3 Winmalee

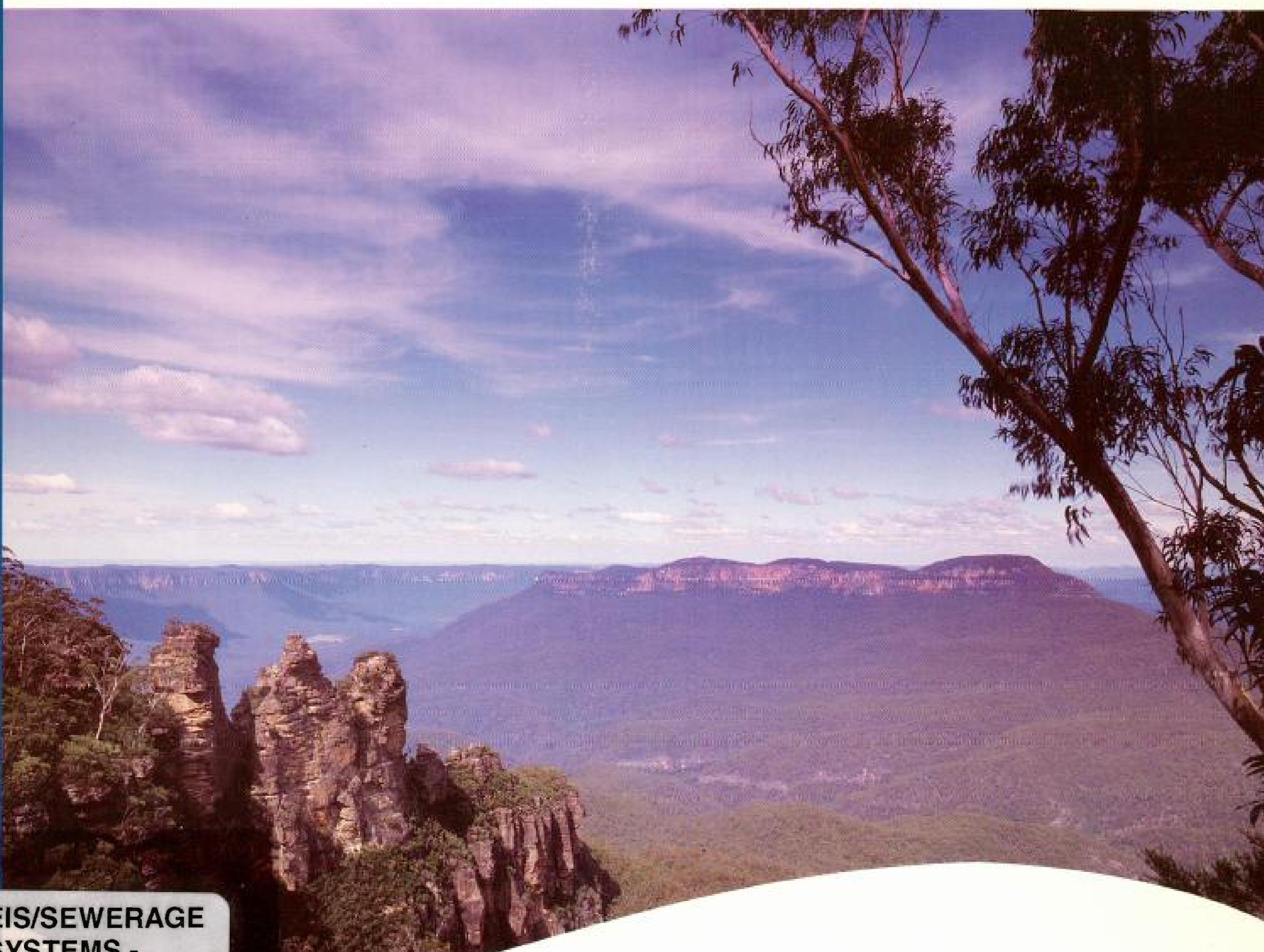
Licensing Sewerage Overflows

ENVIRONMENTAL IMPACT STATEMENT – JUNE 1998

Volume 3

Blue Mountains Geographic Area

Winmalee



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Licensing Sewerage Overflows – Environmental Impact Statements

Document Hierarchy

Sewerage Overflows Licensing Project
Environmental Impact Statement

Volume 3

Winmalee Sewerage System Overflows

JUNE 1998

Sydney WATER

Hyder Consulting

Volume Summary

Background

As part of its wastewater business, Sydney Water has applied to the EPA for licences for overflows from its 27 sewerage systems. These licences will set performance standards and pollution reduction targets for Sydney Water to meet in the future. The sewerage overflow Environmental Impact Statements (EISs) are part of the process of obtaining a licence for operation of each sewerage system. A key outcome of the EISs will be licences that include agreed improvement programmes. Engineering works associated with infrastructure improvements will be subject to project specific impact assessment at the time of their implementation as appropriate.

The EIS includes five levels of documentation to describe the problems, impacts and solutions associated with sewerage overflows, as follows:

1. Volume 1 - Sydney Wide Overview
2. Volume 2 - Blue Mountains Geographic Area
3. Volume 3 - Separate system documents for Winmalee (this volume), Blackheath and Mount Victoria sewerage systems
4. Appendices
5. Methods.

