determining whether *Legionella* could survive or proliferate in the tunnel. On this issue of *Legionella* viability NSW Health submitted:

...Conditions in sewage are, however, not conducive for Legionella proliferation, particularly in the storage tunnel as Legionella requires warm (above 30 degrees) undisturbed water to proliferate and reach levels sufficient to cause disease.⁷²

6.10 With respect to temperatures in the tunnel however, Assoc Prof Kearney indicated that while *Legionella* would probably not grow to the point where large numbers will occur under 20 degrees Celsius, it will certainly survive under that temperature.⁷³

6.11 In evidence, Prof Lyn Gilbert confirmed the temperatures range within which *Legionella* could survive, but also added the following comments:

Legionella multiplies best at around 30 degrees Celsius. At 20 degrees Celsius it will survive in small numbers. Interestingly, there is some work that suggests that at those numbers, although it survives, the amoebae that live quite happily at that concentration actually ingest and kill them. It is only at higher temperatures that they survive within the amoebae. That is probably one of the reasons why the higher temperatures are more potentially dangerous in terms of infection and why warm water systems and cooling towers are more likely to be the cause of legionella rather than sewage where the temperature is generally too low for the combined effect of both the amoebae and the legionella to survive.⁷⁴

6.12 In correspondence to the Committee, Sydney Water provided details of tunnel temperature conditions collected during construction of the tunnel:

Temperatures collected during construction indicate that the temperature in the tunnel is typically 20 degrees Celsius, with construction activities including large machinery operating. It is highly improbable that the temperature of materials

⁷¹ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 10 August 2000, p.50.

⁷² Submission No. 163, NSW Health, p.3.

⁷³ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 10 August 2000, p.46.

⁷⁴ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.24.

deposited in the tunnel will exceed 22 degrees Celsius and for most of the year the temperature will be in the range of 17 to 20 degrees Celsius.⁷⁵

- 6.13** In addition to temperature conditions in the tunnel, the Committee sought to identify whether or not water in the tunnel would be sufficiently still to sustain *Legionella*. The Alliance was asked whether, it would be possible for stagnant pools of water to form when the tunnel is not operating. Mr Dietsch responded:

The design of the tunnel is a continuous grading tunnel. It has fairly relatively flat slopes, but it slopes from both Scotts Creek and from Lane Cove all the way to North Head and it varies, depending on the geological features that it had to pass through.

At the moment, we are in the process of completing the concreting of the base of the tunnel and we have set fairly tight constraints on what the accuracy for ponding in that is and, therefore, we do not expect any significant ponds of material.

In addition to that, because of the depth of the tunnel, and it is essentially below the groundwater system, there is always positive groundwater pressure in the tunnel, so there is infiltration into the tunnel of slightly salty water in most of those areas. That, at the moment, based on our current information, is estimated to perhaps be four to five megalitres per day that will flow through the tunnel. So that fresh water will, in fact, flush through any of the ponding that happens to be in the base of the tunnel.⁷⁶

- 6.14** Along with the issue of ponding in the base of the tunnel, the Committee sought to identify whether *Legionella* could breed in the unlined walls of the tunnel. The Committee asked Prof Charles Kerr, Professor of Preventative and Social Medicine, University of Sydney, whether *Legionella* could breed in droplets of water in the tunnel on the roof or on the sides that may not be flushed. Prof Kerr stated that:

If it were stagnant enough to produce biofilms, that is, other organisms and slime organisms, then it could, yes.⁷⁷

- 6.15** The Committee further asked Prof Kerr, that if the tunnel were to fill rapidly and the air were vented very fast and the filtration system was bypassed, would it possible for *Legionella* to be vented into the air at Scott's Creek. Prof Kerr replied:

It is possible, but unlikely. The environment is still hostile for these organisms to flourish.⁷⁸

⁷⁵ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, pp.3-4.

⁷⁶ Evidence of Mr Alec Dietsch, Engineering Manager, Northside Storage Tunnel Alliance, 9 August 2000, pp.12-13.

⁷⁷ Evidence of Prof Charles Kerr, Department of Public Health and Community Medicine, University of Sydney, 9 August 2000, p.59.

⁷⁸ Evidence of Prof Charles Kerr, Department of Public Health and Community Medicine, University of Sydney, 9 August 2000, p.59.

- 6.16** The Committee further asked Prof Kerr, if impurities in sewage may adhere to the sandstone whether there would be a medium there which might grow things. Prof Kerr stated that:

It is possible. You are dealing with an ubiquitous organism.⁷⁹

- 6.17** The Committee noted the comments of Assoc Prof Kearney with respect to risks which may not be immediately present, but which may increase over time:

The quantification of health risk in this tunnel system...can be assessed only after the tunnel is opened and operational for some months – years, ie, when slime and biofilms etc have built up on the immense surface of the tunnel.

The point made is that the dynamics of risk to health will change and in all probability, with time, worsen. This will need to be taken into consideration with any epidemiological study.⁸⁰

Evidence of public health risks from pathogens in sewage

- 6.18** In light of the varying evidence concerning the conditions in which *Legionella* grows, the Committee attempted to ascertain whether or not there was any scientific evidence of risk from *Legionella* in sewage. Written advice from Prof Charles Kerr of the University of Sydney to the school council of the Glenaeon Rudolf Steiner School, on the issue of *Legionella* stated:

...As to the legionellosis situation, I never regarded it as a 'high potential risk' but as a possible infectious hazard mainly because a large majority of infections have arisen with enclosed built environments via contaminated water towers of air conditioning systems. The risk of any exposure in open air would, of course, be very much smaller. As I understand it, *Legionella* bacteria need a stagnant environment to thrive and any sort of flushing, even with raw sewage, would be enough to prevent them building up in a biofilm.⁸¹

- 6.19** The Committee asked Dr Corbett whether NSW Health could guarantee there would not be a problem of *Legionella* being emitted from the vent. In response Dr Corbett explained that an assessment regarding *Legionella* was made from experience of public health hazards:

Clearly, information about its biology, its temperature dependence, is germane to that discussion but it is certainly not the only factor you would use to assess the potential hazard. To give you an example, *Legionella* outbreaks have most often been associated, as most people would be aware, with air cooling towers. There are 15,000 or so of those in Sydney alone. New South Wales Health regulates that as a public health hazard.

⁷⁹ Evidence of Prof Charles Kerr, Department of Public Health and Community Medicine, University of Sydney, 9 August 2000, p.59.

⁸⁰ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 20 October 2000, p.43.

⁸¹ Correspondence from Prof Charles Kerr, Department of Public Health and Community Medicine, University of Sydney to Chairperson, School Council, Glenaeon Rudolph Steiner School, 6 July 2000, provided to the Committee as part of Submission No. 169, Glenaeon Rudolf Steiner School.

We are familiar with, to a certain extent, the conditions under which outbreaks of *Legionella* can occur and, I guess, we have made a judgment in this situation that, whilst it is a theoretical possibility, we have to look at whether it is in our view an actual possibility, and our judgment in this case has been that it is not. So, I do not think we are in the business of giving absolute guarantees about safety. With a ubiquitous organism such as *Legionella*, I do not think that is possible. Our judgment is that the risk is extremely low in this context.⁸²

6.20 The Waterways Advisory Panel undertook a review of the Scotts Creek vent as part of its report on progress of the Northside Storage Tunnel project. Advisory Panel member Mr Bob Wilson informed the Committee that the Advisory Panel had found that the filtered vent is environmentally acceptable, poses minimal health risk to the local community and represents a substantial improvement on the current environmental conditions in that valley.

6.21 In evidence to the Committee, Mr Wilson said in view of the lack of evidence of public health impacts from the filtered vent, that a way to resolve the matter would be the installation of an alarm system to alleviate concerns in the community:

I think we are happy that the Scott's Creek vent is going to be built and that it will make the whole system work much better. I cannot comment on the Legionella issue. Up to the time that we submitted our report, we were happy that the vent was safe but we thought that an alarm system needed to be available to the public to communicate those issues so they could see that those issues were being dealt with and that they could actually find out from Sydney Water whether proper monitoring of any discharge was taking place.⁸³

6.22 Dr Corbett expressed the need to place this risk assessment in terms of practical possibilities:

... in the context of the risk as we know it as practising health physicians in New South Wales, and I think, as I said, it is important for us to make a very important distinction between theoretical and actual possibilities in terms of the potential to cause disease.⁸⁴

6.23 A submission provided by Mr Clive Broadbent AM, who was made a Member in the Order of Australia⁸⁵ for his work on control measures for Legionnaires' disease hazards, stated:

No known outbreak, or even cases, of Legionnaires' disease in Australia have yet been traced to sewage systems. Nonetheless, the possibility exists as the causative agent is present.⁸⁶

⁸² Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.44.

⁸³ Evidence of Mr Bob Wilson, Waterways Advisory Panel Member, 9 August 2000, page 68.

⁸⁴ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.47.

⁸⁵ "For service to the promotion of environmental health and safety in the field of mechanical building services, particularly the occurrence of legionella bacteria in cooling towers": <http://www.itsanhonour.gov.au/receipients/oa%5Fmember%5F2000/broadbent.htm>

⁸⁶ Submission No.24, Clive Broadbent and Associates Pty Ltd, p.1.

- 6.24** Although the presence of the *Legionella sp.* micro-organism in sewage was a significant focus of attention during hearings for the inquiry, it was the view of Dr Mark Donohoe, a medical practitioner in the field of environmental medicine, that the focus on *Legionella* in the community was because of its severity as an illness. However he warned of the potential prevalence of many other less serious pathogens:

The *Legionella* organism, in my opinion, is grossly overrated as a massive focus on one organism because of our awareness of the severity of the illness it can cause to the exclusion of many other illnesses, which can be not as serious but more prevalent. No, I believe you heard Ray Kearney and others who are expert on *Legionella* give their advice. I have seen *Legionella* cases, but I have seen them mainly from air conditioning or what is suspected to have been air conditioning exposure rather than anything to do with sewage.⁸⁷

- 6.25** Assoc Prof Kearney expressed a similar view regarding focus on *Legionella* during his evidence:

I am rather concerned that there is a preoccupation with *Legionella*. There are other organisms as well that are more important⁸⁸

- 6.26** It was the view of Prof Lyn Gilbert that release of pathogenic micro-organisms from the vent was not a great concern:

I think the chances of any pathogenic micro-organisms at all being released from the vent are extremely small. Therefore, it is difficult to make any assessment of what organisms they would be because, to be honest, I do not think that there will be microbiological organisms released from the vent.⁸⁹

- 6.27** Dr Dwyer further advised:

We discussed in the panel the source of viruses that are associated with sewage and they really relate to the family of viruses that the Chair mentioned, the Coxsackie virus and its related members, which also includes polio. There are other viruses such as Hepatitis A and those are really the main groups that are transmitted from sewage and for any community that does not have good sewerage, these pathogens are particularly important. Those viruses were discussed. Other viruses are not really an issue because they do not survive in sewage very well. Most viruses have an envelope around them, which means that they are relatively sensitive to the environment. Therefore, viruses such as Hepatitis C, HIV, and influenza are not transmitted this way and are completely irrelevant to the discussion. The discussions were really limited to these gastro and testinal viruses.⁹⁰

⁸⁷ Evidence of Dr Mark Donohoe, Medical Practitioner, 10 August 2000, p.39.

⁸⁸ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 10 August 2000, p.47.

⁸⁹ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.3.

⁹⁰ Evidence of Dr Dominic Dwyer, Medical Virologist, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.27.

6.28 Nevertheless, during the public hearing on 9 August 2000, Dr Corbett from NSW Health indicated that the risk of *Legionella* from the tunnel was as yet unquantified. He stated that the expert panel agreed that:

...this is an eminently testable proposition and we discussed with Sydney Water the possibility of testing it.⁹¹

Conclusion

6.29 There would appear to be insufficient scientific evidence before the Committee to determine whether or not there is a significant risk of certain pathogenic micro-organisms remaining viable or proliferating in the tunnel environment. NSW Health have however, indicated it is possible to conduct appropriate testing for *Legionella* and other pathogens and it is the Committee's opinion that this should occur as soon as possible and be conducted on a regular basis.

Recommendation 4

The Committee recommends that NSW Health immediately prepare appropriate testing protocols to regularly evaluate the potential public health risks from *Legionella* and other pathogenic micro-organisms that may survive and proliferate in the Northside Storage Tunnel.

Late recognition of health issues

6.30 Both submissions and evidence before the Committee indicated that Sydney Water and NSW Health may not have addressed potential health risks of the Scotts Creek vent until the REF was published. The submission from the Glenaeon Rudolph Steiner School makes this point:

Sydney Water did not seek advice on health risks until forced to do so by the community, in May 1999, when the REF had already been prepared.⁹²

6.31 In evidence, Dr Andrew Wilson, Chief Health Officer, NSW Health, indicated that NSW Health prepared a submission on the EIS for the NST in October 1997 however he indicated that it may also have been beneficial for NSW Health to have been involved in the later community consultation process:

We provided initial advice in relation to the original EIS and where we have been asked to do so we provided that information. I believe that where we could do better next time is by becoming involved in the community consultation process earlier and being involved earlier in understanding the community's concerns and where they are coming from. My understanding is that we first became involved at

⁹¹ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.45.

⁹² Submission No.169, Glenaeon Rudolph Steiner School, p.3.

the time when mediation was already under way and it may have been better for us to have been involved earlier.⁹³

6.32 That NSW Health was not included in community discussion on health issues during the project was also acknowledged by Dr Corbett:

I think the first contact we had with this issue was when we received the REF report. But then I was subsequently called, along with Professor Kerr, to be a member of the community consultation panel, and that was really the first opportunity that we had.

In fact, this was a slightly unusual proposal in some senses in that the first time that the department became involved in terms of talking to the community was at a mediation session. Quite commonly with these proposals, we get involved directly with community members before that but my first real involvement was as, I guess, a public health expert and member of the mediation panel that was called...⁹⁴

6.33 Dr Corbett indicated that NSW Health was not cognisant of community concerns about health issues concerning the vent until mediation:

Now, when I first received the reports of this issue we provided an opinion. I think it is fair to say that at the time we provided our initial opinion we were unaware of the depth of community concern about this proposal and subsequently we have learnt a great deal more about those concerns and about the potential risks, and I think our comments have absorbed that information as we have gone along.⁹⁵

6.34 Dr Corbett advised the Committee that NSW Health also provided an opinion on the REF when it was published although this only raised the issue of trade waste discharges as a potential for concern.⁹⁶

6.35 The Committee asked Dr Corbett whether he disagreed with the assessment by two health experts on the Experts Panel during the mediation process, that there was a potential health risk from the vent. Dr Corbett stated:

...we presented a contrary view. There is always scientific debate about these matters. I stand by what we said and I see no evidence, convincing evidence, to change from that position.⁹⁷

⁹³ Evidence of Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, 9 October 2000, p.19.

⁹⁴ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.48.

⁹⁵ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.47.

⁹⁶ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.49.

⁹⁷ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.45.

6.36 Dr Corbett also indicated that NSW Health had not considered the potential *Legionella* risk until this issue was raised by Mr Ralph Kaye.⁹⁸

Conclusion

6.37 The Committee is concerned that Sydney Water did not sufficiently consider health risks associated with the Scotts Creek vent prior to the publication of the REF. This was demonstrated by the absence of NSW Health input to the community consultation process until the project was significantly complete.

6.38 The Committee is also concerned that it was not until community representatives raised the issue of potential health risks associated with *Legionella* and other pathogens, that NSW Health responded to that issue.

Aerosol transfer of pathogenic micro-organisms

6.39 Pathogenic micro-organisms in raw sewage can become airborne in water droplets or aerosols (bioaerosols) when the surface of the sewage is agitated, for example in aeration tanks at STPs. Within the NST, aerosols may be generated as sewage flows down the drop shafts.⁹⁹ It is recognised that bioaerosols have the potential to transfer viable micro-organisms to members of the population within an approximate transfer area.¹⁰⁰ While Sydney Water recognised the potential for disease to spread by bioaerosols from wastewater, it noted that it does not appear to be a very effective or significant route of transmission. Additionally, scientific reviews found that sewage bioaerosols do not constitute a significant public health risk.¹⁰¹

6.40 In its report to DUAP, AWN Consultants explained that research indicates there is limited potential for bioaerosols from sewage to transfer viable micro-organisms because:

- organisms settle under gravity;
- some organisms die or are so weakened that they are no longer capable of reproduction (facilitated by droplet evaporation and sunlight).

6.41 Further, the AWN Consultants report referred to studies that suggest micro-organism counts typically reduce to background levels within a few hundred metres of a sewage treatment plant. The report acknowledged the potential risk of pathogen transfer but concluded that the risk is limited:

⁹⁸ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.45.

⁹⁹ Submission No.158, Sydney Water Corporation p.41.

¹⁰⁰ AWN Consultants, *Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents*, June 1999, p.9.

¹⁰¹ Submission No.158, Sydney Water Corporation p.41.

Based on the available evidence, Reference (4)¹⁰² concludes that the potential for human health effects due to bioaerosol emissions from sewage treatment plants exists, however, it appears that the risk is not very high and illness is uncommon. Community studies referenced suggest that some minor illnesses have been reported, however the results are not consistent. Any effects observed represent minor increases in background illness rates.¹⁰³

6.42 The possibility that *Legionella* could be transmitted by aerosol was acknowledged by NSW Health in its submission:

...the vast majority of pathogenic microorganisms in sewage are not transmissible through aerosolisation. An exception to this may be *Legionella sp.*, which is present in small levels in sewage.¹⁰⁴

6.43 In its submission and correspondence to the inquiry, Sydney Water stated that the tunnel design minimises this potential by providing de-aeration zones which are designed to dissipate energy generated and to effectively de-aerate the dilute sewage. Additionally, Sydney Water states that the distance aerosols would need to rise would make the likelihood of aerosols reaching the filters improbable.¹⁰⁵

6.44 It was the view of the NSW Health expert panel that a variety of circumstances were responsible for minimising risks from the vent. On behalf of the panel, Dr Lyn Gilbert stated:

...we do not believe that there is a problem with organisms getting to the filter, let alone through it, because of the engineering construction of the tunnel and all of the things that have been discussed in terms of dilution of sewage, and not only dilution of sewage but dilution of air.¹⁰⁶

6.45 Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, held the view that:

The likelihood that these aerosols will be a significant risk of *Legionella* infection is extremely low...the water from which they arise will contain low numbers of *Legionella* bacteria; they must ascend a 40m shaft and pass through a densely packed filter before being emitted.¹⁰⁷

¹⁰² Referring to literature review by: AM Brown, *Wastewater Treatment Works and Health (Report to Hunter Water Corporation)*, Discipline of Environmental and Occupational Health, Faculty of Medicine, The University of Newcastle, May 1993.

¹⁰³ AWN Consultants, *Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents*, June 1999, p.9.

¹⁰⁴ Submission No. 163, NSW Health, p.3.

¹⁰⁵ Submission No. 158, Sydney Water Corporation p.41; Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 3, pp.14-15.

¹⁰⁶ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.9.

¹⁰⁷ Correspondence from Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 21 August 2000, p.4.

6.46 By contrast, it was the opinion of Assoc Prof Kearney that bioaerosols could travel up the Scotts Creek ventilation shaft. He stated:

Aerosols generated above turbulent sewage could travel up a 90m shaft from the tunnel when the bioaerosols eg. 5 microns, and invisible to the eye, are under positive pressure from rising sewage.¹⁰⁸

6.47 It was contended in correspondence from Sydney Water that there is no significant pressure build up in the tunnel either before it starts to vent at Scotts Creek, or during venting, even up to maximum vent rate. The maximum resistance of all of the filters (pre-activated carbon) at 8 m³ per second is about 1 kilopascal, about 1/100 of normal atmospheric pressure. Sydney Water states:

...The fan does not add significant pressure to the vented air, just enough to maintain a slight negative pressure in the building so that there are no fugitive odours during operation.¹⁰⁹

6.48 Later, the correspondence indicates:

At the maximum vent rate of 8 m³/sec, the water surface and the air in the tunnel are moving at less than 1 kilometre per hour. At the average vent rate of 2 m³/sec, the air/liquid is moving at one metre every 15 seconds. The surface of the stored water in the tunnel is essentially stationary, with no turbulence or bubbling.¹¹⁰

6.49 Assoc Prof Kearney provided additional comments on the size of aerosols during the hearings on 9 October 2000:

By definition an aerosol is a description of fine particles of liquid or solid substances suspended in the air or in some other gas. The particles are so fine they remain in the air for a long time. I have here an aerosol pack just to illustrate the fact. What you see is vapour; what you do not see are the bioaerosols or that level of dimensions of the aerosols that are carrying infectious organisms. What you see there, the spray of droplets is not what we are talking about. It is when that droplet spray has dispersed into particles that you cannot see; of a dimension of five microns and less is what we are discussing here.¹¹¹

6.50 It was the view of Assoc Prof Kearney that the engineering design features of the tunnel such as vortex flows and settling chambers would not effectively reduce or remove bio-aerosols:

As I understand, these are designed to capture droplets, which we saw visibly, or fine mist. They are not designed to arrest invisible bio-aerosols. The panel has not disclosed validation data that so-called settling chambers capture the invisible bio-

¹⁰⁸ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 21 August 2000, p. 14.

¹⁰⁹ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 5 p.34.

¹¹⁰ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 5 p.35.

¹¹¹ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 9 October 2000, p.43.

aerosols. As I understand, the so-called settling requires a time period of stillness. This is not the situation here during the operation of the vent in a stormy period.¹¹²

6.51 The Committee notes during the 9 August 2000 hearing, Dr Corbett explained that whether the tunnel would generate aerosols had not been tested:

Our view is that, whilst unlikely, the generation of aerosols is an eminently testable proposition because it is our strong view that if there is not a sufficient generation of aerosols, that would be further proof for us that the transmission of disease would be even less likely. Without aerosols you are not going to get the transmission of bugs and that is why we are suggesting that a middle course may be to test the proposition which has been raised that these aerosols are emitted from these vents.¹¹³

¹¹² Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 9 October 2000, p.45.

¹¹³ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.51.

Effectiveness of an activated carbon filter to capture micro-organisms

Engineering design features

6.52 Sydney Water advised the committee that numerous engineering design features were incorporated into the tunnel to prevent creation and transmission of aerosols and summarised the features as follows:

Sydney Water would like to clarify the possibility of aerosols both reaching the filters and passing through them. The overflow dropshafts are designed to create a vortex to dissipate energy and to control the overflow entry into the tunnel. While some aerosols can be generated when the dilute sewage drops into the tunnel, most aerosols will be re-entrained in the dilute sewage flow or vented at North Head. Aerosols may be entrained when air is venting at Scotts Creek, however only minimal quantities of aerosols will reach the top of the ventshaft because of the low velocities and the time taken to reach the surface. At the higher flowrates, some aerosols may be entrained, but this will occur for only 30 to 40 hours per year. Professor Lyn Gilbert, in evidence to the Committee, stated that the “removal of some aerosols may be necessary and my understanding is that the carbon filters will do that quite efficiently” (page 4, Hansard 9 October 2000). Whilst it is possible that aerosols may pass through the activated carbon filters, it is expected that the quantity of such aerosols will be minimal. The risk of infectious concentrations of contaminants reaching any of the surrounding residences, including the school, is negligible.¹¹⁴

6.53 Sydney Water also provided the committee with the following additional information about the following design features: vortex flow, settling chamber, 60 metre shaft, reentrainment and condensation chambers.

- The overflow dropshafts are designed to create a vortex to control the overflow entry into the tunnel, and to minimise turbulence. However, aerosols can be generated when the dilute sewage drops into the tunnel (at Scotts Creek 50 metres fall). The dilute sewage can draw some of the air from the sewer in with the overflowing dilute sewage stream. The impact of the sewage at the bottom of the shaft creates turbulence and aerosol generation. Most aerosols will be re-entrained in the dilute sewage flow or vented at North Head.
- The chamber at the bottom of the dropshaft is designed to dissipate the energy generated and to effectively deaerate the dilute sewage. IF the air is travelling up the ventshaft, some aerosols may be entrained in the airstream, depending on their size and the velocity of the air up the dropshaft.
- Aerosols will not be entrained in the air in the Scotts Creek facility when overflows to the tunnel start. When overflows start at any of the overflows sites, air is being drawn in at Scotts Creek and ventilated at North Head. At

¹¹⁴ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, p.4.

this stage fresh air is being drawn down the dropshaft at a rate of 15 to 20 m³/s. It is considered highly improbable that aerosols can rise 60 metres up a shaft, against a downward flow of fresh air. This fresh air is blended with the sewer air that is drawn in with the dilute overflow and the mixed airstream, together with any aerosol created, to North Head. The velocities of air in the tunnel are quite low and it is expected that all of the aerosols will be reentrained with the dilute sewage on the way to North Head.

- There is only about 100 mg/l solids in the dilute sewage that overflows into the tunnel. As the dilute sewage flows along the tunnel the potential for aerosol generation is minimal. The flowing velocities in the stored dilute sewage are less than 0.5 metres per second and there is minimal turbulence. Most of the air, a mix of mostly fresh air mixed with dilute sewer air, is in contact with a relatively still surface and there is minimal potential for creation and transport of aerosols back to Scotts Creek.
- Aerosols may be entrained when air is venting at Scotts Creek. Some aerosols may be entrained in the ventshaft when air is vented. At the lower flowrates (0 to 3 m³/s), only minimal quantities of aerosols will reach the top of the ventshaft because of the low velocities and the time taken to reach the surface. At the higher flowrates (3 to 8 m³/s), some aerosols may be entrained, but this will occur for only 30 to 40 hours per year.
- It is expected that minimal quantities of aerosols will pass through the activated carbon filters. Within the Scotts Creek facility, the air flow is quite tortuous. The air passes through a number of chambers and increases and decreases velocity, and changes direction a number of times. This will cause aerosols to be deposited from the airstream before it reaches the activated carbon filter. The activated carbon filter contains over 15 tonnes of activated carbon, with a surface area containing in the order of 18 billion square metres of active surface area. Whilst the activated carbon filters are not specially designed to capture aerosols, it is agreed that there will be significant capture of aerosols because of the size and structure of this particular filters.
- It is possible that some aerosols will pass through the activated carbon filter. Whilst this is possible, the quantity and size of such aerosols is expected to be minimal. The vented air is discharged into the atmosphere and disperses quite quickly, mixing with the atmospheric air, and reducing the concentration of any entrained material significantly. The Scotts Creek Vent has been modelled a number of times, and with the specific topographical aspects of the site considered. The modelling has been carried out by an air quality modelling expert, using the EPA approved modelling methodology. These studies show substantial dilution in the concentration of materials in the vented air, under all conditions. The possibility of significant concentrations of contaminants reaching any of the surrounding residences, including the school, is extremely low.¹¹⁵

6.54 Notwithstanding the advice of Sydney Water regarding engineering design features to prevent creation and transmission of aerosols, the Committee sought to determine whether

¹¹⁵ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 3, pp.14-15.

the proposed filters for the Scotts Creek vent are appropriate to capture or remove micro-organisms which may be emitted from the vent.

6.55 The Committee asked the Alliance whether the activated carbon filters were designed by the manufacturer to filter out bacteria and viruses. Mr Alec Dietsch responded that:

The granulated activated carbon filters are designed primarily for the removal of hydrogen sulphide, mercaptans and odour-generating materials, and that is for the purpose of meeting the original EPA guidelines and licence requirements with respect to those materials.¹¹⁶

6.56 In its submission to the inquiry NSW Health contended that it was unlikely any aerosols generated in the tunnel would transfer through the vent filters:

Before discharge, the air and any aerosols must pass through a pre-filter and an activated granulated carbon filter. It is the opinion of expert microbiologists that it is very unlikely that any aerosols would pass through the charcoal filter to be dispersed into the atmosphere, in which case there would be no mechanism for the transmission of disease by this route. This hypothesis could be tested experimentally to ascertain the permeability of the filters for aerosols under simulated operating conditions.¹¹⁷

6.57 In addition, the Chief Health Officer's Expert Panel advised that:

The Expert Panel agrees that the proposed activated granulated carbon filter is largely irrelevant since it is extremely unlikely that infective material will reach this part of the vent. Nonetheless it is likely that it will form an additional physical barrier to the passage to any aerosol which does reach the filter by virtue of its action as a depth filter - presenting a tortuous path for aerosol particles to traverse.¹¹⁸

6.58 In response to questions, Prof Charles Kerr advised the Committee that while the proposed filters would capture pathogenic organisms in aerosol, not all pathogenic micro-organisms would be captured:

In general, yes, but I still would not accept that the filters would obstruct all pathogenic organisms from getting through, which I think is the main issue.¹¹⁹

6.59 Assoc Prof Kearney highlighted the 3-6mm mesh size of the activated carbon filter, contrasting that with the size of bioaerosols (5 microns), 'Golden Staph' cocci (2 microns) and virus particles (0.5 microns). He argued:

It is clear that the mesh size of the GAC 'filter' is not of a dimension to retain

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¹¹⁶ Evidence of Mr Alec Dietsch, Engineering Manager, Northside Storage Tunnel Alliance, 9 August 2000, p.5.

¹¹⁷ Submission No. 163, NSW Health, p.2.

¹¹⁸ Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 30 August 2000, p.2.

¹¹⁹ Evidence of Prof Charles Kerr, Department of Public Health and Community Medicine, University of Sydney, 9 August 2000, p.60.

6.60 The Committee notes that there has been some confusion as to the meaning of mesh size of the activated carbon filter. Assoc Prof Kearney's original view regarding the meaning of mesh size:

I stated that the mesh size was between 3mm and 6mm in diameter... a 3mm hole.

...a "mesh" is the space between a net.¹²¹

6.61 Sydney Water has advised that:

The 3-6 mm mesh size actually refers to the nominal size of the activated carbon pellets used in the filter and not to any "hole" through the filter or the activated carbon itself. The activated carbon consists of irregular sized granules generally in the range of 3 mm to 6 mm that are randomly compacted into the bed.¹²²

6.62 In correspondence to the Committee, Assoc Prof Kearney further clarified his view with respect to the mesh size of the activated carbon filter and the potential passage of bioaerosols. He stated:

It is my understanding that in accordance with the American Society for Testing Materials (ATSM) that carbon in such filters is sold in terms of a mesh x mesh rating. Thus a 3-6 mm mesh, according to the ATSM standard, are pellets which pass through a 'square' hole 6.73 mm i.e. in two dimensions but, not through a 3.36 mm 'square' hole. Thus a particle of about 5 mm size (round, flat, square or irregular in shape) constitutes the granulated activated carbon product. Thus in the carbon bed there will be an infinite combination of spaces between the particles.¹²³

6.63 However, Prof Gilbert indicated that the ability of a carbon filter to remove particles related more to the difficult passage the particles faced rather than particle size. With respect to carbon filters, Prof Gilbert stated:

...they obviously remove gases and they clearly remove particles not necessarily related to the size of the particles but to the very tortuous route that they have to go between layers of particles, and the fact that these water droplets coalesce and therefore become larger and deposit on the surface of the carbon particles seems to be well accepted in the literature, but there is very little evidence for this. I certainly have satisfied myself by at least what we have heard from Sydney Water about the specifications of the filter, and what I have read and discussed with a

¹²⁰ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 21 August 2000, pp. 2-3.

¹²¹ Correspondence from Assoc Prof Kearney to Dr Ross O' Donoughue, Director, Health Protection, dated 28 August 2000, pp. 9, 10: in response to Minutes of Meeting of Chief Health Officer's Expert Panel on 23 August 2000.

¹²² Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 5, p.30.

¹²³ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 20 October 2000, pp.6-7.

colleague who is an expert in this. It is very difficult to explain how it works, but they do appear to work.¹²⁴

6.64 During the course of the public hearings, Dr Corbett from NSW Health was asked whether it was likely any aerosols generated in the tunnel would transfer through the vent. Dr Corbett responded:

Certainly, the design of the system is primarily to control odour. In assessing the risk associated with filtration at this system we had to make a judgment about the likelihood that aerosols of respirable size would make their way through a fairly tightly packed, activated carbon filter. But we are making no *a priori* judgments about that likelihood.

Common sense would dictate that large droplets of water would have trouble making their way through a granulated carbon filter, but what we are asserting is that it is an eminently testable proposition to see whether aerosols in fact do escape from the filter.¹²⁵

6.65 The Committee questioned Sydney Water representatives about whether the filters had been tested to determine whether aerosols would transfer through the vent. Mr Walker stated that it had not, but accepted that that is something that could do be done.¹²⁶

6.66 Prof Lyn Gilbert indicated that scientific research on the effectiveness of carbon filters as microbial filters was limited and that her discussion with a colleague, Dr Margaret Peel who is the co-author of a standard text on sterilisation and disinfection indicated that:

...there was a fairly small amount of evidence in the literature where these have actually been tested as microbial filters.¹²⁷

6.67 In the event that pathogenic bio-aerosols might penetrate through the activated carbon filters, the Committee asked the EPA whether it was possible for the licence issued by the EPA to require measurement and control of microbiological and chemical air quality from the point of emission. As part of its response, the EPA stated:

NSW Health has advised that in addition to being unnecessary, microbiological monitoring of vent emissions is also problematical. While methods do exist to [conduct] microbiological monitoring in air they are usually only employed to monitor sterile environments such as operating rooms. There are no meaningful guidelines against which to judge any sample that would be taken from a setting such as the tunnel vent.¹²⁸

¹²⁴ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.14.

¹²⁵ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.45.

¹²⁶ Evidence of Mr Alex Walker, Managing Director, Sydney Water Corporation, 9 August 2000, p.9.

¹²⁷ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.4.

¹²⁸ Correspondence from Joe Woodward, Acting Assistant Director General, NSW Environment Protection Authority, dated 21 August 2000, p.4.

6.68 The statement is verified by the submission from NSW Health, which states:

Residents from both Lane Cove and Scotts Creek have proposed that monitoring of airborne pathogens be an obligatory part of the post commissioning phase of these projects. While monitoring for pathogens in air is routinely undertaken in closed settings such as hospital operating rooms, or food processing plants, it has not been used in an open setting such as this, so there are no meaningful standards to apply, if it were to be employed. NSW Health is reluctant to go down this path. Considerable development work would be needed to establish a meaningful monitoring program, and to little public health benefit.¹²⁹

6.69 During the Committee hearing on 9 October 2000, the Committee asked Dr Andrew Wilson whether NSW Health had undertaken testing on the capacity of these charcoal filters to filter particulate matter. He stated:

We are trying to seek some additional information about charcoal filters from experts about this issue. To date we are not able to provide you with that advice because we have not been able to find the relevant expertise, the expert advice to be able to give you that, but we are seeking that information... We have spoken to experts in the CSIRO about how you might go about doing that, and we are seeking that advice.¹³⁰

Potential of carbon filters as a medium for Legionella growth

6.70 In the event that activated carbon filters are effective in capturing some or all micro-organisms such as *Legionella*, the Committee sought to identify whether the activated carbon filters would then act as a medium for *Legionella* to breed.

6.71 The specific concerns raised in this regard were that the matter or micro-organisms captured in the filter would provide nutrient for pathogenic micro-organisms such as *Legionella* and that the moisture accumulation in the filter from aerosols or condensation (as discussed in Chapter 5) would provide sufficient solution for *Legionella* to breed. With respect to nutrient accumulation, in correspondence to the Committee, Assoc Prof Kearney stated:

...there are microbes of no importance, medically, that are vital to the various ecosystems that exist on this planet. On every substrate including the surface of a granule of carbon there will be organisms which colonise to form its characteristic "biofilm". These will involve facultative chemo organotrophs in the middle, and in this case, sulphate-reducing micro-organisms on the bottom. Thus depending on the energetic situation and diffusion rates, these biofilms can become more complex layers or organisms of different types... More complex biofilms can develop to form a three-dimensional structure with cell aggregates, interstitial pores and conduit channels.

¹²⁹ Submission No.163, NSW Health, p.3.

¹³⁰ Evidence of Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, 9 October 2000, p.14.

...such complex biofilms are a major source of *Legionella* species in various water systems.¹³¹

6.72 Dr Stephen Corbett acknowledged the possibility of *Legionella* accumulating in the filters:

That has been raised also as a theoretical possibility—again, an untested hypothesis. But, of course, in any new system like this we have to take notice of new potential problems. Certainly, when I met with Mr Ralph Kaye in my office some weeks ago he raised this and expanded on his concerns about this possibility, and certainly that was one of the issues that we took to the expert group convened by Dr Andrew Wilson.

...it is an eminently testable proposition. Without aerosol escape from the charcoal filter, the risk of *Legionella* is extremely small. That is a testable proposition. We do not believe that it will be significant. We are happy to put that to the test.¹³²

6.73 The Committee asked Dr Corbett whether it was possible for *Legionella* to breed in activated carbon, to which Dr Corbett responded that:

I do not think we deny that possibility. The advice we have received from our own expert microbiologist tells us that it is unlikely in this situation for a number of factors. I believe the factors associated with pH, the absence of sunlight, et cetera, make it unlikely that *Legionella* will grow in this situation, but I think, even more than that, the physical barrier which that filter places in the way of aerosols so that such aerosols that are generated in the system impact on that and are removed, we suggest, is going to be the most important factor in reducing risk, if there is any.¹³³

6.74 In evidence to the Committee, Prof Lyn Gilbert expressed similar views:

In order to multiply they need warm, moist conditions and nutrient, and so do the amoebae that carry them. My understanding from what we have heard about the filters is that for all but the small number of days per year during which the filter is functioning so that air is coming out of it, the filters will be subject to air being drawn in specifically to dry them. I think that the presence of sodium hydroxide on the surface of the carbon will inhibit both the organisms and the amoebae; that there will be virtually no nutrient for those organisms to multiply; and that they will die very rapidly in the unlikely event that any actually get to the carbon filter.¹³⁴

¹³¹ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 20 October 2000, p.76.

¹³² Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, pp.45-46.

¹³³ Evidence of Dr Stephen Corbett, Manager, Environmental Health Unit, NSW Health, 9 August 2000, p.46.

¹³⁴ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, pp.21-22.

6.75 Prof Gilbert further stated:

I think based on what I know about *Legionella*...these organisms are hardy in one way in that they survive very well in some environments. But, despite being ubiquitous in the environment, in many environments they rarely cause disease and clearly there is a particular format—that is still poorly understood, but a particular format—in which these organisms are virulent, which is associated particularly with...cooling towers and warm-water systems.¹³⁵

6.76 The Committee asked Mr Kaye if he could produce any evidence to support his claim, made at the hearing of 9 October 2000, that micro-organisms grow on caustic impregnated activated carbon. Mr Kaye could not produce any documented evidence to confirm his answer.¹³⁶

6.77 Sydney Water acknowledged that moisture would be captured in the filter during an overflow event mainly at the inlet to the bed, however it was explained that a ventilation fan will be operated after an overflow event to dry the filter :

At the end of an overflow event, the ventilation fan will continue to operate. The fan draws air from the outside atmosphere and passes it through the carbon bed. Almost all of the time the air will be sub-saturated and will absorb moisture from the surface of the carbon and exhaust it from the vent. That is, the filters will be dried by the action of air being forced through them. If the incoming air is fully saturated, no water will be evaporated for that period of time. Initially, it is planned that the fan will operate for a period of 72 hours after the Scotts Creek facility ceases venting. In addition, the fan will be operated for a period of 8 hours each week, provided that there is no overflow event.¹³⁷

6.78 Findings in the Report by the Expert Panel convened by the Chief Health Officer dispute Assoc Prof Kearney's contention about Legionella growth:

The Expert Panel does not believe it is likely that regrowth of pathogenic bacteria will occur in this filter. The dry environment between storm events, the absence of nutrients and the high pH will inhibit bacterial growth.¹³⁸

6.79 Sydney Water further explained that the effectiveness of this drying process will be assessed:

This will involve measuring the relative humidity of the inlet and outlet airflows and confirming that the relative humidity of the outlet air is not much higher than

¹³⁵ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.22.

¹³⁶ Correspondence from Mr Ralph Kaye, dated 20 October 2000, p.14.

¹³⁷ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, p.2.

¹³⁸ Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 30 August 2000, p.2.

the incoming air (ie not adding moisture). The activated carbon will be tested for free water during the scheduled testing of the carbon beds.¹³⁹

Conclusion

- 6.80** The Committee is concerned that Sydney Water has not conducted sufficient testing for the possibility of *Legionella* accumulating and breeding to provide a satisfactory basis for concluding minimal risk. The Committee is also concerned that although it appears possible to test for *Legionella* breeding and escaping from activated carbon filters, this testing had not occurred. The Committee believes it is imperative that such tests be conducted.