Overflows are defined for the purpose of the EISs as all liquid discharges from either designed overflow structures or non-designed locations within the sewerage system, all odour discharges from the sewerage system and partially treated (ie. partially disinfected flows greater than 150 cfu per 100 millilitres) wet weather sewage treatment plant (STP) discharges. Discharges from STPs are currently licensed by the EPA.

Overflows from the Winmalee sewerage system are defined for the purpose of the EISs as all liquid discharges from either designed overflow structures or non-designed locations within the sewerage system. The components of the sewerage system which have been identified as causing overflows to the surrounding environment include wet weather overflows from the reticulation system due to capacity problems, partially treated sewage treatment plant (STP) discharges, chokes, sewage pumping station (SPS) failures, exfiltration (leakage from the sewerage system) and odours. The EPA currently licenses the treated effluent discharges from the Winmalee STP. Partially treated STP discharges in excess of the full treatment capacity are included as overflows for the purpose of this impact assessment.

The Winmalee sewerage system is the largest system in the Blue Mountains GA. There are 51 wet weather overflow events per ten years from the Winmalee sewerage system, which at a total volume of 583 ML per ten years, contributes 94% of the average annual overflow wet weather volume from the Blue Mountains GA of 623 ML per ten years. This is, however, a relatively small volume compared to other systems around Sydney.

The Winmalee sewerage system provides tertiary treatment to flow 28.4 ML/day. Partially treated STP discharges occur when the full treatment capacity is exceeded. Modelling suggests that partially treated STP discharges occur 110 times in ten years from the sewerage system. These overflows are marginally more frequent than wet weather overflows from the rest of the sewerage system. Based on modelling Winmalee STP (the largest STP in the Blue Mountains GA) contributes 4,400 ML of partially treated STP discharge over ten years to the Blue Mountains GA.

During intense rainfall, the full treatment process train operates at full capacity but excess flows receive a reduced level of treatment. At such times, pathogens are the only pollutants from overflows which significantly contribute to waterway pollution. Therefore, an STP discharge is defined as an overflow if its faecal coliform density exceeds 150 cfu per 100 millilitres because then the objective of maintaining recreational water quality may be compromised. Modelling suggests the volume of partially treated STP discharges is 30 times in ten years from the sewerage system. These overflows are marginally more frequent than wet weather overflows from the rest of the sewerage system.

Overflows can occur in dry or wet weather due to chokes in the sewerage system. These can be caused by roots, broken pipes and other obstructions. Suburbs have been ranked by choke density on a system basis as either high, medium or low compared to the Sydney wide average. Winmalee has no suburbs with a high density of chokes and seven suburbs out of a total of eleven suburbs within its area, with a choke density of medium, no suburbs with a high density of chokes, and an estimated 77 repeat chokes.

The Winmalee sewerage system has three sewage sub-areas (Wentworth Falls, Hazelbrook and Valley Heights) out of seven which are recognised as being of medium exfiltration potential, from the monitoring and modelling of sewer leakage from reticulation, however, surface water quality monitoring shows a high level of faecal coliform in the Leura Cascades and Yosemite Creek. Further investigation is recommended to identify the extent and environmental impact associated with this overflow type.

In addition to overflows at pumping stations, due to wet weather flows in excess of the pumping station capacity, there were an estimated 214 documented overflow events due to SPS failures in the Winmalee sewerage system during 1996/97.

Most odour complaints have been received in four sub-areas of the Winmalee sewerage system - Katoomba, Springwood, Wentworth Falls and Faulconbridge, however the number of complaints does not indicate that there is a significant odour problem.

The permanent population growth in the Winmalee sewerage system is expected to be significant with predicted increases from 37,567 people to 65,270 by the year 2021. This represents an annual average growth rate of 2.45 %. This growth will potentially increase the occurrence of overflows due to the increased demand on the sewerage systems if no augmentation or rehabilitation of the sewerage system is undertaken.

Environmental impacts

The Winmalee sewerage system is located in both the Blue Mountains receiving environment zone (REZ) and the Lake Burragorang REZ. The system area is flanked by Blue Mountains National Park on the eastern side and the Lake Burragorang water catchment on the western side. The streams in the Blue Mountains REZ drain either north or east into the tributaries of the Grose River or west into Lake Burragorang REZ incorporating the Coxs River and its tributaries. Rivers in the Lake Burragorang REZ flow into Lake Burragorang which is a principal source of Sydney's water supply.

All waterways within the Blue Mountains National Park are classified as Class P (Protected Waters) in accordance with the *Clean Water Regulations 1972*. The immediate receiving waters of the sewerage overflows are generally Class C (Controlled Waters) and drain into either Class P or Class S (Specially Protected) Waters. In addition to this are the drinking water supply catchments (Special Areas) for Lake Woodford and Katoomba Cascade Dams where overflows may impact directly on drinking water storages. The requirements for protection of Classified Waters and Special Waters apply to sewerage overflows, although new legislation requires issues such as the quality of the receiving environment and the degree of urban encroachment to be considered in determining water quality requirements.