Recommendation 5

The Committee recommends that Sydney Water and NSW Health undertake research into the effectiveness of activated carbon filters to capture micro-organisms. The Committee suggests that pilot scale trials be implemented to simulate operating conditions of the vent filtering mechanisms. The simulation should ascertain:

- the permeability of the filters for aerosols;
 - under what conditions aerosols could permeate the filters;
 - what types of bioaerosols can permeate the filters; and
 - what percentage of bio-aerosols are being captured by the filters.
-

Recommendation 6

The Committee recommends that Sydney Water and the NSW Health conduct detailed investigations into:

- whether it is possible for *Legionella* to remain viable and breed in activated carbon filters; and
 - if it is found that it is possible for *Legionella* to remain viable and breed in activated carbon filters, whether public health risks could result from transfer of *Legionella* from the filter into the atmosphere.
-

Risks of harm to public health from pathogens in the air

- 6.81** In the event that pathogenic micro-organisms are emitted from the vent, the issue of potential health risks arises in relation to the local community and school. Assoc Prof Kearney informed the Committee about the behaviour of micro-organisms when released into the atmosphere:

¹³⁹ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, p.2.

When organisms are out on the surface and exposed to ultraviolet [UV] light there is sanitisation. On a cloudy day UV light is absorbed into the cloud and organisms survive longer on the ground..... On a cloudy day when these emissions are being distributed and drifting perhaps up and down the valley encroaching upon residential areas and so on, then I believe there is a risk.¹⁴⁰

Exposure to emissions

6.82 In evidence before the Committee, Assoc Prof Kearney drew attention to the cumulative effects of breathing in air with concentrations of certain emissions:

What I mean by a cumulative effect is that an adult breathes over 24 hours 18 cubic metres of air. The cumulative effect is what happens, not by breathing one cubic metre of air that contains a defined concentration, but what happens at the end of 24 hours of breathing that concentration of air and the next day and the next day.

...the EPA and the Health Department ignored the cumulative effects of these sorts of emissions. What I am putting to this Committee, Mr Chairman, is that the cumulation of breathing in contaminated air is a significant factor in considering the health risk.¹⁴¹

6.83 A contrasting view was put by Prof Lyn Gilbert with respect to the concentration of organisms in the air emitted from the vent and the length of exposure to this air. Prof Gilbert stated:

I guess there is a lot of anecdotal evidence here, but there is no doubt that the more hours that one is exposed to potential pathogens—and we are talking about extremely dilute pathogens and the number of organisms required to cause disease—in most cases, even a cloud of organisms very close to the surface of liquid will not deliver enough organisms in a form that will be effective. Most of the organisms we are talking about here are organisms that cause intestinal disease, not respiratory disease, and therefore they need to be actually taken into the mouth in food or water. So even an occasional inhalation of these organisms will not be a clinical problem. Personally, I do not think that is going to occur.¹⁴²

6.84 It was the view of Assoc Prof Kearney that dilution of sewage does not directly result in a reduced risk of harm:

...in microbiological terms, so-called diluted sewage does not necessarily imply a significantly less risk of harm. If we have something like 10 million organisms per

¹⁴⁰ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 10 August 2000, p.49.

¹⁴¹ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 10 August 2000, p.50.

¹⁴² Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.10.

millilitre and it is diluted one in 20, for example, 500,000 organisms per millilitre is not a significant reduction of risk in microbiological terms.¹⁴³

Empirical evidence of infectious disease risks

6.85 It was the opinion of Sydney Water that past experience with its own ventilation stacks have shown no demonstrated health impacts. Sydney Water also cited similar storage tunnel systems which operate in Rochester (New York), Chicago and Milwaukee where although there have been some odour complaints, no health issues have been linked to those tunnels.¹⁴⁴

6.86 In evidence before the Committee, Mr Geoff Noonan, Director, Development and Infrastructure Assessment Branch from the Department of Urban Affairs and Planning, explained the Department's risk analysis assessment for infectious disease. Mr Noonan stated:

In doing that analysis, we came to the conclusion quite early that there was no reliable quantitative data that would describe that infectious diseases risk. That is in the global literature. We did quite a search and there are a number of reasons for that that the submission discusses, so we based our risk analysis on a qualitative model. We went through a logical framework, and that is the basis of the recommendation to the Minister.¹⁴⁵

6.87 During one Committee hearing Dr Holmes was asked whether there was any epidemiological study that indicates public health risks from sewer operations. Dr Holmes indicated that research conducted in the past did not reveal identifiable health risks:

The studies that I have drawn upon and other people have drawn upon to support the position that there was not a large health risk associated with this type of operation or similar operations, the fact that they were old, I do not think that invalidates them.

In my experience as a research scientist, there are often times when there is considerable community concern about a particular issue and a lot of research is done on that issue and nothing much is found and so no more research is done for some time. I consider that, just looking at that information, because most or almost all of the epidemiological studies done in the 80s and 70s did not show anything, people concluded that there was not certainly a really measurable health impact from sewage treatment plants where aerosols are being generated as they often are.

...I understand that you have to exercise the precautionary principle in all of this because lack of information does not mean there is no effect. I understand that principle. However, great difficulty in finding information, any direct link or any causality or even just association, indicates that the effect, whatever it is, is not

¹⁴³ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 9 October 2000, p.42.

¹⁴⁴ Submission No. 158, Sydney Water Corporation p.43.

¹⁴⁵ Evidence of Mr Geoff Noonan, Director, Development and Infrastructure Assessment Branch, Department of Urban Affairs and Planning, 10 August 2000, pp.11-12.

likely to be very substantial. That was certainly one of the things that was agreed upon by the expert panel that, whatever the effects were, and it certainly was not agreed what the health risk was from this vent, whatever they were, they were not likely to be at an epidemic level and the effects were likely to be, according to those who thought there would be an effect, more at a subtle level rather than anything at an epidemic level.¹⁴⁶

- 6.88** In response, the Committee queried whether two or three decades ago our scientific knowledge was unable or of insufficient standard to identify a risk and as no studies are being undertaken now whether an assumption of low risk is being made. Dr Holmes conceded that she could not categorically disagree with that statement. The Committee then queried whether in that case there is reasonable basis for a potential doubt. Dr Holmes stated:

There is some doubt and that is why we are here because we all agree we have not proved anything conclusively. The balance of evidence, in my opinion, is that the risk is very low.¹⁴⁷

- 6.89** On behalf of the expert panel, Prof Lyn Gilbert provided a summation based on evidence available to the panel, which was in accordance with the view of Dr Holmes:

The expert panel has had two meetings and we have exchanged a number of documents relating to the proceedings. We have reviewed the mechanics of the Northside Tunnel and the rationale behind it, the various structural measures that have been put in place to review it and we have also looked at, at least on paper and on video, the alternatives and what the tunnel has been built to replace and to overcome. We have discussed at some length possible problems that could arise, particularly in relation to worst case scenarios. We have reviewed the precautionary principle document, which I think outlines the worst case situations with a combination of worst case scenarios each compounding the other. We have reviewed literature related to organisms in the air relating to sewage treatment works, which we think are not directly relevant to the situation but are still of some interest. We have reviewed a number of studies that look at the health of people associated with sewage treatment plants. To my knowledge there are no such studies in relation to this sort of air vent.

We have reviewed Professor Kearney's concerns, both on paper in that we have reviewed the transcript of his evidence to this Committee, and we met with him at one of our meetings. The conclusion that we have come to is that notwithstanding all the concerns that have been raised by the community, which are understandable, and other concerns raised by others, we feel that there is no risk to health. It is always very difficult to be absolutely dogmatic about a situation that is unique—and all these situations are unique and complex—but we feel there is no plausible risk to the health of the children at the school in the area or to any of the local residents, including any who may be elderly or otherwise ill.¹⁴⁸

¹⁴⁶ Evidence of Dr Kerry Holmes, Air Quality Consultant, Holmes Air Sciences, 9 August 2000, p.78.

¹⁴⁷ Evidence of Dr Kerry Holmes, Air Quality Consultant, Holmes Air Sciences, 9 August 2000, pp.78-79.

¹⁴⁸ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.6.

6.90 Dr Donohoe contended that exposure risks are not identified until communities show higher illness rates:

The outcomes of exposure to communities shows that these illness rates do increase. How does it increase? Our theory may not be very good at explaining it, but our theory was not good for *Legionella* until 25 years ago. It could not exist either. Then suddenly we found it did. The mechanism is not always decided until you come to understand and study the people who have become infected. So, in my view, the medical literature that looks at the outcomes and says does it occur, has a greater relevance in this particular situation because the mechanisms of a lot of microbiology and a lot of risks are unknown.¹⁴⁹

6.91 In an answer to a question on notice concerning air quality health concerns and subsequent studies relating to sewer emissions by utilities in Australia and overseas Sydney Water provided the following response:

Sydney Water is not aware of any air quality concerns or illnesses relating to sewer emissions by utilities in either Australia or overseas. It has been claimed...that sewage treatment plant workers fall ill as a result of exposure to sewage during their employment. This has not been Sydney Water's experience with workers at its sewage treatment plants and sewage pumping stations.

However, Sydney Water is aware of subsequent studies as a result of health concerns conducted during the 1980s in the United States. Sydney Water consulted the Odour and Corrosion Technology Consultants Inc. to examine the literature on health effects of exposure to raw wastewater aerosols. Based on a wide literature review, this study concluded that exposure to raw aerosolised wastewater poses no serious threat to human health at large, and therefore it can be stated that exposure to such aerosolised substances through inactivated carbon media systems would be even less likely to pose a serious health threat to humans."¹⁵⁰

6.92 Given his assertion that pathogenic organisms may exist in sewage, the Committee questioned Assoc Prof Kearney about why there would appear to be no evidence that the 20,000 'green vents' located in Sydney have caused major illness. Assoc Prof Kearney stated:

...The answer would be, well, has the Department of Health monitored that incidence? We have regular outbreaks of gastroenteritis. We have regular cases of food poisoning where the food can look nice, taste nice and smell nice and still cause food poisoning such as by *Staphylococcus aureus*. My point is that all that is monitored to a degree is the incidents that turn up at some of the hospitals. A lot of them are self-limiting where the patient does not go to hospital or does not see the doctor. So it is not recorded.

...

¹⁴⁹ Evidence of Dr Mark Donohoe, Medical Practitioner, 10 August 2000, p.39.

¹⁵⁰ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, p.51.

Let me remark that in gastroenteritis, 20 per cent of the cases of gastroenteritis, the cause is not established. One might ask, well, are there other organisms we cannot culture, responsible for some of those 20 per cent.¹⁵¹

6.93 Dr Donohoe was asked whether he believed the vent will pose an unacceptable health risk. In response he stated:

... it is not that I know that it will. I am saying that we do not know that it will not. This is not the same thing. We do not know what the health risk is from the sewage that is currently overflowing those pipes there at the moment, or the structure there at the moment. Since it is unstudied we have no base line against which to assess it.¹⁵²

6.94 In evidence before the Committee, Prof Gilbert was asked whether the absence of studies in relation to a vent like this meant that it is difficult to conclude that there was no risk. Prof Gilbert stated:

All I can say is there is no plausible risk as far as we are concerned as experts. We believe that there is not any reason to believe—and I guess that is different from saying there is no risk. You can never say there is no risk under any circumstances and that is a reasonable thing to say but I can say that there is no plausible risk.¹⁵³

Conclusion

6.95 There is a divergence of expert views about the risks of illnesses and diseases associated with sewage, primarily because of the absence of reliable quantitative data. Accordingly, the Committee is not convinced there is no risk of harm posed by the Scotts Creek vent.

Risk mitigation - The Precautionary Principle

6.96 A number of submissions received and evidence heard by the Committee contended that Sydney Water was not following Ecologically Sustainable Development (ESD) and precautionary principles in respect of risks to human health.¹⁵⁴

6.97 In evidence before the Committee, a community representative, Mrs Wendy Norton was critical of Sydney Water in not considering risks to human health under the precautionary principle:

Matters which have been of grave concern to us and are still not satisfactorily resolved include the lack of application of the precautionary principle to the

¹⁵¹ Evidence of Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, 10 August 2000, p.50.

¹⁵² Evidence of Dr Mark Donohoe, Medical Practitioner, 10 August 2000, p.34.

¹⁵³ Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.7.

¹⁵⁴ For example, Submission No. 164, Willoughby Environmental Protection Association, pp.3-5; Evidence of Mr Brian Moran, President of the Parents Association of Glenaeon Rudolf Steiner School, 9 August 2000, pp.33, 34.

venting at Scotts Creek. It is apparent that the notion of possible health effects of the venting was not considered by the Alliance until they were raised by CLC members. Also, absence of evidence that the vent will be safe. There has been a steadfast refusal to address our concerns regarding health.¹⁵⁵

6.98 In May 1992, the Intergovernmental Agreement on the Environment committed all nine Australian Governments to the concept of ESD. A core principle of ESD is the “precautionary principle” which was adopted in the following terms.¹⁵⁶

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. In the application of the precautionary principle, public and private decisions should be guided by:

- (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
- (ii) an assessment of the risk-weighted consequences of various options.

6.99 In NSW, section 6(1) and (2) of the *Protection of the Environment Administration Act 1991* (POEA Act) introduced the principles of ESD and the precautionary principle to NSW environmental legislation. For present purposes, section 21 of the *Sydney Water Act 1994* requires that Sydney Water must conduct its operations in accordance with the principles of ESD as defined in the POEA Act.

6.100 In its submission to the inquiry, Sydney Water addressed its conformity with the precautionary principle in a lengthy document as an appendix to its submission. This document is attached at Appendix 5 to this report. In addition, Sydney Water stated:

Sydney Water has undertaken extensive work on the environmental impact assessment (EIA), environmental management plans (EMPs) and operational environmental management plan (OEMP) for the Northside Storage Tunnel. All of this work demonstrates the actions Sydney Water is taking to reduce the chance of serious or irreversible damage caused by unfiltered air borne and water borne sewage discharges to the Scotts Creek environment.¹⁵⁷

6.101 Sydney Water makes several references in the document to part of its primary objective of the NST being “to protect public health”.

6.102 Dr Mark Donohoe, contended that the unique nature of the Scotts Creek vent required a need to apply the precautionary principle where human health is concerned:

In my view, having reviewed the literature, having listened to the arguments on both sides, we have what effectively is an experimental set up in the Scotts Creek vent. We do not have good models upon which to base it.

I note that in a 1979 report written by Johnson and Camann, the conclusion of that report was:

¹⁵⁵ Evidence of Mrs Wendy Norton, Scotts Creek Community Liaison Committee, 9 August 2000, p.31.

¹⁵⁶ Intergovernmental Agreement on the Environment, May 1992, para. 3.5.

¹⁵⁷ Submission No. 158, Sydney Water Corporation p.10.

The primary difficulty in designing a definitive health watch regarding sewage is the lack of a sufficiently large sensitive population, that is, young children whose immunological defences against infectious disease are still developing, but resides close enough to the source to receive a high dose of aerosolised agents.

Clearly, my concern is that we do not wish to become the community in the country which creates the experiment that nobody wished to see done in the first place and that allowing a vent to be close to a school is an abrogation of the precautionary principle. We do not know enough about the health consequences. We appear, in the absence of adequate knowledge, to be prepared to take risks with the health of the children who live in the area and the health of the community in general, and we have not made provision for how we would compensate that community or how we would address the community concerns should they arise at a later date.¹⁵⁸

6.103 It is the view of Sydney Water that the absence of full scientific certainty should not necessarily impede a development. In correspondence to the Committee, Sydney Water stated:

The application of the Principle does not mean that in the absence of full scientific certainty about any environmental impact, a development should not proceed. Every development has the potential for impacts and, in most cases, the exact sense of the impact cannot be fully known. The principle is a common sense application, being cautious and undertaking a risk-weighting approach on the part of the decision makers (ie. Sydney Water Board of Directors) and the regulators (ie. relevant Ministers and regulatory bodies, such as the Environment Protection Authority).¹⁵⁹

6.104 Sydney Water further advised:

The standard of proof is not beyond a reasonable doubt. The standard of proof is regarded in the law as “on the balance of probabilities”.

Sydney Water believes that it has satisfied this requirement in seeking independent expert assessments on the potential health and air quality impacts of the Scotts Creek facility. The advice received by Sydney Water, which includes advice from various independent experts, NSW Health Department, DUAP and the EPA, indicates that there a negligible health impact is likely to result from operation of the vent at Scotts Creek.¹⁶⁰

6.105 In evidence before the Committee, Cr Pat Reilly, Mayor of Willoughby Council expressed the need for scientific certainty with respect to the vent as soon as it was possible to determine by stating:

¹⁵⁸ Evidence of Dr Mark Donohoe, Medical Practitioner, 10 August 2000, p.32.

¹⁵⁹ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 2 p.4.

¹⁶⁰ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 2 pp.2, 3.

...council is in agreement with the community that the Government should undertake a full health study on the long-term effects of this vent should it proceed to operation.¹⁶¹

6.106 The Committee notes, however, the statements of Prof Gilbert and Dr Wilson regarding the value of health impact studies:

...my belief is that any effect on the health of either the school or the community related to Scotts Creek would be so small that to get a statistically significant difference between that another control group would be quite difficult and would require a long-term study.¹⁶²

Professor Gilbert has raised the possibility that in the longer term it may be possible to design a study to monitor any ongoing health impacts from this, although pragmatically it is like a given, that the health risk will be so low that it will be extremely difficult to measure.¹⁶³

6.107 Since the Committee is not convinced that there is no risk of harm posed by the Scotts Creek vent and that there are well established environmental principles to protect human health, the Committee believes that Sydney Water should pursue a precautionary approach to any future operation of the sewer ventilation facilities.

Recommendation 7

The Committee recommends that, if the Scotts Creek ventilation facility becomes operational, a full health study should be conducted on the long-term effects of exposure to emissions from the vent by residents and the school children of the Glenaeon Rudolph Steiner School.

Potential health risks from odorants

6.108 As hydrogen sulphide and sulphur emitting compounds are the major odorous compounds that will be exhausted from Scotts Creek during an overflow event, it is important to consider their potential health risks and that of other potentially toxic odorants.

6.109 In her submission to the Committee, Dr Kerry Holmes of Holmes Air Sciences explained that ambient goals for sulphide compounds are based on their odorous properties. She further advised that the major odorant, hydrogen sulphide, has been well studied and its health effects over a range of concentrations has been well documented. Dr Holmes advised the Committee that:

¹⁶¹ Evidence of Cr Pat Reilly, Mayor of Willoughby City Council, 10 August 2000, p.56.

¹⁶² Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.20.

¹⁶³ Evidence of Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, 9 October 2000, p.35.

The level at which hydrogen sulphide odour can be detected (0.1 - 4 ppb) is 1000 times lower than the level at which even relatively minor health effects such as eye irritation start to occur (10 - 20 ppm).

The maximum concentration of the hydrogen sulphide in the vent emissions before any control takes place is likely to be in the lower levels of these health bands, that is, below 10 ppm and expected to be within the range 1 to 5 ppm.¹⁶⁴

6.110 The issue of odorous chemical compounds in the sewage other than sulphides was raised during the course of the Committee's hearings. It was the view of Dr Holmes that they would not be present in significant enough concentrations to pose a health risk:

One of the issues we looked at was the potential for other air toxics to be emitted from this vent, and we did that by reviewing the information that was provided in the EIS on the likely trade waste contaminants in the liquid waste that would be in the tunnel. There certainly were a wide range of compounds that were likely to be there. Some of them were volatile, but given the levels of the compounds and the fact that there was likely to be dilution of the sewage or of the liquid in the tunnel, I considered that it was very unlikely that these would cause certainly any health effects. They may contribute to some extent.¹⁶⁵

6.111 In response to questions about how she formed this view, Dr Holmes stated:

I made the decision because all of these compounds have health goals associated with them. They have air quality goals, or most of them do, that are based either on health or odour, whichever is the more stringent, so there is completely independent information available in the literature to indicate what is, if you like, a safe level in the air for these compounds. So that was based on those goals that are set by regulatory authorities for the individual compounds.

The Victorian EPA has set a range of air quality goals for a wide range of air toxic compounds, so it was based on that that I came to that conclusion.¹⁶⁶

6.112 Evidence was received from a number of other witnesses¹⁶⁷ that confirmed the view of Dr Holmes, and no specific evidence was received which disputed the dilution of chemicals in the NST. However, concerns were raised that emissions from the interaction of chemicals entering wastewater could impact on sensitive populations such as children, immune suppressed and elderly people.¹⁶⁸

¹⁶⁴ Holmes Air Sciences, *Northside Storage Tunnel Odour and Health Impacts of Vent Operation at Scotts Creek and Lane Cove River West*. Prepared for Northside Storage Alliance, 13 September 1999, p.5.

¹⁶⁵ Evidence of Dr Kerry Holmes, Air Quality Consultant, Holmes Air Sciences, 9 August 2000, p.75.

¹⁶⁶ Evidence of Dr Kerry Holmes, Air Quality Consultant, Holmes Air Sciences, 9 August 2000, p.76.

¹⁶⁷ Evidence of Mr Peter Fisher, Manager, Product Delivery, Wastewater, Sydney Water Corporation, 9 August 2000, p.26.

¹⁶⁸ Correspondence from Dr Mark Donohoe, Medical Practitioner, dated 21 August 2000, pp.3-5.

Chapter 7 Alternatives to proposed Scotts Creek Vent arrangements

Venting options

- 7.1** During the preparation and exhibition of the 1999 REF, Sydney Water and the Alliance assessed several options for the venting configuration at Scotts Creek. The major venting options outlined in the REF included:
- Option 1 - limit Scotts Creek to 3.5m³ per second and draw balance back to Lane Cove or North Head;
 - Option 2 - limit Scotts Creek to 3.5m³ per second only while tunnel is less than 75% full.
 - Option 3 - eliminating Scotts Creek vent by venting at North Head.¹⁶⁹
- 7.2** During the mediation process with the Scotts Creek community, a technical sub-committee was established to examine a number of engineering alternatives for exhausting displaced air from the tunnel outside the Scotts Creek area or to examine opportunities for higher safety standards at the Scotts Creek site. Detailed design work and associated costings were carried out on 15 alternative options which are detailed in Appendix 6.
- 7.3** These alternatives were assessed against eight key criteria:
- separation from people;
 - impact on existing background pathogen levels;
 - relative health risk;
 - public perception of acceptability;
 - ease of operation and maintenance;
 - fail safe system rating;
 - additional cost to project; and
 - time impact on project.
- 7.4** After five months of mediation, it was acknowledged by all participants to the mediation that there had been no consensus reached and no alternative to the currently proposed Scotts Creek vent was found that met all the agreed criteria of both parties. A table summarising the evaluation of the 15 options is attached at Appendix 7.
- 7.5** The Scotts Creek Community representatives regarded only Options 2a and 2b as acceptable. These options proposed construction of a return exhaust line from Scotts

¹⁶⁹ Department of Urban Affairs and Planning, Northside Storage Tunnel Proposed Modifications to Tunnel Configuration and Construction Works at Lane Cove and Scotts Creek, Director-General's Report, July 1999, pp.8-9.

Creek to North Head STP, which would result in no exhaust emissions from the Scotts Creek vent. Sydney Water regarded Option 1b as acceptable. This option was for a Scotts Creek facility with a 15 metre exhaust stack instead of the four metre stack.¹⁷⁰

Return exhaust line to North Head STP

7.6 A number of submissions received from community groups argued the case for a return exhaust line to the North Head STP.¹⁷¹ This suggested solution follows the reasoning that:

...returning the airflow to the North Head STP will only result in an extra 1% increase of the total air treated at Manly. We believe the scrubber system at North Head STP, is better sited than the Scotts Creek vent, and can more effectively remove pathogens.¹⁷²

7.7 The Committee questioned the Alliance about the possibility of piping air from Scotts Creek back to North Head. Mr Allan Henderson stated:

Sydney Water believes this is not an acceptable proposal, whether it is technical, social or economically viewed. Apart from the actual cost of the pipeline itself, there are other costs to consider and there are technical issues to consider. There is the environmental assessment to consider which would, no doubt, delay the operation of the tunnel.

If we even disregard the cost implications which are quite considerable themselves - we are talking about in the order of \$30 million for the pipeline - there could be additional costs for on-site structures. There would be additional costs for an environmental assessment process. That process could take anything up to one or even beyond, maybe two years, and could delay the implementation of the tunnel, and it could delay the time frame when the tunnel could be available for the people of Sydney to benefit from.

It would increase the amount of maintenance required for the tunnel system. There would be additional facilities to be maintained. It would reduce the available volume in the tunnel to accept overflows, and that would reduce the environmental performance of the tunnel.

There is a very real chance that it could not be justified in an environmental assessment process and, if it went to that stage, may well lead to a question of whether the tunnel could be acceptable to operate. So we cannot see any reason whatsoever in a technical, environmental, social or economic sense that that alternative be considered.

The other point that we need to note is, if it was implemented for the Scotts Creek vent, it would necessarily have to be implemented for every other overflow location, and that would include Lane Cove or the Lane Cove River west location which is in the Hunters Hill municipality. That would increase the cost again.

¹⁷⁰ Submission No. 158, Sydney Water Corporation, p.61.

¹⁷¹ for example: Submission No. 169, Glenaeon Rudolf Steiner School, pp.16-18.

¹⁷² Submission No. 164, Willoughby Environmental Protection Association, p.3.

It would severely restrict the amount of volume in the tunnel between Tunks Park and Lane Cove and make maintenance of that section of the tunnel extremely difficult. So that is a technical reason far above the cost of the tunnel that would reject that option.¹⁷³

7.8 Information provided by Sydney Water in their submission to the Committee (see Appendix 7) indicates that the total estimated cost for installation of an exhaust line in the tunnel roof for both Scotts Creek and Lane Cove River West to North Head STP scrubber is approximately \$48 million.

7.9 The Committee asked Sydney Water whether its lack of acceptance of some options was driven by the Government's commitment to have the NST operational by the Sydney 2000 Olympics in September 2000. Mr Walker responded by stating:

I do not know that we could say that. The key element of our argument is simply that we have considered all of the options. We have taken account of the risks, especially as evaluated by the Department of Health in relation to community health. When you take account of an assessment which says that there is effectively negligible risk from the vent operation, we could simply not justify the tens of millions of dollars which is involved in other solutions.

I know that point has been made by some members of the community that what is \$20 million or \$30 million in a \$450 million project, but I can assure you that there are plenty of other projects for the benefit of the environment and public health on which we could spend those funds. We are obliged to take account of all these sorts of factors in making this judgment.¹⁷⁴

7.10 With respect to the Olympics factor, a representative of the community group provided a contrasting view to that of Sydney Water:

I cannot tell you how many times we were told, "We cannot do anything; we have got the Olympic deadline." It horrifies me that the answer slid away from that. We were told that from the beginning. We were told it in the CLC meetings and we were told it in mediation.¹⁷⁵

7.11 During the course of the inquiry, submissions were received and evidence heard which indicated concern by Manly residents towards funding being applied to piping tunnel exhaust back to North Head. Mr Ian Kiernan, an independent member of the Waterways Advisory Panel emphasised that venting tunnel exhaust at North Head would exacerbate community feeling in Manly:

...it is not a matter of it being a health problem. It is a matter of the angst it will cause within Manly that suddenly there is a huge amount of money being applied to deliver them a vent stack for an area out of their precinct.¹⁷⁶

¹⁷³ Evidence of Mr Allan Henderson, Manager, Capital Programs, Sydney Water Corporation, 9 August 2000, p.11.

¹⁷⁴ Evidence of Mr Alex Walker, Managing Director, Sydney Water Corporation, 9 August 2000, p.23.

¹⁷⁵ Evidence of Ms Wendy Norton, Scotts Creek Community Liaison Committee, 9 August 2000, p.30.

¹⁷⁶ Evidence of Mr Ian Kiernan, Independent Member, Waterways Advisory Panel, 9 August 2000, p.69.

7.12 In evidence before the Committee, Mr Bob Wilson, also an independent member of the Waterways Advisory Panel, stated that the priorities of the residents of Manly were getting sludge trucks out and fixing Manly Lagoon, neither of which transpired. Mr David Barr MP, Member for Manly and member of the Manly Community Liaison Committee reiterated the concern of Manly residents:

Sydney Water promised the people of Manly that as part of the project a sludge pipe would be incorporated into the tunnel in order to pipe sludge out of Manly. They have failed to live up to this promise.¹⁷⁷

7.13 The Committee is cognisant of the Manly residents' concerns and on 18 August 2000, resolved to conduct an inquiry into Sydney Water's Biosolids Strategy which directly impacts on the Manly community.

Return exhaust line from Tunks Park to North Head STP in tunnel roof

7.14 Given the cost of installing exhaust lines from Scotts Creek and Lane Cove River West to the North Head STP scrubber is estimated to be \$48 million, the Committee was interested to explore an alternative option that would reduce emissions at Scotts Creek.

7.15 The Committee examined option 2c, which would involve installation of a return exhaust line placed in the tunnel roof from Tunks Park to North Head STP. This option would result in reduced emissions, at a lower cost than installing separate exhaust lines from Scotts Creek and Lane Cove River West.

7.16 Option 2c would operate from the time the tunnel reaches the 15% full (80 megalitre) mark and would continue to vent until the sewage level reached the tunnel roof at Tunks Park at about 80% capacity. At this point, the remaining air in the tunnel would vent at Scotts Creek. The Committee asked Sydney Water whether any modelling was done to determine how often air would vent at Scotts Creek if option 2c was implemented. Mr Allan Henderson stated that Sydney Water has not specifically modelled that situation.¹⁷⁸

7.17 Mr Alex Walker was asked by the Committee whether the lost tunnel capacity as a result of sealing-off the Tunks Park vent was approximately four or five megalitres. Mr Walker, responded:

It would be less than that. It would be in that order of magnitude.¹⁷⁹

7.18 The Committee asked Sydney Water whether a benefit of option 2c would be that the remaining tunnel air that would vent at Scotts Creek would be less polluted as emissions would only occur when the tunnel was near 80% capacity. It was the view of Mr Walker that the cost of option 2c could not be justified on that basis:

...it is still \$26 million, the figure which is included in our submission on option 2c....The point is, in any case, that the Scotts Creek vent will only come into

¹⁷⁷ Submission No. 162, Mr David Barr MP, Member for Manly, p.2.

¹⁷⁸ Evidence of Mr Alan Henderson, Manager, Capital Programs, Sydney Water Corporation 9 August 2000, p.21.

¹⁷⁹ Evidence of Mr Alex Walker, Managing Director, Sydney Water Corporation, 9 August 2000, pp.19-20.

operation under the very sorts of conditions... when you do have a major storm event and when the inflow to the tunnel is very diluted—that is, diluted with rainwater, sewage—so it is only those conditions, anyway, which constitute the five or six days a year or the couple of occurrences a year where you are going to get that.¹⁸⁰

7.19 Mr Marc Lee, a Scotts Creek resident contended that the cost of option 2c would be significantly lower than the costing provided by Sydney Water. He stated:

The indication we have been given for the Scott's Creek part of it is that it would be at least as low as \$16 million. But let me go to the cost just quickly. In the mediation they said \$24 million plus an extra 25 per cent loading just in case. In the CLC for the same solution they said \$18 million.

We got a costing that dropped it right down to \$16 million and possibly as low as \$10 million depending on the cost of the pipe, which we did not actually get to suppliers about. But we assumed Sydney Water's costing for the pipe, and that is what came to \$16 million. If the pipe cost was lower, it would come down to less than that. You would have to add in a little bit more for the Lane Cove end if you wanted to add Lane Cove into it.

7.20 Mr Lee was unwilling to provide the source of the costing to the Committee on the basis that it was given in confidence by a large engineering organisation which has dealings with Sydney Water.¹⁸¹

7.21 From examination of the various alternative options for a return exhaust line to North Head, the installation of a return exhaust line to Tunks Park, would possess a number of benefits over Options 2a and 2b which would involve return exhaust lines to Scotts Creek and to Lane Cove River West. Firstly, several megalitres of volume which has been lost through the proposed closure of the Tunks Park vent would be more effectively utilised. Secondly, both Lane Cove River West and Scotts Creek local areas would benefit proportionately from an exhaust line to Tunks Park. Thirdly, the Tunks Park option would negate the need to incur additional costs of installing exhaust lines up the Lane Cove River West and Scotts Creek branch sections of the tunnel. Finally, not installing exhaust lines up the Lane Cove River West and Scotts Creek branch sections of the tunnel would result in less tunnel capacity being lost through displacement.

Installation of a final filter

7.22 The Committee sought to determine whether the installation of a final filter in addition to the pre-filter and impregnated granulated activated carbon filters would address concerns relating to the emissions of micro-organisms. A type of final filter discussed by both Sydney Water and community groups was a high-efficiency particle-arrestor (HEPA) filter. Prof Gilbert advised the Committee that HEPA filters are:

¹⁸⁰ Evidence of Mr Alex Walker, Managing Director, Sydney Water Corporation, 9 August 2000, p.21.

¹⁸¹ Evidence of Mr Marc Lee, Engineering adviser to mediation and the technical subcommittee, 9 August 2000, p.40.

...used specifically to remove micro-organisms in circumstances such as a laboratory or a safety cabinet in a laboratory where organisms are being vented into the external atmosphere which may contain significant pathogens. These are high efficiency filters which remove bacteria.¹⁸²

7.23 The Committee asked Sydney Water, why this option was not pursued. Mr Ron Quill, General Manager, Asset Solutions, Sydney Water Corporation, indicated that the option had been discussed with the Scotts Creek community during mediation. He further advised:

We are still having ongoing discussions with the Department of Health about the merits of such a filter. Now, when we talk about hospital grade, it does not necessarily mean that it is the same sort of filter that is actually typically installed in an operating theatre but it still has, as I understand it, relatively high operating efficiency.¹⁸³

7.24 Of interest to the Committee was that correspondence from some community representatives claimed that Sydney Water “dropped” the technical specifications for a HEPA filter after mediation,¹⁸⁴ however correspondence from Sydney Water indicates that the offer of both a 15 metre stack to assist air dispersion and a HEPA filter was rejected by the community.¹⁸⁵

7.25 The Committee asked Sydney Water whether the HEPA filter would that remove Legionella. In response, Mr Walker stated:

We understand, ...that it removes some aerosols and the key issue, of course, with Legionella is that the manner in which Legionella would be conveyed from the tunnel, if it gets there at all, would be by aerosols.¹⁸⁶

7.26 In correspondence to the Committee following the hearing, Mr Quill elaborated on Mr Walker’s response by stating:

The HEPA filter we have proposed, has a 95% removal efficiency and according to the specification will remove particles down to 0.3 microns in size.¹⁸⁷

7.27 In his correspondence, Mr Quill highlighted a statement made in the submission from Mr Clive Broadbent AM, relating to the outbreak of Legionnaires’ disease in Wollongong in April 1987:

¹⁸² Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.19.

¹⁸³ Evidence of Mr Ron Quill, General Manager, Asset Solutions, Sydney Water Corporation, 9 August 2000, p.19.

¹⁸⁴ For example, Correspondence from Mr Brian Moran, President, Parents Association, Glenaeon Rudolph Steiner School, dated 21 August 2000, p.2.

¹⁸⁵ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.19-20.

¹⁸⁶ Evidence of Mr Alex Walker, Managing Director, Sydney Water Corporation, 9 August 2000, p.19.

¹⁸⁷ Correspondence from Mr Ron Quill, General Manager, Asset Solutions, Sydney Water Corporation, dated 17 August 2000.

High quality filters, ie having a performance of, say, 95% against particles around 2 to 5 micron size would doubtless have prevented this outbreak.¹⁸⁸

7.28 The Committee asked Assoc Prof Ray Kearney whether he believed the addition of a HEPA filter would remove health risks to the Scotts Creek community from the vent. Assoc Prof Kearney stated he was not confident a HEPA filter would be suitable at the Scotts Creek facility:

My experience with HEPA filters is that they are very effective in protecting operators at work stations in which infectious materials are handled. Under such conditions they are designed to filter dry air, not moist. With this understanding I am not confident of their suitability to filter contaminated humid atmosphere at Scotts Creek at such a high rate and capacity needed without becoming blocked.¹⁸⁹

7.29 In later correspondence to the Committee, Assoc Prof Kearney further stated:

I believe such a filter has been offered without any validation of its suitability and that it will not block when exposed to wet-bioaerosols. Blockage of the third-filter (0.3) micron would result in unacceptable pressure build-up across the filter surfaces to force Sydney Water Corporation to open the pressure relief valve and exhaust unfiltered sewage emissions.

If however, such validation can be provided together with a graded series of such filters then it is my belief that the risk to health and well being would probably be negligible.¹⁹⁰

7.30 The Committee also asked Assoc Prof Kearney whether he was aware of any filter technologies which would remove the health risks to the community from the vent. Assoc Prof Ray Kearney indicated that:

I am not aware of any technology that will remove micro-organisms at a rate and capacity as required in this situation. Whilst electrostatic precipitators are highly efficient in removing dry particulates, including viruses, they are not designed to remove bioaerosols under such humid conditions.¹⁹¹

7.31 Nevertheless, during the mediation process, the Mediation Expert Panel was asked to consider an option of fitting an additional filter at Scotts Creek to control particles down to 0.3 microns. In the final report on mediation, the Mediation Expert Panel stated:

¹⁸⁸ Submission No.24, Clive Broadbent and Associates Pty Ltd, pp.1-2.

¹⁸⁹ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 21 August 2000, p.8.

¹⁹⁰ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 20 October 2000, p.29.

¹⁹¹ Correspondence from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, dated 21 August 2000, p.8.

In summary, the experts either support or do not oppose the use of this filter, if properly designed and maintained, as a solution to the problem, provided its efficacy in substantially reducing aerosols is demonstrated.¹⁹²

7.32 In correspondence provided to the Committee by Sydney Water, the Committee was informed that Sydney Water reached agreement with Hunters Hill Council, Lane Cove Council and Lane Cove River West CLC for the installation of a final HEPA filter at the Lane Cove West Ventilation Facilities. Under the agreement, Sydney Water has undertaken to provide:

A final filter, at least 95% efficient on 0.3 micron HOT DOP¹⁹³ particles, in addition to the pre-filter and GAC filter. This is to be installed for as long as the community believe it is needed and regularly services and/or replaced to maintain its effectiveness and efficiency in accordance with the regulatory conditions for operation of the tunnel.¹⁹⁴

Sydney Water's response to alternative proposals

7.33 Sydney Water considered alternative options to venting at Scotts Creek, including what is known as Option 2(c) in the mediation process (Exhaust line in Tunnel from Tunks Park to North Head STP scrubber).

7.34 Sydney Water advised the Committee of practical reasons why it does not support this option, including:

Sydney Water believes the suggested piping of displaced air back to Manly is an unacceptable proposal based on the negligible health impacts associated with the proposed vent as well as some economic, technical and environmental considerations. In addition, if this option were implemented for the Scotts Creek filtered vent, it would be necessary, in equity grounds, for it to be implemented for every other vent location, including the Lane Cove River West location in the Hunters Hill Municipality, thereby causing a further increase in cost.

Sydney Water doubts that this option could be justified in an environmental assessment process for the reasons identified below.

FINANCIAL COST

The cost of piping displaced air from Scotts Creek to North Head was determined as part of Mediation process. The preferred option was costed at \$30 million.

¹⁹² Final Report on Mediation between Sydney Water and the Community of the Scotts Creek Area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment, March 2000, p.21

¹⁹³ According to Australian Standard 4260, para: 1.3.20, A (hot) DOP particle refers to a test aerosol generated by condensing vapour evaporated from liquid dioctylphthalate by heating, onto atmospheric nuclei.

¹⁹⁴ Correspondence from Mr Ron Quill, General Manager, Asset Solutions, Sydney Water Corporation, dated 19 September 2000, attaching Letter from Allan Henderson, Manager, Capital Programmes, Sydney Water Corporation to Barry Smith, General Manager, Hunters Hill Council, dated 5 September 2000.

The Mediation Report identified the additional cost of incorporating Lane Cove River West as \$18 million. The community endorsed this costing during Mediation.

It is probable that the capital cost would be greater because the difficulty of working within the constraints of the tunnel will identify a significant number of additional issues not considered by the Mediation Technical Sub-Committee.

There would be further additional costs for on-site structures at North Head STP.

TECHNICAL ISSUES

Environmental Impact Assessment would delay the operation of the tunnel. There would be additional costs for an environmental assessment process. Completion of that process could take up to one year, or even longer, and would delay the implementation of the tunnel project, thus delaying the time frame when the benefits of the tunnel would be available to the people of Sydney.

The proposal would increase the amount of maintenance required for the tunnel system. There would be additional facilities to be maintained.

The air pipeline would reduce the available volume in the tunnel to accept overflows. The pipeline would severely restrict the amount of volume in the tunnel between Tunks Park and Lane Cove River West and make maintenance of that section of the tunnel extremely difficult.

ENVIRONMENTAL IMPACT

The reduction in tunnel volume available for collection of overflows would reduce the environmental performance of the tunnel.

Other impacts include:

- Breach of commitments under Sewer Overflow Licensing Program (SOLP) EIS
- Breach of approved Northside Storage Tunnel EIS
- Continued loss of amenity and increased public health risks resulting from additional wet weather overflows to Sydney Harbour
- New EIS required to cover:
 - Pipe in tunnel
 - New fan house and above ground facilities at Scotts Creek and Lane Cove River West
 - Increased air release at North Head STP
 - Revised hazard assessment for North Head STP
- Probable delay in the effective start up of tunnel by at least one year
- Possibility of rejection of EIS, based on inadequately demonstrated benefit, with no possible resolution.¹⁹⁵

¹⁹⁵ Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.12-13.

Conclusion

- 7.35** In arriving at a conclusion for an alternative option to the proposed Scotts Creek facility, the Committee has given considerable thought to several issues raised during the course of the inquiry.
- 7.36** The health impacts of the Scotts Creek vent are unknown. There is an absence of consistent information regarding the ability of activated carbon filters to control emissions of airborne pathogens into the Scotts Creek valley. While HEPA filters are proven to be relatively effective in filtering micro-organisms, no evidence was received by the Committee to enable it to determine whether a HEPA filter will be suitable for the Scotts Creek facility. However, no evidence was received by the Committee to enable it to determine whether there are other suitable technologies available which might prove an effective filter for the Scotts Creek facility.
- 7.37** The ventilation facility is arguably unique in nature, therefore comparison with similar vents is difficult. However, some of the uncertainty about health impacts is attributable to Sydney Water's oversight of potential health impacts of the vent until after publication of the REF.
- 7.38** Uncertainties also exist in costings for project alternatives as community information is not verifiable and Sydney Water has an unfavourable track record with the NST budget. A certainty however, is that the cost for an alternative option will be significant and no cost benefit analysis is available to the Committee to permit an effective evaluation.
- 7.39** Since Sydney Water is clearly amenable to installation of a HEPA filter at Scotts Creek, as a minimum and interim measure, this option should be implemented.
- 7.40** The Committee accepts that health risks associated with the Scotts Creek vent are unknown, however it is of the view that children, the aged, the immuno-suppressed and the wider community should not be exposed to risks which may harm their health.

Recommendation 8

The Committee recommends that Sydney Water install a final filter, at least 95% efficient on 0.3 micron Total Suspended Solids (TSS) particles, in addition to the pre-filter and impregnated granulated activated carbon filter, as a means to alleviate concerns raised by the community.

Recommendation 9

The Committee recommends that as a permanent measure, Sydney Water construct a return exhaust line from Tunks Park to the North Head STP.

Statement of Dissent: Government Members

- We strongly disagree with the findings and recommendations adopted by the Committee in the Report.

Committee Report

- It is clear that the final recommendations of the Committee seek to implement an entirely superfluous and expensive engineering project. The Committee's approach is simplistic, ignores overwhelming scientific evidence and disregards the experience of operating sewers in Sydney for over 100 years.
- A number of factual inaccuracies were brought to the committee's attention, however, unfortunately, the Report still contains some erroneous information. It would appear that the sole purpose of the Report is to create unnecessary alarm about matters that have clearly been resolved. This is shown in the Minutes attached to the Report.
- We believe that the Committee Report ignores the scientific evidence presented by numerous experts who provided advice to the Inquiry. This means that the selection of evidence incorporated into the Report is misleading.
- An independent expert panel convened by the NSW Chief Health Officer met to discuss alleged impacts on public health. The Expert Panel was unanimous in its view that the evidence indicates that the filtered vent presents no increase in risks to public health. We concur with this advice. The Report of the Expert Panel is attached to this Dissenting Statement.
- We believe that the Committee's recommendations, if implemented, would reduce the efficiency and environmental benefits from the Northside Storage Tunnel, increase costs by about \$48 million and cause delays of a year or more. These consequences would be unfortunate.
- We believe that it is unfortunate that the Report does not consider the issues in a comprehensive manner. Regrettably, and despite the voluminous evidence provided to the Committee about the project's benefits, significant resources have been allocated to this Inquiry which could have been better utilised elsewhere.

Recommendation

- It should be noted that Sydney Water first proposed the installation of a final filter at Scotts Creek during Mediation which commenced in August 1999. Sydney Water is continuing discussions with the community about this option. We recommend that these discussions continue.

Attachment

Report of the Chief Health Officer's Expert Panel

The Hon Richard Jones MLC
Committee Chair
General Purpose Standing Committee No 5
Parliament House
Macquarie Street
SYDNEY 2000 NSW

Dear Mr Jones

I have convened an expert panel of microbiologists and public health physicians to advise me on possible health problems related to the commissioning of the Scott's Creek and Lane Cove vents of the Northside Storage Tunnel. The terms of reference of this Expert Panel are to:

- Provide expert advice to the Chief Health Officer on the potential and likely health effects of the Northside Storage Tunnel Project
- Review relevant literature and attend appropriate briefings to ensure that the advice available to the Chief Health Officer is accurate and evidence based
- At the request of the Chief Health Officer and through the Expert Panel Chair, to be available to respond to media inquiries in regard to health related aspects of the Northside Storage Tunnel Project

The members of this group are:

Professor Lyn Gilbert (Chair) – Director, Centre for Infectious Diseases and Microbiology Laboratory Services (CIDMLS), Institute of Clinical Pathology and Medical Research (ICPMR), Westmead Hospital.

Professor Adrian Lee – Pro Vice Chancellor (Education) University of NSW.

Former Head of Microbiology and Immunology, UNSW

Professor Tania Sorrell – Professor of Infectious Diseases, University of Sydney and Director, CIDM, Westmead Hospital.

Dr Dominic Dwyer – Medical Virologist, CIDMLS, ICPMR, Westmead Hospital.

Dr David Cunliffe – Microbiologist, Department of Human Services, South Australia.

Dr Jeremy McAnulty - Medical Epidemiologist, NSW Health

Dr Stephen Corbett – Public Health Physician, NSW Health

The members of the expert panel have reviewed submissions to the General Purpose Standing Committee No 5 into the Northside Storage Tunnel at Scott's Creek and have been briefed by Sydney Water on the operation of the tunnel and the associated vents. These reviews have included the contrary scientific evidence presented to the Standing Committee and in particular the concerns raised by Associate Professor Kearney in relation to microbial risk.

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E-mail nswhealth@doh.health.nsw.gov.au

At the most recent meeting of this Expert Panel on 23rd August A/Professor Kearney was in attendance. He was able to put his views to the assembled group.

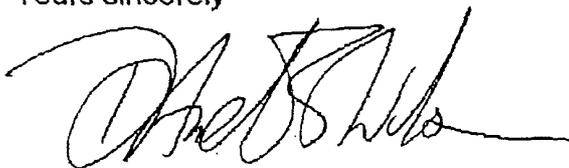
After reviewing this evidence and notwithstanding the evidence presented by A/Professor Kearney, the Expert Panel has reached agreement on a number of key issues which have been raised both by the community and during the Parliamentary Inquiry:

- Diluted sewage overflow in the Northside tunnel although likely to contain a number of potentially harmful bacteria is considered a low microbial risk in the context of the Scott's Creek vent. *Legionella pneumophila*, the organism that causes Legionnaires' Disease may for example be present in low numbers. The panel is strongly of the view that the tunnel and its associated vents and filter systems will not favour proliferation of this organism. For practicable purposes there is a negligible risk of Legionnaires' Disease associated with this vent.
- The Expert Panel has noted that notwithstanding this low microbial risk, the design of the tunnel and its vents are likely to capture any aerosols that may be generated within the tunnel during high rainfall events. Several design features of the tunnel, such as vortex flow, a series of settling chambers, airflow in the main tunnel and re-entrainment of discharging air with the in-flow, will reduce the concentration of aerosol in the discharged airflow.
- The Expert Panel agrees that the proposed activated granulated carbon filter is largely irrelevant since it is extremely unlikely that infective material will reach this part of the vent. Nonetheless it is likely that it will form an additional physical barrier to the passage to any aerosol which does reach the filter by virtue of its action as a depth filter – presenting a tortuous path for aerosol particles to traverse.
- The Expert Panel does not believe it is likely that regrowth of pathogenic bacteria will occur in this filter. The dry environment between storm events, the absence of nutrients and the high pH will inhibit bacterial growth.
- The Expert Panel is unanimous in their view that the evidence indicates that these vents present no increase in risks to public health. There is no evidence to indicate that the emissions from these vents will contain bacteria likely to cause illness. There is no direct evidence, in the scientific literature, of microbiological or disease risk associated with a filtered storage tunnel vent. Similar vents in North America have been operating for some years with no reports of public health problems.

- The Expert Panel notes the desire of community members in Lane Cove and Scott's Creek for air monitoring for microbes after these vents are commissioned. The Panel believes that for technical reasons it would be difficult to establish a meaningful air monitoring program. More importantly, the Expert Panel is strongly of the view that such a monitoring program is unnecessary given the engineering controls and maintenance program already in place and would not provide meaningful data on which to base a public health decision. However, if your Committee was strongly of the view that some form of short term testing would help allay the concerns of the community, I would ask the Expert Panel to reconsider how this might be achieved.
- The proposed Northside Tunnel and vent are likely to confer important public health benefits because of improved recreational water quality in Sydney Harbour. The potential for aerosol generation at the Scott's Creek site will likely be considerably reduced for all rainfall events because overflows will be routed either into the tunnel or directly at reduced frequency and volume into Scott's Creek and not as at present into an uncontrolled and cascading overflow.
- In conclusion the Expert Panel is satisfied that the operation of the Northside Storage Tunnel, Scott's Creek Vent will not present an increased public health risk for the surrounding community. The Expert Panel is satisfied that the hierarchy of controls of chemical and microbial hazards from these vents is more than adequate and that ongoing monitoring for bacteria emitted from these vents is unnecessary.

I would commend the conclusions of this Expert Panel, which NSW Health believes represents a consensus of credible and current scientific opinion to the Standing Committee.

Yours sincerely



Dr Andrew Wilson
Deputy Director-General, Chief Health Officer

30 August 2000

Appendix 1

List of Submissions

List of Submissions

Number	Name (Organisation)	Number	Name (Organisation)
1	White, James	37	Curtis, George & Margherita
2	Baumann, J & J	38	Chan, Bernard & Audrey
3	Kay, Paulette	39	Chen, C W
4	Reynolds, D N	40	Cooper, Nicky & Henry
5	Mirana, Chris	41	Farina, Savario
6	Anonymous	42	Tuohy, Frank
7	Crane, Yvonne	43	Dengate, Margret (Trading Places Pty Ltd)
8	Stehlik, Ian (Orana School for Rudolf Steiner Education)	44	Ngui, Janet
9	Witkop, Leslie	45	Pearson, Geoff
10	Peters, Nancy	46	Congues, Michelle
11	Medin, Ivan	47	Boezeman, Bonita
12	Champion, Sean	48	Bal, Diana
13	Sorrell, Eva & Albert	49	Freeman, Andrea & Judes, Edythe
14	Lam, D	50	Ortega, Sonia & Luis
15	Rosenthal, D M	51	Zabeti, Fatima
16	Rosenthal, J A	52	Mahmoodifar, Mr/Ms
17	Russell-Jones, Helen	53	Stepp, N P
18	Vilensky, Leo	54	Izdfar, Alan & Yasmih
19	Harvey, Patricia (Mosman Municipal Council)	55	Tsieng, T
20	Luget, Judith Anne	56	Sonego, V
21	Charlton, Geoff, Natasha & Ruth	57	Kaldor, Deberah
22	Ling, William & Margret	58	Rice, Shirley
23	Martin, Leigh (Total Environment Centre)	59	Jackson, Geoffery & Araminta
24	Broadbent, Clive	60	Kaldor, Peter
25	Cliffe, William	61	Sully, Primrose
26	Timbrell, Ruth	62	Terado, Satomi
27	Jephcott, Lynne	63	Ogama, Mariko
28	Wickham, Jennifer	64	McDonell, Ian
29	Hickling, Martin	65	Hibner, Deon & Kim
30	Segal Cranko, Lynne	66	Byrnes, Pamela & Kevin
31	Macqueen, W G & E	67	Gallaher, Aland
32	Wubben, Harry & Elizabeth	68	Gosse Family
33	Major, Pamela	69	Hussey, Brenton
34	Connolly, Kay & Pat	70	Biuiano, P
35	Vilensky, M	71	Pennefather, John
36	Staroba, Helene	72	English, David & Van Toorn, Penny

73	Arnold, D & M	114	Ponchan, Doris
74	Street, John & Enid	115	Taylor, Craig
75	Ryan, Holi	116	Stillman, Murray
76	Drahos Family	117	Yip, Phillip & Lowe, Sandra
77	Elliott, Jenny	118	Bowen, Christine
78	Goff, Anthony	119	Harte, Martina
79	Latham, Valerie & Garry	120	O'Donnell, Stephen
80	McGree, Bernadette	121	Fahey, Garry & Helen
81	O'Malley, Kim	122	Bates, Melita
82	Smith Family	123	James, D A & M H
83	Price, John	124	Layden, Michael (Rudolf Steiners School of Australia & Association)
84	Harrod, Garnt & Debbie	125	Hayes, R W
85	Blattmawn, Leve	126	Romans-Campbell, Anni
86	Martin, David	127	Coggins, Liz
87	McGowan, Shane	128	Zarb, Annette
88	Charles, Pressley	129	Brown, Morag
89	Cage, Jillian	130	Norris, Phillip
90	Mirams, Angela	131	Foster, Wendy
91	Maiorana, Joyce	132	Manconi, G & B
92	McDonell, Kathleen	133	Bradshaw, Bruce
93	Dengate, Gordon	134	Mankoni, Peter & Karla
94	Kunz, Gaby (Bowral Rudolf Steiner School)	135	Manconi, Angela
95	Koulias Family	136	Medway, A T & Burger, J E
96	Cottee, Don (Hunters Hill Council)	137	Macalpine, Stephan & Wendy
97	Kaye, Ralph (Ralph Kaye Consulting)	138	Ee, T P
98	Donohoe, Mark	139	West, Caroline
99	Schoeman, John & Christine	140	Segto, Helena & William
100	Rickli, Monika	141	Busch, S (Little Yarra Steiner School)
101	Missen, Shirely Ruth	142	Small, Julie & Phillip
102	Murphy, Dean & Sally	143	Tullon, David
103	Jesse, Graham	144	Kiesewetter, Andrew, Roger & Linda
104	Shteinman, Diane	145	George, Jenny & Ed
105	Poole, Alwyn	146	Mortazavi Family
106	Spragg, Tony	147	Campbell, Seamus & Sandy
107	Hargis, M V	148	Kelly, Vanessa
108	Frazer, Andrew (Castle Cove Parents & Citizens Association)	149	Kelly, Joyce
109	Durose, Eileen	150	Emery, Jill
110	Lee, Maria	151	Emery, Pam
111	Lesnie, Warren & Marianne	152	Dowrick, Stephanie
112	Miller, Dixie	153	Kwan, Edgar & Lilian
113	Quinn, Tom		

154	West, Murray	190	Gallagher, James & Mary
155	Keller, J	191	Barclay, H E
156	Shaw, Robin	192	Hiley, Geoff & Elaine
157	Colman, Jacqueline & Gary	193	O'Grady, Stan
158	Walker, Alex (Sydney Water Corporation)	194	Macfarlane, Doreen
159	Noonan, Geoff (Department of Urban Affairs & Planning)	195	Conolly, Richard
160	Hymann, Rod	196	Burchfield, J B
161	Dowden, Martin & Mary-Anne	197	Hayes, John
162	Barr, David (Member for Manly, NSW Legislative Assembly)	198	Eastwood, Grant & Barley, Jude
163	Reid, Michael (NSW Health Department)	199	Tastzidis, Con
164	Mitchell, Louise (Willoughby Environmental Protection Association)	200	Shaw, Elizabeth
165	Moran, Brian (Gleneaon Parents Association)	201	Brown, Jock
166	Chapman, Terry (Association of Independent Schools of NSW Ltd)	202	Pooley, Michael
167	Norton, Wendy (Scotts Creek Liaison Committee)	203	Blackwood, J A
168	Norton, Wendy	204	Mabbott, Glen & Barbara
169	Rowan, Leony (Gleneaon Rudolf Steiner School)	205	Rosenburg, Louise
170	Reilly, Pat (Willoughby City Council)	206	Sano, Mihoko
171	Gentle, Rosemary	207	Cohan, Zac
172	Rutherford, Ken (Castle Cove Progress Association)	208	Pilko, Catherine
173	Woodward, Joe (Environment Protection Authority)	209	Dowick, Gabriel
174	Richadi, Phyllis	210	Mowday, Glennis
175	Failes, Robert	211	Breneson, Gay
176	Lockett, Linda	212	Horan, Ben
177	Williams, Ian	213	Hamann, Elliott
178	Kool, Joanna & David	214	Vranken, Saskia
179	Nicholls, Marie	215	Naughton, Marg
180	Grundy, Eva & Stephen	216	Westcott, Lane
181	Allen, Peter	217	Forrest-Smith, Peter
182	Tantipech, John & Orapin	218	Smith, Janet Elizabeth
183	Whisson, Tina (Mt Baker Waldorf School)	219	Rodley, Luke
184	Ireson, Craig & Sharon	220	Bacash, Michelle
185	Aldridge, Sharne	221	Hughes, Kiera & O'Loughlin, Justin
186	Moran, Robert & Nicola	222	Rowan, John
187	Hartley, Simon	223	Rowan, Leony
188	Crane, Richard	224	Naughton, Sarah
189	Scard, Robert	225	Leroux, Mike

226	Clark, Andrew	266	Dickinson, Angela
227	Davey, Surya	267	Hart, James
228	Garske, Linda	268	Richardson, Daniel
229	Basch, Sandra (Little Yarra Steiner School)	269	McMahon, Paul & Marion
230	Jacobson, Else	270	James, D G & D T
231	Barton B W	271	Kennedy, Gael
232	Ellean, Elizabeth	272	Macpherson, Jean & John
233	Weastratt, Mia	273	Harrison, Michael
234	Greenwood, Shannon	274	Header, Tony
235	Hill, Andrew	275	Merline, Rosemary (The Childrens' Garden School)
236	Carniato, Walter & Pritchard, Lisa	276	Kerr, Shaun
237	Lillicrap, Christian	277	Underwood, Ruth (Cape Byron Rudolf Steiner School)
238	Ramsey, Max	278	Georg, Dietrich
239	Wilson, Malcolm	279	Platt, Reg
240	St Clair, Linda	280	Rankin, Enid
241	Mitterhuener, Emily	281	Lockwood, Lyle
242	Thatcher, Judy	282	Lockwood, Sylvia
243	Calandra, Maria (Glenaeon Rudolf Steiner School)	283	Johns, G C
244	Blackie, Georgia	284	Ringbauer, C
245	Ridley, Paul	285	Rollans, Gary & Tietge-Rollans, Brigitte
246	Bradshaw, Julia	286	Rowland, Vivienne
247	Chiarella, Hugo	287	Watkins, Rachel
248	Blackie, Maureen	288	Lynch, Denis
249	Allan, Michelle	289	Schulz, Judith
250	Mees, Cleo	290	Scharla, Laurel
251	Collins, Daniel	291	Gissing, Julie
252	Parkes, Amber	292	Macdonald, K & L
253	Sheldon, Pip	293	Fendon, Joseph
254	Pitt, Adam	294	Bryne, Cath (Chemical Awareness in Schools)
255	Huber, Robert	295	Elliott, Patsy
256	Brooker, Kym	296	Holtsmark, Eric
257	Bendeli, L M	297	Scott, Lesley & Fergus
258	Ryan, Janis	298	Tait, M
259	Day, Mike	299	Robertson, J
260	Sase, Kyo	300	Riches, Robert, Judith & Barbara
261	McCudden, Lucy and Fluhrer, Ju Ju	301	Puckeridge, Tracey (Casuarina Steiner School)
262	Fluhrer, Jonathan	302	Avenell, Kerry
263	Simpson-Goff, Carly	303	Selby, Simone
264	Collett, Lynne & Nguyen, Tri	304	Begley, Charles
265	Zajac, Monica	305	Friedman, John

306	Marshall, Stephen	347	Peters, Cate
307	Spragg, Adrian & Spragg-Rickli, Anita	348	McLennan, Geoffrey Keith
308	Scard, Helen & Rysenbery, Linda (Mothers of Glenaeon School)	349	Malolakis, John
309	Kenny, Pamela & Peter	350	Bradford, Christopher
310	Scott, Ned & Kathy	351	Powell, Alma
311	Rysenbry, Linda	352	Chow, Owen
312	Coburn, Kristin	353	Allen Hrovat
313	Dudman, V H	354	Peam, Rosslyn
314	Wilderink, Deborah & Bernard	355	Augoloupis, Steve
315	Ed (surname not provided)	356	Baverstock, S L
316	Henderson, Therese & Miller, Sam	357	Wolanski, Phillip
317	Schneider, Kathleen	358	Hendy, R A
318	McComb, Christine	359	Hayes E
319	Harvey, Tim	360	Catterns, David
320	Roberts, N	361	Crowley M G
321	Broekman, Shane	362	Adzersen, H & B
322	Purssey, James	363	Dalton, S
323	Lindon, Tahlie	364	Dengate, Christine Anne
324	Max (surname not provided)	365	Opie, Deborah
325	Rahilly, Jack	366	Hicks, Evelyn
326	Bendall, Lyndall	367	Marshall K S
327	Cottrell-Dormer, John	368	Powell, Robert & Eleni
328	Gordon, Louis	369	Marshall, Peter
329	Killat, Ashley	370	Powell, Sue
330	Blenkhorn, Amelia	371	Chan, Beverley
331	Milch, Ann	372	Watson, Karin
332	Lambert, Judy (The Manly Greens)	373	Barbour, Jennifer
333	Niedergessass, Dagmar	374	Caplice, Patrick & Therese
334	Wiesner, Diane	375	Debenham, Margaret
335	Kramer-Maier, Jacqueline & Maier, Karlheinz	376	Stewart, Kerry
336	Basser, L S	377	Cobb, Christopher
337	Mullins, Michael	378	Fleming, W & Y
338	Berney, Erwin	379	Kuerzinger, Imtraud
339	Francis, Christine & Simon	380	Luis, David R (Northside Clinic)
340	McKenzie, G S	381	Wilmer, Uschi
341	Traill, Jennifer	382	Stiller, G W & J G
342	Cooper, Michael	383	White, Ian
343	Kendler, Dianne	384	Selwyn, Ralph & Evelyn
344	Jones, Carolyn	385	Mathams, Grace
345	Frischknecht, M, P & N	386	Hamilton, Valerie
346	Carmichael, S	387	Gage, David & Louise

388	Fitch, Jacqueline	430	Thornley, Jennifer
389	Grant, F M	431	Caramanis, A & A
390	Robertson, Candi	432	Stackhouse, Susan
391	Lau, Anthony	433	Walters, J F & English, K A
392	Goesch, Pamela	434	Croyden, Ron & Rosemary
393	Krajcer, Sarapina	435	Warwick, G and F
394	Chey, J V	436	Henderson, Scott
395	Schwarch, Gisele	437	Adie, Jean Patricia
396	Anderson, Janet	438	Kidd, L & E
397	Daniele, Tony	439	Macarthur, Ann
398	Barbour, Jane & Andrew	440	Hallett, Brian
399	Bradbury, Mark	441	Milling, Joanne
400	Glen, Allan & Mildred	442	Burtenshaw, E
401	Grima, Marion & Valentine	443	Jaramillo, Patricia
402	Stoecker, Ilse	444	Javanillo, Juan
403	Wong, George	445	Leon, Andrea
404	Walkley, E L (Jean)	446	Farrelly, Bryn,
405	Landsberry, Gwen	447	Phillp, E
406	McMurray, L B	448	Gladding, Shirley
407	Campbell, R B	449	Stinson, O G
408	Long, Clyde Philip	450	Dertch, Sandra
409	Taafe, Margaret	451	Lynch, Judith
410	Jinoian, V & E	452	Miller, J
411	Collins, Christine	453	Webster, L
412	Rodely, David & Maggie	454	Dutoit, V J
413	Witkop, Peter	455	Bothwell, D K
414	White, Lorna	456	Illegible
415	Hamann, Julie	457	Findlay, H
416	Steel, Maryn	458	Walsh, S
417	Lupacchini, Antonio & Vilma	459	Esdaile, G J
418	White, Carolyn	460	Carfrae, Yvonne & Bruce
419	Fonsny, Pierre & Claire	461	Young, J
420	Clark, Kay & Lambert, Arthur Sydney	462	Mercer, R H
421	Llewellyn-Smith, Carole Lucy	463	Bevan, Jan
422	Walter, Ellen	464	Hufschmid, Sonja
423	Don, Jennifer	465	Gosse, Fiona
424	Bevan, Carmel	466	Vincent, Kylie
425	Pounder, Richard	467	Carlill, D J
426	Finkelde, Anne	468	Muller-Loth, L
427	Kery, Otto	469	Kersch, A F
428	Ginsborg, Stephen	470	Klotz, W
429	Totsuka, Tetsuya	471	Naylor, M

472	Horstead, N	514	Tizzard, N
473	Young, C	515	Connolly, M A
474	Smallhorn, B	516	Nelson, Margaret
475	Timmins, I	517	Becker, Erica
476	Vranluen, R	518	Illegible
477	Campbell, M	519	Mansour, Michael, Castlecrag Post Office???
478	Timmins, R	520	Bowman, Sharryn
479	Lauricella, R	521	Fitzpatrick, Karen
480	Harris, R E	522	Wilson, Kylie
481	Timmins, B I	523	Ward, Alan
482	Timmins, B A	524	Ming, Wei
483	Hetherington, G	525	McLean, Rose
484	Ryder, A M	526	McGuire, S
485	Bush, N	527	Chambers, Chris
486	Witkop, N	528	Tyalor, David
487	Witkop, S	529	Blessington, J
488	Stone-Herbert, J	530	Clare, Anita
489	Bowyer, M & J	531	Woolston, D
490	Adams, L	532	Cobbin, Lisa
491	O'Mara, J	533	Klavins, Peter
492	Joachim, M	534	Pieters-Hawke, Sue
493	Jensen, Clare	535	Concannon, Susan
494	Willkinson, Margaret	536	Korner, Val
495	Gillard, C	537	Chambers, J
496	Nardane, P	538	Anderson, N
497	Hutchinson, Margaret	539	Long, Anne
498	Hordern, C E	540	Spurr, C K
499	Drake, L	541	Allison, Edward
500	McPherson, J A	542	Allen, James
501	Corcoran, Clare	543	Misrlai, Sandor
502	Wilkins, Meg	544	Richards, Linda
503	Basil-Jones, Caroline	545	Berton, Jo
504	McDonald, Joanne	546	Carmody, Judith
505	Baker, M C	547	Betts, P
506	Mendens, Sean	548	Rogers, C
507	Hooper, Daniel	549	Kearney, Richard
508	Celik, Dilek	550	Thomson, Catriona
509	Leung, Pamela	551	Gladstone, George
510	Cordony, Phillip	552	Jones, Andrew
511	Dale, Louise	553	Harris, Lynne
512	Raftos, John	554	Lord, Merope
513	Cripps, D	555	Shodr, John

556	Fitzpatrick, Craig	598	Salter, Diane
557	Beckett, Ron	599	Pratt, Vickie
558	Smith, Rachael	600	Tierney, Sue
559	Dorilewik, Heidi	601	Doyle, Jean
560	Lucas, John	602	Portolesi, Teresa
561	Walker, Mandy	603	Fisher, Jean
562	Johnston, David	604	Long, P H
563	Jolly, Marion	605	Goodfellow, Stella
564	Lake, Louise	606	O'Grady, Roy
565	Davies, Margaret	607	Beauchamp, Rachael
566	Sinavam, Fawzi	608	Newman, Danielle
567	Gabara, T	609	Dunn, T
568	Spencer, Stuart	610	Parker, J
569	Spencer, R	611	Thompson, John
570	Middleton, Eric	612	Fitzgerald, Anna
571	Perkins, Michelle	613	Carapiet, Helen
572	Middleton, H	614	Martin, David
573	Timms, Gaynor	615	Hunter, Paul
574	Timms, Lucinda	616	Jackson, Sara
575	Strefnor, Lorelei	617	Ryan, Kerrie
576	Hunter, Carol Ann	618	Buckley, Judith
577	Lakmas, Jeff	619	McEleourn, Marion
578	Cooper, Malcolm	620	Walker, Suzi
579	Bulgin, Theresa	621	Connor, Irene
580	Marcin, Evelyne	622	Hartigan, F
581	Seeley, Gillian	623	Richards, J S
582	Jankelowitz, S	624	Richards, D S
583	Sutton, Peter	625	Bavanan, H
584	O'Sullivan, Victoria	626	Driffield, Linda
585	Brown, Julie	627	Moy, J D
586	Brown, Jean	628	Dalman, M S
587	Broxom, Genevieve	629	Scobie, Jeanette
588	Steven-Jones, Bronwin	630	McCoy, A
589	Harcourt, M	631	St Quintin, L
590	Cooper, Martin	632	Samuel, Yvonne
591	Haigh, David and Judith	633	Burley, R
592	Power, Dorothy	634	Taylor, D
593	Brown, Anna	635	Proudian, Z V
594	O'Neil, Christine	636	Smith, Peggy
595	Gallaher, Brigitta	637	Levine, Sydney
596	Clarke, Annette	638	Keen, Jean
597	Beran, Maureen	639	Richardson, Rebekah

640	Anderson, M	682	Wolfers, Jane
641	Heath, Geraldine	683	Sills, Donna
642	Takahdshi, Angelina	684	Gallo, E
643	McElhone, Melissa	685	Brutans, Dace
644	Tai, Ikumi	686	Van Snippenburg, D
645	Oppl, Barbara	687	Calandra, Maria
646	Crowthek, Beryl	688	Schmidt, Juliet
647	Stebbing, Lyn	689	Farrell, Robin
648	Carruthers, Norma	690	Smart, Yvonne
649	Burnside, S	691	Psaltis, M
650	Hayashi, Saeri	692	Aritz, Kirstin
651	Crooks, Melissa	693	Lew, Kylie
652	Powell, Catherine	694	Coleman, N
653	Raymond, June	695	Pritchard, Lisa
654	Blunck, J	696	Hensler, N
655	Ho, Mandy	697	Koche, Louise
656	Ho, Vicci	698	Zammit, Janelle
657	Ho, Queenie	699	Speling, D
658	Wills, Robyn	700	Borrer, Patrina
659	Giblin, M T	701	Gorman, Alex
660	Rudder, Marilyn	702	Greg (surname not provided)
661	Macgregor, Michele	703	Ramsay, Victoria
662	Wright, Helen	704	Conabere, Anthony
663	McLeod, Bill	705	Jardan, R
664	Illegible	706	O'Donoghue, Debbie
665	Lipworth, E	707	Goesch, Peter
666	Downie, Kate	708	Osborne, T
667	Badcock, W M	709	Dunstan, I
668	Tucker, Gwen	710	Curson, Sheila
669	Agnew, Jane B	711	Gundland, Rob and Julie
670	Moran, J	712	Macolino, Caroline
671	Thomas, Dylan	713	Kassabian, Sylvia
672	Illegible	714	Jeghelian, M
673	Kennedy, B	715	Mattiolo, T
674	Robinson, John	716	Voyez, Denise and Martin
675	Glenn, Margaret	717	Martorana, Cathy and Matthew
676	Evans, Michelle	718	McElhone, Christine and Robert
677	Carroll, Paul	719	La Rosa, Julie
678	Crampton, P	720	Bruce, Sally
679	Blunck, Nina	721	McMullen, Susan
680	Marue, R	722	Kwok, W and C
681	Marshall, Barbara	723	Chan, Teresa

724	Ngui., David and Mary	766	Binkanee, Anon
725	Kuchid	767	Smith, Diana
726	Sussman, Pam	768	Schiller, Antonella
727	Bela	769	Sudradjat, Kevin
728	Keegan, Maggie	770	Kamsler, Gillian and Tim
729	Adams, Kareena	771	Mascenon, T
730	Sussman, A	772	McComb, J Adrian
731	Andary, Fay	773	Smith, Peter and Robyn
732	Moss, Stephen and Antoinette	774	Simpson, Joyce
733	Coyle, Rosalind and Coylis, Michael	775	Bach, Janni
734	Davey, Anne	776	Dickings, Karen
735	Cartwright, Susan	777	Chan, Nancy
736	Thatcher, R	778	Geraghty, C
737	Cranney, Jillian	779	Webb, Judy
738	Jarjovra, Richard and Liz	780	Richard, Karin
739	Braude, Nola and Garry	781	Leonard, Yvette
740	Seeto, Michael	782	Lucas, Sally-Ann
741	Lee, Peter	783	Flint, Janet
742	Kusumi, Takashiro and Agnes	784	Miller, J
743	St Clair, Paul	785	Elstone, Susan
744	Dean, Ingeborg and Edward	786	Cavenagh, Jean
745	Naughton, J	787	Thompson, Jeanette
746	Lee, Karen	788	Arbiv, Donna
747	Fluhrer, Joachim and Julia	789	Hedges, Grahame
748	Illegible	790	Thurlow, Fay
749	Johns, Margaret	791	Williams, Dawn
750	Eddie, Debra	792	Stark, Amos
751	Elihngton, Robin	793	Gray, Jane
752	Cooper, Kim	793	Wood, Cathy
753	Lamb, Chris	795	Forster, Ruth
754	Duffy, Emily	796	Allan, Lee
755	Klein, Nicole	797	Mann, Howard
756	Bayne, Kathy	798	Penn, Dennise
757	McRae, Shona	799	Gearside, Diana and Paul
758	Burgess, James	800	Theakstone, Gwynne
759	Wilson, Peter	801	Balhi, Soo
760	Le Roux, Graham	802	Rea, M
761	Gilfillan, A	803	Clark, Sandra
762	Sampson, Gregory	804	Kim, Veronica
763	Dlouhy, Karol	805	Barwick, A
764	Tribe, Sally	806	Byrne, Carol
765	Mathis, Catherine	807	Mane, Faye

808	Stankovic, Glenda	849	Markovich, Pamela
809	Hitchings, Diana	850	Rea, Julie
810	Dingwau, Paul	851	Svops, Charlie
811	Swan, M	852	Wardley, K
812	Hawey, Leanne	853	Thorvaldson, Wendy
813	Hanley, Heidi	854	Jacobsen, Ann
814	Steel, Lisa	855	Mirkin, J
815	Woo, Nora	856	Kravchenko, Christine
816	Fealy, Jeanelle	857	Chiplin, Jennifer
817	Illegible	858	Manning, Ann
818	Rysenbry, M	859	Colli, P
819	Baronh, Sandrine	860	Nelson, Fiona
820	Madderom, Stephanie	861	Nannetti, Flavia
821	Scard, H	862	Tsarnas, Kylie
822	Cooper, Elizabeth	863	Purves, Ruth
823	Catling, Ann	864	Adams, D
824	Castaldi, Lucinda	865	Isaacs, D J
825	von Aesch, Evelyne	866	Victoria, Sandra
826	Ilic, Frances	867	Beckett, C
827	Goode, Penny	868	Dann, Beverley
828	Tierney, Peter	869	Haas, Elisabeth
829	English, Kerin	870	Donat, Ina
830	Naughton, E	871	Medow, Jill
831	Deutinger, Bernard	872	Craig, Vicki
832	Barber, K and P	873	Saward, B
833	Porteous, Martin	874	Blackleu, Robin
834	Dedden, Lisa	875	Cunningham, Linda and Michael
835	O’Kane, Richard	876	Jarret, Greg
836	Green, Robby	877	Michas, A
837	Koulias, Adriana	878	Nay, Igor
838	Schuthof, Margaret	879	Capodistrias, Peter and Dube-Capodistrias, Catherine
839	McInnes, Jacqueline	880	Lees, Catherine
840	Lukianovich, C	881	Jackman, Gillian
841	Alder-Vager, Nicole	882	Bradey, Blake
842	Cooke, Kylie	883	Bekkedahl, S
843	Bodame, Ebba	884	Bryson, Leigh
844	Noll, Peter	885	Brooke, Julia
845	Naughton, M	886	Bevitt, Lee
846	Mackenzie, Catriona and Menzies, Peter	887	Schuntner, Louisa
847	Lazarevic, Serge	888	Bartholomew, Margaret
848	Stow, Annette	889	Lee, Robyn

890	Lee, J	932	Worrall, E
891	Dowden, E	933	Marel, Kriss
892	Lipscombe, J	934	Sauage, G
893	Kettle, Karey	935	Trimmell-Ritchard, Delwyn
893	Valk, S	936	Taylor, Janet
895	Lee, Lynda	937	Giovannine, R
896	Cohen, Juliet	938	Gombosi, Marianna
897	Donaldson, Michelle	939	Pearson, C
898	Weiser, S	940	Grady, Julie
899	Dembecki, Gale	941	Thomas, Monique
900	Perry, Joanne	942	Snowden, John
901	Haggerty, Louise	943	Harvey, V
902	Tafueo, D	944	Gray, Joan
903	Mornson, Debra	945	Brown, Betty
904	Illegible	946	Mitchell, J
905	Nicholas, Louise	947	Hogan, Christine
906	Cronder, Allan	948	Stueckelberger, M
907	Illegible	949	Shaddock, Jan
908	Mourney, Joanne	950	Avalos, Carlos
909	East, Stephanie	951	Sinclair, Sarah
910	Veitch, Alan	952	Illegible
911	Thybulle, Elizabeth	953	Guest, Rhia
912	Illegible	954	Maguire, C
913	Kery, I	955	Geddes, M
914	Watts, M	956	Brown, R
915	Dowes, S	957	Clark, H
916	Schasser, Belinda	958	Detre, A
917	Reid, Heather	959	Feszle, Janice
918	Long, Keith	960	Bourgeois, Simone
919	McDonough, Kim	961	James, Linda
920	Park, Mia	962	Pignatti-Morano, Natasha
921	Joye, Sarah	963	Hayes, G
922	Braude, Cathi	964	Adie, G
923	Strudwick, M	965	Mawson, Pat
924	Teixeira, Arthur	966	de Marr, Isabel
925	Beauchamp, Lyn	967	Illegible
926	Fengels, Mary	968	Farrell, Dorothy
927	Hayes, S	969	Bright, Valerie
928	Cooper, Tony	970	Marsh, J
929	Illegible	971	Muir, Vida
930	Adorni, Alexandra	972	Richard, J
931	Jorensen, Rikke	973	Nihill, H

974	Heafell, Peter	1016	Pearson, Susan
975	Alvarez, Rex	1017	Chiu, Ross
976	Klanosali, K	1018	Saffron-Lee, Kylie
977	Alvarez, Maree	1019	Wilson, Tania
978	Armstrong, Marie	1020	Michel, Linda
979	Foakes, Roberta	1021	Jones, Jennifer
980	Moor, Donna	1022	Bird, Katrina
981	Lopez-Tomko, Erika	1023	Slatyer, J
982	Jeavers, M	1024	Smidmore, Kathryn
983	Hayden, M	1025	McCall, Susan
984	Thompson, Julie	1026	Crooks, Robert
985	Schaverien, Mel and Alan	1027	Yeung, F L
986	Swan, Paula	1028	Mocclair, F
987	Laird, D	1029	Chen, Vicki
988	Drewe, Maryanne	1030	Wilkinson, Deborah
989	Tony, Tran	1031	Gulson, H
990	Ackermans, R	1032	Sandeman, Dianne
991	Watson, Julianne	1033	Holder, Christine
992	Gray, Les	1034	Naua, Christine
993	Norris, R	1035	Williams, Brett
993	Walster, Susan	1036	Barrett, Michael
995	Inglis, Ruth	1037	Mrsic, Meri
996	Apps, Lindy	1038	Joneyball, Danielle
997	Eagles, John	1039	Viapiana, Hector
998	Smith, Anne	1040	Salvage, Mark
999	Leonard, Penelope	1041	Lulham, David
1000	Mitchell, Yvette	1042	Colman, Belinda
1001	Buckland, Pauline	1043	Mason, Jon & Kathie
1002	Tawse, L	1044	Taylor, Colin
1003	Wotherspoon, F	1045	Osburn, A
1004	Bevan, Mark	1046	Salvage, John D
1005	Clarke, Susan	1047	O'Brien, Elizabeth
1006	Margetts, K	1048	Coffey, Sandra
1007	Maine, Fiona	1049	Del Vecchio, Silvio
1008	Chatfield, Kelly	1050	Suttor, Diane
1009	Hophins, J	1051	Ure, J
1010	Marcell, Gillian	1052	Honan, Claudia
1011	Birt, L	1053	Stokes, Diane
1012	Coverley, John	1054	Fisher, Carolen
1013	Paterson, Alan	1055	Dobrovic, Sara
1014	Carroll, Rosalind	1056	Moore, A
1015	Brittain, Cathy	1057	Rohanna, V