Other environment protection goals for the Winmalee sewerage system have been determined by the Hawkesbury-Nepean Catchment Management Trust, Blue Mountains City Council and other community groups. These goals primarily relate to the protection of aquatic and terrestrial ecosystems but also include the protection of water quality for drinking water supplies.

The potential impacts of sewerage overflows on the aquatic environment have been assessed based on actual monitoring data and water quality modelling. The assessment indicates the potential for impacts at a regional as well as a local level. At a regional level overflow events have a minor impact when compared with other polluting events such as stormwater and STP discharges. However, it is recognised that minor impacts do contribute to the overall cumulative impact on the Blue Mountains GA in terms of water quality, ecology and public health related effects. At a localised level overflow events are more significant with a potential to impact upon water quality, ecology and public health over a confined area. These localised impacts are considered significant due to the high environmental quality of the Blue Mountains area and the high community importance placed on preservation of this area.

Sensitive areas identified within the vicinity of the Winmalee sewerage system include threatened species habitat, the Blue Mountains National Park, Classified Waters and drinking water catchment Special Areas, "Environment Protection" and "Residential Bushland Conservation" zones, and community lands. In addition the Grose River catchment has been nominated as a Wilderness Area. These areas require a high level of protection to satisfy community expectations for the quality of the Blue Mountains, legal requirements(especially for the protection of classified waterways and drinking water supply) and the principles of Ecologically Sustainable Development.

Impacts on the socio-economic environment as a result of sewerage overflows include reduced recreational value and the presence of litter which is unacceptable to the community. Uses of the waterways include primary and secondary contact recreation and drinking water supplies. These activities allow a pathway for human exposure to occur. However, the results of ecological and human health risk assessment undertaken for the project did not indicate a potential risk to human health as a result of incidental water ingestion.

The modelled wet weather overflows and SPSs have been ranked to provide an estimate of the significance of environmental impacts potentially arising from overflow events. The overflow ranking provides a comparison with results in a Sydney wide context and allows for prioritisation of abatement works. The overflow types in the Blue Mountains GA are amongst the highest ranked (high potential risk of environmental impact) Sydney wide due to the high environmental sensitivity of the region. In Winmalee, the wet weather overflows from some sub-areas rank within the highest ten ranked Sydney wide (North and South Katoomba are seven and ten respectively) and ten Winmalee SPSs are ranked in the top 12 Sydney wide.

Proposed solution

A standardised level of overflow performance, known as the minimum performance objectives, has been adopted as the starting point for evaluation of overflow abatement strategies. Strategies have been developed to meet the minimum performance objectives, as well as additional abatement of overflows above the minimum performance objectives where there is some justification to protect sensitive areas within the Winmalee sewerage system.

The long term water quality goal identified for this area is the protection of water catchments supplying potable water storages which include Lake Woodford and Lake Burragorang.

Water quality modelling of the Grose River has identified that the major sources of pollution are from stormwater (urban and rural runoff) and STP dry weather discharges. At a regional level the removal of all wet weather overflows from the model does not result in any significant water quality improvements compared to the minimum performance objectives abatement level. However, results of a cost-benefit analysis undertaken by Sydney Water indicate that an overflow containment of between ten and 20 events in ten years is considered most beneficial. Thus, due to the high environmental sensitivity of the Blue Mountains and the NSW community's expectations for the environmental quality of the area, the one year containment level has been selected for the Blue Mountains GA (ten events in ten years for system overflows). The lower environmental sensitivity of the receiving environment of the Winmalee STP (Nepean River) means that a lower reduction in the number of partially treated STP discharge events will be acceptable (20 events in ten years).

These levels are therefore recommended as the preferred overflow abatement strategy for the Winmalee sewerage system. This means a reduction from 51 overflow events to ten events in a ten year period, for wet weather reticulation overflows, and 110 events for partially treated STP discharges, to 20 events in a ten year period. The strategies also recommend the upgrading of SPSs and maintaining the current levels of chokes, exfiltration and odour, however, further investigations are needed to identify the extent of the exfiltration in the system.

The Best Management practices utilised by Sydney Water will continue to be updated and implemented for the system as part of the overflows management program and the continuous improvement process. Additional monitoring has been recommended to better characterise the locations and extent of impacts from overflows, and allow for improved definition of overflow abatement strategies thus providing for rapid mitigation.

Implementation of the preferred option is expected to cost $94.45 million for the Winmalee sewerage system over the time period from 2006 to 2010, with all SPS upgrades expected to complete by 2005.

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Volume 3: Winmalee

A. Modelled system performance data
B. Measured system performance data
C. Full details of overflow ranking results for system

Chapter 1

Introduction

Synopsis

As part of its wastewater business, Sydney Water has applied to the EPA for licences for overflows from its 27 sewerage systems. The licences will set performance standards and pollution reduction targets for Sydney Water to meet in the future. The sewerage overflow Environmental Impact Statements (EISs) are part of the process of obtaining a licence for operation of the sewerage system.

This EIS includes five levels of documentation to describe the problems, impacts and solutions associated with sewerage overflows, as follows:

1. Volume 1 - Sydney Wide overview
2. Volume 2 - Blue Mountains Geographic Area (GA)
3. Volume 3 - Winmalee sewerage system overflows (this volume)
4. Appendices
5. Methods.