1058	Bounds, Lisa	1100	Ronnie, Ruth
1059	Simpson, Suzanne	1101	Sinclair, Ann
1060	Romanin, Kay	1102	Marlborough, L
1061	Thorpe, Meaghan	1103	Chan, Carisa
1062	Jones, Sara	1104	Siviour, B
1063	Gee, Rachel	1105	Lewicki, J
1064	Gee, Karen	1106	Amalfitano, Terese
1065	Zahariev, Nick	1107	Elphick, K
1066	Carr, Myvanwy	1108	Morris, Caroline
1067	Brooks, Michael & Mandy	1109	Wickman, Erika
1068	Barrett, S & A	1110	Wilson, Ken
1069	Mathews, Victoria	1111	Whelan, Caroline
1070	Luchetti, Sara	1112	Percival, Helen
1071	Beilby, F	1113	Meredith, Melissa
1072	Lacey, S	1114	Wood, Ellen
1073	Hall, Robin	1115	McMichael, Cathy
1074	Morgan, Louise	1116	Holt, Lyn
1075	Gray, Elizabeth	1117	Breislin, Carol
1076	Jarvis, Lyn	1118	Wynne, Carolyn
1077	Parkinson, Kim	1119	Navarrete, Renato
1078	Mentivic, Karen	1120	Fisher, Frances
1079	Cotton, Judy	1121	Valenzuela, Vanessa
1080	McDermott, J	1122	Curtis, Sarah
1081	Coleman, Robert	1123	Harris, Marie
1082	Browne, Clare	1124	Rusitis, S
1083	Wanerstey, Karen	1125	Martin, R
1084	Cravigan, W	1126	Thorntwaite, Louise
1085	Jones, Amanda	1127	Humphry, M
1086	Hillsley, Tracey	1128	Duncan, C
1087	Vaughan, Jacqui	1129	Woskomian, E
1088	Trajkovski, Alan	1130	Yemenian, Ani
1089	Wise, K	1131	Chevers, Susan
1090	Coyle, Marny	1132	Treadgold, Mellissa
1091	Issa, Elie	1133	Barton, T
1092	Tingle, Alfred Lewis	1134	McGregor, Ian
1093	Stanistreet, Edward	1135	Rhodes, J
1094	Abernethy, Olivia	1136	Popper, Bill
1095	Crawford, S	1137	Marcarian, T
1096	Carthy, M	1138	Sewell, J
1097	Nickoll, R	1139	Corr, Margaret
1098	Passmore, David	1140	Hoade, Daphne
1099	Harry, Sandra	1141	Astell-Tanhre, P

1142	Haigh, Patsy	1184	Nagafuchi, Sachio
1143	Hull, Karen	1185	Taylor, Brian
1144	Iacovou, Paul	1186	Van Der Meer, Kristen
1145	Dutton, T	1187	Ellis-Southwell, Kym
1146	Sandor, Debbie	1188	Pritchard, Zoe
1147	Downes, C	1189	Etherington, Angela
1148	Wallis, Diana	1190	Gernell, A
1149	Blacklaw, Graeme	1191	Srinivasan, Anne
1150	Edwards, J B	1192	Weston, Marguerite
1151	Weeks, Stephen	1193	Mailler, Lily
1152	Mollett, Jennifer	1194	Bratter, Judy
1153	Morgan, Kirsty	1195	Bloem, David
1154	Weldon, Cecille	1196	Rotheraine, Sandra
1155	Sheehan, Bridget	1197	Pitt, Michaela
1156	Blair, June	1198	Donald, Julie
1157	Brake, Judy	1199	Skipper, Max
1158	O'Reilly, John	1200	Fudge, Nigel
1159	West, Karin	1201	Salzgeber, E
1160	Plattner, N	1202	Trevena, Lou
1161	Sutton, Lorraine	1203	Balsdon, Elaine
1162	Printon, Sanna	1204	Bindar, F
1163	Illegible	1205	Winolloch, Yvonne
1164	Carslaw-Maher, Kylie	1206	Comtoni, Nick
1165	Hall, T	1207	Marion, Elizabeth
1166	Campbell, Denise	1208	Sheehan, Mark
1167	Anderson, Sharon	1209	Bradshaw, Adrian
1168	Pharo, Tim	1210	Spinks, Neville
1169	Norton, G	1211	Johnson-Roll, S
1170	Gates, Barbara	1212	Newman, Audrey
1171	Matthews, Mary	1213	Lovett, Jane
1172	Harding, Ray	1214	Powell, Karen
1173	Hunt, Warwick	1215	Mossman, Robyn
1174	Hunt, T	1216	Hammond, Keith
1175	Zulstra, Leonie	1217	Koulias, A
1176	Grycewicz, Leah Renya	1218	Koulias, S
1177	Day, Joy	1219	O'Neil, Lionel
1178	O'Loughlin, Justin	1220	Polich, J
1179	Smith, J S	1221	Jones, M
1180	Turton, S	1222	Spinks, Sue
1181	Voss, H	1223	Copeland, Miranda
1182	Shillington, Anne	1224	Spinks, Tony
1183	Stuart, Kerri	1225	Bell, Stephen

1226	Sills, Geoffrey	1268	Tahani, Sohrab
1227	Franklin, Maggy	1269	Le Mesurier, Edith
1228	Bateson, A	1270	Nortor, Lyn
1229	Pells, Alan	1271	Ambrogio, Robert
1230	Fletcher, Margot	1272	Irons, H & D
1231	Kahramanian, S & H	1273	Payne, Julie
1232	Nicholls, Yvonne	1274	Morimoto, Chika
1233	Bowen, Christopher	1275	Newling, Rachel
1234	Staples, Finny	1276	Vowles, B L
1235	Hunter, Janet	1277	Johnson, Susan
1236	Matesic, Roberta	1278	Ho, Yvonne
1237	Perzic, Sam	1279	Shaw, Jenni
1238	McCann, Cathryn	1280	von Aesch, Adrian
1239	McNally, B	1281	McPhee, P N
1240	Wilcox, Michelle	1282	Weis, Zita
1241	Best, Fiona	1283	Edwards, Melissa
1242	Prosser, Ann	1284	Henderson, Brian
1243	Chote, Toni	1285	Likitalo-Goesch, Hanna
1244	Hollows, M N	1286	Max, Lindie
1245	Unmace, Liane	1287	Vickers, Margaret
1246	McNamara, C A	1288	Goldin, Barbara
1247	Brown, Clare	1289	Oates, Inga
1248	Carnovale, Mia	1290	Underwood, G
1249	Campbell, Doris	1291	Harris, M K
1250	Somerville, Robert	1292	Sandles, Martina
1251	Leisk, Carol	1293	Macken, Juliet
1252	Pilkington, Susan	1294	Schaefer, Belinda
1253	Whitechurch, Sylvia	1295	Meyer-Breitling, Stephan
1254	Kaye, Sita	1296	McCoy, Kelly
1255	Jarrott, Kavi	1297	Schultz, L V
1256	Kaye, Janet	1298	Illegible
1257	Kendall, Iain	1299	Brown, Clare
1258	Roberts, Nicola	1300	Mutchison, Maxene
1259	Shepherd, Elizabeth	1301	Parkes, Rowena
1260	Steenberger, Peter-Paul	1302	Bullock, Tracey
1261	Donnelly, Andrew	1303	Court, Nicole
1262	Kennedy, D	1304	Robson-Scott, Mariana
1263	Finnigan, Roma & Daniel	1305	Berney, Gina
1264	Lascelles, Kathryn	1306	Read, Judith
1265	Nrbsn, Vstmrl	1307	Ashton, Virginia
1266	White, Wendy & Phil	1308	Gittoes, Jon
1267	Aureli, Jasmine	1309	Buckle, E A

1310	Lloyd, J	1352	Russell-Jones, G
1311	Bauden, Christenke	1353	Kaldor, Jade
1312	Rotheraine, Michael	1354	Gleeson, M
1313	Temple, J	1355	Roberts, N
1314	Brett, Sarah	1356	Alford, Philippa
1315	Rose, Patricia	1357	Peacock, M
1316	Shakallis, Rosemary	1358	Fisher-Cox, L
1317	Bakewell, Jody	1359	Wallace, A
1318	McCudden, Edmund	1360	Richards, A
1319	Vuoso, Aniello & Antonietta	1361	McLeod, Beverley
1320	Thompson, Fiona	1362	Beeston, Jo
1321	Attard, J	1363	Monk, V
1322	Levings, John	1364	Boyle, Frances
1323	Harvey, Jane	1365	Dunn, Melinda
1324	Ferguson, A	1366	Wong, Eliza
1325	Lee, May-Sen	1367	Stephens, Norma
1326	Craig, Norman	1368	Hamada, Naomi
1327	Harrowell, Michael & Michele	1369	Edwards, A
1328	Herrick, J	1370	Perry, Norma
1329	Zabeti, Fatima & Michael	1371	Fisher, Penelope
1330	Reinhardt, J	1372	Montalbano, A
1331	Donjerkovic, J	1373	Speamtt, P
1332	Hayes, Joseph	1374	Evans, Jade
1333	Mahony, Frances	1375	Miletil, Marko
1334	Sattler, Angela & Graham	1376	Brean, Susie
1335	Dibbs, Simon	1377	Allen, Gloria
1336	Dibbs, Kerry	1378	McQuillan, Wendy
1337	Wolanski, Suzy	1379	Officer, Z
1338	Ishmael, Ken	1380	McMurray, D
1339	O'Sullivan, Shauna	1381	Gissing, G
1340	Soghomonian, Avo	1382	Gissing, Ella
1341	Soghomonian, Laura	1383	Walshe, W
1342	Johns, K	1384	Jones, Angela
1343	Barton, Judith	1385	Tsang, Mami
1344	Ngui, David	1386	Brooks, Julie
1345	Barley, Jude	1387	Zauchenberger, Shan
1346	Burchfield, Elvie	1388	Harkin, John
1347	Hiley, Geoffrey	1389	Harris, Cornelia
1348	McGowan, Samantha	1390	Lok, Tak Hing and Angela, and Chan, Selina
1349	McGowan, Brian	1391	Ringrose, J
1350	McGowan, Naomi	1392	Bratter, Philip
1351	Smith, Stephen and Diana	1393	Plazas, Ginette and John

1394	Trevor-Jones, Beverley	1397	Sharpen, Caroline
1395	Rodney, Peter	1398	Barrow, Robert
1396	Sheldon, G	1399	Tredinnick, Keiko

In addition, the Committee received petitions containing 63 signatures.

Appendix 2

List of Witnesses

List of Witnesses

Mr Alex Walker	Managing Director, Sydney Water Corporation 9 August 2000
Mr Ron Quill	General Manager – Asset Solutions, Sydney Water Corporation 9 August 2000
Mr Allan Henderson	Manager – Capital Programs, Sydney Water Corporation 9 August 2000
Mr Peter Fisher	Manager – Product Delivery, Wastewater, Sydney Water Corporation 9 August 2000
Mr Craig Barton	Product Delivery Manager – Georges River Wastewater, Sydney Water Corporation 9 August 2000
Mr Alex Dietsch	Engineering Manager, Northside Storage Tunnel Alliance 9 August 2000
Mr Andrew Wild	Environmental and Regulatory Manager, Northside Storage Tunnel Alliance 9 August 2000
Mr John Callaghan	Design Manager, Northside Storage Tunnel Alliance 9 August 2000
Ms Rosemary Gentle	Glenaeon Rudolph Steiner School 9 August 2000
Mr Brian Moran	Glenaeon Rudolph Steiner School 9 August 2000
Ms Helen Scard	Glenaeon Rudolph Steiner School 9 August 2000

Ms Wendy Norton	Scotts Creek Community Liaison Committee 9 August 2000
Mr Marc Lee	Scotts Creek Community Liaison Committee 9 August 2000
Ms Louise Mitchell	Scotts Creek Community Liaison Committee 9 August 2000
Mr Ken Rutherford	Scotts Creek Community Liaison Committee 9 August 2000
Ms June Cunningham	Scotts Creek Community Liaison Committee 9 August 2000
Dr Steven Corbett	Manager – Environmental Health, NSW Health 9 August 2000
Prof Charles Kerr	Professor of Preventative and Social Medicine, University of Sydney 9 August 2000
Mr Ian Kiernan	Waterways Advisory Panel 9 August 2000
Mr Robert Wilson	Waterways Advisory Panel 9 August 2000
Dr Kerry Holmes	Director, Holmes Air Sciences 9 August 2000
Mr Joe Woodward	Executive Director – Sydney Region, NSW Environment Protection Authority 10 August 2000
Mr Warren Hicks	Manager – Sydney Catchments, NSW Environment Protection Authority 10 August 2000

Mr Bob Marr	Senior Officer – Sydney Catchments, NSW Environment Protection Authority 10 August 2000
Mr Nick Agapides	Manager – Air Assessments Unit, NSW Environment Protection Authority 10 August 2000
Mr Geoff Noonan	Director – Development & Infrastructure, Dept of Urban Affairs & Planning 10 August 2000
Mr Neville Osborne	Assistant Director – Development & Infrastructure, Dept of Urban Affairs & Planning 10 August 2000
Mr Ralph Kaye	Air Pollution Consultant to Glenaeon Rudolph Steiner School 10 August 2000; 9 October 2000
Dr Mark Donohoe	Environmental Medicine Adviser to Glenaeon Rudolph Steiner School 10 August 2000
A/Prof Ray Kearney	Associate Professor of Infectious Diseases, University of Sydney 10 August 2000; 9 October 2000
Cr Pat Reilly	Mayor, Willoughby City Council 10 August 2000
Cr Patricia Harvey	Mayor, Mosman Municipal Council 10 August 2000
Dr Andrew Wilson	Deputy Director-General and Chief Health Officer of NSW Health 9 October 2000
Prof Lynn Gilbert	Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital 9 October 2000

Dr Dominic Dwyer Medical Virologist, Centre for Infectious Diseases and Microbiology
Laboratory Services, Institute of Clinical Pathology and Medical Research,
Westmead Hospital

9 October 2000

Appendix 3

Responses by Sydney Water to
recommendations of the Select
Committee on the Proposed
Duplication of North Head Sewerage
Tunnel

Recommendations relevant to the
Northside Storage Tunnel

Source:

Submission No. 158, Sydney Water, pp.21-25

Responses by Sydney Water to recommendations of the Select Committee on the Proposed Duplication of North Head Sewerage Tunnel

Recommendations :

- That construction of the Sydney Water Tunnel be discontinued until a full and independent cost/benefit analysis of the Tunnel against other reasonably developed on site treatment options is conducted.
- The Committee recommends:
An economic cost benefit analysis be undertaken for on-site storage and treatment solutions incorporating an economic value of environmental outcomes for comparison with the Northside Storage Tunnel by an independent organisation.

Sydney Water response:

Economic cost-benefit analysis is only one input into the decision-making process regarding infrastructure projects, and needs to be considered alongside other issues such as potential environmental impacts and technical feasibility. In addition, the Northside Storage Tunnel needs to be considered in the context of a complete overflow abatement program (OAP) for the entire NSOOS.

As part of the 1997 EIS, Sydney Water considered a range of alternatives which could potentially address the wet weather gap between the existing capacity of the NSOOS, the current load in the system and the capacity required in order to meet the adopted containment standard, including an option incorporating on-site capture and treatment facilities at key overflow sites. Computer based mathematical models such as HYDROGEN, MOUSE, MOST, SEEKER and MIKE were utilised in developing an overflow abatement program for the NSOOS. The OAP included detailed investigations into a range of alternative solutions for meeting various containment standards. This ensured that all options were subjected to a comprehensive evaluation process that considered:

- population growth in the NSOOS catchment area;
- current and future sewage volumes in the NSOOS;
- hydraulic capacity of the NSOOS;
- storage capacities needed in the system and at STPs;
- cost; and
- impact on water quality (benefits).

A major outcome of these investigations was that 73 out of approximately 100 overflow sites in the NSOOS did not have sufficient physical space to construct facilities for on-site overflow capture, treatment and discharge. At major overflow sites intercepted by the tunnel, for example, any facility constructed would need enough capacity to store and treat the equivalent of up to 800 megalitres of sewage per day – more than 50 per cent of the capacity of North Head STP. As a result, many potential options were not technically feasible.

Various companies also made representations to Sydney Water suggesting on-site treatment facilities as an alternative to the tunnel. The construction cost details for the proposals were similar to the cost estimate for the tunnel. Apart from the issue of costs and technical feasibility, these on-site treatment options would pose significant health risks associated with chlorine storage, would have major visual and/or construction impacts, would involve significant on-going traffic and noise impacts on the local community, and would not deliver maximum water quality improvements to Sydney Harbour because of continued sewage discharge at these sites.

DUAP independently concluded, after consideration of the alternative options including on-site effluent treatment, that the tunnel proposal was justified. Moreover the Waterways Advisory Panel concluded, also after consideration of alternative options, that not proceeding with the tunnel option would pose too great a risk considering the required time frame and priority areas identified and that on-site chlorine or ultraviolet disinfection may not prove effective.

Alternatives such as on-site overflow capture, treatment and discharge rank poorly in an economic cost-benefit analysis in comparison to the tunnel because of greater environmental, health, visual and noise impacts on the community at a similar cost to the tunnel. In addition, the economic cost-benefit analysis completed as part of the EIS did not quantify a range of benefits attributable to the tunnel, such as increased tourism. The tourism benefits delivered by the tunnel would be greater than those that could be potentially delivered by alternative options.¹⁹⁶

Recommendations :

- The Committee finds that there is conflicting evidence about the impact of the tunnel on Fairy Penguins and seagrasses. Other concerns have yet to be resolved involving the Red-crowned Toadlet and the Long-nosed Bandicoot. The committee therefore recommends that construction of the tunnel should not proceed until the full extent of potential impact of these species is known.

Sydney Water response:

Protection of the environment is a vital component of the Northside Storage Tunnel project. So far, the proposal has been subjected to a rigorous environmental assessment process. The EIS found that the tunnel will result in

¹⁹⁶ Submission No. 158, Sydney Water pp.21-22.

significant benefits, particularly as a result of improvements in environmental conditions.

Sydney Water has conducted extensive environmental monitoring of the potential impact on flora and fauna of both aquatic and terrestrial environments throughout the project. ... These examinations are based on independent studies by numerous organisations...as well as ecological studies undertaken by Sydney Water. The studies concluded that there will be no significant impact on threatened species at any of the work sites during the delivery of the Northside Storage Tunnel project. To ensure that there is no impact, assessment and monitoring of these animals will be undertaken before, during and after construction. Sydney Water and the Alliance project team has also developed and will implement detailed EMPs to ensure the environmental impacts of the tunnel are minimised and the benefits are achieved.

The potential impacts of construction on native plants and animals have been recognised and measures have been taken to minimise or avoid the impact. Any removal of vegetation has been checked for nests of arboreal mammals and birds prior to removal and any fauna found has been relocated to appropriate habitat adjacent to the sites. Following construction of the tunnel, sites will be rehabilitated and bush regeneration will be undertaken. These activities are expected to improve the existing quality of the bushland at and immediately surrounding the sites. The permanent surface facilities at some sites will be smaller than those described in the 1997 EIS, further improving the situation. As construction of the project nears completion, the Alliance team is conducting further investigations to verify EIS predictions. Preliminary conclusions confirm that mitigation measures have been successful and negligible adverse impacts have resulted from the works.

Long-nosed Bandicoot

An endangered population of Long-nosed Bandicoots forages within the North Head STP and at Little Manly Point.

Eight-part tests were carried out for Long-nosed bandicoots at Little Manly Point by independent consultants. The tests for the bandicoot conclude that impacts on bandicoots are not likely to be significant and the corridor link to the National Park will not be altered. Trapping and radio tracking of the animal provided information about species demography and behaviour. This additional study concluded that the tunnel project would not have a significant impact on the bandicoot.

To prevent accident or injury caused by construction activities, a fence has been constructed around the site at North Head STP to restrict bandicoots from the area. Bandicoots trapped within the fence have been relocated to suitable nearby habitat. Continuous monitoring of relocated bandicoots, which commenced in November 1998, has shown that the species remain outside construction sites.

Other mitigation measures for the Long-nosed bandicoot include construction work on conveyor and loading ramp at Little Manly Point to be restricted to daylight hours, checking all equipment prior to commencing works and covering equipment each night when construction ceases.

The Alliance is also assisting the National Parks & Wildlife Service (NPWS) in the development of a Recovery Plan for the Long-nosed Bandicoot population at Little Manly Point and North Head STP.

Little Penguin or Fairy Penguin

The Little Penguin, an endangered population, uses the waters surrounding Little Manly Point. Their presence has been fully taken into account in the project plans for the management of this site.

Eight-part tests were carried out for penguins at Little Manly Point by independent consultants. The eight-part tests for the Little Penguin population conclude that, although the Penguins are known to swim and feed near the site of the proposed activities, the loss of use of the area of proposed works will not significantly affect the viability of the population. It also states that the proposed works are unlikely to interfere with other aspects of the lifecycle of the birds.

An additional study was prepared following modifications to the project, which confirmed the findings in previous reports.

Monitoring of the penguins has been and will continue to be undertaken throughout the construction and operational phase. The monitoring will be coordinated with the Little Penguin Recovery Team's monitoring program.

The Alliance is also assisting the NPWS in the development of a Recovery Plan for the Little Penguin population at Little Manly Point.

Any potential impact has been mitigated by ensuring barges approach the wharf at a restricted speed to minimise turbidity and the stirring of sandy sediments and at specified times to avoid impacts on the behaviour of Fairy Penguins. No barges will approach or leave the spoil transfer point at Little Manly Point in the one-hour period either side of dusk, as this is an active time for the penguins at the Point.

An incident management plan is being developed to manage accidental discharge of spoil into the water from barging operations to reduce the risk of impact on the colony, and a boom will be available on the site to contain impacts. Additionally, operational lighting will be limited to downward facing lighting and will not project any illumination across Spring Cove.

Aquatic Flora

Spring Cove contains a number of seagrasses and kelp beds that provide foraging ground for aquatic fauna. Manly Point has also been found to contain seagrasses and other aquatic plants. The Spring Cove area is part of the North Harbour Aquatic Reserve and is protected under the *Fisheries Management (Aquatic Reserves) Regulation 1995*.

The seagrasses and kelp found in the waters of Spring Cove have been mapped and impacts have been assessed with regard to the wharf and barging activities at Little Manly Point. The study found that the seagrass beds at the site are small and of low density compared with other areas within Spring Cove. The study also found that the two seagrass species found which potentially would be impacted by the proposal (*Halophila ovalis* and *Zostera capricorni*), tend to

recolonise rapidly (within a year). Kelp (predominantly *Ecklonia radiata*) was also mapped. The study considered the impacts on this species to also be minor, in light of the abundance of the kelp in other areas in Spring Cove. The study concluded that the impacts on the seagrasses and the kelp would be considered minor.

Additional studies at Little Manly Point following modifications to the approved project confirmed the assessment in previous reports.

Appropriate monitoring of the seagrasses will continue to be undertaken during and after barging activity.

Mitigation measures to date include the provision of silt curtains at all times during pile and wharf construction to contain turbid water, and prevent damage to seagrass and kelp communities. Any potential impact will be mitigated by ensuring barge movements are restricted to a designated corridor, at a restricted speed, and without the use of anchors to reduce surge impact and by ensuring that there is no accidental discharge of spoil into the water from barging operations. Additionally, in the event of a spill, appropriate containment procedures will be implemented.

Red-crowned Toadlet

Independent surveys have been conducted for Red-crowned Toadlets throughout the project.

Eight-part tests carried out for Red-crowned Toadlets by independent consultants conclude that the species is not likely to be affected by the proposal.

A field investigation of the affected areas upon configuration of the project did not discover the Red-crowned Toadlet and therefore the proposed changes posed little or no threat to the species. Further studies by independent consultants, prepared in response to community concerns, also confirmed previous assessments.

Appendix 4

Various odorants of identified lesser significance in sewer gasses

Various odorants of identified lesser significance in sewer gasses¹⁹⁷

Reduced sulphur compounds (other than hydrogen sulphide)

- Dimethyl sulphide
- Carbonoxy sulphide
- Methyl mercaptan
- Carbon disulphide
- Dimethyl disulphide
- Dimethyl trisulphide
- Ethyl mercaptan
- Propyl mercaptan
- Butyl mercaptan isomers
- Pentyl mercaptan
- i-propyl mercaptan
- Methyl ethyl sulphide
- Methyl propyl sulphide isomers
- Methyl allyl sulphide

Volatile fatty acids

Acetaldehyde

Reduced nitrogen compounds:

- Ammonia
- Amines
- Cadaverine
- Indole
- Skatole

Volatile organic compounds (VOC)

¹⁹⁷ AWN Consultants, Assessment of Air Quality Impacts, Northside Storage Tunnel, Lane Cove and Scotts Creek Vents, June 1999, p.8; citing: LCC Koe, SH Chew, Control of Odorous Emissions at Wastewater Treatment Plants – The Singapore Experience, Air and Waste Management Association, 91st Annual Meeting and Exhibition, June 14-18, 1998, San Diego, California, U.S.A; AM Brown, Wastewater Treatment Works and Health (Report to Hunter Water Corporation), Discipline of Environmental and Occupational Health, Faculty of Medicine, The University of Newcastle, May 1993; DJM Stone, R Kaye, Odour Measurement of Sewage Treatment Emissions: Quantitative Analysis by GC-MS and Correlation with Dynamic Olfactometry, Clean Air Society of Australia and New Zealand, 12th International Clean Air Conference, Perth, October 1994; R Stone, Sewage Treatment Odors and Air Pollutants, ASCE Journal of the Sanitary Engineering Division, Vol. 96, No. SA4, pp.905-909, August 1970.

The VOC present will principally be dependent on trade waste discharges to the NSOOS. Information provided by Sydney Water in "Overview of Sewerage System Infrastructure", EIS Appendix D, would suggest very low VOC concentrations in sewage during dry weather flows.

Appendix 5

Sydney Water response to Terms of Reference

Application of the Precautionary Principle

Source:
Submission No. 158, Sydney Water Corporation, Appendix C

Sydney Water response to Terms of Reference - Application of the Precautionary Principle

This question is answered in terms of what is Sydney Water doing to reduce the chance or serious or irreversible damage caused by uncontrolled air borne and water borne sewage discharges to the Scotts Creek environment. Presently, the discharge of uncontrolled air borne and water borne sewage poses a risk to the integrity of the environment at Scotts Creek and a human health risk for those in contact with sewage overflow discharges.

The following demonstrates how Sydney Water has and continues to apply the precautionary principle (in conjunction with the other principles of ecologically sustainable development provided in section 21 of the *Sydney Water Act 1994*) in:

- Planning of the Northside Storage Tunnel.
- Venting at Scotts Creek.
- Understanding the scientific certainty and quantification with proposed venting at Scotts Creek.
- Future Actions.

Precautionary Principle - SWC Response:	
What is the Precautionary Principle?	<p>Precautionary Principle:</p> <ul style="list-style-type: none"> ▪ One of the earliest statements on the Precautionary Principle was at the Declaration of the United Nations Conference on the Human Environment (16 June 1972) ▪ Precautionary Principle was announced after previous years of research (See "Our Common Future" Dr G Brundtland 1987) in the Rio Declaration on Environment and Development 3-14 June 1992. See principle 15 of the 27 principles for sustainable development ▪ Precautionary Principle is stated in many declarations or proclamations at international conferences convened by the United Nations ▪ Australian Governments recognised principles of ecological sustainable development (ESD) (among other things) in the Inter-Governmental Agreement on the Environment, May 1992 ▪ In NSW, the principles of ESD were reduced to domestic law in (for example) the: <ul style="list-style-type: none"> ▪ <i>Protection of the Environment Administration Act 1991</i> ▪ <i>Environmental Planning and Assessment Regulation 1994</i> ▪ <i>Sydney Water Act 1994</i> ▪ These principles are: <ul style="list-style-type: none"> ▪ The precautionary principle ▪ Inter-generational equity ▪ Conservation of biological diversity and ecological integrity ▪ Improved valuation and pricing of environmental resources ▪ The precautionary principle is: "namely, that if 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. In the application of the precautionary principle, public and private decisions should be guided by: <ul style="list-style-type: none"> ▪ careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and ▪ an assessment of the risk-weighted consequences of various options." See section 6(2) of the <i>Protection of the Environment (Administration) Act 1991</i>
What is the Precautionary Principle for Sydney Water?	<ul style="list-style-type: none"> ▪ For SWC in conducting its business, these principles of ESD are a primary objective of SWC along with protecting public health and being a successful business. These objectives are of equal importance to SWC (section 21 of the <i>Sydney Water Act</i>).

Precautionary Principle - SWC Response:	
	<ul style="list-style-type: none"> ▪ SWC has developed an ESD policy where SWC implements the principles of ESD by integrating environmental, social and economic considerations in our business. This is consistent with our principal objectives – to protect the environment and public health and be a successful business. ▪ SWC has developed ESD indicators gazetted this year ▪ SWC believes that the precautionary principle is a common sense principle where it must act cautiously ▪ SWC implements or applies the precautionary principle by asking: <ul style="list-style-type: none"> ▪ What is the risk of serious or irreversible environmental damage? -Identify a problem issue through internal or external reporting or consultation ▪ What scientific research has been done? Understand the problem through research, develop options for a solution ▪ Is there a lack of scientific certainty as to the effectiveness of options? Select an option based on research, experience and/or performance criteria, test this selected option based on issues like, engineering performance, public consultation, health and environmental impacts, risk assessments, put selected option in place and monitor it, review its performance, audit and report findings, improve solution, keep solution or delete solution if required ▪ SWC believes that the above is embodied, and in some cases to a large extent, in environmental impact assessment (ie, EIS's, REF's and assessment by regulators and community consultation) and operational management plans and procedures (among other things). For the most part these are regulated in the: <ul style="list-style-type: none"> ▪ <i>Environmental Planning and Assessment Act 1979 (DUAP)</i> ▪ <i>Protection of the Environment (Operations) Act 1997 (EPA)</i> ▪ <i>SWC Operating Licence (SWC Licence Regulator)</i>
<p>What has SWC done to establish whether the Precautionary Principle is being adhered to in the planning of the NST facilities at Scotts Creek?</p> <ul style="list-style-type: none"> ▪ For the Northside Storage Tunnel EIS 1997 ▪ For Northside Storage Tunnel REF 1999 <p>For ongoing operation and maintenance</p>	<p>For the EIS:</p> <ul style="list-style-type: none"> ▪ The problem at Scotts Creek is the continuation of untreated wet weather overflows to Middle Harbour. These overflows give rise to a continued reduction in water quality in Middle Harbour and a continued reduction in air quality in the Scotts Creek Valley ▪ SWC's actions in the EIS are to improve on the existing situation. Accordingly the facilities at Scotts Creek are to collect overflows and reduce their frequency to Middle Harbour and, collect and treat air that currently is directed untreated to the atmosphere ▪ <u>How was the precautionary principle applied to the planning of the NST?</u> ▪ Equivalent assessment and treatment was given to proposed facilities at all overflow sites, Lane Cove River, Scotts Creek, Tunks Park and Quakers Hat Bay during the planning of the NST ▪ The facilities at Scotts Creek include: <ul style="list-style-type: none"> ▪ Ventilation and access shaft ▪ Drop shaft ▪ Activated carbon filters which treat air expelled from the tunnel during a storm (on average 5-6 times per year) ▪ A building to house the above structures ▪ These facilities are inextricably linked to the working of the NST ▪ Therefore in order to answer the question strategic and local answers are necessary ▪ <u>Strategic Answer:</u> ▪ <i>What was the risk of serious or irreversible environmental damage and how was this researched or tested?</i> <ul style="list-style-type: none"> ▪ Discharge of untreated sewage to the Sydney Harbour catchment, and in particular, an untreated sewage discharge from the Hart Lid at the Scotts Creek overflow 15m above the surface of the ground ▪ The NST is a solution to help achieve a sustainable Sydney and Middle

Precautionary Principle - SWC Response:	
	<p>Harbours by reducing 80-90% of the frequency of flows from Sydney's four largest overflows as well as treating the discharge of air from the overflow contained in the tunnel when it operates on average 5-6 times per year at Scotts Creek</p> <ul style="list-style-type: none"> ▪ As a result, the primary objective of the NST was and continues to be: <ul style="list-style-type: none"> “To protect public health, recreational uses and aquatic ecosystems in the Sydney Harbour catchment and minimise the aesthetic and community amenity impacts of sewage overflows.” Section 2.4.1, page 40 of the EIS. ▪ See the justification of the project in section 12.3.2, meeting the primary objective, page 275 and meeting the secondary objectives page 275 of the EIS ▪ This discharge to Scotts Creek and its continuation posed serious environmental damage to the riparian and aquatic ecosystems within Scotts Creek (see Chapter 7 of the EIS). Furthermore, it posed a serious environmental risk to recreational users of Scotts Creek <ul style="list-style-type: none"> ▪ <i>Was there any lack of scientific certainty as to the effectiveness NST to pick up major overflows?</i> <ul style="list-style-type: none"> ▪ No ▪ Its design criteria were to reduce the frequency of flows to 80-90%. ▪ The research into this solution is described sections 2.1.3, page 37 and 2.1.4, page 38 of the EIS. It is also considered in chapter 4, project alternatives ▪ The environmental impacts of the NST were assessed in the September 1997 EIS and approved by the Minister for Urban Affairs and Planning on 22 December 1997 <p>For the REF</p> <ul style="list-style-type: none"> ▪ <u>Local Answer:</u> ▪ In order to achieve the strategy and therefore pick up and reduce the frequency of flows from Scotts Creek, infrastructure facilities had to be built at this location ▪ <i>What was the risk of serious or irreversible environmental damage of the facilities and how was this researched or tested?</i> ▪ The construction of these facilities could have posed serious environmental damage. This issue was researched in areas of the EIS such as: <ul style="list-style-type: none"> ▪ Chapter 7 sections 7.2 (water quality impacts), 7.5 (aquatic flora and fauna) ▪ Chapter 8, sections 8.3 (soils), 8.4 (terrestrial flora and fauna) ▪ Chapter 9, sections 9.4 (recreation), 9.5 (public health), 9.6 (air quality), 9.7 (traffic), 9.8 (noise and vibration), 9.9 (visual amenity), 9.10 (aboriginal heritage) ▪ The construction of these facilities was also researched in the May 1999 REF as a result of modifying the construction of the facilities at Scotts Creek. See: <ul style="list-style-type: none"> ▪ Chapter 2 review of options ▪ Chapter 3 description of proposed changes ▪ Chapter 4 description of the existing environment and assessment of impacts. EG: traffic, page 46; noise and vibration, page 49; visual amenity, page 53; surface water, page 57; flora and fauna, page 59; air quality, page 61; heritage, page 65 ▪ Supporting these were assessments of traffic (Appendix B), noise and vibration (Appendix C), odour (Appendix D) and construction safety (Appendix E) ▪ This work was further assessed by the Director-General of DUAP in her environmental impact assessment report of August 1999 ▪ <i>Was there a lack of scientific certainty about the construction of facilities at Scotts Creek?</i> <ul style="list-style-type: none"> ▪ No ▪ This is demonstrated in the assessment as described above and the mitigative measures proposed to prevent environmental degradation. The measures are also described in these assessments ▪ Construction EMPs were proposed in the EIS, section 11.2 ▪ A construction EMP has been produced for Scotts Creek. This EMP is about

Precautionary Principle - SWC Response:	
	<p>reducing construction impacts</p> <ul style="list-style-type: none"> ▪ <i>Could the operation of these facilities pose serious environmental damage and how was this researched or tested?</i> <ul style="list-style-type: none"> ▪ No ▪ This was researched in the following ways in the EIS: <ul style="list-style-type: none"> ▪ Ventilation and access shafts were described in section 5.2.2, page 105 and section 5.2.4, page 105 ▪ Activated carbon filters were proposed to treat the air coming from the vents. The assessment of the facilities was described in section 9.6 with a reference to Appendix O, preliminary hazard analysis ▪ Director-General also researched this in her environmental impact assessment report (December 1997) section 5.3.2, page 61. ▪ This was also researched or tested in the May 1999 REF in the following ways: <ul style="list-style-type: none"> ▪ Section 2.3, page 15, options for tunnel venting rates ▪ Section 4.10 air quality ▪ Appendix D Odour assessment – CHM2Hill Australia & Holmes Air Sciences ▪ <i>Was there a lack of scientific certainty about the operation of the facilities at Scotts Creek?</i> <ul style="list-style-type: none"> ▪ No ▪ In addition to the above, this was researched or tested in the following ways: <ul style="list-style-type: none"> ▪ Public Health Risk Review by Charles Kerr ▪ NSTA fax to Professor Kerr dated 16 July 1999 ▪ Professor Kerr's fax response dated 19 July 1999 ▪ Letter from Stephen Corbett of NSW Health 4 June 1999 ▪ Literature search "Health Effects of Exposure to Raw Wastewater Aerosols" ▪ Director-General's environmental impact assessment report of August 1999 <p>For ongoing operation and maintenance</p> <ul style="list-style-type: none"> ▪ <u>So what is the result in the application of the precautionary principle and how will this affect the operation of facilities at Scotts Creek?</u> ▪ The NST will contain 80-90% of the frequency of overflows from Lane Cove River, Scotts Creek, Tunks Park and Quakers Hat Bay. This is aimed at protecting public health, recreational users and the aquatic ecosystem. Therefore this is about preventing environmental degradation ▪ In order to contain these flows drop shafts for collecting these flows and ventilation shafts for treating the air from the flows when the tunnel is used in wet weather on average 20 times per year will be installed ▪ The vented air coming from Scotts Creek on average 5-6 times per year will be treated using activated carbon filters with an over a five year life expectancy. The treatment of this air is about preventing environmental degradation ▪ Operational EMPs were outlined in section 11.3 of the EIS page 257. Such documents and their use are aimed at mitigating impacts. See table 11.2, page 262. This table has an air quality environmental outcome to have no odour complaints. One of the measures to achieve this outcome is to replace the activated carbon when it has reached 80% saturation. The 1999 REF at page 64 went further and stated that the activated carbon when it has reached 70-80% saturation. ▪ The tunnel ventilation design aims to minimise the potential for generation of odorous air needing treatment at Scotts Creek by way of: <ul style="list-style-type: none"> - air in tunnel is always kept fresh by way of inducting air from the Scotts Creek and Lane Cove air inlets - there is ongoing and tightening source control of industrial waste discharged to the NSOOS sewer systems (see below), reducing the potential for odour generation - no need to vent at Scotts Creek for all smaller events (leading to less than 80ML storage volume, 60 – 70% of all overflow events)

Precautionary Principle - SWC Response:	
	<ul style="list-style-type: none"> - the water overflowing into the tunnel once air is vented at Scotts Creek will be more dilute than that at the beginning of the storm at which time air is vented to NH STP. Therefore its odour creation potential is lower. - any potentially more odorous air associated with the first flush when overflow water of a new event enters the tunnel will be exhausted and treated at North Head - at any time where raw sewage might be in the tunnel ventilation will be exclusively via NH STP unless the storage volume exceeds 80ML. - overflow water stored in the tunnel will be fresh and will be kept in the tunnel for the minimum time possible - the Scotts Creek odour control system is designed on a peak rate of 8m³/s at 5ppm H₂S. This is expected to be reached for less than 12 hours a year on average with data available showing that the maximum H₂S concentration to be expected under those kinds of high flow conditions is <2.5ppm H₂S and typically only 1ppm H₂S. This means that the system will always have significant reserve design capacities and that for all the other 20 -30 days a year where the system is expected to vent, it will operate at a flow rate far below its design capacity. ▪ A back up power supply will be used and the performance of the activated carbon filters will be monitored. <i>Note that the on site backup power does not drive the fans though. The control valves and the computer control this function. However, there will be mobile backup power mounted on a ute type vehicle that can be brought in at short notice (4 - 8 hrs)</i> ▪ This monitoring arrangement was described in section 9.6.2, page 204 of the EIS and in REF approval conditions by the Minister for Urban Affairs and Planning <p>The monitoring arrangement is regulated in the Pollution Control Approval issued by the EPA on 2 March 1999 and also conditions of approval issued by the Minister for Urban Affairs and Planning. Monitoring arrangements and an operational EMP (required by DUAP and for EPA licensing) for the facilities are to monitor performance. The operational EMP is being prepared.</p>
<p>How has Sydney Water understood scientific certainty and its quantification?</p> <ul style="list-style-type: none"> ▪ What studies have been done on content of tunnel, vent structure, filters over time ▪ What studies have been done on air dispersion in the Scotts Creek area ▪ Studies on potential health effects ▪ Studies on “worst case scenario” breakdowns and emergencies <ul style="list-style-type: none"> ▪ Affecting quality of air emissions <p>Affecting quantity (rate and/or duration) of emissions</p>	<p>Studies content of tunnel, vent structure etc:</p> <ul style="list-style-type: none"> ▪ Appendix D of the NST EIS ▪ Monitoring of the air extracted from the NSOOS at North Head STP and at the discharge from the associated chemical scrubbers. The tunnel air content (during an overflow event) is expected to be equal and most likely lower in concentration of relevant key constituents to that measured during wet weather at the NSOOS at North Head STP. See attached tables ▪ These assumptions have been carried across to CHM2Hill Australia & Holmes Air Sciences and used in their studies referred to above. <p>Studies on air dispersion in Scotts Creek:</p> <ul style="list-style-type: none"> ▪ Please refer to Holmes Air Sciences and CH2MHill Australia studies. <p>Studies on potential health effects:</p> <ul style="list-style-type: none"> ▪ Please refer to literature search “Health Effects of Exposure to Raw Wastewater Aerosols <p>Studies on Worst Case Scenario:</p> <p>Quality of air emissions:</p> <p>Refer CH2MHill study which contains that only for:</p> <ul style="list-style-type: none"> ▪ Assuming an unrealistically low (for the weather conditions necessary to create an overflow event) worst case 0.5m/s wind speed ▪ Complete failure of odour control system (ie as if it was vented directly without any treatment whatsoever) ▪ Maximum vent rate of 8m³/s for full duration of model run (even though this rate only happens for a total of 12 hrs/yr on average) ▪ Maximum H₂S concentration of 5ppm (even though existing NSOOS data shows that during high flow events [such as needed to create a 8 m³/s vent rate])