Volume 2 describes the overflows in the Blue Mountains GA, including the extent of the overflow problem, the environmental impacts, proposed solutions and environmental benefits resulting from the preferred solution for the GA. Volume 3 (this volume) describes the specific solutions developed for each sewerage system located within the Blue Mountains GA (Winmalee, Blackheath and Mount Victoria).

In this EIS, all liquid and odour discharges from the Winmalee sewerage system and partially treated wet weather sewage treatment plant (STP) discharges are considered to be overflows. All flows from the STP, including partially treated flows, are currently licensed by the EPA.

This volume provides the background to the assessment of the overflow problem, the associated environmental impacts and the preferred overflow abatement strategies for the Winmalee sewerage system.

1. Introduction

1.1 Background

As part of its wastewater business, Sydney Water has applied to the EPA for licences for overflows from its 27 sewerage systems. These licences will set performance standards and pollution reduction targets for Sydney Water to meet in the future. The sewerage overflow Environmental Impact Statements (EISs) are part of the process of obtaining a licence for operation of the sewerage system. A key outcome of the EISs will be licences that include agreed improvement programmes.

The NSW Government's Waterways Package commits the Government to addressing the problems of sewerage overflows across Sydney Water's area of operations. The Waterways Package establishes a 20 year plan of action which includes proposals for reducing overflows. The Environmental Impact Statements for Sydney Water's overflows licensing form an important part of this package.

The Sydney Water Corporation has three equal objectives; to protect the environment, to protect public health and to be a successful business. Overflows are just one element of Sydney Water's wastewater system. Sydney Water's vision for sustainable waste water management, including the reduction of sewage overflows, is outlined in WaterPlan 21 (Sydney Water 1997). As part of this plan, an outcome of these sewerage overflow EISs will be licences that include agreed improvement programs. Structural components of these programs will be subject to project specific impact assessment at the time of their implementation as second stage environmental impact assessment.

This volume is the third volume in this EIS. Volume 1 describes the Sydney wide overflow abatement program and provides information on the generic considerations and methodology that form the licensing project. It summarises the performance, impacts, proposed solutions, costs and benefits for Sydney Water's 27 sewerage systems and outlines the prioritisation process for implementation of the plan.

Volume 2 provides the background to the EISs and describes and assesses the environmental impacts of overflows in the Blue Mountains Geographic Area (GA). Volume 2 also contains information regarding the relative contributions environmental impacts of overflows in the GA. It proposes overflow abatement strategies for the Blue Mountains GA (ie. the Blue Mountains REZ and the Lake Burragorang REZ). The overflow abatement strategies are based on the appropriate response to the assessed impacts of sewerage overflows on the environment of the Blue Mountains.

This volume (Volume 3) describes Winmalee sewerage system, the extent of overflows from that system and the abatement strategy required to meet the preferred overflow abatement option for the Blue Mountains GA.

Additional details of the methods used during the preparation of the EIS documentation including sewer modelling, water quality modelling and overflow ranking are described in the Methods Volume. All reference data and information used to support Volumes 1,2 and 3 are included in the Appendices Volume.

1.2 Purpose and contents of volume 3

This volume assesses overflows from the Winmalee sewerage system. System-specific strategies comprising a range of actions which are realistically achievable and affordable are developed to meet the Blue Mountains GA overflow abatement objectives identified in Volume 2. It is important to note that improved overflow performance is the principal objective defined for this EIS.

Volume 3 includes:

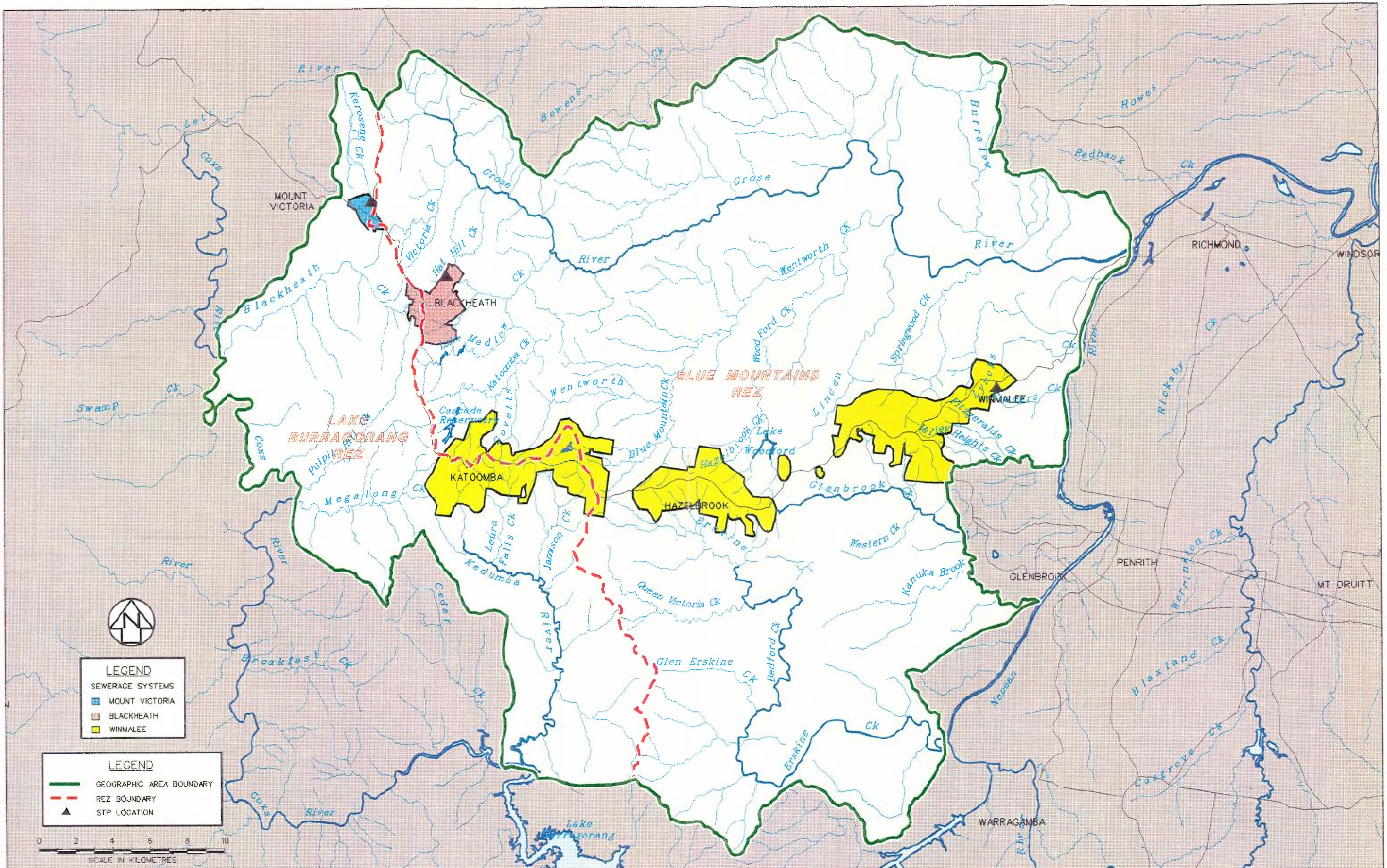
1. a description of the Winmalee sewerage system and
2. a description of the extent of the overflow problem related to the Winmalee sewerage system in Chapter 2
3. a description of the environmental impacts from overflows in the Winmalee sewerage system in Chapter 3
4. an analysis of options, strategies, and possible actions to achieve the strategies to meet the preferred abatement option, as proposed in Volume 2, in Chapter 4
5. a description of the environmental benefits of the preferred strategy in Chapter 5.

1.3 The study area

The area served by the Winmalee sewerage system consists of all the areas whose sewage is transported to and treated by the Winmalee STP. The Winmalee system extends from the middle to upper Blue Mountains and serves the residential and industrial areas of Winmalee, Valley Heights, Springwood, Faulconbridge, Linden, Woodford, Hazelbrook, Lawson, Bullaburra, Wentworth Falls, Leura and Katoomba. Winmalee has a catchment area of 5,745 ha, most of which is used for commercial or urban dwelling. The permanent population served is estimated at 37,567 (refer to Table 2.2, volume 2).

The two receiving environments for overflows from the Winmalee sewerage system are the Blue Mountains REZ (Grose River and tributaries, Erskine and Glenbrook Creeks to the confluence with Western Creek) and Lake Burragorang REZ (Coxs River and tributaries and Kedumba River and tributaries to the inlet of Lake Burragorang). Both REZs are considered to be sensitive environments for overflow events due to their high environmental quality. There are also a number of areas within the area served by Winmalee sewerage system including remnant bushland, threatened species habitats, recreational areas, National Parks and some classified waterways which for the purposes of this project have been categorised as “sensitive areas”.

The study area and the boundaries of each sewerage system and both REZs are shown on Figure 1.1.



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SEWERAGE OVERFLOWS LICENSING PROJECT
BLUE MOUNTAINS GEOGRAPHIC AREA

FIGURE 1-1
THE STUDY AREA

Chapter 2

System Performance

Synopsis

This Chapter describes sewerage system performance details for the Winmalee sewerage system. The components of the system performance which have been identified as causing overflows to the surrounding environment include wet weather overflows, partially treated sewage treatment plant (STP) discharges, chokes, sewage pumping station (SPS) failures, exfiltration and odours.

Sewerage system modelling indicates there are 51 wet weather overflow events in ten years from the Winmalee sewerage system. Wet weather overflows from the Winmalee sewerage system contribute 94% (58.3 ML per year) of the average annual overflow volume of 62.3 ML within the Blue Mountains GA. This is, however, a relatively small volume compared to other systems in Sydney.

The Winmalee STP provides tertiary treatment of all flows, up to 28.4 ML/day, although discharges of partially treated sewage occur when the flow capacity of the various treatment levels is exceeded in wet weather. The number of partially treated STP discharges is currently 110 events in ten years. Although the volume of STP partially treated flows is greater than system overflows (440 ML per year), STP partially treated flows have a higher level of treatment and hence quality than reticulation overflows.