	<ul style="list-style-type: none"> • Venting would occur only while the tunnel is filling or until the failure is – at least temporarily - repaired. This is expected to take less than 6 hrs for any failure assessed. Therefore the event duration shown in the charts supplied are not equal to the vent duration. Volumes could be anywhere from 1 – 2 ML to ~250ML (if not repaired earlier) depending on the size of the one event for which complete odour control system failure was assumed. The vent rates for that event could be anywhere from 0.5 m³/s to 8 m³/s. Repairs can be accomplished in time for the next event. Therefore, this failure would account for one event only. Operationally, if in this extreme scenario air quality was considered to be far more important than water quality, there may be the option to isolate the tunnel and prevent inflows to the tunnel from any one of the four overflows to prevent venting. <p>In comparable overseas systems with long term operating data (Rochester and Milwaukee) it was found that tunnel air could be vented without the need for treatment. Sydney Water have applied the precautionary principle and decided to still provide full odour control facilities</p>
<p>Has Sydney Water analysed future increase in volumes &/or changes in the contents in the tunnel as a result of population growth in Sydney?</p>	<p>Yes</p> <p>Volumes:</p> <ul style="list-style-type: none"> ▪ SWC’s dry weather planning figure for the next 20 years at North Head STP is growth from approximately 310ML/d to approximately 344 ML/d ▪ SWC’s WaterPlan 21 contains strategic wastewater planning for its area of operations to 2021. WaterPlan 21 has a discussion on the planned improvements to the sewerage system, which are currently being discussed in pollution control licence negotiations with the EPA ▪ In WaterPlan 21 there are no plans to change the volumes in the NST which contains wet weather flows <p>Contents:</p> <ul style="list-style-type: none"> ▪ Sewage in the NSOOS is made up of domestic sewage and trade waste (industrial and commercial waste) ▪ SWC’s Wastewater source control section advises that trade waste discharges have decreased from 15.9% in 1995 to 6.9%, the remaining content is domestic sewage. On-going source control work is expected to provide further reductions in trade waste ▪ The content of domestic sewage is expected to remain the same <p>Meeting Future Growth:</p> <p>DUAP and local councils regulate meeting the needs of further growth in Sydney. DUAP and local councils are required to formally consult on strategic plans like local environment plans and regional environment policies. SWC is required as a service provider to assist with meeting any future needs if so determined through these strategic plans. SWC’s work is subject to environmental impact assessment and environmental management regulated by the <i>Environmental Planning and Assessment Act 1979</i> and the <i>Protection of the Environment (Operations) Act 1997</i>.</p>

Precautionary Principle - SWC Response:	
<p>So what regulatory requirements have resulted from the environmental impact assessment for the venting of the Northside Storage Tunnel?</p>	<p>Approval Granted By Minister for Urban Affairs and Planning</p> <p>CONDITION 12</p> <p>.An independent post -construction environmental audit report shall be submitted to the Director-General and any other relevant authority:</p> <ul style="list-style-type: none"> ▪ six (6) months following practical completion; and ▪ at any additional period(s) following construction as the Director-General may require. <p>The audit(s) shall be carried out at the Proponent's expense and shall assess the impacts relating to the proposal and the adequacy of post-construction safeguards and mitigation measures. The audit(s) shall include results of consultation with the community in terms of feedback on the project and any issues of concern shall also be included. The Proponent shall comply with all requirements of the Director-General and any other relevant authority with respect to any measures arising from, or recommendations by, the audit(s). In determining whether additional audits are required, the Director General shall take into account the operation of the vents at Lane Cove and Scotts Creek.</p> <p>CONDITION 13</p> <p>Prior to the commencement of operation of the tunnel, a project specific EMP shall be prepared to the satisfaction of the Director-General following consultation with relevant approval/ consent authorities. The EMP (Operation) shall be prepared in accordance with the conditions of this approval, all relevant Acts and Regulations and accepted best practice management procedures.</p> <p>Where relevant, the EMP (Operation) shall address at least the following issues:</p> <ol style="list-style-type: none"> 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) monitoring and inspection for all activities and environmental qualities which are important to the environmental performance of the project during its operation including description of potential site impacts, performance criteria, specific monitoring requirements and procedures to follow. c) steps the Proponent intends to take to ensure that all plans and procedures are being complied with; d) consultation requirements including relevant government agencies and the local community; e) complaint handling procedures; f) strategies for the main environmental elements including: water quality (including erosion and sedimentation controls); vegetation management; issues relating to threatened species; hydrology and flooding; hazards and risks; energy use and measures for minimisation; and g) any other matter relating to the compliance by the Proponent with the conditions of this approval or as requested by the Director-General. <p>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 license or approval. The EMP (Operation) shall be made publicly available.</p> <p>Specific reference shall be made to the manner in which operation of the tunnel is to be integrated into operation of North Head STP.</p> <p>CONDITION 14</p> <p>The Proponent shall report to the Director-General and to the EPA regarding progress on all relevant strategies and initiatives being undertaken in conjunction with the Northside Storage Tunnel to improve water quality in the Sydney Harbour catchment. The first report shall be submitted 6 months after the commencement of works associated with the Northside Storage Tunnel and every 6 months thereafter until the Director-General is advised that appropriate arrangements are in place for the implementation of the complementary strategies and initiatives identified in the Sewerage Overflows Licensing Project.</p> <p>CONDITION 51G</p> <p>For the first year of operation, on a quarterly basis, activated carbon samples collected from the bed inlet at 50% level and 80% level, shall be analysed to determine the hydrogen sulphide adsorptive capacity. The sampling and analytical methods shall be as approved by</p>

Precautionary Principle - SWC Response:	
	<p>the EPA. Thereafter, activated carbon samples collected from the bed inlet at 50% level and 80% level, shall be analysed to determine the total sulphur content and VOC adsorptive capacity. The sampling frequency and sampling and analytical methods shall be as approved by the EPA.</p> <p>CONDITION 51H</p> <p>Prior to the commencement of the Tunnel operation, the proponent shall prepare and implement an Odour Complaints Management Plan in consultation with the EPA. The system shall cover Lane Cove River West and Scotts Creek and be implemented prior to the commencement of operation of the tunnel and should include the following:</p> <ul style="list-style-type: none"> - a hotline to receive odour complaints; - a system for logging and dealing with complaints; - a complaints confirmation procedure; - a record of complaints and operators response/actions; and - a system for providing feedback to the local community. <p>CONDITION 51 I</p> <p>The proponent shall as soon as possible, and in any case within six months of regular operation, undertake odour emission sampling and analysis in the vent. This shall be downstream of the air pollution control equipment at Lane Cove River West and Scotts Creek during a tunnel-filling event that causes discharges from the vent. The following parameters will be monitored:</p> <ul style="list-style-type: none"> (a) discharge velocity (m/sec) (b) discharge temperature (°C) (c) discharge rate wet and dry basis (m³/min) (d) odour concentration <p>The odour emissions sampling and analysis program shall be undertaken to the satisfaction of the EPA. The odour emissions must be sampled and analysed in accordance with “European Standard - Air Quality - Determination of odour concentration by dynamic olfactometry. (CEN/TC264 WG/N222/e “European Committee for Standardisation Brussels”). All other emissions sampling and analysis methods shall be in accordance with the Manual of Air Quality Testing or as otherwise as agreed with the EPA.</p> <p>CONDITION 51 J</p> <p>Odour sampling shall be undertaken on an annual basis and the results of the emission sampling and analysis made available to the EPA. A draft program for the emission sampling must be submitted to the EPA prior to sampling and analysis.</p> <p>CONDITION 125</p> <p>The Proponent shall prepare and submit for the approval of the Director-General the following studies:</p> <p><u>Hazard and Operability Study</u></p> <p>Following finalisation of the design but prior to commissioning, the Proponent shall undertake a Hazard and Operability Study for the proposed tunnel and all associated facilities, chaired by an independent qualified person approved by the Director-General prior to the commencement of the study. The study shall be carried out in accordance with the principles of the Department of Urban Affairs and Planning’s HIPAP No. 8, HAZOP Guidelines. This shall also include a computer systems HAZOP (CHAZOP) of the control and safety systems.</p> <p><u>Final Hazard Analysis</u></p> <p>The Proponent shall undertake a Final Hazard Analysis for the scrubber at North Head STP, this to be prepared in accordance with HIPAP No. 6, Guidelines for Hazard Analysis following finalisation of scrubber design.</p> <p>CONDITION 126</p> <p>The Proponent shall, at least two months prior to commissioning of the proposed storage tunnel and associated facilities, shall demonstrate to the satisfaction of the Director-General, the manner in which the components of the Safety Management System (SMS) for the tunnel and its associated facilities are to be integrated into the North Head STP SMS. Further, the Proponent shall submit for the approval of the Director-General, those components of the SMS pertaining to the tunnel and its associated facilities. This shall be undertaken in accordance with HIPAP No. 9 Safety Management and the recommendations</p>

Precautionary Principle - SWC Response:

made in the PHA contained in Appendix O of the EIS.

CONDITION 127

Twelve months after the commencement of operations of the proposed storage tunnel and associated facilities or within such further period as the Director-General may agree, the applicant shall carry out a comprehensive hazard audit of the proposed development and within one month of the audit submit a report to the Director-General. The audit shall be carried out at the applicant's expense by a duly qualified independent person or team approved by the Director-General prior to commencement of the audit. If required, further audits shall be carried out as directed by the Director-General and a report of each audit shall within a month of the audit be submitted to the Director-General. Audits shall be carried out in accordance with HIPAP No. 5, Hazard Audit Guidelines. The initial audit shall include a review of those components of the site SMS relating to the tunnel and its associated facilities and a review of all entries made in the incident register since the previous audit

Licence number 6989 issued by the Environment Protection Authority**CONDITION U 1.1**

Within 90 days from the completion of the project and in any case by 1 June 2000, the licensee must submit to the EPA a detailed proposal to monitor the effectiveness of the Northside Storage Tunnel and the associated strategies and initiatives to improve water quality in the Sydney Harbour Catchment

CONDITION U 1.2

Within 12 months of the completion of the Northside Storage Tunnel the licensee must submit to the EPA a detailed report on the effects of the works as it relates to the North Head Sewage Treatment Plants final effluent in terms of quality and quantity (volume) over a period of not less than 9 months

Operational Conditions (Environment Protection Licence # 6989)

CONDITION O 6.1 Noise

The licensee must conduct a noise awareness education and training program for all operational staff to instruct operators on the practices which need to be undertaken to minimise noise at the premises listed in condition E1.1

CONDITION O 8.1

Installation of air pollution control and monitoring equipment

The licensee must install air pollution control equipment capable of ensuring that, under all operating and meteorological conditions, discharges from the vent at Scotts Creek and Lane Cove West sites, and the ventilation shafts at North Head Sewage Treatment Plant do not result in an offensive odour or air quality impacts at or beyond the boundary of the premises at any sensitive receptor

CONDITION O 8.2

Installation of air pollution control and monitoring equipment

Sampling ports must be installed in the vent downstream of the air pollution control equipment strictly in accordance with the requirements of "Australian Standard AS 4323.1 - 1995: Stationary Source Emissions Method 1 - Selection of Sampling Positions"

CONDITION O 8.3

Installation of air pollution control and monitoring equipment

Equipment must be installed that is capable of continuously monitoring the temperature, flow rate and concentration of hydrogen sulfide in the vent, downstream of the air pollution control equipment in accordance with the requirements of the US EPA performance specifications: *Performance Specification 6 - Specifications and test procedures for Flow Rate Continuous Emission Monitoring in Stationary Sources (Code of Federal Regulations, Title 40, part 60 Appendix B, US Government Printing Office DC)* and *performance Specification 7 - Specifications and Test Procedures for H₂S Continuous Emission Monitoring Systems in Stationary Sources (Code of Federal Regulations, Title 40 part 60, Appendix B, US Government Printing Office DC)*. Alternative methods for monitoring temperature, flow rate and concentration of hydrogen sulfide must be agreed to in writing by the EPA

The continuous monitoring equipment must be operational prior to the commencement of regular operations

Precautionary Principle - SWC Response:	
	<p>CONDITION R 1.1</p> <p><u>Annual Return Documents</u></p> <p>The licensee must complete and supply to the EPA an annual return in the approved form comprising</p> <p>(a) a Statement of Compliance and</p> <p>(b) a Monitoring and Complaints Summary</p> <p>A copy of the form in which the annual return must be supplied to the EPA accompanies this licence. Before the end of each reporting period, the EPA will supply to the licensee a copy of the form that must be completed and returned to the EPA</p> <p><u>Deadline for Annual Return</u></p> <p>The Annual Return for the reporting period must be supplied to the EPA by registered post no later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the due date)</p> <p>CONDITION U 1.1</p> <p><u>Special Reports</u></p> <p>Within 90 days from the completion of the project and in any case by 1 June 2000, the licensee must submit to the EPA a detailed proposal to monitor the effectiveness of the Northside Storage Tunnel and the associated strategies and initiatives to improve water quality in the Sydney Harbour Catchment</p> <p>CONDITION U 1.2</p> <p><u>Special Reports</u></p> <p>Within 12 months of the completion of the Northside Storage Tunnel, the licensee must submit to the EPA, a detailed report on the effects of the works as it relates to the North Head Sewage Treatment Plants final effluent in terms of quality and quantity (volume) over a period of not less than 9 months.</p> <p>CONDITION E 3.1.2</p> <p><u>Odour and Air Quality Impacts</u></p> <p>At the commencement of regular operation, the licensee must ensure that, under all operating and meteorological conditions, discharges from the vents at Scotts Creek, Lane Cove West, and the scrubber serving the ventilation shafts for the Northside Storage Tunnel at North Head Sewage Treatment Plant do not result in an offensive odour or air quality impacts at or beyond the boundary of the premises at any sensitive receptor</p> <p>CONDITION E 3.1.3</p> <p><u>Odour and Air Quality Impacts</u></p> <p>Prior to the commencement of regular operation, an odour complaints management system shall be developed to the satisfaction of the EPA. The odour complaints management system should include (but not be limited to) the following elements:</p> <ul style="list-style-type: none"> - informing local residents of complaint hotline to receive odour complaints - A system for logging and dealing with complaints - A complaint confirmation procedure - Records of complaints and operators responses / actions; and - A system for providing feedback to the local community <p>The complaints management system must be implemented prior to the commencement of regular operation</p> <p>CONDITION E 3.1.4</p> <p><u>Odour and Air Quality Impacts</u></p> <p>The temperature, flow rate and concentration of hydrogen sulfide in the vent, downstream of the air pollution control equipment must be continuously monitored and electronically recorded during venting</p> <p>CONDITION E 3.1.5</p> <p><u>Odour and Air Quality Impacts</u></p> <p>As soon as possible and in any case within 6 months of commencement of regular operation, an odour emissions sampling and analysis program must be conducted in the vent for the following parameters</p> <p>(a) discharge velocity (m/s)</p> <p>(b) discharge temperature (deg C)</p>

Precautionary Principle - SWC Response:	
	<p>(c) discharge rate wet and dry basis (m³/min) (d) moisture content (%); and (e) odour concentration</p> <p>Odour emission must be sampled and analysed in accordance with European Standard - <i>Air quality - determination of odour concentration by dynamic olfactometry.</i> (CEN/TC264/WG2/N222/e. European Committee for Standardisation, Brussels). All other emissions sampling and analysis methods must be in accordance with the manual of Air Quality Testing or as otherwise agreed to in writing by the EPA</p> <p>The odour emissions sampling and analysis program must be developed to the satisfaction of the EPA and a draft program submitted prior to sampling and analysis. The results of the emissions sampling and analysis must be reported according to the requirements as agreed to by the EPA</p> <p>The results of the odour emissions sampling and analysis program and the continuous monitoring for hydrogen sulfide must be forwarded to the EPA's Manager Sydney Catchments within 14 days of completion of the initial emission sampling.</p> <p>CONDITION E 3.1.6 <u>Odour and Air Quality Impacts</u></p> <p>Using the emissions data in conditions E 4.1.3 and E 4.1.4, ground level concentrations of odour and hydrogen sulfide shall be predicted using the AUSPLUME dispersion model under all possible operating and meteorological conditions</p> <p>The dispersion modelling must be used to derive hydrogen sulfide and odour concentrations in the vent that will not cause an offensive odour at or beyond the boundary of the premises at any sensitive receptor, under all conditions. A report presenting results from the dispersion modelling must be forwarded to the EPA's Manager Sydney Catchments within 1 month of completion of the emissions sampling and analysis program established in condition E 3.1.5</p> <p>CONDITION E 3.1.7 <u>Odour and Air Quality Impacts</u></p> <p>On an annual basis from the start of regular operations, the odour emissions sampling detailed in condition E 3.1.5 must be undertaken. This data must be kept in records by the licensee and made available to an EPA officer on request</p>
What additional advice has Sydney Water received?	<ul style="list-style-type: none"> ▪ NSW Health has written to SWC on 15 May 2000 advising that "Officers of the Environmental Health Branch have considered both the potential for a risk to public health from the tunnel vent emissions, and the utility of monitoring tunnel vent emissions for micro-organisms. The public health risk from the emissions are considered to be very low, and a considerable improvement on the current situation where the public is exposed to uncontrolled raw sewage overflows." ▪ SWC continues to consult with NSW Health regarding continued community concern ▪ SWC has prepared an operational environment management plan and this has been done following consultation with community groups
What Future Actions will Sydney Water undertake?	<p>Monitoring and Reporting</p> <ul style="list-style-type: none"> ▪ SWC will submit Annual Returns and Annual System Performance Reports for the Northern Suburbs sewage treatment system Licence against the requirements of the Licence issued by the Environment Protection Authority ▪ SWC will report on the water quality monitoring to demonstrate the benefits of tunnel performance and impacts on North Head sewage treatment plant performance (Pursuant to conditions U1.1 and U1.2 of the Licence issued by the Environment Protection Authority) ▪ SWC will provide a publication of emission tests, bed adsorptive capacity and meteorological data for the facilities at Lane Cove River West and Scotts Creek under condition 51N of the approval granted by the Minister for Urban Affairs and Planning. ▪ SWC will report on environmental performance in Sydney Water's Annual Environment and Public Health Report

Precautionary Principle - SWC Response:	
	<ul style="list-style-type: none"> ▪ SWC will submit to the Department of Urban Affairs and Planning a post-construction audit on the adequacy of the safe guards and mitigative measures under condition 12 of the approval granted by the Minister for Urban Affairs and Planning ▪ SWC will submit reports regarding the progress on all relevant strategies and initiatives being undertaken in conjunction with the Northside Storage Tunnel to improve water quality in the Sydney Harbour catchment under condition 14 the approval granted by the Minister for Urban Affairs and Planning ▪ SWC will submit to the Department of Urban Affairs and Planning of a comprehensive audit under condition 127 of the approval granted by the Minister for Urban Affairs and Planning <p>Communication with the Community</p> <ul style="list-style-type: none"> ▪ SWC continues to discuss through its construction liaison committees issues pertaining to construction and operation of the Northside Storage Tunnel and investigates and reports on issues raised through these forums. ▪ SWC will publicly report on the effectiveness of the Northside Storage Tunnel and monitoring results will be provided in Sydney Water's Annual Environment and Public Health Report and in the Environment Protection Authority's Annual Licence Annual Returns and Annual System Performance Report. These documents will be accessible on Sydney Water's web-site and will also be made available to the Sydney Water Customer Councils and the Sydney harbour Catchment Board. ▪ SWC will, in the course of usual briefings, provide updates on the usage, performance and condition of the Northside Storage Tunnel. The briefings, over the 12 month period following commissioning of the Northside Storage Tunnel, will be based on performance criteria set out in the Operational Environmental Management Plan for the Northside Storage Tunnel ▪ For maintenance activities at the overflow sites, other than routine or emergency, SWC will implement a community liaison strategy, including contact with local residents. A strategy will also be implemented for NSOOS maintenance that requires the tunnel to operate in Maintenance of NSOOS Mode. The Strategy will identify a range of communication activities associated with works or activities, and will identify the communities in the vicinity and potentially affected by the work or activities ▪ SWC will develop a communication strategy to address an agreed outcome of the Mediation between Sydney Water and the Community of Scotts Creek Area (2000). That is: <p><i>"There is agreement on the requirement for some (yet to be defined) form of community monitoring and ongoing involvement during the operation of the tunnel.</i></p>

Appendix 6

Summary of alternatives considered in mediation

Source:
Submission No. 158, Sydney Water Corporation, pp.53-54

Summary of alternatives considered in mediation

1 *Local Site Alterations - Low Separation*

- 1a Scotts Creek Facility as Proposed
Original proposal includes pre-filter, activated carbon filter and 4 m high exhaust stack.
- 1b Scotts Creek Facility as Proposed with 15 m Exhaust Stack at existing Site
As for 1a with exhaust stack extended from 4 m to 15 m.
- 1c Scotts Creek Facility as Proposed with 15 m Exhaust Stack and HEPA filter at existing Site
As for 1b plus a HEPA filter rated at 95% @ 0.3 micron.
- 1d Scotts Creek Facility as Proposed with 10 m Exhaust Stack along Access Road
As for 1a but with exhaust air piped about 250 m back along the access road and incorporating a 10 m high stack.

2 *Exhaust to North Head STP - High Separation*

- 2a Return Exhaust Line from Scotts Creek to North Head STP in Tunnel Roof
Exhaust returned via a blower at Scotts Creek, through a pipe suspended from the tunnel roof, back to the chemical scrubber at North Head STP.
- 2b Return Exhaust Line from Scotts Creek to North Head STP in Tunnel Floor
As for 2a except pipe is laid in concrete in the tunnel floor.
- 2c Return Exhaust Line from Tunks Park to North Head STP in Tunnel Roof
Exhaust returned from Tunks Park only, via a blower at Tunks Park, through a pipe suspended from the tunnel roof extending from Tunks Park back to the chemical scrubber at North Head STP. This system would only operate until the sewage level reached the tunnel roof at Tunks Park (at about 80% full). Beyond that the exhaust venting would be as per original proposal 1a.

3 *Regional Options – Medium Separation*

- 3a Filter House and Exhaust relocated to Harold Reid Reserve
Scotts Creek filters and exhaust stack relocated to an alternative location in Harold Reid Reserve. Tunks Park to Scotts Creek tunnel diverted 500 metres to the east, and connected via two directional boreholes to a new surface filter house and stack in Harold Reid Reserve. Directional boreholes require a surface drilling site in Harold Reid Reserve.
- 3b Only Exhaust relocated to Harold Reid Reserve
Tunks Park to Scotts Creek tunnel as per Scheme 1a. Exhaust passes through the Scotts Creek filter as per 1a and then, via an additional fan system at Scotts Creek, back through a pipe suspended from the tunnel roof and connected via two directional boreholes to a new surface stack in Harold Reid Reserve. Directional boreholes require a surface drilling site in Harold Reid Reserve.
- 3c Only Exhaust relocated to Harold Reid Reserve with Limited Surface Works
As for 3b except directional boreholes are replaced by conventional tunnelling, and the connection to the surface by microboring up from the tunnel, all to reduce surface works in Harold Reid Reserve. In addition, the exhaust point relocated closer to Middle Harbour.
- 3d Only Exhaust relocated to Yeoland Point with Limited Surface Works
Tunnel extended 1850 m past Scotts Creek to Yeoland Point. Exhaust passes through the Scotts Creek filter as per 1a and then, via an additional fan system at Scotts Creek, through a pipe suspended from the tunnel roof and up to a new surface stack at Yeoland Point. This last stage

would be by microboring up from the tunnel to reduce surface works. In addition, the exhaust point relocated closer to Middle Harbour.

4 *Regional Options - Low Separation*

- 4a Exhaust Line to Castle Cove Golf Course
Exhaust passes through the Scotts Creek filter as per 1a and then, via two directional boreholes, up to a new surface stack at Castle Cove Golf Course. Directional boreholes require a surface drilling site at Castle Cove Golf Course.
- 4b Filter and Exhaust moved to East Chatswood Industrial Complex
Tunnel extended to East Chatswood Industrial Complex, with Scotts Creek filters and exhaust stack relocated to that location.
- 4c Filter and Exhaust moved to Willis Park
Tunnel extended to Willis Park, with Scotts Creek filters and exhaust stack relocated to that location.
- 4d Filter and Exhaust moved to Roseville Chase
Tunnel extended to Roseville Chase, with Scotts Creek filters and exhaust stack relocated to that location.

Appendix 7

Summary of alternatives evaluation

Source:
Submission No. 158, Sydney Water Corporation, pp.55-60

Summary of alternatives evaluation

Local Site Alterations - Low Separation

	1a - Scotts Creek Facility As Proposed	1b - Scotts Creek Facility As Proposed + 15m Stack at Current Site	1c - Scotts Creek Facility As Proposed + 15m Stack at Current Site with HEPA Filter	1d - Scotts Creek Facility As Proposed plus 10m Stack Along Access Road
Exhaust Separation Distance from People	~20 m from public tracks ~80 m from school ~100 m from houses	~20 m from public tracks ~80 m from school ~100 m from houses	~20 m from public tracks ~80 m from school ~100 m from houses	~20 m from public tracks ~120 m from school ~160 m from houses
Background Pathogen Levels at Site	Low pathogen levels in quality bush environment, impacted about twice per year by sewage overflow not captured by tunnel.	Low pathogen levels in quality bush environment, impacted about twice per year by sewage overflow not captured by tunnel.	Low pathogen levels in quality bush environment, impacted about twice per year by sewage overflow not captured by tunnel.	Low pathogen levels in quality bush environment, impacted about twice per year by sewage overflow not captured by tunnel.
Health Risk <i>This evaluation assumes current model results are correct despite outstanding confirmation on model validity regarding temperature inversion & particulates.</i>	Health risk not quantified or agreed by experts. No guarantees on pathogen levels in exhaust or near people.	Health risk not quantified or agreed by experts. No guarantees on pathogen levels in exhaust or near people.	Health risk not quantified or agreed by experts. No guarantees on pathogen levels in exhaust or near people.	Health risk not quantified or agreed by experts. No guarantees on pathogen levels in exhaust or near people.
Public Perception of Acceptability	Not acceptable (as demonstrated at public meetings): unquantified, unagreed health risk; no pathogen level guarantees.	Probably not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; visual impact of stack.	Probably not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; visual impact of stack.	Probably not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; visual impact of stack.
Ease of Operation and Maintenance	Low maintenance equipment, simple to operate.	Low maintenance equipment, simple to operate. Stack adds minimal overhead.	Low maintenance equipment, simple to operate. Stack adds minimal overhead. HEPA filter to maintain and replace.	Low maintenance equipment, simple to operate. Stack and pipe add minimal overhead.
Fail Safe System Rating	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Activated carbon filters are simple, reliable proven technology. HEPA filter blockage overcome by adding HEPA filter bypass. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.
Additional Cost <i>Includes appropriate contingency</i>	Nil	\$50,000	\$250,000	\$800,000

Time Impact on Project	No impact	No impact	No impact	Up to one month delay or greater if an EIS is required.
Comments, Advantages and Disadvantages	The community feels that sewage exhaust can be trapped and focussed in the narrow, steep-sided valley by local weather conditions including wind funnelling and clouds held under temperature inversion layers. Exhaust particles and aerosols can drop to ground.	The community feels that sewage exhaust can be trapped and focussed in the narrow, steep-sided valley by local weather conditions including wind funnelling. Exhaust particles and aerosols can drop to ground. Stack may improve dispersion by ejecting exhaust above temperature inversion layers.	The community feels that sewage exhaust can be trapped and focussed in the narrow, steep-sided valley by local weather conditions including wind funnelling. Exhaust particles and aerosols can drop to ground. Stack may improve dispersion by ejecting exhaust above temperature inversion layers. HEPA filter should reduce the amount of aerosols emitted from the vent. Aerosol-borne pathogens likely to be reduced. No HEPA filters used like this worldwide. May also require similar HEPA filter at Lane Cove River West at similar cost.	The community feels that sewage exhaust can be trapped and focussed in the narrow, steep-sided valley by local weather conditions including wind funnelling and clouds held under temperature inversion layers. Exhaust particles and aerosols can drop to ground. Stack modelling as per comments in 1c.

Exhaust to North Head STP - High Separation

	2a - Exhaust Line in Tunnel Roof to North Head STP Scrubber	2b - Exhaust Line in Tunnel Floor to North Head STP Scrubber	2c - Exhaust Line in Tunnel Roof from Tunks Park to North Head STP Scrubber
Exhaust Separation Distance from People	~500-700 m from houses ~700-900 m from hospital Exhaust dispersion assisted by headland weather conditions.	~500-700 m from houses ~700-900 m from hospital Exhaust dispersion assisted by headland weather conditions.	~500-700 m from houses ~700-900 m from hospital Exhaust dispersion assisted by headland weather conditions.
Background Pathogen Levels at Site	Pathogen levels as present at North Head STP. Tunnel scrubber exhaust is sited next to other STP exhaust points.	Pathogen levels as present at North Head STP. Tunnel scrubber exhaust is sited next to other STP exhaust points.	Pathogen levels as present at North Head STP. Tunnel scrubber exhaust is sited next to other STP exhaust points.
Health Risk	Negligible additional health risk over that already present around North Head STP. This assumes that the exhaust volume increase due to this option, of less than 0.1% per annum above the tunnel exhaust volume already planned for North Head STP, has negligible health impact.	Negligible additional health risk over that already present around North Head STP. This assumes that the exhaust volume increase due to this option, of less than 0.1% per annum above the tunnel exhaust volume already planned for North Head STP, has negligible health impact.	Negligible additional health risk over that already present around North Head STP. This assumes that the exhaust volume increase due to this option, of less than 0.1% per annum above the tunnel exhaust volume already planned for North Head STP, has negligible health impact.
Public Perception of Acceptability	Acceptable to Scotts Creek community.	Acceptable to Scotts Creek community.	Probably acceptable to Scotts Creek community.
Ease of Operation and Maintenance	Low maintenance equipment, simple to operate. Additional pipe in tunnel and blowers at Scotts Creek with higher power. 24 hour, 365 day on-site staff at North Head for scrubber.	Low maintenance equipment, simple to operate. Additional pipe in tunnel and blowers at Scotts Creek with higher power. 24 hour, 365 day on-site staff at North Head for scrubber.	Low maintenance equipment, simple to operate. Additional pipe in tunnel and blowers at Tunks Park with higher power. 24 hour, 365 day on-site staff at North Head for scrubber.

	2a - Exhaust Line in Tunnel Roof to North Head STP Scrubber	2b - Exhaust Line in Tunnel Floor to North Head STP Scrubber	2c - Exhaust Line in Tunnel Roof from Tunks Park to North Head STP Scrubber
Fail Safe System Rating	Filters remain to protect blowers. Additional complexity of blowers compared to fans. In the event of power failure filters still operate but with the risk of some leakage from control dampers due to increased pressure.	Filters remain to protect blowers. Additional complexity of blowers compared to fans. In the event of power failure filters still operate but with the risk of some leakage from control dampers due to increased pressure	Filters remain to protect blowers. Additional complexity of blowers at Tunks Park. In the event of power failure filters still operate but with the risk of some leakage from control dampers due to increased pressure
Additional Cost <i>Includes a 25% contingency</i>	\$30 M for Scotts Creek Site only	\$43 M for Scotts Creek Site only	\$26 M
Time Impact on Project	EIS Approvals if necessary - August 2000. Design/construct - to end 2001.	EIS Approvals if necessary - August 2000. Design/construct - to end 2001.	EIS Approvals if necessary - August 2000. Design/construct - to mid 2001.
Comments, Advantages and Disadvantages	Additional \$18 M cost if similar option adopted for Lane Cove River West site	Additional \$18 M cost if similar option adopted for Lane Cove River West site	Option only works for tunnel up to 80% full, beyond that air is exhausted at Scotts Creek and Lane Cove River West sites.

Regional Exhaust Options - Medium Separation

	3a - Filter and Exhaust moved to Harold Reid Reserve by moving filter buildings to Harold Reid Reserve, with surface works for boreholes to tunnel. Scotts Creek tunnel diverted 500 m to east.	3b - Exhaust Line to Harold Reid Reserve via tunnel and directional boreholes, with surface works for boreholes to tunnel.	3c - Exhaust Line to Harold Reid Reserve with Less Surface Work via tunnel and spur tunnel, microboring up from tunnel to minimise surface works	3d - Exhaust Line to Yeoland Point with Less Surface Work via tunnel extension, microboring up from tunnel to minimise surface works
Exhaust Separation Distance from People	~20 m from public tracks ~300-400 m from houses. Exhaust dispersion assisted by headland position.	~20 m from public tracks, ~300-400 m from houses. Exhaust dispersion assisted by headland position.	~20 m from public tracks, ~300-400 m from houses. Exhaust dispersion assisted by headland position.	~200 m from public tracks, ~300-400 m from houses. Exhaust dispersion assisted by headland position.
Background Pathogen Levels at Site	Low pathogen levels in quality bush environment.	Low pathogen levels in quality bush environment.	Low pathogen levels in quality bush environment.	Low pathogen levels in quality bush environment.
Health Risk	No guarantees on pathogen levels in exhaust or near people. Presumably, risk at houses reduced by extra separation but public track risk increases due to more people using open space.	No guarantees on pathogen levels in exhaust or near people. Presumably, risk at houses reduced by extra separation but public track risk increases due to more people using open space.	No guarantees on pathogen levels in exhaust or near people. Presumably, risk at houses reduced by extra separation but public track risk increases due to more people using open space.	No guarantees on pathogen levels in exhaust or near people. Presumably, risk at houses and bush tracks reduced by extra separation.

	3a - Filter and Exhaust moved to Harold Reid Reserve by moving filter buildings to Harold Reid Reserve, with surface works for boreholes to tunnel. Scotts Creek tunnel diverted 500 m to east.	3b - Exhaust Line to Harold Reid Reserve via tunnel and directional boreholes, with surface works for boreholes to tunnel.	3c - Exhaust Line to Harold Reid Reserve with Less Surface Work via tunnel and spur tunnel, microboring up from tunnel to minimise surface works	3d - Exhaust Line to Yeoland Point with Less Surface Work via tunnel extension, microboring up from tunnel to minimise surface works
Public Perception of Acceptability	Probably not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; new large filter building and stack location in prime bush reserve.	Probably not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; new stack location in prime bush reserve; surface construction work.	Probably not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; new stack location in prime bush reserve; surface construction work.	Probably not acceptable: unquantified, unagreed health risk; no pathogen level guarantees; new stack location in prime bush reserve; surface construction work; marine access structure; visual impact of any stack from water. Located on Commonwealth property.
Ease of Operation and Maintenance	Low maintenance equipment, simple to operate. New Harold Reid site is similar to old Scotts Creek site.	Low maintenance equipment, simple to operate. Additional pipe in tunnel and blowers at Scotts Creek with higher power.	Low maintenance equipment, simple to operate. Additional pipe in tunnel and blowers at Scotts Creek with higher power.	Low maintenance equipment, simple to operate. Additional pipe in tunnel and blowers at Scotts Creek with higher power.
Fail Safe System Rating	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.
Additional Cost <i>Includes a 15% contingency (3b, 3c and 3d only)</i>	\$5 M	\$12 M	\$31 M, reducing down to \$29 M if main tunnel diverts slightly.	\$31 M
Time Impact on Project	EIS Approvals - Aug 2000 Design /Construct - to mid 2001	EIS Approvals - Aug 2000 Design /Construct - to mid 2001	EIS Approvals - Aug 2000 Design /Construct - mid to late 2001	EIS Approvals - Aug 2000 Design /Construct - mid to late 2001

Regional Exhaust Options - Low Separation

4a - Exhaust Line to Castle Cove Golf Course via directional boreholes	4b - Filter and Exhaust moved to East Chatswood Industrial Complex via tunnel extension and moving filter, with surface works for boreholes to tunnel	4c - Filter and Exhaust moved to Willis Park via tunnel extension and moving filter, with surface works for boreholes to tunnel	4d - Filter and Exhaust moved to Roseville Chase via tunnel extension and moving filter, with surface works for boreholes to tunnel
~20 m from golfers ~100 m from houses ~500 m from school Exhaust dispersion assisted by fairly high, open position.	~20 m from pedestrians ~100 m from houses ~500 m from school Exhaust dispersion across fairly flat land near industrial complex.	~20 m from pedestrians ~100 m from houses ~400 m from school Exhaust dispersion across fairly flat land near tennis courts.	~20 m from pedestrians ~100 m from houses ~500 m from school Exhaust dispersion across fairly flat land near golf course and parkland.

4a - Exhaust Line to Castle Cove Golf Course via directional boreholes	4b - Filter and Exhaust moved to East Chatswood Industrial Complex via tunnel extension and moving filter, with surface works for boreholes to tunnel	4c - Filter and Exhaust moved to Willis Park via tunnel extension and moving filter, with surface works for boreholes to tunnel	4d - Filter and Exhaust moved to Roseville Chase via tunnel extension and moving filter, with surface works for boreholes to tunnel
Pathogen levels in golf course in residential area.	Pathogen levels in commercial and light industrial area.	Pathogen levels of residential area near main road.	Pathogen levels of parkland area.
No guarantees on pathogen levels in exhaust or near people. Number of golfers increases risk.	No guarantees on pathogen levels in exhaust or near people. Number of pedestrians and workers in area increases risk.	No guarantees on pathogen levels in exhaust or near people. Number of pedestrians in area increases risk.	No guarantees on pathogen levels in exhaust or near people. Number of pedestrians in area increases risk.
Not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; new stack location in golf course.	Not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; new stack in new location.	Not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; new stack in new location.	Not acceptable: too close to people; unquantified, unagreed health risk; no pathogen level guarantees; new stack in new location.
Low maintenance equipment, simple to operate. Additional boreholes and larger fans need more power.	Low maintenance equipment, simple to operate. New East Chatswood site would be similar to planned Scotts Creek site.	Low maintenance equipment, simple to operate. New Willis Park site would be similar to planned Scotts Creek site.	Low maintenance equipment, simple to operate. New Roseville Chase site would be similar to planned Scotts Creek site.
Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology. In the event of power failure, filters still operate but with risk of some leakage from control dampers due to increased pressure.	Simple, reliable proven technology.
\$3.5 M	\$12.5 M	\$8 M	\$19 M
EIS Approvals - Aug 2000 Design /Construct - to mid 2001	EIS Approvals - Aug 2000 Design /Construct - to mid 2001	EIS Approvals - Aug 2000 Design /Construct - to mid 2001	EIS Approvals - Aug 2000 Design /Construct - to mid 2001
	Extending the 6.3m tunnel 1500m to East Chatswood gives added benefit of approximately 8% extra tunnel capacity.	Extending the 6.3m tunnel 1000m to Willis Park gives added benefit of approximately 5% extra tunnel capacity.	Extending the 6.3m tunnel 2500m to Roseville Chase gives added benefit of approximately 13% extra tunnel capacity.

Appendix 8

Minutes of Meetings

Minutes

Minutes No. 33

Thursday 6 July 2000

At Parliament House at 10:00am

1. Members Present

Mr R Jones (in the Chair)
Mr Dyer
Ms Burnswoods
Mr Johnson
Mr M Jones
Mr Lynn (Jobling)
Mr Ryan (Bull)

2. Apologies

Nil

3. Budget Estimates reference

The Chair advised that, Mr Lynn would be substituting for Mr Jobling, and Mr Ryan would be substituting for Mr Bull.