Overflows also occur in dry and wet weather due to blockages or chokes in the sewerage system caused by roots, broken pipes and other obstructions. Suburbs have been ranked by choke density on a system basis as either high, medium or low compared to the Sydney wide average Within the area served by the Winmalee sewerage system, 36% of the suburbs have a low choke density and 64% have a medium choke density, which compares favourably with the overall performance Sydney wide. Repeat chokes have occurred in the Winmalee sewerage system.

Three of the eleven sub-areas in the Winmalee sewerage system were identified as having potential exfiltration problems. The exfiltration in these sub-areas will be investigated as part of the ongoing infiltration/exfiltration (I/E) program.

In 1996/97, 214 SPS failures occurred in the Winmalee sewerage system which resulted in overflows. This is considered to be a high rate of overflows compared to the Sydney wide average.

Odour complaints were found to be above the Sydney wide average in four suburbs served by the Winmalee sewerage system (Katoomba, Springwood, Wentworth Falls and Faulconbridge).

The population served by the Winmalee sewerage system is expected to be 1.7 times greater in 2021 than 1997 which represents an annual average growth rate of 2.5% over the 30 year period. The Winmalee sewerage system can cope with the increased sewage and flows, however unless wet weather abatement strategies are introduced there is predicted to be an increase in the number of overflow events from 51 in ten years to 59 in ten years, and a small increase in the total overflow volume in 2021.

Chapter 3 of this volume describes the impacts of overflows from the Winmalee sewerage system on the environment.

2. System performance

2.1 Current system overflows

The total Winmalee sewerage system catchment consists of seven discrete sub-areas (refer to Figure 2.1). The seven sub-areas are:

1. North Katoomba sub-area
2. South Katoomba sub-area
3. Wentworth Falls sub-area
4. Hazelbrook sub-area
5. Valley Heights sub-area
6. Springwood sub-area
7. Winmalee sub-area.

The age of the Winmalee sewerage system, ranges from 1915 for South Katoomba sub-area to the early 1980s for sections within the Winmalee sub-area. Each of the above sub-areas was serviced by an STP, which discharged the effluent directly into a local watercourse. These STPs are now decommissioned (with the exception of the decommissioning of the South Katoomba STP which is expected by mid 1998) with sewage from these sub-areas discharging directly into the Blue Mountains Sewer Tunnel for transportation to the Winmalee STP. The Winmalee STP processes and treats the incoming sewage for discharge to an unnamed tributary of the Hawkesbury-Nepean River.

Table 2.1 below compares the Winmalee system with other systems within the Blue Mountains GA and the total Sydney Water wastewater system. The area served by the Winmalee sewerage system represents approximately 93% of the total area served by sewerage systems in the Blue Mountains GA, and approximately 3% of the total area of Sydney Water's 27 sewerage systems.

Table 2.1 - Comparison of Winmalee system to Blue Mountains GA and total Sydney Water wastewater system

Description	Winmalee	Blue Mountains GA	Total Sydney Water
Area Served(ha)	5,745	6,182	187,121
Population served	37,567	42,012	3,884,212
Length of main sewers > 300 mm (km)	105	109	2,497
Length of reticulation sewers < 300 mm (km)	487	553	18,966
Total length of sewers (km)	592	662	21,463
No. of SPS	61	69	642
No. of designed overflows	48	49	3,109

Designed overflows provide relief points within the sewerage system to manage dry weather operational failures and/or hydraulic overload which may occur during periods of wet weather. There are 48 known designed overflow structures in the Winmalee system. Designed overflow structures from SPSs are structures for overflows from the SPS if the storage capacity of the SPS is exceeded. Design overflow structures in gravity sewer lines, such as overflow pipes from some access chambers, lead overflows to a selected receiving environment when the capacity of the line downstream of the designed overflow is exceeded. The overflow is then able to be controlled and directed to a chosen discharge location. These overflows either discharge directly into a natural water body or into the stormwater system. Compared to the total Sydney Water wastewater system, the relative number of designed overflows contained within the Winmalee sewerage system is small.

The ultimate receiving waters for overflows within the Blue Mountains GA are the:

1. Grose River, Glenbrook and Erskine Creeks and Nepean River systems in the Blue Mountains REZ
2. the Kedumba River in the Lake Burragorang REZ (from the South Katoomba and Wentworth Falls Sub-areas).

Figure 2.2 (a-c, areas as shown on Figure 2.1) shows details of the sewerage system infrastructure and the location of individual designed overflow structures and their discharge pathways.

Overflows can occur anywhere in a sewerage system in both dry or wet weather conditions and are not necessarily limited to designed overflow structures. Examples of overflows from non-design locations include sewage surcharges from access chambers, leakage of sewage through cracks in sewer pipes and joints (exfiltration), and odour emissions via liquid overflow discharges or from sewerage plant such as chambers and vent stacks. Overflow discharges from non-design locations in the Winmalee sewerage system are discussed in Section 2.2 below.