The Chair made a statement to Members regarding the broadcasting of proceedings.

The Committee deliberated.

Resolved, on motion of Mr Ryan, that Members will question witnesses in 15 minute blocks alternating between cross bench and opposition Members.

The following departmental staff were admitted:

Department of Corrective Services

Dr Leo Keliher, Commissioner
Mr Ron Woodham, Senior Assistant Commissioner (Inmate and Custodial Services)
Ms Catriona McComish, Assistant Commissioner (Inmate Services)
Ms Pat Maurer, Director, Indigenous Services Unit

The public and media were admitted.

The Chair made a statement regarding certain procedural matters during hearings on estimates.

The Chair declared the proposed expenditure for the portfolio area of corrective services (inmate and custodial services) open for examination.

The departmental officers answered questions by Members of the Committee.

The examination of the proposed expenditure for the portfolio area of corrective services (inmate and custodial services) concluded and the witnesses withdrew.

The public and media withdrew.

The Committee deliberated.

Resolved, on motion of Mr Ryan, that Members are to lodge questions on notice for the portfolio of corrective services (inmate and custodial services) with the Committee Clerk by 5:00pm Friday, 7 July 2000.

The Committee deliberated.

The Chair tabled draft Minutes of meeting No.'s 30, 31 and 32.

The Committee deliberated.

Resolved, on motion of Ms Burnswoods, that the draft Minutes of meeting No.'s 30, 31 and 32, be confirmed.

The Committee deliberated.

Resolved, on motion of Mr Lynn, that the Committee meet at 11:00am on Wednesday, 12 July 2000 to consider a draft version of the Committee's first report on the 2000-2001 budget estimates reference.

The Committee deliberated.

The Chair tabled a draft terms of reference entitled "Sydney Water Biosolids Strategy – Northside Storage Tunnel" and a number of supporting documents (attached).

The Committee deliberated.

Mr Ryan moved that:

Sydney Water Biosolids Strategy – Northside Storage Tunnel

1. The General Purpose Standing Committee No.5 inquire into and report on Sydney Water's biosolids strategy and the impact of the Northside Storage Tunnel.
2. That, in relation to venting of the Northside Storage Tunnel at Scott's Creek, the committee consider:
 - (a) the health and odour risks associated with venting at Scott's Creek,
 - (b) the ability for the vent to meet ambient air quality standards and licence requirements during operation under all circumstances,
 - (c) the roles and responsibilities of bodies accountable for monitoring and maintaining ambient air quality standards,
 - (d) the appropriateness, measurability and reliability of monitoring licence conditions associated with venting the tunnel,
 - (e) interim alternative options to venting at Scott's Creek,
 - (f) permanent alternative options to venting at Scott's Creek.

3. That in relation to construction of the Northside Storage Tunnel, the committee consider:
 - (a) the effectiveness of alliance contracting, contract tendering and contract management to achieve budgetary targets and project outcomes,
 - (b) the effectiveness of public consultation and public accountability.
4. That in relation to Sydney Water's biosolids strategy, the committee consider:
 - (a) the options presented for public consultation,
 - (b) the scope the selected options provide for decentralisation and devolving of the system,
 - (c) the consultation process to determine its integrity.
5. That the committee consider and report on the implementation of recommendations from previous parliamentary inquiries and reports on the Northside Storage Tunnel and Sydney Water.
6. That the committee present an interim report dealing with the matters in paragraphs 2 and 3, by 8 September 2000 and a final report dealing with paragraph 4 and 5 by 4 December 2000.

The Committee deliberated.

Resolved, on motion of Ms Burnswoods, that the Committee adjourns debate of Mr Ryan's motion until the next committee meeting.

4. Adjournment

The meeting adjourned at 11:30am until 11:00am Wednesday, 12 July 2000.

Steven Carr
Clerk to the Committee

Minutes No. 34

Wednesday 12 July 2000
At Parliament House at 11:05am

1. Members Present

Mr R Jones (in the Chair)
Mr Dyer
Ms Burnswoods
Mr Johnson
Mr M Jones
Mr Jobling
Mr Ryan (Bull)

2. Substitution of Members

The Chair advised that Mr Ryan would be substituting for Mr Bull.

3. Confirmation of Minutes

Resolved, on motion of Mr Dyer: that Minutes of meeting No.33 be confirmed.

4. Budget Estimates reference

The Chair tabled his draft first report into the 2000-2001 budget estimates reference, entitled "Budget Estimates 2000-2001, Volume 1."

The committee proceeded to consider the draft first report.

Environment, Emergency Services and Corrective Services

Resolved, on motion of Ms Burnswoods: that page 5, paragraph 3 be amended by inserting "and other

Resolved, on motion of Ms Burnswoods: that page 5, paragraph 4, be deleted.

Resolved, on motion of Ms Burnswoods: that paragraph 1.13 be amended by deleting "and it is the EPA's view that there is." at the end.

Resolved, on motion of Ms Burnswoods: that paragraph 1.18 be amended by deleting all words after "The" and inserting instead:

Committee was told by Dr Shepherd that:

The fact is that the target of 60 per cent reduction in waste going to landfill by the end of 2000 will not be achieved. However, that position has been made abundantly clear by the Minister for the Environment in several statements earlier this year.

Dr Shepherd later added:

It was, from an EPA point of view, target that was always going to be exceedingly difficult to achieve but one that was worth striving for.

The Committee was further informed that significant waste reductions have been attained in the municipal and industrial waste streams, but there has been an increase in waste from the construction and demolition waste stream, partly due to Olympic related construction.

Resolved, on motion of Ms Burnswoods: that paragraph 1.19 be amended by deleting all words after “Dr Shepherd” and inserting instead “fielded a number of questions relating to the Woodlawn facility and the Alternative Waste Management Technologies and Practices Inquiry Report.”

Resolved, on motion of Mr Ryan: that paragraph 1.24 be amended by omitting the heading and inserting instead “Stormwater contamination by pets.”

Resolved, on motion of Ms Burnswoods: that paragraph 1.33 be amended by deleting the final sentence.

Resolved, on motion of Mr Dyer: that paragraph 1.43 be amended by deleting the words “was required

Resolved, on motion of Mr Dyer: that paragraph 1.45 be amended by deleting “found it necessary to

Resolved, on motion of Mr Dyer: that paragraph 1.49 be amended by deleting “refuting” and inserting

Resolved, on motion of Mr Dyer: that paragraph 1.49 be further amended by deleting the words “by Mr

Resolved, on motion of Mr Dyer: that paragraph 1.49 be further amended by deleting the words “community organisations and” and inserting instead “community organisations.”.

Regional Development and Rural Affairs

Resolved, on motion of Mr Dyer: that paragraph 2.7 be amended by deleting all words after “locally and” in the second sentence and inserting instead “that the Department is interested in them as they are talking about manufacturing industries in the area.”, and deleting “number of”.

The Committee deliberated.

Resolved, on the motion of Mr Dyer: that the report, as amended, be adopted.

Resolved, on the motion of Mr Ryan: that the report be signed by the Chair and presented to the House in accordance with the resolution referring the Budget Estimates of 23 May 2000, and the resolutions of 21 June 2000 and 29 June 2000.

Resolved, on the motion of Mr Jobling: that 5 pm Monday, 7 August 2000 be the date by which Ministers are requested to respond to questions placed on notice in relation to each of the portfolios examined by the Committee, and that answers be made available to Members of the Committee by 5 pm on Tuesday, 8 August 2000.

Resolved, on the motion of Mr Jobling: that the President and Committee Members be advised of any questions not answered by Ministers within the timeframe set by the Committee, including any reasonable extension agreed to by the Committee Chair, and that the President be requested to report to the House any questions not so answered.

Resolved, on the motion of Mr Ryan: that pursuant to the provisions of section 4 of the *Parliamentary Papers (Supplementary Provisions) Act 1975* and under the authority of Standing Order 252, the Committee

authorises the Clerk of the Committee to publish the answers provided to questions placed on notice, after these answers have been circulated to Committee Members.

5. Northside Storage Tunnel

The Committee resumed debate from the previous meeting.

The Committee deliberated.

Resolved, on motion of Mr Jobling, that the motion of Mr Ryan be amended by deleting all the words after “that” and inserting instead:

7. That General Purpose Standing Committee No.5 inquire into and report on Sydney Water’s Northside Storage Tunnel, and in particular:
8. In relation to venting of the Northside Storage Tunnel at Scott’s Creek, the Committee consider and report on:
 - (a) the health and odour risks to the community, their scientific quantification and the application of the Precautionary Principle;
 - (b) the ability for the vent to meet ambient air quality standards and licence requirements during operation under all circumstances;
 - (c) the roles and responsibilities of bodies accountable for community health impacts, and monitoring and maintaining ambient air quality standards;
 - (d) the appropriateness, measurability and reliability of licence conditions associated with venting; and
 - (e) interim alternative options to venting at Scott’s Creek.
9. To consider and report on permanent alternative options to venting at Scott’s Creek.
10. To consider and report on the implementation of recommendations from previous parliamentary inquiries and reports on the Northside Storage Tunnel.
11. That the Committee present a report by 8 September 2000.

Resolved, on motion of Mr Jobling, that the short title of the inquiry be: “Northside Storage Tunnel –

6. Adjournment

The meeting adjourned at 12:40pm, *sine die*.

Steven Carr

Clerk to the Committee

Minutes No. 35

Wednesday 26 July 2000

At North Head Water Pollution Control Plant, Manly at 2:30pm

1. Members Present

Mr R Jones (in the Chair)
Ms Burnswoods
Mr M Jones
Mr Jobling
Mr Manson
Mr Ryan

2. Apologies

Mr Johnson

3. Member in attendance

In accordance with Standing Order 251, Mr Breen attended the meeting.

4. Business Arising

Mr Ryan moved: that the Committee undertake a half day site visit to the Warriewood Sewerage Treatment Plant with Sydney Water being invited to make appropriate arrangements for the inspection of the site.

The Committee divided.

Ayes: Mr R Jones
Mr Jobling
Mr M Jones
Mr Ryan

Nos: Ms Burnswoods
Mr Manson

Resolved, on motion of Ms Burnswoods, that the Committee agree to one additional hearing date to complete the taking of evidence from the witnesses identified by Members.

The Committee deliberated

Resolved, on motion of Mr Manson, that the additional hearing be held on Thursday 10 August 2000.

Resolved, on motion of Mr Jobling, that the hearings on Wednesday 9 and Thursday 10 August 2000 be held between 10.00am and 5.00pm.

The Committee deliberated on the issue of organisations and individuals to be invited to attend and give evidence before the Committee on Wednesday 9 August and Thursday 10 August 2000. The following witnesses were suggested by the Committee as a guide:

Sydney Water and representatives of the Alliance

Community Groups
NSW Health
The Glenaeon Rudolph Steiner School
Academics/Expert advisers

6. Adjournment

The meeting adjourned at 2:40pm, until 10.00 am on Wednesday 9 August 2000.

Rob Stefanic
Clerk to the Committee

Minutes No. 36

Wednesday 9 August 2000
At Parliament House at 10.00 am

1. Members Present

Mr R Jones (in the Chair)
Mr Breen (M Jones)
Ms Burnswoods
Mr Jobling
Mr Johnson
Mr Manson (Dyer)
Mr Ryan (Bull)

2. Confirmation of minutes

Resolved, on the motion of Mr Ryan, that the minutes of meetings no 34 and 35 be accepted.

3. Tabled Documents*3.1 Submissions – Inquiry into Northside Storage Tunnel – Scotts Creek Vent*

The Chair tabled the following 37 submissions received:

Submission No	
1	Jim White
2	Dr J Baumann
3	Paulette Kay
4	Mrs D N Reynolds
5	Chris Mirana
6	Hean Phuah
7	Dick Crane
8	Orana School for Rudolf Steiner Education (Ian Stehlik)
9	Leslie Witkop
10	Nancy Peters
11	Ian Medin
12	Sean Champion
13	Eva & Albert Sorrell
14	Mr and Mrs D Lam
15	Dorothy Rosenthal
16	J H Rosenthal
17	Helen Russell-Jones
19	Mosman Municipal Council
20	Judith Anne Luget
24	Clive Broadbent & Associates
97	Ralph Kaye
98	Dr Mark Donohoe
158	Sydney Water
159	Department of Urban Affairs and Planning
160	Rod Hymann
161	Martin and Mary-Anne Dowden
162	David Barr MP

163	NSW Health
164	Willoughby Environmental Protection Association (WEPA)
165	Glenaeon Parents Association (Brian Moran)
166	Association of Independent Schools of New South Wales
167	Scotts Creek Community Liaison Committee
168	Wendy Norton
169	Glenaeon Rudolf Steiner School
170	Willoughby City Council
171	Rosemary Gentle
172	Castle Cove Progress Association

3.2 Correspondence – Inquiry into Northside Storage Tunnel – Scotts Creek Vent

The Chair tabled the following 10 items of correspondence received.

Memo from the Hon John Jobling MLC, Opposition Whip, to Director, dated 11 July 2000, advising that the Hon John Ryan MLC will be representing the Hon Richard Bull MLC for the purpose of the meeting to be held on 12 July 2000.

E-mail from the Hon Peter Primrose MLC, to Director, dated 12 July 2000, advising that the Hon Andy Manson MLC will be representing the Hon Ron Dyer MLC for the inquiry into the Northside Storage Tunnel.

Memo from the Hon John Jobling MLC, to Director, dated 17 July 2000, advising that the Hon John Ryan MLC will be replacing the Hon Richard Bull MLC for the inquiry into the Northside Storage Tunnel – Scott's Creek Vent.

Letter from the Hon Richard Jones MLC, the Hon John Ryan MLC and the Hon Malcolm Jones MLC, to Director, dated 19 July 2000, requesting a special meeting of General Purpose Standing Committee No 5 to consider a site visit to Warriewood Sewerage Treatment Plant as part of the inquiry into the Northside Storage Tunnel – Scott's Creek Vent.

Memo from the Hon Peter Breen MLC, to Director, dated 20 July 2000, advising that he will be representing the Hon Malcolm Jones MLC at the Committee meeting to be held on 9 August 2000.

Memo from the Hon Peter Breen MLC, to Director, dated 20 July 2000, requesting that he be granted permission to attend the Committee's site visit on 26 July 2000.

Memo from the Hon Peter Breen MLC, to Director, dated 3 August 2000, advising that he will be representing the Hon Malcolm Jones MLC for all meetings held during the period from Monday, 7 August 2000 to Friday, 11 August 2000 (inclusive) relating to the inquiry into the Northside Storage Tunnel – Scott's Creek Vent.

Facsimile from June Cunningham, of the Glenaeon Rudolf Steiner School Council, to Secretariat, dated 4 August 2000, advising that Prof Ray Kearney of the University of Sydney would like to appear as a witness before the Committee in relation to the inquiry into the Northside Storage Tunnel – Scott's Creek Vent.

Facsimile from Assoc Prof Ray Kearney, University of Sydney, to Director, dated 7 August 2000, requesting the opportunity to provide evidence to the Committee in relation to the inquiry into the Northside Storage Tunnel – Scott's Creek Vent.

Letter from the Hon Peter Breen MLC, to Chair, dated 7 August 2000, advising that he will be unable to attend the Committee hearing on Thursday, 10 August 2000.

4. Inquiry into Northside Storage Tunnel – Scotts Creek Vent

The media and the public were admitted.

Mr Alexander Walker, Managing Director, Mr Ronald Quill, General Manager, Asset Solutions, Mr Allan Henderson, Manager, Capital Programs, Mr Peter Fisher, Manager, Product Delivery, Wastewater, Mr Craig Barton, Georges River Wastewater Product Delivery Manager, all of Sydney Water Corporation, and Mr Alex Dietsch, Engineering Manager, Mr Andrew Wild, Environmental and Regulatory Manager, and Mr John Callaghan, Design Manager, all of the Northside Storage Tunnel Alliance, were admitted and sworn.

The witnesses answered questions by Members of the Committee.

Evidence concluded and the witnesses withdrew.

Ms Rosemary Gentle, Mr Brian Moran and Ms Helen Scard, all of the Glenaeon Rudolph Steiner School, and Ms Wendy Norton, Mr Trevor Lee, Ms Louise Mitchell, Mr Kenneth Rutherford, and Ms June Cunningham, all of the Scott's Creek Community Liaison Committee, were admitted and sworn.

The witnesses answered questions by Members of the Committee.

Evidence concluded and the witnesses withdrew.

Dr Steven Corbett, Manager, Environmental Health Branch, NSW Health and Prof Charles Kerr, Professor of Preventative and Social Medicine, University of Sydney, were admitted and sworn.

The witnesses answered questions by Members of the Committee.

Evidence concluded and the witnesses withdrew.

Mr Robert Wilson and Mr Ian Kiernan, both Members of the Waterways Advisory Panel, were admitted and sworn.

The witnesses answered questions by Members of the Committee.

Evidence concluded and the witnesses withdrew.

Dr Kerry Holmes, Director of Holmes Air Sciences, was admitted and sworn.

Dr Holmes answered questions by Members of the Committee.

Evidence concluded and the witness withdrew.

The media and the public withdrew.

The Committee deliberated.

Resolved, on motion of Mr Ryan, that pursuant to the provisions of section 4 of the *Parliamentary Papers (Supplementary Provisions) Act 1975* and the authority of Standing Order 252, the Committee authorises the Committee Director to publish the submissions tabled by the Chair today and the transcript of evidence of today's hearing.

Mr Ryan moved:

1. That, under paragraph 8 of the Resolution establishing General Purpose Standing Committee No. 5, which is inquiring into the Northside Storage Tunnel – Scott’s Creek Vent, the Committee be provided with any document in the possession, custody or power of New South Wales Health, that relates to the Northside Storage Tunnel – Scott’s Creek Vent, or has been used in relation to any health assessment of the Northside Storage Tunnel – Scott’s Creek Vent.
2. That a return be prepared and lodged with the Director of the Committee showing, in relation to each document: the author; a description of its contents; and the date of its creation.
3. That the documents and the return be delivered to the Director of the Committee by 5.00 pm on Friday, 18 August 2000.
4. That where it is considered that a document required to be lodged with the committee is privileged and should not be made public by the committee:
 - (a) a return be prepared and lodged with the Clerk of the Parliaments showing, in relation to each document: the author; a description of its contents; the date of its creation; and reasons for the claim of privilege.
 - (b) the documents and the return be delivered to the Clerk of the Parliaments by 5.00 pm on Friday, 18 August 2000 and made available only to Members of the Legislative Council, the Director of the Committee and the Senior Project Officer to the Committee.
5.
 - (a) *That in the event of a dispute by any Member of the Legislative Council communicated in writing to the Clerk of the Parliaments as to the validity of a claim of privilege in relation to a particular document, the Clerk of the Parliaments is authorised to release the disputed document to an independent legal arbiter who is either a Queen’s Counsel, a Senior Counsel or a retired Supreme Court judge, appointed by the President, for evaluation and report to the Clerk of the Parliaments within 5 days as to the validity of the claim.*
 - (b) A report from the independent arbiter provided to the Clerk of the Parliaments is to be made available only to Members of the Legislative Council, the Director of the Committee and the Senior Project Officer to the Committee.
6. That the terms of this resolution be conveyed to Dr Col Gellatly, Director-General of the Premier’s Department, by the Clerk of the Parliaments.

Resolved, on the motion of Ms Burnswoods that the motion be amended by inserting after paragraph 4 (b):

- (c) The Clerk of the Parliaments is to maintain a record of the documents inspected, the date and time of the inspection and the name of the Member inspecting the document.

Question - as amended - put and passed

5. Adjournment

The meeting adjourned at 5.45 pm until 10.00 am on Thursday, 10 August 2000.

Anna McNicol
Director

Minutes No. 37

Thursday 10 August 2000
At Parliament House at 10.00 am

1. Members Present

Mr R Jones (in the Chair)
Ms Burnswoods
Mr Jobling
Mr Johnson
Mr Manson (Dyer)
Mr Ryan (Bull)

2. Apologies

Mr M Jones

3. Submissions

Inquiry into Northside Storage Tunnel – Scotts Creek Vent

The Chair tabled the following submission received:

Submission No	
173	New South Wales Environment Protection Authority

4. Inquiry into Northside Storage Tunnel – Scotts Creek Vent

The media and the public were admitted.

Mr Colin Woodward, Executive Director, Sydney Region, Mr Nicholas Agapides, Manager, Area Assessments Unit, Mr Warren Hicks, Manager, Sydney Catchments, and Mr Robert Marr, Senior Regional Operations Officer, all of the NSW Environment Protection Authority, were admitted and sworn.

The witnesses answered questions by Members of the Committee.

Evidence concluded and the witnesses withdrew.

Mr Maxwell Noonan, Director, Development and Infrastructure Branch, and Mr Eugene Osborne, Assistant Director, Development and Infrastructure Branch, both of the Department of Urban Affairs and Planning, were admitted and sworn.

The witnesses answered questions by Members of the Committee.

Evidence concluded and the witnesses withdrew.

Mr Ralph Kaye, Air Pollution Consultant, was admitted and sworn.

Mr Kaye answered questions by Members of the Committee.

Evidence concluded and the witness withdrew.

Dr Mark Donohoe, Medical Practitioner, was admitted and sworn.

Dr Donohoe answered questions by Members of the Committee.

Evidence concluded and the witness withdrew.

Dr Ray Kearney, Associate Professor, Department of Infectious Diseases, University of Sydney, was admitted and sworn.

Dr Kearney answered questions by Members of the Committee.

Dr Kearney tendered two documents to support his evidence.

Resolved, on the motion of Mr Ryan, that the Committee accept the documents.

Evidence concluded and the witness withdrew.

Cr Patrick Reilly, Mayor of Willoughby City Council, was admitted and sworn.

Cr Reilly answered questions by Members of the Committee.

Evidence concluded and the witness withdrew.

Cr Patricia Harvey, Mayor of Mosman Council, was admitted and sworn.

Cr Harvey answered questions by Members of the Committee.

Evidence concluded and the witness withdrew.

The media and the public withdrew.

The Committee deliberated.

Resolved, on the motion of Mr Ryan, that pursuant to the provisions of section 4 of the *Parliamentary Papers (Supplementary Provisions) Act 1975* and the authority of Standing Order 252, the Committee authorises the Committee Director to publish the submission tabled by the Chair today, those documents accepted by the Committee during today's hearing and the transcript of evidence of today's hearing.

Resolved, on the motion of Mr Ryan, that any additional questions for the witnesses who appeared at today's and yesterday's hearings be lodged with the Director by 9am on Tuesday, 15 August 2000, and that answers to these questions be requested by 9am on Monday, 21 August 2000.

Resolved, on the motion of Mr Ryan, that the Committee no longer undertake its proposed half day site visit to the Warriewood Sewerage Treatment Plant.

Resolved, on the motion of Ms Burnswoods, that the Committee hold a meeting after the receipt of written answers to questions forwarded to witnesses, to consider options for resolving issues of difference between the Sydney Water Corporation and the community of Scott's Creek.

5. Adjournment

The meeting adjourned at 4.20 pm *sine die*.

Anna McNicol
Director

Minutes No. 40

Wednesday 6 September 2000
At Parliament House at 1.00 pm

1. Members Present

Mr R Jones (in the Chair)
Ms Burnswoods
Mr Jobling
Mr Johnson
Mr M Jones
Mr Manson (Dyer)
Mr Ryan (Forsythe)

2. Confirmation of minutes

Resolved, on the motion of Mr Jobling that the minutes of meetings no 36 and 37 be confirmed.

3. Correspondence

The Chair tabled 24 items of correspondence received.

Letter from Ralph Kaye, to Chair, dated 11 August 2000, clarifying a statement made in his submission to the Committee.

Correspondence from Ron Quill, General Manager, Asset Solutions, Sydney Water, to Director, dated 17 August 2000, clarifying evidence provided to the Committee.

Letter from Ken Rutherford, to Director, dated 17 August 2000, providing responses to questions on notice and commenting on evidence received by the Committee.

Letter from Col Gellatly, Director General, Premier's Department, to Director, dated 18 August 2000, providing documents from NSW Health, requested by the Committee.

Letter from Prof Charles Kerr, to Director, dated 18 August 2000, providing responses to questions on notice.

Letter from Rosemary Gentle, Glenaeon Rudolf Steiner School, to Chair, dated 18 August 2000, providing responses to questions on notice.

E-mail from Brian Moran, dated 20 August 2000, providing responses to questions on notice.

Letter from Ralph Kaye, to Chair, dated 20 August 2000, clarifying evidence provided to the Committee.

Letter from Wendy Norton, to Director, dated 20 August 2000, responding to issues raised at the public hearings.

Answers to questions placed on notice, from Ralph Kaye, undated (received 21 August 2000).

Letter from Alex Walker, Managing Director, Sydney Water, to Chair, dated 21 August 2000, providing responses to questions on notice.

Letter from Joe Woodward, Acting Assistant Director General, NSW Environment Protection Authority, dated 21 August 2000, providing responses to questions on notice.

Letter from Assoc Prof Ray Kearney PhD, to Director, dated 21 August 2000, providing answers to questions on notice and clarification of evidence provided to the Committee.

Answers to questions placed on notice, from Bob Wilson, undated (received 21 August 2000).

E-mail from Dr Mark Donohoe, dated 21 August 2000, providing responses to questions on notice.

E-mail from Rosemary Gentle, dated 21 August 2000, providing responses to questions on notice.

Facsimile from Kerry Holmes PhD, to Director, dated 21 August 2000, providing responses to questions on notice and clarifying evidence provided to the Committee.

Letter from Geoff Noonan, Director, Development and Infrastructure, Department of Urban Affairs and Planning, to Director, undated (received 21 August 2000), providing responses to questions on notice and clarifying evidence provided to the Committee.

Answers to questions placed on notice, from Dr Stephen Corbett, undated (received 21 August 2000).

E-mail from Marc Lee, to Director, dated 21 August 2000, providing responses to questions on notice.

Facsimile from Ralph Kaye, to Director, dated 22 August 2000, clarifying issues relating to his submission and his correspondence of 20 August 2000.

Facsimile from Ralph Kaye, to Chair, dated 24 August 2000, providing a further explanation of his evidence.

Facsimile from Ralph Kaye, to Chair, dated 30 August 2000, providing copies of recent correspondence with the NSW Environment Protection Authority.

Facsimile from Dr Andrew Wilson, Deputy Director-General, Chief Health Officer, NSW Health, to Chair, dated 30 August 2000, advising he has convened an expert panel of microbiologists and public health physicians to advise him on possible health problems relating to the commissioning of the Scotts Creek and Lane Cove vents of the Northside Storage Tunnel.

4. Northside Storage Tunnel – Scotts Creek Vent

The Chair submitted his draft report entitled “Northside Storage Tunnel – Scot’s Creek Vent”, which having been circulated to each Member of the Committee, was accepted as being read.

The Committee deliberated.

Resolved, on the motion of Mrs Burnswoods, that consideration of the Chair’s draft report be deferred in order for the Committee to consider matters raised in the correspondence from Dr Andrew Wilson, Deputy Director-General, Chief Health Officer, NSW Health, to Chair, dated 30 August 2000.

The Committee deliberated.

Mrs Burnswoods moved: that the Committee invite Dr Wilson to address the Committee tomorrow.

The Committee deliberated.

Mr Jobling moved: that the motion be amended by deleting all words after “that” and instead inserting “the Committee hold a one day hearing, on a day yet to be determined, at which Dr Andrew Wilson, Deputy Director General and Chief Health Officer, NSW Health, Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services (CIDMLS), Institute of Clinical Pathology and Medical Research, Westmead Hospital, Prof Adrian Lee, Pro Vice Chancellor (Education), University of NSW and former Head of Microbiology, University of NSW, Prof Tania Sorrell, Professor of Infectious Diseases, University of Sydney and Director, CIDM, Westmead Hospital, Dr Dominic Dwyer, Medical Virologist, CIDMLS, ICPMR, Westmead Hospital, Prof Ray Kearney, Associate Professor of Infectious Diseases, University of Sydney, and Mr Ralph Kaye, Air Pollution Consultant to Glenaeon Rudolph Steiner School, are invited to attend and give evidence before the Committee.”

Question: that the amendment of Mr Jobling be agreed to – put and passed.

Original question, as amended – put and passed.

Resolved, on the motion of Mr Jobling, that the Committee extend the reporting date for the inquiry into the Northside Storage Tunnel – Scott’s Creek Vent until Friday, 17 November 2000.

The Committee deliberated.

Resolved, on the motion of Mr Ryan, that the Director General of NSW Health be requested to provide the Committee, by 5pm on Friday, 29 September 2000, with:

- copies of all submissions made to the expert panel of microbiologists and public health physicians convened to advise Dr Andrew Wilson, Deputy Director General and Chief Health Officer, NSW Health, on possible health problems relating to the commissioning of the Scotts Creek and Lane Cove vents of the Northside Storage Tunnel project (the “Expert Panel”);
- copies of all correspondence sent to NSW Health relating to or emanating from the Expert Panel;
- copies of any report(s) produced by the Expert Panel; and
- a bibliography of literature reviewed by the Experts Panel.

5. Adjournment

The meeting adjourned at 2.24 pm until the as yet undetermined date of the public hearing relating to the inquiry into the Northside Storage Tunnel – Scott’s Creek Vent.

Anna McNicol
Director

Minutes No. 41

Monday 9 October 2000

Room 814/815, Parliament House at 10.00 am

1. Members Present

Mr R Jones (in the Chair)

Ms Fazio (Burnswoods)

Mr Jobling

Mr Johnson

Mr M Jones

Mr Manson (Dyer)

Mr Ryan (Forsythe)

2. Confirmation of minutes

Resolved, on the motion of Mr Ryan that the minutes of meetings No. 40 be confirmed.

3. Correspondence

The Chair tabled 8 items of correspondence received.

Facsimile from Assoc Prof Ray Kearney, PhD, University of Sydney, to Chair, dated 6 September 2000, providing copies of correspondence between Prof Kearney and NSW Health.

E-mail from the Hon Peter Primrose MLC, Government Whip, to Director, dated 8 September 2000, advising that the Hon Amanda Fazio MLC will be representing the Hon Jan Burnswoods MLC at the hearing on 9 October 2000.

Letter from Prof Adrian Lee, Pro-Vice Chancellor (Education), University of New South Wales, to Clerk Assistant Committees, dated 21 September 2000, advising he is unable to attend the hearing on 9 October 2000 as he will be overseas.

Letter from Mr Mick Reid, Director General, NSW Health, to Chair, dated 26 September 2000, providing documents requested by the Committee and advising of the availability of witnesses to attend the hearing on 9 October 2000.

Letter from the Hon John Johnson MLC, to Director, dated 4 October 2000, requesting Dr Kerry Holmes be invited to give evidence at the hearing on 9 October 2000, and proposing a format for the hearing.

Facsimile from Assoc Prof Ray Kearney, PhD, University of Sydney, to Chair, dated 4 October 2000, providing a copy of material tabled at a meeting of the Lane Cove West Progress Association.

Facsimile from Ross O'Donoghue, Director – Health Protection, NSW Health, dated 6 October 2000, advising that Prof Tania Sorrell is unable to attend the hearing on 9 October 2000 due to a sudden sickness in her family.

Letter from the Hon John Jobling MLC, Opposition Whip, to Director, dated 9 October 2000, advising that the Hon John Ryan MLC will be representing the Hon Patricia Forsythe MLC at the hearing on 9 October 2000.

4. Northside Storage Tunnel – Scotts Creek Vent

The media and the public were admitted.

Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, and Dr Dominic Dwyer Medical Virologist, Centre for Infectious Diseases and Microbiology Laboratory Services Institute of Clinical Pathology and Medical Research, Westmead Hospital were admitted and sworn.

The witnesses answered questions by Members of the Committee.

Evidence concluded and the witnesses withdrew.

Assoc Prof Ray Kearney, Assoc Prof of Infectious Diseases, University of Sydney, was admitted under former oath.

The witness answered questions by Members of the Committee.

Assoc Prof Kearney tendered a document to support his evidence.

Resolved, on the motion of Mr M Jones, that the Committee accept the document.

Assoc Prof Kearney tendered 15 documents to support his evidence.

Resolved, on the motion of Mr Ryan, that the Committee accept the documents.

Evidence concluded and the witness withdrew.

Mr Ralph Kaye, Air Pollution Consultant to Glenaeon Rudolph Steiner School, was admitted under former oath.

The witness answered questions by Members of the Committee.

Evidence concluded and the witness withdrew.

The media and the public withdrew.

The Committee deliberated.

Resolved, on the motion of Mr Ryan, that pursuant to the provisions of section 4 of the *Parliamentary Papers (Supplementary Provisions) Act 1975* and the authority of Standing Order 252, the Committee authorises the Committee Director to publish the transcript of evidence of today's hearing.

Resolved, on the motion of Mr Manson, that the Chair write to all Members and officers of the Committee, seeking written advice as to whether they provided a copy of the correspondence from Dr Andrew Wilson, Chief Health Officer of NSW Health, dated 30 August 2000, to any individual outside of the Committee.

Resolved, on the motion of Mr Manson, that any additional questions for the witnesses who appeared at today's hearings be lodged with the Director by 5pm on Wednesday, 11 October 2000, and that answers to these questions be requested by 5pm on Friday, 20 October 2000.

Resolved, on the motion of Mr Jobling, that Sydney Water provide the Committee by 5 pm on Friday 20 October 2000 with relevant information regarding the activated carbon filters installed at the Scotts Creek Vent site including: technical and performance specifications as identified in tender documents; technical and performance specifications of the filters supplied by the successful tenderers; and any performance warranties applicable to the filters.

Resolved, on the motion of Mr Ryan, that Sydney Water confirm the date for commissioning of the Scotts Creek facility.

Resolved, on the motion of Mr Ryan, that Sydney Water and NSW Health be provided with an opportunity, up until 5pm on Friday 20 October 2000, to provide a written response to evidence presented by Prof Ray Kearney and Mr Ralph Kaye on 9 October 2000.

Resolved, on the motion of Mr M Jones, that further clarification be provided by Sydney Water, about the process which will be utilised to dry the activated carbon filters after the vent has been required to operate in exhaust mode.

Due to the decision of the Committee to take further evidence in relation to the inquiry, the Chair withdrew his draft report on the Northside Storage Tunnel – Scotts Creek Vent and requested that Members return all copies of this draft report to the Committee Secretariat.

5. Adjournment

The meeting adjourned at 4.40 pm until a date yet to be determined, after Monday 30 October 2000.

Anna McNicol
Director

Minutes No. 42

Monday 13 November 2000
Room 1153, Parliament House at 10.00 am

1. Members Present

Mr R Jones (in the Chair)
Ms Burnswoods
Mr Jobling
Mr Johnson
Mr M Jones
Mr Ryan (Colless)
Mr Tsang (Dyer)

2. Confirmation of minutes

Resolved, on the motion of Mr Tsang: That the minutes of meetings No. 41 be confirmed.

3. Correspondence

The Chair tabled 25 items of correspondence received.

Correspondence concerning Committee matters

Letter from Robert Stefanic, Senior Project Officer, to Chair, received 16 October 2000, advising that he did not provide correspondence to individuals outside of the Committee.

Letter from the Hon Jan Burnswoods MLC, to Chair, received 16 October 2000, advising that she did not provide correspondence to individuals outside of the Committee.

Letter from the Hon John Johnson MLC, to Chair, received 16 October 2000, advising that he did not provide correspondence to individuals outside of the Committee.

Letter from the Hon Malcolm Jones MLC, to Chair, received 16 October 2000, advising that he did not provide correspondence to individuals outside of the Committee.

Letter from Anna McNicol, Director, to Chair, received 16 October 2000, advising that she did not provide correspondence to individuals outside of the Committee.

Letter from Phaedra Parkins, Committee Officer, to Chair, received 17 October 2000, advising that she did not provide correspondence to individuals outside of the Committee.

Letter from the Hon Andy Manson MLC, to Chair, received 19 October 2000, advising that he did not provide correspondence to individuals outside of the Committee.

Letter from the Hon John Jobling MLC, to Chair, received 27 October 2000, advising that he did not provide correspondence to individuals outside of the Committee.

Letter from the Hon John Ryan MLC, to Chair, received 13 November 2000, advising that he did not provide correspondence to individuals outside of Committee.

Letter from the Hon John Jobling MLC, Opposition Whip, to Clerk of the Committee, dated 13 November 2000, advising that the Hon John Ryan MLC will be representing the Hon Richard Colless MLC at the meeting on 13 November 2000.

Letter from the Hon Peter Primrose MLC, Government Whip, to Clerk of the Committee, dated 13 November 2000, advising that the Hon Henry Tsang MLC will be representing the Hon Ron Dyer MLC at the meeting on 13 November 2000.

General correspondence

Letter from Michael Reid, Director-General of NSW Health, to Chair, received 18 October, advising of a Departmental liaison person.

Letter from Ron Quill, General Manager, Asset Solutions, Sydney Water, to Chair, received 18 October 2000, advising of agreement with Hunters Hill Council for installation of HEPA filter on the Lane Cover River West facility.

Letter from Ralph Kaye, to Chair, received 20 October 2000, clarifying a date error in his evidence.

Answers to questions placed on notice, from Ralph Kaye, undated (received 20 October 2000).

Letter from Alex Walker, Managing Director, Sydney Water, to Chair, received 20 October 2000, replying to Committee's request for information with attachments.

Letter from Dr Andrew Wilson, Chief Health Officer, NSW Health, to Chair, received 23 October 2000, replying to Committee's request for information.

Answers to questions placed on notice, from Assoc Prof Ray Kearney, The University of Sydney, dated 20 October (received 23 October 2000).

Letter from Stuart Miller, Senior Advisor, Government Relations, Sydney Water, to Senior project Officer, received 23 October 2000, advising of amended pages to correspondence from 20 October. and enclosing correspondence from Dr Kerry Holmes.

Email from Leony Rowan, Chair, Glenaeon Rudolph Steiner School Council, to Chair, received 24 October 2000, outlining precautionary principle arguments.

Facsimile from Assoc Prof Ray Kearney, Department of Infectious Diseases, University of Sydney, to Chair, received 27 October 2000, attaching references omitted from answers to questions on notice.

Facsimile from Ralph Kaye, Air pollution consultant, to Director, received 6 November 2000, providing further explanation of evidence.

Answers to questions placed on notice from Dr Andrew Wilson, Deputy Director-General, Chief Health Officer, NSW Health, to Chair, dated 19 October 2000 (received 3 November 2000).

Letter from Dr Kerry Holmes, Holmes Air Sciences, to Chair, received 7 November 2000; responding to claims made in evidence by Assoc Prof Ray Kearney.

Facsimile from Taylor Tsieng, to Chair, received 7 November 2000, comments on offer of HEPA filter to Hunters Hill and Lane Cove Councils.

4. Northside Storage Tunnel – Scotts Creek Vent

The Chair submitted his draft report entitled “Northside Storage Tunnel – Scotts Creek Vent”, which, having been circulated to each Member of the Committee, was accepted as having been read.

The Committee proceeded to consider the draft report.

Chapter 1 read.

Resolved, on the motion of Mr Jobling: That the Committee Secretariat be permitted to correct grammatical errors in the report.

Resolved, on the motion of Mr Jobling: That paragraph 1.3 be amended by deleting all words and inserting instead, “At its meeting on 12 July 2000, the Committee decided to advertise in the North Shore Times and the Manly Daily newspapers, calling for submissions and with a closing date of Friday, 4 August 2000.”

Resolved, on the motion of Mr Jobling: That paragraph 1.15 be amended by inserting the word “alternative” before “options” and deleting the words “that may be implemented as alternatives”.

Chapter 1, as amended, agreed to.

Chapter 2 read.

Resolved, on the motion of Mr Jobling: That paragraph 2.5 be amended by deleting all words after “odour” and inserting instead, “in addition to environmental and public health risks.”

Ms Burnswoods moved: That paragraph 2.11 be amended by inserting at the end:

“Sydney Water will operate the tunnel to meet its primary objective as defined in the EIS (Sydney Water, 1997b), namely:

To protect public health, recreational uses and aquatic ecosystems in the Sydney Harbour catchment and minimise the aesthetic and community amenity impacts of sewage overflows.

Sydney Water will operate the tunnel to meet the specified tunnel operating principles described above at all times. However operation of the tunnel will change over time as experience is gained and Sydney Water aims to optimise the performance of the tunnel and minimise impacts on the environment and human health.”

Question put and negatived.