The Winmalee STP provides tertiary treatment by means of the extended aeration activated sludge process followed by filtration and disinfection. The extended aeration process comprises intermittently decanted aerated lagoons (IDALs) designed to achieve a high degree of removal of suspended solids (SS), organic matter (BOD) and nitrogen. Chemical precipitation for phosphorous removal is also provided by dosing chemicals to the IDAL (simultaneous precipitation).

The STP is a continuous flow nutrient removal plant with advanced physical and chemical treatment facilities, and is being commissioned in stages. Stage 1 of the plant was constructed and commissioned in the 1960s. Stage 2 facilities were constructed and commissioned in the 1970s (Sydney Water 1995d). The STP is currently being amplified to Stage 3 standard. Upon commissioning as Stage 3, the STP capacity will increase from the designed equivalent population (EP) capacity of 25,000 for Stage 2, to a designed equivalent population capacity of 60,000 . The timing of the commissioning of the STP stages has been to coincide with the decommissioning of the individual STPs in the lower Blue Mountains and later the commissioning of the Blue Mountains Tunnel and the de-commissioning of the upper Blue Mountains STPs at North and South Katoomba and Wentworth Falls.

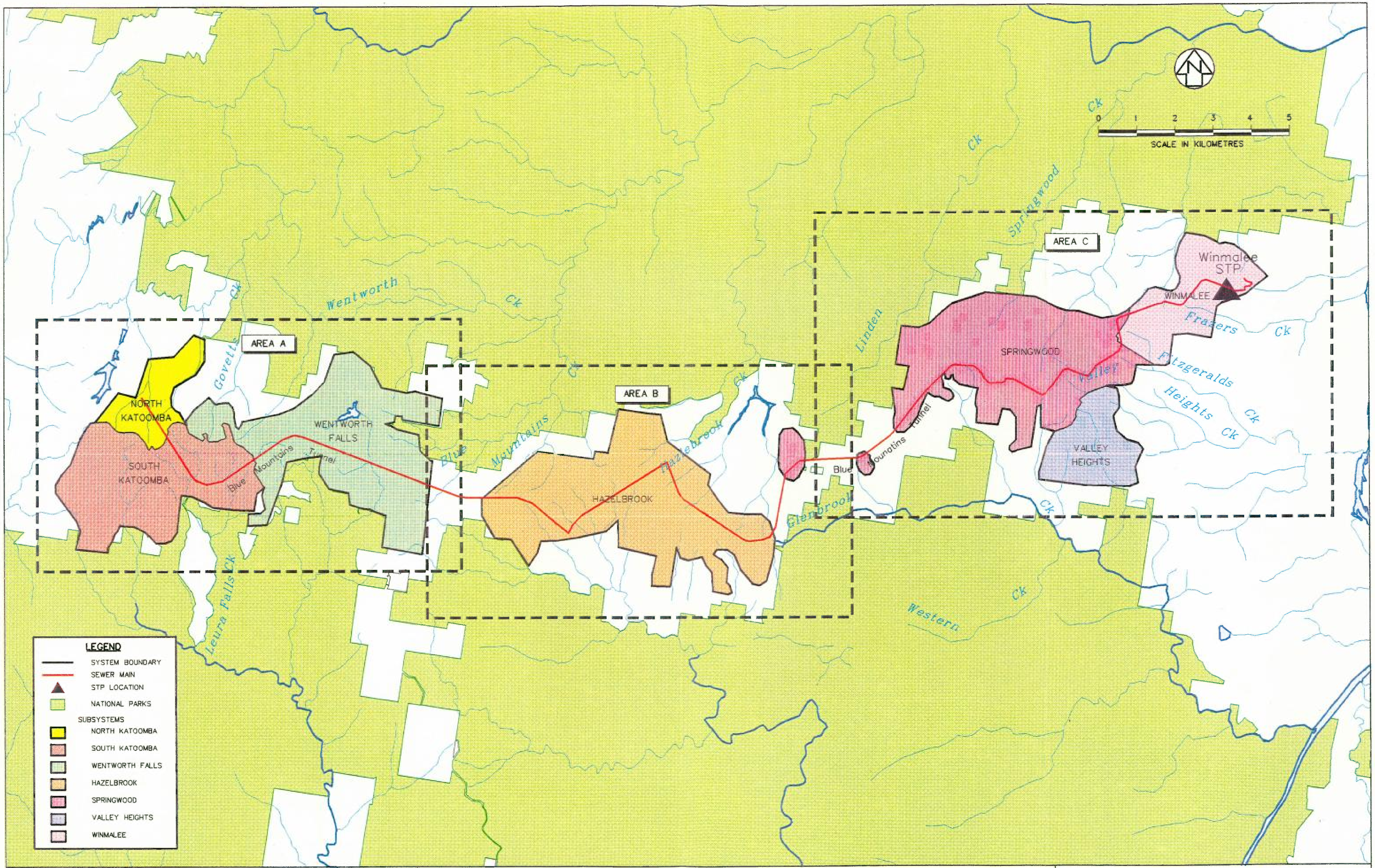
Treated STP discharge is released into an unnamed natural gully, north of and parallel to Frasers Creek, which flows directly to the Hawkesbury-Nepean River system approximately four kilometres downstream of the STP discharge point (Sydney Water 1995a). The average dry weather flow is estimated at 12.6 ML/day.