Resolved, on a motion of Mr Ryan: That paragraph 2.15 be amended by inserting at the end:

“Sydney Water advised in evidence that the vent is not necessarily operating for the whole day on the days which record Scotts Creek being “in use”. For most of this time, additional air is being drawn into the tunnel. Actual venting time is expected to be less than 150 hours per year.”
(footnote: Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, p.42)

Resolved, on the motion of Mr Jobling: That paragraph 2.16 be amended by deleting the last sentence.

Ms Burnswoods moved: That after paragraph 2.22, insert the following paragraphs:

“Waterways Advisory Panel

2.23 The Waterways Advisory Panel was reconvened in 1999 to assess progress on the Northside Storage Tunnel project. The Advisory Panel undertook extensive community consultation with about 40 groups. In its Second Report, the Advisory Panel found that the Northside Storage Tunnel and other stormwater management programs will deliver significant environmental improvements to Sydney’s waterways and that progress has been achieved by the Government and Sydney Water in ameliorating the effects of pollution, particularly sewer overflows, on Sydney Harbour.

The Panel also noted the impressive amount of work being done and the progress achieved by Sydney Water on Waterways Package programs such as sewage treatment plant improvements and upgrades, sewer overflow abatement, effluent reuse/recycling, backlog sewerage and stormwater management. Additionally, the Advisory Panel noted that the Northside Storage Tunnel Alliance has performed well in relation to safety, industrial relations, quality and environmental objectives and that the project is well on track.

2.24 In relation to the filtered vent at Scotts Creek, the Advisory Panel recently found that the filtered vent is environmentally acceptable, poses minimal health risk to the local community and represents a substantial improvement on the current environmental conditions in that valley.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Chapter 2, as amended, agreed to.

Chapter 3 read.

Ms Burnswoods moved: That after paragraph 3.3, insert the following paragraph:

“The REF considered a number of possible alternatives, including limiting venting rates at Scotts Creek to 3.5m³/sec and eliminating the Scotts Creek vent by venting at North Head STP. None of the alternatives in the REF were found to be viable.

The REF assessed odour and health risks from the Scotts Creek vent, and concluded they were negligible. Professor Charles Kerr and the NSW Health Department were consulted and confirmed this conclusion.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on the motion of Ms Burnswoods: That paragraph 3.9 be amended by deleting all words and inserting instead:

“Based on the consultants report and community concerns, DUAP recommended that the modifications proceed subject to safeguards and additional conditions of approval. The Minister subsequently approved the following safeguards:

- The installation, operation and maintenance of appropriate air pollution control equipment at Lane Cove River West and Scotts Creek to ensure that, under all operating conditions and meteorological conditions, discharges from the vent do not result in offensive odours.
- A remote monitoring system shall be established to provide an audible and visible alarm at a Sydney Water 24 hour Operations Centre should the hydrogen sulphide concentrations exceed EPA requirements.
- Odour emission sampling and analysis be undertaken to the satisfaction of the EPA.
- For the first year of operation, on a quarterly basis, the activated carbon shall be analysed for hydrogen sulphide adsorptive capacity, subject to approval by the EPA.
- An Odour Complaints Management Plan be implemented in consultation with the EPA.
- Two impregnated activated carbon filter beds be installed and designed to hydrogen sulphide efficiency greater than 99% at 80% bed saturation, based on vent gases having a relative humidity range of 60-100%, and mercaptan removal efficiency greater than 99% at 70% bed-saturation.
- Design of the filter beds be based on an anticipated venting rate of 8m³/sec at Scotts Creek.
- A weather station be established.
- If there is evidence that the system is not performing to expectation, that additional plume dispersion modelling be conducted at the request of the Director-General.

(footnote: Conditions 51B-51N; Minister of Urban Affairs and Planning, Modification of an Approval granted under section 115B of the *Environmental Planning and Assessment Act 1979*, 31 August 1999, pp 3-6.)

Ms Burnswoods moved: That paragraph 3.10 be amended by deleting all words and inserting instead:

Question: That the amendment of Mr Ryan be agreed to – put and passed.

Resolved, on a motion of Mr M Jones: That paragraph 3.10, in the third sentence, be amended by deleting the words “resulted from” and inserting instead “as supported in”.

Ms Burnswoods moved: That recommendation 1 be deleted.

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on a motion of Mr Jobling: That recommendation 1 be amended by omitting all words after “that” and inserting instead:

“The Committee recommends that, the independent post-construction audit report required under NST operation conditions, be tabled by the relevant Minister in each House.”

Chapter 3, as amended, agreed to.

Chapter 4 read.

Ms Burnswoods moved: That after paragraph 4.1 insert the following paragraph:

“Through the Community Liaison Committees, the Alliance has made meaningful design modifications, relocation of construction sites, noise reduction and controls, traffic management, changed working hours and re-vegetation plans. Some of the specific modifications incorporated into the project at Scotts Creek following community consultation include:

- blasting hours at Scotts Creek were modified to be conducted only outside school hours;

- construction hours for the chamber for the relocated overflow at Scotts Creek were modified following discussion and agreement with the Community Liaison Committee;
- ventilation infrastructure at Scotts Creek was largely buried underground (75 per cent) to maintain visual amenity;
- relocation of the access track at Scotts Creek; and
- blasting times at Scotts Creek were restricted during exam times at Glenaeon School to reduce impacts on students.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 4.3 insert the following paragraph:

“Other impacts raised through community consultation and considered in the REF and REF Representations Report include air quality, traffic, noise and vibration, risk and hazards, flora and fauna, current land use and ownership, visual amenity, geology and soils, surface water, spoil and waste management and other issues.

The REF Representations Report found that the modifications were consistent with the Northside Storage Tunnel’s primary objective to protect public health, recreational uses and aquatic ecosystems in the Sydney Harbour catchment and minimise the aesthetic and community impacts of sewage overflows.

The REF Representations Report also supported the conclusion in the REF that the proposed modifications were not likely to significantly effect the environment.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on a motion of Ms Burnswoods: That paragraph 4.4 be amended by deleting all words after “was” in the second sentence and inserting instead, “selected by the Scotts Creek community and agreed to by Sydney Water to mediate between the parties.”

Resolved, on a motion of Ms Burnswoods: That paragraph 4.5 be amended by deleting the footnote to the first sentence and inserting after the first sentence:

“The Members of the Mediation Expert Panel included the following people:

- Dr Terry Bellair, Environmental Scientist, Agricultural Scientist and Biochemist, Consulting Environmental Engineers;
- Dr Steven Corbett, Manager, Environmental Health Branch, NSW Health;
- Dr Mark Donohoe, Environmental Medical Specialist, Medico-Legal Adviser and Researcher;
- Dr Kerry Holmes, Air Quality and Odour Consultant, Holmes Air Sciences;
- Prof Charles Kerr, Professor of Preventative and Social Medicine, Department of Public and Community Health, University of Sydney;
- Terry Schulz, Air Quality and Odour Consultant, Chemical Engineer, CH2Mhill Consultants”

(footnote: Final Report on Mediation between Sydney Water and the Community of the Scotts Creek Area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment , March 2000, p.9.)

Ms Burnswoods moved: That after paragraph 4.6 insert the following paragraphs:

“In relation to advice from the Mediation Expert Panel, three of the five health experts shared the view that the vent was unlikely to cause a health impact and the following summary was provided in the Mediation Report:

Professor Charles Kerr: Professor Kerr has not changed his view from his original position, that is, that the vents are very unlikely to cause a public health problem and with the activated carbon filters in place are extremely unlikely to cause a health problem. In practical terms, this means that the vents would not result in discernible changes to the health of the local community.

Dr Steven Corbett: Dr Corbett’s view is very similar to that of Professor Kerr, in that he considers there to be a very low risk of any public health impacts from the vent. In practical terms this means that from a decision-makers point of view, a public health authority would not object to the proposed placement of these vents.

Terry Schulz: Mr Schulz has abstained from making comments on health grounds as he is not an expert in this area. Further information provided has not changed his view on this.

Dr Kerry Holmes: Dr Holmes’ view is very similar to that of Professor Kerr and Dr Corbett, that is, that the risk to public health is very low and further information has not changed this view.

Dr Terry Bellair: Dr Bellair’s view again has not changed substantially from his initial position, that is that the risks to public health are difficult to quantify, but are not negligible. He considers that risks to human health will be reduced but not eliminated by passage through the proposed filters which have not been specifically designed to remove aerosols.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That paragraph 4.7 be amended by deleting the quote and inserting instead:

“In the Mediation Report there is an Agreed Statement of Outcome prepared by Sydney Water and the Scotts Creek community. With respect to health impact, the following points are documented in the Agreed Statement of Outcome:

- Notwithstanding these constraints [Olympic deadline and limited budget] it is accepted that Sydney Water would not proceed with any such development unless it genuinely believed that the development posed no risk to human health. This decision to proceed would be based on its own experience, inspections and enquiries made of similar facilities elsewhere in the world, and on advice obtained from health experts.
- It is accepted that the community believes that there will be a health risk from the operation of the vent. This belief has been reinforced by the inability of the Expert Panel to agree on the matter.
- The community is also concerned that there exists no specific experience which can validate the long term safety of this vent, in this community.
- The community is constrained by its duty of care to avoid new health risks, especially to the more vulnerable members of the community, especially nearby school children. It is also constrained by its duty to avoid other consequential economic and environmental damages.
- While there are preferred venting alternatives acceptable to individual participants representing their stakeholders, there was no alternative that fitted all of the constraints placed on all of the parties by their stakeholders.
- Agreement by health experts that health risks exist but were difficult to quantify. There was disagreement on the degree of potential impact on public health.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 4.8 insert the following paragraphs:

“Assessment Panel for Community Relations

4.9 In his evidence to the Committee, Mr Brian Moran noted the establishment of an independent Assessment Panel for Community Relations which was a panel of three eminent citizens who were there to look at the way in which the community consultation process had actually been conducted.

The Assessment Panel for Community Relations is composed of Martin Stewart-Weeks, Principal, The Albany Consulting Group, Jenny Onyx, Associate Professor in the School of Management, University of Technology, Sydney and Meg Hart, Director of Consulting at the St James Ethics Centre

4.10 Sydney Water has advised that this external assessment panel has completed and issued its second community relations audit report. The panel has found that the NST Alliance's overall performance in the community relations objective is also at Best Practice level."

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Chapter 4, as amended, agreed to.

Chapter 5 read.

Resolved, on a motion of Ms Burnswoods: That paragraph 5.13 be amended by deleting all words and inserting instead:

"The Committee requested information as to what safeguards will be put in place to ensure proper control and monitoring of the licence requirements. Sydney Water provided the following information to the Committee:

Stringent licence conditions have been imposed by the EPA and DUAP to ensure that controls to the Scotts Creek filtered vent are fully implemented and maintained.

Sydney Water proposes a rigorous inspection and maintenance program to be carried out on the granulated activated carbon filters on a regular basis. The activated carbon filters installed have been specified with a five-year operating life. Nevertheless appropriate tests will be carried out to ensure that they remain viable and are changed before they reach 80 per cent saturation.

Samples of activated carbon will be collected from the 30 per cent, 50 per cent and 80 per cent locations in the bed on a quarterly basis in the first year of operation and analysed for H₂S adsorptive capacity. The results of testing in the first year will provide Sydney Water with information necessary to forecast the operating life of the activated carbon bed.

Thereafter, testing will be carried out on a regular basis with sampling frequency and sampling and analytical methods approved by the EPA. Testing will include total sulphur and volatile organic compound adsorptive capacity.

The exit stream (vented air) will be continuously measured for H₂S, flow rate and temperature. This information is continuously monitored at Sydney Water's Strategic Operating Centre, with appropriate alarms and data recording.

Odour emissions sampling and analysis will be undertaken. This will be carried out on air being discharged from the Scotts Creek filtered vent during an overflow event and the sampling and analysis program must be approved by the EPA. The following information will be collected:

- Discharge velocity (m/s)
- Discharge temperature (deg C)
- Discharge rate wet and dry basis (m³/min)
- Moisture content (%)
- Odour concentration.

A weather station is being installed at Scotts Creek to collect local data for temperature, wind speed and wind direction. In future, additional plume dispersion modelling may be required and the data collected from the weather station will be used in the analysis.

The Scotts Creek vent has a high level of redundancy built into its operating systems. It has a spare ventilation fan, back up power for all instrumentation and critical control functions.

The average non-use period for the tunnel (length of time between overflows) is at least 20 days, leaving plenty of time for any required maintenance. The replacement of the activated carbon from all three beds will take 3 – 4 days, and will be required no more often than every 5 years. The multiple parallel beds in the Scotts Creek activated carbon filter allow single beds to be replaced progressively.

Additionally, Sydney Water will operate the Northside Storage Tunnel in accordance with the OEMP, which specifies the environmental requirements for the operation of the tunnel. The OEMP is being prepared to the satisfaction of the Director-General of DUAP, following the consideration of community and stakeholder input and consultation with the relevant approval/consent authorities.

In addition, the design of the Scotts Creek facility provides significant information on the status and performance of the filters and associated equipment. This includes:

- Inlet H₂S (continuous)
- Outlet H₂S (continuous)
- Vented Air Outlet Temperature
- Vented Air Outlet flow rate
- Air Inlet Temperature (to GAC Filter)
- Air Inlet Pressure
- Carbon Filter Differential Pressure
- Prefilter Differential Pressure
- Ventilation Fan Status (Duty/Standby, On/Off)
- Damper(s) Status
- Dilute Sewage Overflow Rate (to Tunnel)
- Penstock(s) Position
- NSOOS Flow and Pressure
- Overflow Flowrate to Scotts Creek (environmental overflow)
- Pressure Relief Valve Status
- Vacuum Breaker Valve Status

- Water Level in Tunnel
- Wind speed, direction and ambient temperature
- Ancillaries Status (ventilation, dewatering, security, fire protection, etc)
- Incoming Power Status
- Back-up Power Status

Most of this information is telemetered to the Sydney Water 24 hour staffed Strategic Operations Centre, all critical information is displayed and abnormal levels are alarmed for Operator response and action.”

(footnote: Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.39-40)

Ms Burnswoods moved: That after paragraph 5.15 insert the following paragraph:

“In contrast, Sydney Water has advised that it is confident that the monitoring system for the Northside Storage Tunnel will not be rendered ineffective through saturation as a result of humid tunnel environment:

Sewage Pumping Station (SPS) 138 at Padstow and SPS 630 at Hoxton Park have activated carbon filters installed for odour control. Both filters commenced operation in January 1999 and are envisaged to have a 5 year operational life before requiring replacement of the activated carbon bed.

No quantitative odour monitoring has been carried out on either activated carbon filter.

However, both filters have been effective in reducing odours as measured by the reduction in odour complaints received from the community. In fact, since the installation of both filters, only one (1) odour complaint has been received relating to SPS 138. This complaint occurred when the activated carbon filter had been turned off to enable painting at SPS 138.

Additionally, since about 7 August 2000, high H₂S alarms have been installed at the outlet of both filters. These alarms are telemetered to Sydney Water’s 24 hour Strategic Operations Centre. The alarm is raised if the H₂S concentration in the filter outlet is above 90 parts per billion (ppb). Neither alarm has been triggered in the short time they have been installed.

An inspection of the filter at SPS 138 in December 1999 (11 months after operation commenced) indicated the carbon bed was only 20 per cent spent. This indicates that the activated carbon filters will be effective in removing odours for several more years before the activated carbon requires replacing.

(footnote: Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, p.32)

Sydney Water further advised that the suggested problems were not credible at the Scotts Creek facility:

Stringent licence conditions have been imposed by the EPA and DUAP to ensure that controls to the Scotts Creek filtered vent are fully implemented and maintained.

Sydney Water proposes a rigorous inspection and maintenance program to be carried out on the granulated activated carbon filters on a regular basis. The activated carbon filters installed have been specified with a five-year operating life. Nevertheless appropriate tests will be carried out

to ensure that they remain viable and are changed before they reach 80 per cent saturation.

Samples of activated carbon will be collected from the 30 per cent, 50 per cent and 80 per cent locations in the bed on a quarterly basis in the first year of operation and analysed for H₂S adsorptive capacity. The results of testing in the first year will provide Sydney Water with information necessary to forecast the operating life of the activated carbon bed.

Thereafter, testing will be carried out on a regular basis with sampling frequency and sampling and analytical methods approved by the EPA. Testing will include total sulphur and volatile organic compound adsorptive capacity.

The exit stream (vented air) will be continuously measured for H₂S, flow rate and temperature. This information is continuously monitored at Sydney Water's Strategic Operating Centre, with appropriate alarms and data recording.

Odour emissions sampling and analysis will be undertaken. This will be carried out on air being discharged from the Scotts Creek filtered vent during an overflow event and the sampling and analysis program must be approved by the EPA. The following information will be collected:

- Discharge velocity (m/s)
- Discharge temperature (deg C)
- Discharge rate wet and dry basis (m³/min)
- Moisture content (%)
- Odour concentration.

A weather station is being installed at Scotts Creek to collect local data for temperature, wind speed and wind direction. In future, additional plume dispersion modelling may be required and the data collected from the weather station will be used in the analysis.

The Scotts Creek vent has a high level of redundancy built into its operating systems. It has a spare ventilation fan, back up power for all instrumentation and critical control functions.

The average non-use period for the tunnel (length of time between overflows) is at least 20 days, leaving plenty of time for any required maintenance. The replacement of the activated carbon from all three beds will take 3 – 4 days, and will be required no more often than every 5 years. The multiple parallel beds in the Scotts Creek activated carbon filter allow single beds to be replaced progressively.”

To which Mr Ryan moved: That the amendment be amended by deleting paragraph four from the first quote and deleting all words after paragraph five.

Question: That the amendment of Mr Ryan be agreed to – put and passed.

Question: That the original question, as amended, be agreed to – put and passed.

Ms Burnswoods moved: That paragraph 5.21 be amended by deleting the quote and inserting instead:

“Mr Ralph Kaye, in his submission on behalf of the Glenaeon School, has quoted from the Sydney Water Annual Environment Report for 1998-99 to the EPA and claimed that H₂S concentrations in excess of 5 parts per million (ppm) were recorded on 87 days, with a peak of 21 ppm for the NSOOS inlet at North Head. He has then implied that these values are equally applicable to Scotts Creek as part of his argument that Sydney Water cannot meet its Licence

obligations. The use of this information is misleading ... the H₂S concentration levels he quoted were for dry weather flows ... the H₂S levels during wet weather flows (when the tunnel operates) are much lower and the typical level for wet weather flows is 1 – 2 ppm, with a maximum of 3.8 ppm in the 1998/99 period quoted.

It is expected that the H₂S concentrations at the outlet of the activated carbon filter at Scotts Creek will be as good or better than that required at North Head STP. Acceptance tests for the first activated carbon filter installed on the Project has shown substantially better performance than specified.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 5.21 insert the following paragraphs:

“With respect to the vent, in answers to questions on notice, Sydney Water has identified Mr Kaye’s assertions were invalid because they were based on incorrect assumptions. Mr Kaye has himself acknowledged inaccuracies in his written submission when he advised the Committee in a letter dated 21 August 2000:

My written evidence to the Committee contains an error of fact.

In addition, Sydney Water stated that it remains confident that the activated carbon filters installed at Scotts Creek will meet both their performance goals and the EPA air impact goals with respect to H₂S and odour:

Sydney Water is committed to, and is confident of, achieving the key objective that “under all operating and meteorological conditions, discharges from the vent at Scotts Creek do not result in an offensive odour or air quality impacts at or beyond the boundary of the premises at any sensitive receptor.

The odour goal set by the EPA is based on frequency of exceedance of two odour units. Exceedances for 1 per cent of the time are permissible. This goal can be complied with under more than one modelling scenario. In the modelling undertaken by Holmes Air Sciences the emissions were assumed to be continuous, but in reality, there will be zero emissions for much of the time.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones

Mr Tsang Mr R Jones
 Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 5.22 insert the following paragraph:

“Sydney Water has advised that acceptance testing of the granular activated carbon filter at Scotts Creek, Lane Cove and Quakers Hat Bay has been completed. The testing involved operating the granular activated carbon filter at maximum volumetric throughput, maximum specified hydrogen sulphide concentrations and recording hydrogen sulphide concentration of outlet air. The hydrogen sulphide concentration for all tests in outlet air was zero. Additional testing with hydrogen sulphide inlet concentration of up to 20ppm was carried out. Outlet concentrations were still zero.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 5.25 insert the following paragraph:

“In response to claims that these filters will not operate effectively during high humidity, Sydney Water advises that:

The impregnated activated carbon filtration system was specified to operate at relative humidities of up to 100 per cent. Sydney Water holds guarantees against the performance of the filtration system for all specified operating conditions. The impregnation with Sodium Hydroxide improves the removal of H₂S at high humidities.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That paragraph 5.26 be deleted.

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Mr Tsang moved: That recommendation 1 be deleted.

Question put.

Question resolved in the negative.

Resolved, on a motion of Mr Jobling: That recommendation 1 be amended by deleting the words “permit random independent” and inserting instead “engage an independent consultant to conduct

Ms Burnswoods moved: That recommendation 2 be deleted.

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on a motion of Mr Jobling: That recommendation 2 be amended by inserting at the end the words, “and report the results to the House.”

Chapter 5, as amended, agreed to.

Chapter 6 read.

Resolved, on the motion of Ms Burnswoods: That the following list of studies be inserted as a footnote to the quote from Sydney Water appearing in the introductory comments to Chapter 6:

“Sydney Water provided the following list of studies relating to potential health and odour impact:

Tunnel Ventilation Odour Impact Assessment (May 1999)

- CH2MHill (Terry Schulz) – Letter to the Alliance re *Odour Responses* (2 June 1999)
- Holmes Air Sciences (Dr Kerry Holmes) – *Appraisal of Odour Issues for Northside Tunnel Storage Tunnel Vents* (May 1999)
- Holmes Air Sciences (Dr Kerry Holmes) – *Northside Storage Tunnel: Odour and Health Impacts of Vent Operation at Scotts Creek and Lane Cove River West* (September 1999)
- Professor Charles Kerr (University of Sydney) – *Northside Storage Tunnel Project: Public Health Risk* (June 1999)
- Dr Stephen Corbett (NSW Health Department) – *Letter to Northside Storage Tunnel Project Alliance Attn: Andrew Wild* (4 June 1999)
- Odour and Corrosion Technology Consultants, Inc (J Joyce) – *Health Effects of Exposure to Raw Wastewater Aerosols* (1999).
- Foundation for Water Research – *Health Hazards at Wastewater Treatment Works – The Implications of the COSHH Regulations* (June 1994)
- Waterways Advisory Panel – *Second Report to the NSW Government on the Proposal by the Sydney Water Corporation for Sewage Overflow Abatement in Sydney Harbour* (March 2000)
- *Final Report on Mediation Between Sydney Water and the Community of the Scotts Creek Area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment* (March 2000)

(footnote: Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.4-5)

Ms Burnswoods moved: That before paragraph 6.1 insert the following paragraphs:

“Current situation

Currently, more than 20 wet weather overflows occur during an average year, resulting in around 1,600 megalitres, almost 1,600 Olympic sized swimming pools, of diluted raw sewage flowing into local waterways. At Scotts Creek, the overflow is located only 40 metres from a nearby school. The construction of the Northside Storage Tunnel will drastically reduce diluted raw sewage flowing into local waterways during wet weather.

In Sydney Water’s evidence before the Committee, the Corporation advised:

The Northside Storage Tunnel will reduce the frequency and volume of overflows to the environment at Scott’s Creek, reducing the number of overflow events from the aqueduct from approximately 20 per year to approximately two per year. This means a considerable improvement on the current situation where the public is exposed to diluted sewage overflows.

NSW Health’s Environmental Health Branch officers considered both the potential for a risk to public health from the tunnel vent emissions and the utility of monitoring tunnel vent emissions for microorganisms. In a letter to other regulatory authorities, NSW Health advised:

The public health risk from the emissions is considered to be very low and a considerable improvement on the current situation where the public is exposed to uncontrolled raw sewage overflows. The tunnel proponents will employ a range of measures, including carbon filters to further minimise the risk of microorganisms spreading via vent emissions.

In NSW Health’s written submission to the Committee, they advised:

The development of sewage systems, however is not without controversy... Parliament in 1894 specifically dealt with community concerns that the 20,000 vents ultimately required for the system would cause no public health problems by the spread of disease. One hundred years on there is no evidence that this existing system of vents has ever caused a public health problem.

On the contrary, the sewage system that the vents support has enabled the community to shift away from an era of infectious disease.

“NSW Health is satisfied that the operation of the Northside Storage Tunnel Scotts Creek vent, subject to the conditions of approval, will not present an increased public health risk to the surrounding community and in fact will provide an improvement to the current risk from uncontrolled sewage overflow.

NSW Health reinforced this view in its evidence before the Committee. Dr Steven Corbett noted:

I would commend to the Committee a video of the current situation at Scott's Creek, because in our view the potential for aerosol generation with the current scenario at Scott's Creek seems to me to be—there was a video, I believe, of such an overflow—something that has been largely unexamined in this debate. Certainly, having seen that, I think it would be important for people here to see that because if we are talking about trying to get some handle on the context of this risk, I think we should at least look at what we are going to replace, and I think our strong view is that the risk management strategies which will accompany the installation of this vent will be an order of magnitude greater than what currently exists.

An Expert Panel convened by the Chief Health Officer was established to provide expert advice to the Chief Health Officer on the potential and likely health impacts of the Northside Storage Tunnel project. The Expert Panel's report is provided at Appendix ____.

The EPA also considered the current situation at Scotts Creek and advised the Committee:

Under the current sewerage system, when there is high rainfall events, there are sewer overflows into Scott's Creek, into Lane Cove River and into other areas which discharge into Sydney Harbour. Those discharges carry pathogens, nutrients and other organic matter into the harbour which cause an environmental problem for the ecology of the harbour and also a potential human health problem as well. The tunnel will capture those and will take them to the North Head Sewage Treatment Plant where the sewage will be treated and discharged to a much higher level.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 6.1 insert the following paragraph:

“The following additional information was provided to the Committee concerning the qualifications, areas of expertise and reputation.

Professor Adrian Lee who is currently Pro Vice Chancellor of Education at the University of New South Wales. However, his expertise in this area comes from the fact that he is an expert in the area of microbiology and immunology. He was formerly head of microbiology and immunology at that university and continues to have an interest in that area.

Professor Tania Sorrell is a Professor of Clinical Infectious Diseases at the University of Sydney and Director of the Centre for Infectious Disease Medicine at Westmead Hospital. She is an international expert particularly in the field of viral infections and other forms of communicable disease.

Dr Jeremy McAnulty, a medical epidemiologist whose specialty is the area of communicable diseases, trained at the Centre for Disease Control in the United States of America and also trained in Australia.

Dr Stephen Corbett is an expert particularly in the field of environmental pollution. He has an international reputation in that field.

... it was particularly good, I thought, to have Professor Lee who really is one of the most outstanding microbiologists that Australia has produced in the last 20 years, with very much an international reputation in precisely the sort – in gastrointestinal organisms of one form or another.

However, Professor Gilbert is a legionella expert.

Professor Gilbert is an international figure in paediatric health.”

Question put.

Question resolved in the negative.

Resolved, on a motion of Mr Jobling: That paragraph 6.2, second sentence, be amended by inserting the word “conflicting” after “Notwithstanding”.

Mr Tsang moved: That after paragraph 6.2 insert the following paragraph:

“The Health Expert Panel advised the committee:

The Expert Panel is unanimous in their view that the evidence indicates that these vents present no increase in risks to public health. There is no evidence to indicate that the emissions from these vents will contain bacteria likely to cause illness. There is no direct evidence, in the scientific literature, of microbiological or disease risk associated with a filtered storage tunnel vent. Similar vents in North America have been operating for some years with no reports of public health problems.

The full report of the Expert Panel to the Chief Health officer is provided at Appendix _.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on a motion of Mr Jobling: That before paragraph 6.6 delete the sub-heading “Types of

Ms Burnswoods moved: That paragraph 6.7 be deleted.

Question put and negatived.

Resolved, on a motion of Mr Jobling: That at the beginning of paragraph 6.7 insert the words “A contrary view was presented by” and insert that the word “who” after “Kearney”.

Ms Burnswoods moved: That after paragraph 6.7 insert the following paragraph:

“Professor Charles Kerr, stated that:

...any pathogenic organisms in sewage diluted by rainfall will be at such low concentrations in the emitted aerosol that the chances of harmful effects arising from their ingestion are negligible.

Mr Jobling moved: That the motion be amended by deleting the word “after” and inserting instead

Question: That the amendment of Mr Jobling be agreed to – put and passed.

Ms Burnswoods moved: That after paragraph 6.7 insert the following paragraphs:

“Overseas experience

Sydney Water advised that similar storage tunnels have been constructed overseas. These projects around the world included vents without filtering of the displaced air, with no adverse impacts reported over its 10 years of operations.

Sydney Water provided the following information about other similar projects at Rochester, Chicago and Milwaukee. Sydney Water advised that the tunnels in Milwaukee and Rochester have used activated carbon filters. In the later case, the filters were subsequently removed because they were found to be unnecessary.

Rochester, New York, USA

At Rochester, a similar storage tunnel system has been in operation for over 10 years. The system consists of over 53 kilometres of deep tunnels, two to five metres in diameter with 57 overflow points. As the tunnel fills, displaced air is released through grated vents located in highly developed residential areas.

Many vents were constructed at ground level as part of nature strips. Although carbon filters were installed initially on these vents they were later removed as they were found to be unnecessary. At no stage have there been any reports of community sickness arising from operation of the storage tunnel system.

Chicago

The Chicago project consisted of over 200 kilometres of tunnel, including 200 drop shafts, for the collection of combined sewage overflows. There have been no health impacts associated with tunnel venting reported. Most citizen complaints have been associated with odours. These complaints are reported to be infrequent and isolated. It is significant that no odour scrubbing equipment has been provided at any of the drop shaft or surface connection structures. Odour episodes have been temporary and have been linked to unfavourable weather conditions.

Additionally, the project was named by the USEPA as one of the United States of America's top Clean Water Act successes and in 1986 won the American Society of Civil Engineers Award for the Most Outstanding Civil Engineering Project?

Milwaukee

No instances of health concerns or any complaints relating to pathogen or health issues have been reported during the eight years of operation of the Milwaukee sewer overflow tunnel system. Residences and businesses are located within 100 metres of the tunnel surface structures. The tunnel vents use granulated activated carbon filters for odour control.

Sydney Water's experience of other sewer vents

Sydney Water has advised it operates numerous ventilation systems on its major sewers. These ventilate the raw sewage conduits upstream of the sewage treatment plants.

The vented air contains far higher concentrations of odorous contaminants, principally hydrogen sulphide, than is likely for the vents on the storage tunnel because of the highly diluted nature of sewage overflow in wet weather. In addition, these large existing vents on the sewerage system, none of which have filters, discharge continuously (24 hours per day, 365 days per year) up to five times the maximum discharge at Scotts Creek (which occurs for less than 24 hours per year). The existing vent stacks are located in residential areas at distances ranging from 10 metres to 100 metres from houses.

The Northside Storage Tunnel Alliance was asked to compare a domestic green vent to the operation proposed for the new ventilation in terms of the volume of air and the area of sewer that is going to be vented from the filtered vent at Scott's Creek. In reply the Mr Dietsch commented there are a number of significant similarities.

The interesting thing, and this is fairly well agreed between the community and Sydney Water, is that the volume in an average year sounds a large number—it is 800,000 cubic metres. That is about the same amount of air that is vented out of one green vent such as the type at Scott's Creek. It is also equal to the amount of air that one bathroom fan actually passes in one year. It is the fact that it is a high flow rate for a very short period of time that makes people think that it is an enormous amount, but in terms of annual rates it is the same as a green vent.

Mr Dietsch also commented on a matter of significant difference between a domestic green vent and the filtered vent at Scotts Creek:

Yes, the green vent comes from an ordinary sewer and is unfiltered and the Scott's Creek vent goes through a filter system from essentially a dilute sewage and fresh air mix.

This view was supported by the New South Wales Health Director-General, Mr Mick Reid, who put the matter into perspective in a letter to the Committee:

The development of sewage systems, however, is often not without controversy. The construction of Sydney's sewerage system in the late nineteenth and early twentieth century

caused considerable public furore and a report from Sydney Water to the New South Wales Parliament in 1894 specifically dealt with community concerns that the 20,000 vents ultimately required for the system would cause public health problems by the spread of disease. One hundred on, there is no evidence that this existing system of vents has ever caused a public health problem. On the contrary, the sewerage system that the vents support has enabled the community to shift away from an era of infectious disease.

The Chief Health Officer confirmed that sewer vents have around for a long time and that no health risk has been identified due to the operation of these vents.

We are not aware of any cluster formation or any disease patterns that have been identified in relation to these. Remember, this goes well back, to the turn of the century. There were issues raised around the vents in the sewerage system at the time it was put in place. But we are not aware of any such health problems. We are not aware of any documentation anywhere else of such health problems.

The Chief Health Officer's Expert Panel was able to confirm that this experience accords with that in Victoria:

The Legionella surveillance officer of the Public Health Division of the Victorian Department of Human Services has advised there are no cases of Legionella in Victoria associated with a sewage vent.

They [existing sewage vents] are however common and several with a similar or greater flow rate operate near homes and schools in Sydney every day of the year and have never been linked with disease. The panel is of the view that open sewage treatment plants potentially represent a much greater microbial hazard than the current vent and public health studies in relation to sewage treatment plants have not shown an increase in infectious disease in surrounding communities.

Sydney Water's experience of sewage treatment plants

Mr Marc Lee commented he believed that exhausted air from the tunnel should be treated in the same manner as a typical sewage treatment plant operation.

In evidence to the committee, Sydney Water advised:

Moreover, numerous studies in the vicinity of sewage treatment plants have shown no significant health effects either to workers or to the communities who live and work around the plants. There is absolutely no evidence to suggest that there will be emissions of unidentified toxic compounds that will affect the health of residents or schoolchildren in the neighbourhood of the vents.

Sydney Water's submission to the committee referred to a number of studies about this issue confirming that Sydney Water's experience had been replicated overseas. A report by Odour and Corrosion Technology Consultants, Inc. (J Joyce) – Health Effects of Exposure to Raw Wastewater Aerosols (1999) reviewed scientific literature:

- Joyce (1999)
- Majeti and Clark (1981)
- Cliver (1980)
- Fannin, Cochran, Lamphiear and Monto (1980)
- Johnson, Camann, Kimball, Prevost and Thomas (1980)

- Camann, Harding and Johnson (1980)
- Clark, Van Meer, Linnemann, Bjornson, Gartside, Schiff, Trimble, Alexander, Cleary and Phair (1980)

Other studies identified by Sydney Water concerning the health impact of sewage have shown no significant health effects, either to workers or to the communities (including schools) who live and work around the plants. (Sorber and Sagik, 1980, Hickey and Reist, 1975, Fannin, 1980, 1981, Northrop and others, 1976, 1981, Clark and others 1976, 1980, Johnson and others, 1980).

The Chief Health Officer's Expert Panel confirmed this advice:

They [existing sewage vents] are however common and several with a similar or greater flow rate operate near homes and schools in Sydney every day of the year and have never been linked with disease. The panel is of the view that open sewage treatment plants potentially represent a much greater microbial hazard than the current vent and public health studies in relation to sewage treatment plants have not shown an increase in infectious disease in surrounding communities.

The committee sought advice from Assoc Prof Kearney about this matter. He was not able to provide alternative evidence to that above."

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 6.11 inserted the following words:

"The Chief Health Officer's Expert Panel advised the Committee that in addition to moisture, pathogenic microorganisms including legionella require a pH near neutral or slightly acidic and complex organic nutrients for growth as distinct for mere survival. Furthermore the Expert Panel believes that these conditions would not be present in the tunnel."

Question put and negated.

Resolved, on the motion of Ms Burnswoods: That the following paragraph be inserted after paragraph 6.13:

The Committee further asked Prof Kerr that if the tunnel were to fill rapidly and the air were vented very fast and the filtration system was bypassed, would it possible for Legionella to be vented into the air at Scott's Creek. Prof Kerr replied:

It is possible, but unlikely. The environment is still hostile for these organisms to flourish.

(footnote: Evidence of Prof Charles Kerr, Department of Public Health and Community Medicine,

University of Sydney, 9 August 2000, p.59)

Ms Burnswoods moved: That paragraph 6.15 be amended by inserting the following words after the last sentence:

“The Committee acknowledges that Assoc Prof Kearney has not provided any substantive evidence to

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 6.17 insert the following paragraphs:

“Waterways Advisory Panel

The Waterways Advisory Panel undertook a comprehensive review of the Scotts Creek vent as part of its report on progress of the Northside Storage Tunnel project. Advisory Panel member Mr Bob Wilson informed the Committee that the Advisory Panel had found that the filtered vent is environmentally acceptable, poses minimal health risk to the local community and represents a substantial improvement on the current environmental conditions in that valley.

In evidence to the Committee, Mr Wilson said in view of the lack of evidence of public health impacts from the filtered vent that a way to resolve the matter would be the installation of an alarm system to alleviate concerns amongst the community:

I think we are happy that the Scott's Creek vent is going to be built and that it will make the whole system work much better. I cannot comment on the Legionella issue. Up to the time that we submitted our report, we were happy that the vent was safe but we thought that an alarm system needed to be available to the public to communicate those issues so they could see that those issues were being dealt with and that they could actually find out from Sydney Water whether proper monitoring of any discharge was taking place.

During its community consultation phase, the Advisory Panel found no concerns within the community or regulators with the operation of the vent at Lane Cove West/Hunters Hill or with venting at North Head associated with the Tunnel. The Advisory Panel believes that community concerns can be alleviated by reporting to the community on the results of monitoring. Accordingly, the Panel recommends that a series of alarms be fixed to the stacks of both vents so that the public can be aware of events such as – when the Tunnel is charged to a level where the vent commences to operate, when the filters are penetrated, when the by-pass is operating, when there is failure of the exhaust fan and when there is discharge of sewage to the environment.”

Mr Jobling moved: That the amendment be amended by deleting the word “comprehensive” in the first sentence and deleting the last paragraph.

Question: That the amendment of Mr Jobling be agreed to – put and passed.

Question: That the original question, as amended, be agreed to – put and passed.

Ms Burnswoods moved: That after paragraph 6.19 insert the following paragraphs:

“Sydney Water has advised that it has never experienced any cases of illness among its sewerage treatment plant workers and that studies into the health effects of exposure to raw wastewater supported this experience:

It has been claimed ... that sewage treatment plant workers fall ill as a result of exposure to sewage during their employment. This has not been Sydney Water’s experience with workers at its sewage treatment plants and sewage pumping stations.

However, Sydney Water is aware of subsequent studies as a result of health concerns conducted during the 1980s in the United States. Sydney Water consulted the Odour and Corrosion Technology Consultants Inc. to examine the literature on health effects of exposure to raw wastewater aerosols (see part of Attachment 1). Based on a wide literature review, this study concluded that exposure to raw aerosolised wastewater poses no serious threat to human health at large...

Similarly, Prof Gilbert provided evidence to the Committee in support of Sydney Water’s view:

They [Legionella organisms] have been detected in sewage but they have never, to my knowledge, been associated with disease in relation to sewage.

The NSW Health Department also provided the following evidence concerning a claim in Victoria of a person contracting Legionnaires disease from a sewer vent:

The Legionella surveillance officer of the Public Health Division of the Victorian Department of Human services, has advised that there are no cases of Legionella in Victoria associated with a sewage vent.

The Dr Wilson also advised in relation to illness associated from green vents that:

These vents have been around for a long time. We carry out a lot of monitoring in the community of disease, including for instance Legionella. We are not aware of any cluster formation or any disease patterns that have been identified in relation to these. Remember, this goes well back, to the turn of the century. There were issues raised around the vents in the sewerage system at the time it was put in place. But we are not aware of any such health problems. We are not aware of any documentation anywhere else of such health problems.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on the motion of Ms Burnswoods: That after paragraph 6.22 insert the following paragraph:

“Dr Dwyer further advised:

We discussed in the panel the source of viruses that are associated with sewage and they really relate to the family of viruses that the Chair mentioned, the Coxsackie virus and its related members, which also includes polio. There are other viruses such as hepatitis A and those are really the main groups that are transmitted from sewage and for any community that does not have good sewerage, these pathogens are particularly important. Those viruses were discussed. Other viruses are not really an issue because they do not survive in sewage very well. Most viruses have an envelope around them, which means that they are relatively sensitive to the environment. Therefore, viruses such as hepatitis C, HIV, and influenza are not transmitted this way and are completely irrelevant to the discussion. The discussions were really limited to these gastro and testinal viruses.”

(footnote: Evidence of Dr Dominic Dwyer, Medical Virologist, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.27.)

Ms Burnswoods moved: That paragraph 6.23 be amended by deleting all words and inserting instead:

“Nevertheless, all experts agree that while *Legionella*, if present, could survive in the tunnel environment, the temperature conditions will be such that it will not proliferate.”

Question put and negatived.

Mr Tsang moved: That paragraph 6.24 be amended by deleting all words and inserting instead:

“There is no scientific evidence before the Committee to suggest that there is a significant public health risk from *Legionella* or other pathogenic organisms proliferating in the tunnel environment.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on a motion of Mr M Jones: That paragraph 6.24 be amended by inserting the words “and other pathogens” after the word “*Legionella*” and inserting at the end the words “and be conducted on a

Resolved, on a motion of Mr Jobling: That recommendation 1 be amended by deleting all words after

“immediately” and inserting instead the words “prepare appropriate testing protocols to regularly evaluate the potential public health risks from *Legionella* and other pathogenic micro-organisms that may survive and proliferate in the Northside Storage Tunnel.”

Ms Burnswoods moved: That after paragraph 6.25 insert the following paragraphs:

“In contrast, Sydney Water has provided evidence that health issues at the Scotts Creek site were actively considered prior to the REF process.

Sydney Water advises that Scotts Creek was not a new addition the project, as claimed, but was considered as part of the 1997 EIS and assessed for potential health risks. As required by the relevant legislation, the EIS and REF both considered health and other hazard impacts.

During preparation of the 1997 EIS, Sydney Water engaged Granherne Pty Ltd to undertake a Preliminary Hazard Analysis of Proposed Northern Suburbs Storage Tunnel (August 1997) which is attached to the EIS as Attachment O. The analysis also considered operation of the activated carbon filters. In relation to an analysis of uncontrolled air discharge through ventilation shafts from stormwater ingress, Granherne advised that the incident was found not to have any hazardous off-site effects.

In addition, with respect to the REF, DUAP sought further advice from Mr Frank Fler, Awn consultants. DUAP also sought and received formal advice from NSW Health and discussed the effectiveness of the filters with respect to *Legionella* bacteria.

NSW Health examined these issues in their consideration of both the EIS and REF. In both instances, NSW Health considered no significant public health risk exists, except for a significant improvement on the current situation due to uncontrolled sewer overflows:

Officers of Environmental Health Branch reviewed the Environmental Impact Statement in 1997, and the Review of Environmental Factors Report in 1999. On both Occasions, after thorough review of the modelling related to the potential health impacts it was the opinion of the officers that the tunnel and vents did not pose any new risk to public health, and in fact provided a considerable improvement on the existing situation of uncontrolled sewage overflows.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That paragraph 6.31 be amended by deleting all words and inserting instead:

“The matter of *Legionella* was raised when the Northside Storage Tunnel Alliance sought advice on potential health impacts from Prof Charles Kerr, Professor and Social and Preventative Medicine at the University of Sydney. Prof Kerr compiled a document entitled Northside Storage Tunnel Project: Public Health Risk Review (June 1999) which was considered during the REF approvals process.

In a letter to the Glенаeon School, Prof Kerr further advised:

I appreciate your continuing concern about the project. As to the legionellosis situation, I never regarded it as a 'high potential risk' but as a possible infectious hazard mainly because a large majority of infections have arisen with enclosed built environments via contaminated water towers of airconditioning systems. The risk of any exposure in open air would, of course, be very much smaller. As I understand it, Legionella bacteria need a stagnant environment to thrive and any sort of flushing, even with raw sewage, would be enough to prevent them building up in a biofilm. ”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on the motion of Mr Jobling: That paragraph 6.33 be amended by deleting all words after “representatives” and instead inserting “raised the issue of potential health risks associated with *Legionella* and other pathogens, that NSW Health responded to that issue.”

Resolved, on the motion of Ms Burnswoods: That paragraph 6.34 be amended by inserting at the end the following paragraph:

“While Sydney Water recognised the potential for disease to spread by bioaerosols from wastewater, it noted that it does not appear to be a very effective or significant route of transmission. Additionally, scientific reviews found that sewage bioaerosols do not constitute a significant public health risk.”

(footnote: Submission No.158, Sydney Water Corporation, p.41)

Mr Tsang moved: That after paragraph 6.44 insert the following paragraph:

“Sydney Water has advised the Committee that:

No evidence has been submitted to the Committee concerning the size and distribution of infectious particulate matter in dilute sewage. Associate Professor Kearney has no knowledge of the size and distribution of aerosols created by dilute sewage travelling down the vortex and impacting in the deaeration chamber. ”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Mr Johnson moved: That after paragraph 6.45 insert the following paragraph:

“Nevertheless, the Committee notes, by Assoc Prof Kearney’s own admission, that he does not have any qualifications or experience as an engineer:

I have neither formal qualifications nor experience of an engineer.

Not being an engineer, I am unqualified to comment on the design and feasibility of Option 3.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Mr Johnson moved: That after paragraph 6.46 insert the following paragraph:

“Prof Gilbert advised the committee that it was unlikely aerosols would reach the activated carbon filters:

I think the chances of micro-organisms even getting to the filters are negligible. As I understand the set-up of the tunnel, the flow of air and sewage and so on, the filters are really a back stop, mainly to remove odours, and they will not be needed to remove micro-organisms because they will not get even to the bottom of the filters, let alone through them. ”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on the motion of Mr Ryan: That paragraph 6.47 be amended by inserting at the beginning the words, “Notwithstanding the advice of Sydney Water regarding engineering design features to prevent

Mr Johnson moved: That after paragraph 6.47 insert the following paragraph:

Engineering design features

Sydney Water advised the committee that numerous engineering design features were incorporated into the tunnel to prevent creation and transmission of aerosols and summarised the features as follows:

Sydney Water would like to clarify the possibility of aerosols both reaching the filters and passing through them. The overflow dropshafts are designed to create a vortex to dissipate energy and to control the overflow entry into the tunnel. While some aerosols can be generated when the dilute sewage drops into the tunnel, most aerosols will be re-entrained in the dilute sewage flow or vented at North Head. Aerosols may be entrained when air is venting at Scotts Creek, however only minimal quantities of aerosols will reach the top of the ventshaft because of the low velocities and the time taken to reach the surface. At the higher flowrates, some aerosols may be entrained, but this will occur for only 30 to 40 hours per year. Professor Lyn Gilbert, in evidence to the Committee, stated that the “removal of some aerosols may be necessary and my understanding is that the carbon filters will do that quite efficiently” (page 4, Hansard 9 October 2000). Whilst it is possible that aerosols may pass through the activated carbon filters, it is expected that the quantity of such aerosols will be minimal. The risk of infectious concentrations of contaminants reaching any of the surrounding residences, including the school, is negligible.

Sydney Water also provided the committee with the following additional information about the following design features: vortex flow, settling chamber, 60 metre shaft, reentrainment and condensation chambers.

- The overflow dropshafts are designed to create a vortex to control the overflow entry into the tunnel, and to minimise turbulence. However, aerosols can be generated when the dilute sewage drops into the tunnel (at Scotts Creek 50 metres fall). The dilute sewage can draw some of the air from the sewer in with the overflowing dilute sewage stream. The impact of the sewage at the bottom of the shaft creates turbulence and aerosol generation. Most aerosols will be re-entrained in the dilute sewage flow or vented at North Head.
- The chamber at the bottom of the dropshaft is designed to dissipate the energy generated and to effectively deaerate the dilute sewage. IF the air is travelling up the ventshaft, some aerosols may be entrained in the airstream, depending on their size and the velocity of the air up the dropshaft.
- Aerosols will not be entrained in the air in the Scotts Creek facility when overflows to the tunnel start. When overflows start at any of the overflows sites, air is being drawn in at Scotts Creek and ventilated at North Head. At this stage fresh air is being drawn down the dropshaft at a rate of 15 to 20 m³/s. It is considered highly improbable that aerosols can rise 60 metres up a shaft, against a downward flow of fresh air. This fresh air is blended with the sewer air that is drawn in with the dilute overflow and the mixed airstream, together with any aerosol created, to North Head. The

velocities of air in the tunnel are quite low and it is expected that all of the aerosols will be reentrained with the dilute sewage on the way to North Head.

- There is only about 100 mg/l solids in the dilute sewage that overflows into the tunnel. As the dilute sewage flows along the tunnel the potential for aerosol generation is minimal. The flowing velocities in the stored dilute sewage are less than 0.5 metres per second and there is minimal turbulence. Most of the air, a mix of mostly fresh air mixed with dilute sewer air, is in contact with a relatively still surface and there is minimal potential for creation and transport of aerosols back to Scotts Creek.
- Aerosols may be entrained when air is venting at Scotts Creek. Some aerosols may be entrained in the ventshaft when air is vented. At the lower flowrates (0 to 3 m³/s), only minimal quantities of aerosols will reach the top of the ventshaft because of the low velocities and the time taken to reach the surface. At the higher flowrates (3 to 8 m³/s), some aerosols may be entrained, but this will occur for only 30 to 40 hours per year.
- It is expected that minimal quantities of aerosols will pass through the activated carbon filters. Within the Scotts Creek facility, the air flow is quite tortuous. The air passes through a number of chambers and increases and decreases velocity, and changes direction a number of times. This will cause aerosols to be deposited from the airstream before it reaches the activated carbon filter. The activated carbon filter contains over 15 tonnes of activated carbon, with a surface area containing in the order of 18 billion square metres of active surface area. Whilst the activated carbon filters are not specially designed to capture aerosols, it is agreed that there will be significant capture of aerosols because of the size and structure of this particular filters.
- It is possible that some aerosols will pass through the activated carbon filter. Whilst this is possible, the quantity and size of such aerosols is expected to be minimal. The vented air is discharged into the atmosphere and disperses quite quickly, mixing with the atmospheric air, and reducing the concentration of any entrained material significantly. The Scotts Creek Vent has been modelled a number of times, and with the specific topographical aspects of the site considered. The modelling has been carried out by an air quality modelling expert, using the EPA approved modelling methodology. These studies show substantial dilution in the concentration of materials in the vented air, under all conditions. The possibility of significant concentrations of contaminants reaching any of the surrounding residences, including the school, is extremely low.

(Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 3, pp.14-15)

Overall, the Chief Health Expert Panel advised that “The engineering controls in place (vortex flow, settling chamber, 60 metre shaft, re-entrainment and condensation chambers) are predicted to result in very little or no aerosol reaching the carbon filter.”

Mr Ryan moved: That the amendment be amended by deleting the last paragraph.

Question: That the amendment of Mr Ryan be agreed to – put and passed.

Question: That the original question, as amended, be agreed to – put and passed.

Resolved, on the motion of Ms Burnswoods: That after paragraph 6.49 insert the following paragraph:

“In addition, the Chief Health Officer’s Expert Panel advised that:

The Expert Panel agrees that the proposed activated granulated carbon filter is largely irrelevant since it is extremely unlikely that infective material will reach this part of the vent. Nonetheless it is likely that it will form an additional physical barrier to the passage to any aerosol which does reach the filter by virtue of its action as a depth filter - presenting a tortuous path for aerosol particles to traverse. ”

(Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 30 August 2000, p.2)

Mr Johnson moved: That after paragraph 6.51 insert the following paragraph:

“However it is noted that no other expert before the Committee has raised Golden Staph as a potential issue. In particular the Chief Health Officer’s Expert Panel considered the matter and agreed that:

Diluted sewage overflow in the Northside Storage Tunnel although likely to contain a number of potentially harmful bacteria is considered a low microbial risk in the context of the Scotts Creek vent. ”

Question put and negatived.

Ms Burnswoods moved: That before paragraph 6.52 insert the following paragraphs:

The Committee notes that there has been some confusion as to the meaning of mesh size of the activated carbon filter. Assoc Prof Kearney’s original view regarding the meaning of mesh size:

I stated that the mesh size was between 3mm and 6mm in diameter...a 3mm hole.

...a “mesh” is the space between a net.

(Correspondence from Assoc Prof Kearney to Dr Ross O’ Donoughue, Director, Health Protection, dated 28 August 2000, pp. 9, 10: in response to Minutes of Meeting of Chief Health Officer’s Expert Panel on 23 August 2000)

To clarify this issue, Sydney Water has advised that:

The 3-6 mm mesh size actually refers to the nominal size of the activated carbon pellets used in the filter and not to any “hole” through the filter or the activated carbon itself. The activated carbon consists of irregular sized granules generally in the range of 3 mm to 6 mm that are randomly compacted into the bed. Each of the three filter beds at Scotts Creek is 750 mm deep with a face surface area of 12 square metres, and the total filter contains approximately 15 tonnes of carbon granules. At the average vent rate of 2 m³/second, the vented airstream will take approximately 12 seconds to travel through the activated carbon bed. The flow path is tortuous through the packed bed and as such entrained solids and liquids, such as bioaerosols, will impinge and be captured in the filter.

(Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 5, p.30)

Mr Jobling moved: That the amendment be amended by, deleting the words “To clarify this issue” and deleting all words after the word “bed” where it first appears.

Question: That the amendment of Mr Jobling be agreed to – put and passed.

Question: That the original question, as amended, be agreed to – put and passed.

Ms Burnswoods moved: That after paragraph 6.54 insert the following paragraph be:

“The Chief Health Officer’s Expert Panel advised the Committee that the activated carbon filter would act as a depth filter and that physical mechanisms by which depth filters remove aerosols containing bacteria and viruses include direct impact of aerosols on the filter structure, inertial impaction, diffusion and gravitational settling.”

Question put and negatived.

Resolved, on the motion of Mr Johnson: That after paragraph 6.65 insert the following paragraph:

“The Committee asked Mr Kaye if he could produce any evidence to support his claim, made at the hearing of 9 October 2000, that micro-organisms grow on caustic impregnated activated carbon. Mr Kaye could not produce any documented evidence to confirm his answer.”

(Correspondence from Mr Ralph Kaye, dated 20 October 2000, p.14)

Mr Johnson moved: That after paragraph 6.66 insert the following paragraphs:

“Findings in the Report by the Expert Panel convened by the Chief Health Officer dispute Assoc Prof

The Expert Panel does not believe it is likely that regrowth of pathogenic bacteria will occur in this filter. The dry environment between storm events, the absence of nutrients and the high pH will inhibit bacterial growth.”

(Correspondence from Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, dated 30 August 2000, p.2)

At the public hearing of 10 October 2000, Mr Kaye informed the Committee that a Melbourne water authority had begun to monitor Legionella in activated carbon filters and biofilters. After subsequent investigation into this matter, Mr Kaye provided evidence that:

Melbourne Water, Sewerage Group has tested for Legionella at its activated carbon and biological odour treatment facilities in response to media claims about Sydney Water’s proposed activated carbon facility. The results of these tests were negative.

The Committee notes that tests undertaken to determine whether Legionella grows on activated carbon have found no such evidence.

Mr Jobling moved: That the amendment be amended by deleting all words after the first paragraph.

Question: That the amendment of Mr Jobling be agreed to – put and passed.

Question: That the original question, as amended, be agreed to – put and passed.

Ms Burnswoods moved: That recommendation 2 be deleted.

Question put and negatived.

Ms Burnswoods moved: That after paragraph 6.69 insert the following paragraphs:

“Sydney Water’s evidence disputes assertions of risk to human health:

Sydney Water is satisfied that expert advice provided to the corporation has indicated that the level of concentration of potential contaminants would be minimal and well below the level that would have any possible adverse health and/or amenity impacts in the Scott’s Creek area.

The corporation believes there is no justifiable reason to consider moving the exhaust point of the Scott’s Creek ventilation facility away from the Scott’s Creek site and that the Northside Storage Tunnel, including the Scott’s Creek vent, will be a significant improvement to public health from the current situation.

This position has been supported in the findings of the Waterways Advisory Panel’s second report into the Northside Storage Tunnel. The panel concluded that the Scott’s Creek vent will operate effectively and with minimum risk.

There have been allegations made against the Northside Storage Tunnel. These allegations are baseless. No evidence has been produced to support allegations that air emitted from the vents is a real threat to public health.

As shown by numerous independent studies, including by New South Wales Health, the Northside Storage Tunnel will only reduce sewage related health risks. The current situation, where sewage flows uncontrollably from overflow points, including at Scott’s Creek, will be virtually eliminated by the operations of the Northside Storage Tunnel.

Similarly, the environmental benefits of the tunnel are significant. Not only will the number of unsafe swimming days at Lane Cove River be halved, leaving the waterway suitable for a predicted 346 days each year, but the tunnel is also expected to reduce nutrient loads in the harbour. This means reduced algal growth rates and a better marine environment for aquatic flora and fauna.

Additionally, the Northside Storage Tunnel will significantly reduce visible pollution and sewage odour of the harbour, leaving a cleaner and healthier harbour for everyone to enjoy.

With respect to the public health impacts from the current situation, where sewage and stormwater overflows into recreational waters, NSW Health advises that:

NSW Health is satisfied that the operation of the Northside Storage Tunnel, Scotts Creek Vent, subject to the conditions of approval, will not present an increased public health risk to the surrounding community, and in fact will provide an improvement to the current risk from uncontrolled sewage overflow.

This is especially so at the Scotts Creek site where current overflows have an obviously greater potential to generate aerosols than the proposed tunnel.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Mr Tsang moved: That before paragraph 6.70 insert the following paragraphs:

“Sewer Gas

Air forming the vapour space above raw sewage in the sewer systems is generically called sewer gas.

With respect to possible health impacts of sewer gas, NSW Health have advised the Committee that:

No outbreaks worldwide have been attributed to exposure to sewage gas... No one would dispute that there are many pathogenic organisms present in sewage. The overwhelming consensus and 100 years of public health experience suggest strongly that venting sewage without filtration is safe. Outbreaks of disease attributable to the organisms mentioned from sewage have not been recorded.

The Health Expert Panel also advised the Committee that:

In Sydney there are about 20,000 sewage vents, several of which service systems which carry a similar volume of sewage every day to that which will be carried in the tunnel several time a year. None of the existing vents are filtered. There is no evidence of excess infectious or other disease in relation to these vents.

In response to a question from the Committee on what noxious gases that are harmful to public health could be in the storage tunnel and could be emitted through this filter, Dr Wilson responded:

The charcoal filter clearly has a very good capacity to clean air. Charcoal filters are considered one of the best forms of air filtering that you can get. Certainly, in the department's assessment of the situation, we believe that it is highly unlikely that any emissions of gas from the tunnel would be of a concentration that would cause health effects.

The Committee also asked Prof Gilbert whether there is any evidence of risk to public health posed by gases emitted from these normal green vents. Prof Gilbert advised:

I can only reiterate what Dr Wilson said. There is a very sensitive system of reporting disease, particularly clusters of gastrointestinal disease, and to my knowledge there is no evidence at all of any localised clustering of disease associated with that. Outbreaks of gastrointestinal disease are almost always associated with food poisoning and other identifiable diseases.

Sydney Water has advised the committee that it has identified potential contaminants of sewer gas in the Northern Suburbs Ocean Outfall Sewer as being hydrogen sulphide and carbon monoxide. Accordingly Sydney Water has determined appropriate identified contaminant limits for those compounds.

Very little of this sewer gas is expected to enter the tunnel. When wet weather events occur, there is a significant increase in the level of fluid in the sewer, displacing the sewer gas towards North Head as part of normal sewer flows. The sewer gas that is in the sewer at the time that overflows to the tunnel start is fresher than in normal dry weather flow, and a smaller percentage of the sewer volume, with lower H₂S and other odour components.

Sydney Water has advised that the air vented at Scotts Creek is generally the air which has recently entered the tunnel, and is 80 to 90% fresh air blended with dilute sewer gas and that the air vented at Scotts Creek is not in contact with diluted sewage for very long (for an average of only 1 day).”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 6.78 insert the following paragraph:

“In an answer to a question on notice concerning air quality health concerns and subsequent studies relating to sewer emissions by utilities in Australia and overseas Sydney Water provided the following response:

Sydney Water is not aware of any air quality concerns or illnesses relating to sewer emissions by utilities in either Australia or overseas. It has been claimed by Dr Mark Donohoe, Medical Practitioner, that sewage treatment plant workers fall ill as a result of exposure to sewage during their employment. This has not been Sydney Water’s experience with workers at its sewage treatment plants and sewage pumping stations.

However, Sydney Water is aware of subsequent studies as a result of health concerns conducted during the 1980s in the United States. Sydney Water consulted the Odour and Corrosion Technology Consultants Inc. to examine the literature on health effects of exposure to raw wastewater aerosols (see part of Attachment 1). Based on a wide literature review, this study concluded that exposure to raw aerosolised wastewater poses no serious threat to human health at large, and therefore it can be stated that exposure to such aerosolised substances through inactivated carbon media systems would be even less likely to pose a serious health threat to humans.”

(Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, p.51)

Mr Ryan moved: That the amendment be amended by deleting the words “by Dr Mark Donohoe,

Question: That the amendment of Mr Ryan be agreed to – put and passed.

Question: That the original question, as amended, be agreed to – put and passed.

Mr Johnson moved: That after paragraph 6.81 insert the following paragraph:

“The Committee is concerned that Assoc Prof Kearney has relied upon the Bible as a source of scientific evidence. Assoc Prof Kearney has told the Committee:

For the honourable member, I will get down to the issue. The fact of the matter is that the statement was made thousands of years ago before a microscope was ever invented. I do not stand here with the temerity and challenge the Almighty God and say, “You have got it wrong.” The point of the comment was that where a person has an infectious discharge and contacts a porous earthenware pot, as opposed to a wooden article, the instruction was to smash the pot and take it out of circulation because you cannot get rid of the absorbed infectious agent. That was the very sound instruction. Would you wash it or use it as an implement to cut vegetables on? An unglazed pot will withhold and absorb infectious material. The instruction was: Do not wash it. Smash it and take it out of circulation. That is the point here. This tunnel is unsealed, unlined and absorbent. The analogy was simply to instruct the reader that I am not saying this; the instruction came, as you read, to the Israelites. That is a scientific fact.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 6.83 insert the following paragraph:

“Implementation of the precautionary principle requires consideration of several factors including the current public health impact from the current sewer overflow at Scotts Creek. The Committee notes NSW Health’s advice that:

...the operation of the proposed system is likely to reduce a more significant public health risk currently posed by the environmental pollution of the harbour and foreshores during storm water sewage overflow events.

The Health Expert Panel considered this position in some detail and rejected this view. The Health Expert Panel advised:

The Expert Panel is unanimous in their view that the evidence indicates that these vents present no increase in risks to public health. There is no evidence to indicate that the emissions from these vents will contain bacteria likely to cause illness. There is no direct evidence, in the scientific literature, of microbiological or disease risk associated with a filtered storage tunnel vent. Similar vents in North America have been operating for some years with no reports of public health problems.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on the motion of Mr Johnson: That after paragraph 6.90 insert the following paragraph:

“Sydney Water further advised:

The standard of proof is not beyond a reasonable doubt. The standard of proof is regarded in the law as "on the balance of probabilities.

Sydney Water believes that it has satisfied this requirement in seeking independent expert assessments on the potential health and air quality impacts of the Scotts Creek facility. The advice received by Sydney Water, which includes advice from various independent experts, NSW Health Department, DUAP and the EPA, indicates that there a negligible health impact is likely to result from operation of the vent at Scotts Creek.”

(Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 20 October 2000, Attachment 2 pp.2, 3)

Mr Tsang moved: That before paragraph 6.91 insert the following paragraph:

“Independent Member of the Waterways Advisory Panel, Mr Ian Kiernan outlined the view taken by the Waterways Advisory Panel and fully supports the precautionary principle and its application by Sydney Water at Scotts Creek. In evidence to the committee Mr Kiernan said:

I am fully conscious of the fact that there is no point in fixing one problem and creating another. I support the precautionary principle. We went to a great deal of trouble through public consultation by consultation with experts to assure ourselves that by fixing the raw overflows into Scott's Creek, we were not creating another problem in relation to the aerosols. The fact that at Bob [Wilson]'s recommendation we not only accepted the very thorough report of DUAP, but we then sought additional assurance from the Department of Health meant that our recommendation was that the recommendation be accepted. It has been a very difficult process and it has been very much kaleidoscopic in that it has changed all the way through.”

Question put and negatived.

Resolved, on the motion of Mr Tsang: That after paragraph 6.91 insert the following paragraph:

“The Committee notes, however, the statements of Prof Gilbert and Dr Wilson regarding the value of health impact studies:

...my belief is that any effect on the health of either the school or the community related to Scotts Creek would be so small that to get a statistically significant difference between that another control group would be quite difficult and would require a long-term study.”

(Evidence of Prof Lyn Gilbert, Director, Centre for Infectious Diseases and Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, 9 October 2000, p.20)

Professor Gilbert has raised the possibility that in the longer term it may be possible to design a study to monitor any ongoing health impacts from this, although pragmatically it is like a given, that the health risk will be so low that it will be extremely difficult to measure. ”

(Evidence of Dr Andrew Wilson, Deputy Director-General and Chief Health Officer, NSW Health, 9 October 2000, p.35)

Ms Burnswoods moved: That recommendation 4 be deleted.

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That paragraph 6.97 be amended by deleting all words and inserting instead:

“All evidence confirms that there is no potential health risk from hydrogen sulphide or other sulphide omitting compounds, or from very small quantities of chemicals that may enter the tunnel as trade waste.

In clarification to a question asked by the Committee as to why the Expert Health Panel did not consider the breakdown of pathogens into noxious materials, Sydney Water advised;

At no time, in any of the verbal or written evidence given to the Committee, has any evidence been provided about the possibility of conversion of materials into noxious substances. As such, it is not reasonable to ask the Expert Panel to consider issues that have not been raised.”

In clarification to a question asked by the Committee to Dr. Wilson as to the possibility of noxious gases in the storage tunnel, Sydney Water advised;

The Community has claimed that there will be chemical reactions between all of the hazardous material that they claim can enter the tunnel and that such a reaction will create NEW compounds with noxious or toxic vapours. However, there has been absolutely no evidence presented to the Committee to support this claim.

With the exception of H₂S and other sulfur like compounds for which the activated carbon filter are specifically designed to remove, significant evidence has been presented by Sydney Water to the Committee to show that there is negligible quantities of noxious or toxic materials or gases present in the sewage. Sydney Water, in the 1997 EIS and subsequent documentation related to the Northside Storage Tunnel project, has shown that the Trade Waste Policy is effective and there is minimal content of Schedule D chemicals in the NSOOS system.

There is no credible scenario which supports the assertion of the Community that there will be a “chemical cocktail” in the tunnel and that this will create toxic or noxious gases which will be emitted from the Scotts Creek vent.

On the issue of hazardous interaction of chemicals in the tunnel, Prof Charles Kerr advised:

As to the possibility of hazardous interaction of chemicals, my conclusion is based on an examination of possible interactions by the Independent Committee on Hazardous Wastes (set up by the Governments of NSW, Victoria and the ACT in the mid 1990s) of which I was a member. We could find no evidence of harmful interaction in much more toxic waste streams than would exist in the storage tunnel. ”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Mr Johnson moved: That after paragraph 6.97 insert the following paragraphs:

“Monitoring

6.98 The concentration of hydrogen sulphide gas in the expelled air will be continuously monitored. This will indicate how efficient the filtering process is. The use of an appropriate "indicator" such as this is a common way of assessing the likelihood of other impurities being present in air or water waste streams.

6.99 In relation to monitoring of pathogens, NSW Health has advised:

The public health risk from the emissions is considered to be very low and a considerable improvement on the current situation where the public is exposed to uncontrolled raw sewage overflows. The tunnel proponents will employ a range of measures, including carbon filters to further minimise the risk of microorganisms spreading via vent emissions. There is no indication that monitoring for microorganisms is warranted in this setting. In addition to being unnecessary, monitoring of vent emissions is also problematical. While methods do exist to monitor for microorganisms in air, they are usually only employed to monitor “sterile” environments, such as operating rooms. There are no meaningful guidelines against which to judge any samples that would be taken from a setting such as the tunnel vent.”

6.100 The monitoring will be in accordance with the requirements of the EPA. Any additional monitoring which may be undertaken will be as advised by NSW Health. Filters will be maintained and their effectiveness monitored with DUAP and EPA regulations.

Dispersion of Vented Air

6.101 Evidence presented to the Committee shows that any contamination in the air vented at the Scotts Creek vent would be substantially diluted before it reached any sensitive receptor in the vicinity.

6.102 Correspondence provided to the Committee by Sydney Water provides a summary of air dispersion modelling carried out for the Scotts Creek vent.

- Air dispersion from stacks in complex terrain is quite complicated. There is a zone immediately around the stack where there is effectively very little impact because the plume rarely reaches the ground, particularly under poor dispersion conditions. These factors apply to Scotts Creek where the school playground sees significantly lower concentrations of vented air than many locations further away. The modelling results confirm this showing that the dilution at the school is significantly better than many of the surrounding locations.
- A number of studies have been undertaken to determine the rate of dispersion and subsequent impact of vent emissions. These studies were undertaken by Holmes Air Sciences and CH2MHILL as part of the project development.
- It must be noted that dispersion modelling is a widely used tool for assessing air quality impacts and provides extremely useful information to decision-makers. Models are indicative. With high quality input information which includes emissions data and meteorological data models can be accurate to ± 40 per cent. For this reason, models use very conservative assumptions. Experience confirms the validity of model results and hence they are commonly used and accepted by engineers and regulators.
- The AUSPLUME modelling has been accepted by EPA and implemented in accordance with published guidelines for dispersion modelling for odour assessment.
- AUSPLUME modelling was carried out by both CH2MHILL and Holmes Air Sciences. As part of mediation, modelling of Scotts Creek was reviewed and updated to reflect the most recent data. This modelling was carried out at the various conditions defined in 10 (d) (see below) and showed significant dilution conditions. Under a computer generated worst condition, the dilution at the school was 100 to 1. With light winds the dilution is 1000 to 1.

- Updated modelling was carried out by Holmes Air Sciences in March 2000, as part of Mediation. All modelling was done at 8m³/s with some worst case meteorological modelling for 3m³/s. The modelling was carried out under four different meteorological conditions;
 - Very low wind conditions, which also includes inversion;
 - Light wind conditions during the day time;
 - Light winds and an inversion; and
 - Meteorological data file, which includes the full range of conditions at the site. The model will select the worst case condition for a given receptor.
- The minimum dilution at the Glenaeon School was 100 to 1 for the worst case meteorological conditions, with similar results for the reduced flow rate of 3m³/s.
- A weather station is being installed at Scotts Creek to collect local data for temperature, wind speed and wind direction. In future, additional plume dispersion modelling may be required and the data collected from the weather station will be used in the analysis.

6.103 Mr Ralph Kaye acknowledged Dr Kerry Holmes capability as a Dispersion Modeller:

I do not criticise Dr Holmes ability as a modeller.

6.104 The Committee received evidence that aerosols or particles smaller than ten micron would behave as gases and the dispersion modelling would be valid for all such sized particles:

The sub-10 micron particle will behave effectively as gases with little settling over the distance travelled from the vent to sensitive receptors

6.105 Evidence was also given to the Committee that dispersion modelling published tends to overestimate the amount of contamination reaching any location in the vicinity of the Scotts Creek vent:

...I looked at the degree of dilution of the aerosols that would occur, so that would give an estimate of the degree of dilution of the aerosols from the original concentration in the vent to wherever the sensitive receptor was. But the modelling is conservative in the sense that it would not assume fallout of the aerosols. It would assume that they all travelled and all dispersed in the atmosphere. So it would tend to overestimate rather than underestimate the aerosols reaching, for example, the school.”

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr Tsang	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That after paragraph 6.97 insert the following paragraph:

“Conclusion

The Committee sought detailed scientific advice from numerous sources – including aspects of engineering and public health. The balance of respected scientific evidence presented to the committee indicates nothing more than minimal health risk from the filtered vent at Scotts Creek and unquestionably, a significant improvement on the current situation where a public health risk arises due to contamination of creeks and the harbour with sewage.”

Question put and negatived.

Chapter 6, as amended, agreed to.

Chapter 7 read.

Mr Johnson moved: That after paragraph 7.29 insert the following paragraphs:

“Sydney Water considered alternative options to venting at Scotts Creek, including what is known as Option 2(c) in the mediation process (Exhaust line in Tunnel from Tunks Park to North Head STP scrubber).

Sydney Water advised the Committee of practical reasons why it does not support this option, including:

Sydney Water believes the suggested piping of displaced air back to Manly is an unacceptable proposal based on the negligible health impacts associated with the proposed vent as well as some economic, technical and environmental considerations. In addition, if this option were implemented for the Scotts Creek filtered vent, it would be necessary, in equity grounds, for it to be implemented for every other vent location, including the Lane Cove River West location in the Hunters Hill Municipality, thereby causing a further increase in cost.

Sydney Water doubts that this option could be justified in an environmental assessment process for the reasons identified below.

FINANCIAL COST

The cost of piping displaced air from Scotts Creek to North Head was determined as part of Mediation process. The preferred option was costed at \$30 million. The Mediation Report identified the additional cost of incorporating Lane Cove River West as \$18 million. The community endorsed this costing during Mediation.

It is probable that the capital cost would be greater because the difficulty of working within the constraints of the tunnel will identify a significant number of additional issues not considered by the Mediation Technical Sub-Committee.

There would be further additional costs for on-site structures at North Head STP.

TECHNICAL ISSUES

Environmental Impact Assessment would delay the operation of the tunnel. There would be additional costs for an environmental assessment process. Completion of that process could take up to one year, or even longer, and would delay the

implementation of the tunnel project, thus delaying the time frame when the benefits of the tunnel would be available to the people of Sydney.

The proposal would increase the amount of maintenance required for the tunnel system. There would be additional facilities to be maintained.

The air pipeline would reduce the available volume in the tunnel to accept overflows. The pipeline would severely restrict the amount of volume in the tunnel between Tunks Park and Lane Cove River West and make maintenance of that section of the tunnel extremely difficult.

ENVIRONMENTAL IMPACT

The reduction in tunnel volume available for collection of overflows would reduce the environmental performance of the tunnel.

- OTHER IMPACTS:
- Breach of commitments under Sewer Overflow Licensing Program (SOLP) EIS
- Breach of approved Northside Storage Tunnel EIS
- Continued loss of amenity and increased public health risks resulting from additional wet weather overflows to Sydney Harbour
- New EIS required to cover:
 - Pipe in tunnel
 - New fan house and above ground facilities at Scotts Creek and Lane Cove River West
 - Increased air release at North Head STP
 - Revised hazard assessment for North Head STP
- Probable delay in the effective start up of tunnel by at least one year
- Possibility of rejection of EIS, based on inadequately demonstrated benefit, with no possible resolution”

(Correspondence from Mr Alex Walker, Managing Director, Sydney Water Corporation, dated 21 August 2000, pp.12-13)

Mr Jobling moved: That the amendment be amended by: inserting the paragraph title “Sydney Water’s

Question: That the amendment of Mr Jobling be agreed to – put and passed.

Question: That the original question, as amended, be agreed to – put and passed.

Resolved, on the motion of Mr Ryan: That the Committee adjourn its deliberation on the Chair’s draft

report and the Committee reconvene at on Monday 20 November 2000 to continue these deliberations.

Resolved, on the motion of Mr Johnson: That the Committee extend the reporting date for the inquiry into the Northside Storage Tunnel – Scotts Creek Vent until Friday, 24 November 2000.

5. Adjournment

The meeting adjourned at 5.00 pm.

Rob Stefanic
Senior Project Officer

Minutes No. 44

Monday 20 November 2000
Room 1108, Parliament House at 1.30 pm

1. Members Present

Mr R Jones (in the Chair)
Ms Burnswoods
Mr Jobling
Mr Johnson
Mr M Jones
Mr Ryan (Mr Colless)
Mr West (Mr Dyer)

2. Northside Storage Tunnel – Scotts Creek Vent

The Committee continued its consideration of the Chair's draft report.

Ms Burnswoods moved: That paragraph 7.32 be deleted.

Question put and negatived.

Resolved, on the motion of Ms Burnswoods: That recommendation 1 be amended by deleting all words after "Water" and instead inserting, "install a final filter, at least 95% efficient on 0.3 micron HOT DOP particles, in addition to the pre-filter and impregnated granulated activated carbon filter, as a means to alleviate concerns raised by the community".

Resolved, on the motion of Mr M Jones: That recommendation 2 be deleted.

Ms Burnswoods moved: That paragraph 7.34 be amended by deleting the words "as a minimum and

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr West	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on the motion of Mr Ryan: That paragraph 7.35 be inserted before recommendation 1.

Ms Burnswoods moved: That recommendation 3 be deleted.

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr West	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Ms Burnswoods moved: That the Report to the Chief Health Officer by the Chief Health Officer's Expert Panel on the Northside Tunnel be attached as an appendix to the Committee's report.

Question put.

The Committee divided:

<u>Ayes</u>	<u>Nos</u>
Ms Burnswoods	Mr Jobling
Mr Johnson	Mr M Jones
Mr West	Mr R Jones
	Mr Ryan

Question resolved in the negative.

Resolved, on the motion of Mr Ryan: That the Committee adjourn its deliberation on the Chair's draft report and the Committee reconvene Thursday 23 November 2000 to continue these deliberations.

3. Written advice from Members

Resolved, on the motion of Mr Jobling: That the minutes note all Members of the Committee advised the Chair in writing, that no correspondence was provided to individuals outside of the Committee.

4. Adjournment

The meeting adjourned at 3.00 pm until 1.00 pm, Thursday 23 November 2000.

Rob Stefanic
Senior Project Officer

Minutes No. 45

Thursday 23 November 2000
Room 1108, Parliament House at 1.00 pm

1. Members Present

Mr R Jones (in the Chair)
Ms Burnswoods
Mr Harwin (Mr Jobling)
Mr Hatzistergos (Mr Dyer)
Mr Johnson
Mr M Jones
Mr Ryan (Mr Colless)

2. Confirmation of Minutes

Resolved, on the motion of Mr Ryan: That Minutes of meeting No.42 and 44 be confirmed (No. 43 relates to other inquiries).

3. Northside Storage Tunnel – Scotts Creek Vent

The Committee continued its consideration of the Chair's draft report.

Resolved, on the motion of Mr Ryan: That paragraph 7.22 be amended by deleting the first sentence and inserting instead:

“The Committee sought to determine whether the installation of a final filter in addition to the pre-filter and impregnated granulated activated carbon filters would address concerns relating to the emissions of micro-organisms. A type of final filter discussed by both Sydney Water and community groups was a high-efficiency particle-arrestor (HEPA) filter. Prof Gilbert advised the committee that HEPA filters are:

...used specifically to remove micro-organisms in circumstances such as a laboratory or a safety cabinet in a laboratory where organisms are being vented into the external atmosphere which may contain significant pathogens. These are high efficiency filters which remove bacteria.”

Resolved, on the motion of Mr Ryan: That the second sentence in paragraph 7.22 becomes paragraph 7.23.

Resolved, on the motion of Mr Ryan: That after paragraph 7.29, insert the following paragraphs:

“Nevertheless, during the mediation process, the Mediation Expert Panel was asked to consider an option of fitting an additional filter at Scotts Creek to control particles down to 0.3 microns. In the final report on mediation, the Mediation Expert Panel stated:

In summary, the experts either support or do not oppose the use of this filter, if properly designed and maintained, as a solution to the problem, provided its efficacy in substantially reducing aerosols is demonstrated.

(Final Report on Mediation between Sydney Water and the Community of the Scotts Creek Area regarding the Impact of the Northside Sewerage Tunnel Vent on Human Health and the Local Environment, March 2000, p.21)

In correspondence provided to the Committee by Sydney Water, the Committee was informed that Sydney Water reached agreement with Hunters Hill Council, Lane Cove Council and Lane Cove River West CLC for the installation of a final HEPA filter at the Lane Cove West Ventilation Facilities. Under the agreement, Sydney Water has undertaken to provide:

A final filter, at least 95% efficient on 0.3 micron HOT DOP particles, in addition to the pre-filter and GAC filter. This is to be installed for as long as the community believe it is needed and regularly services and/or replaced to maintain its effectiveness and efficiency in accordance with the regulatory conditions for operation of the tunnel.”

(Correspondence from Mr Ron Quill, General Manager, Asset Solutions, Sydney Water Corporation, dated 19 September 2000, attaching Letter from Allan Henderson, Manager, Capital Programmes, Sydney Water Corporation to Barry Smith, General Manager, Hunters Hill Council, dated 5 September 2000).”

Resolved, on the motion of Ms Burnswoods: That any dissenting statement relating to the report be provided to the Committee Secretariat no later than close of business Thursday 23 November 2000.

Resolved, on the motion of Mr Ryan: That the draft report as amended, be the report of the Committee and that it be signed by the Chairman and presented to the House.

Resolved, on the motion of Mr Ryan: That the transcripts of evidence, submissions, documents and correspondence received (except any confidential documents upon which there has been a request of confidentiality) be tabled with the report and made public.

4. Adjournment

The meeting adjourned at 1.30 pm, *sine die*.

Rob Stefanic
Senior Project Officer

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