During heavy rain, sewerage treatment plants have to handle much larger flows than in dry weather and can sometimes only partially treat the wastewater before discharging it. At such times pathogens are the only pollutant types from overflows which significantly contribute to waterway pollution. Accordingly, a partially treated sewage treatment plant discharge is defined to be a sewerage overflow if its faecal coliform density exceeds 150 cfu per 100 millilitres because then the objective of maintaining recreational water quality criteria may be compromised. Disinfection to 150 cfu per 100 millilitres can be termed "full disinfection".

Water quality modelling (refer section 3.3.4 Volume 2) suggests that during wet weather, STP discharges are not a significant source of nutrients, with the majority of nutrients deriving from stormwater runoff within the catchment.

For the majority of times the STP will operate at full sewage treatment levels. Partially treated discharges will only occur during large rainfall events and hence represent only a small proportion of the normal STP operational time. Most of the treatment including the disinfection of higher flows, will be appropriate for the environmental conditions.

The STP is currently in the process of upgrading to the Stage 3 capacity which will provide full tertiary and secondary treatment up to 48.6 ML/day.



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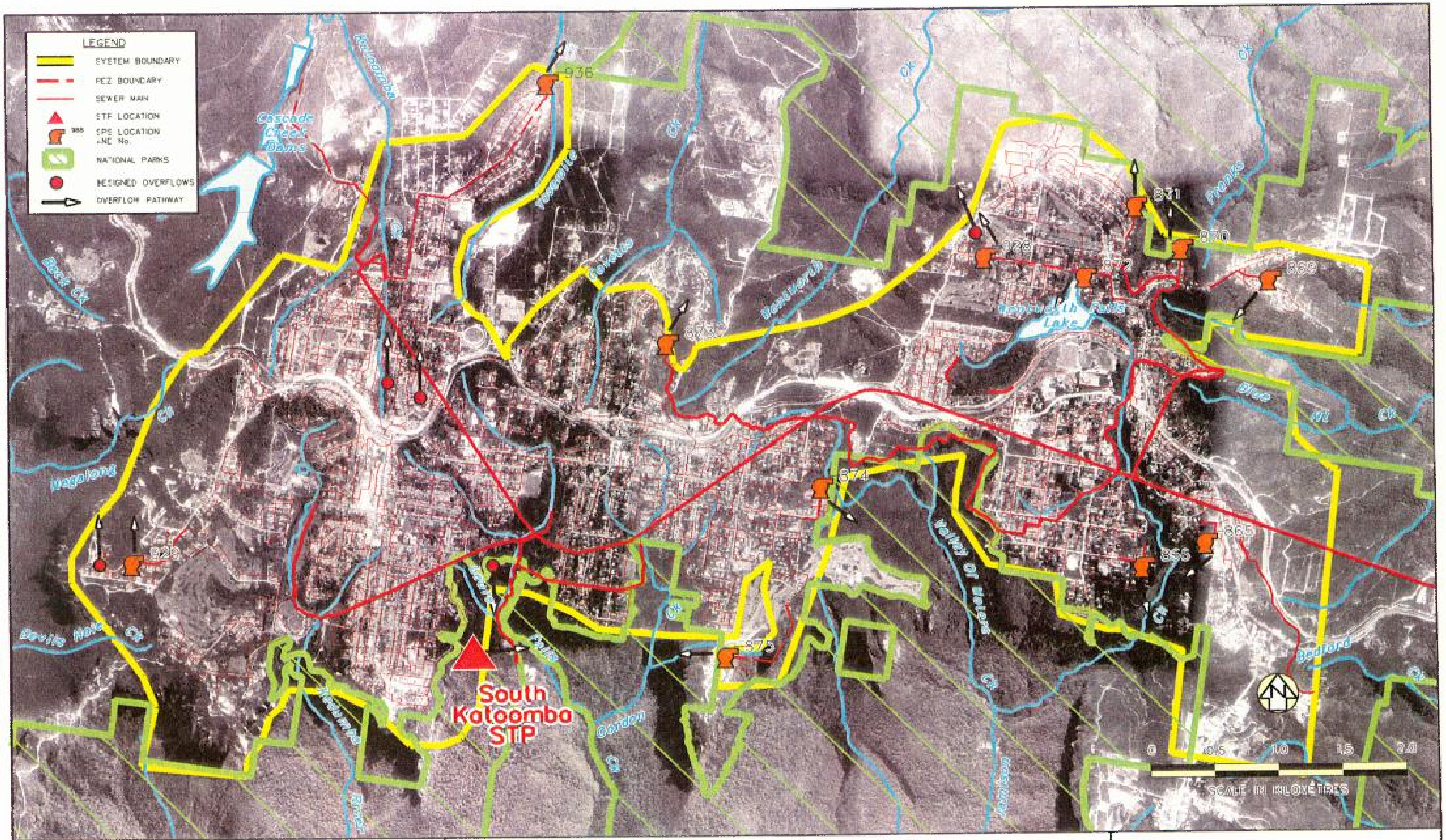
SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 2-1
THE STUDY AREA



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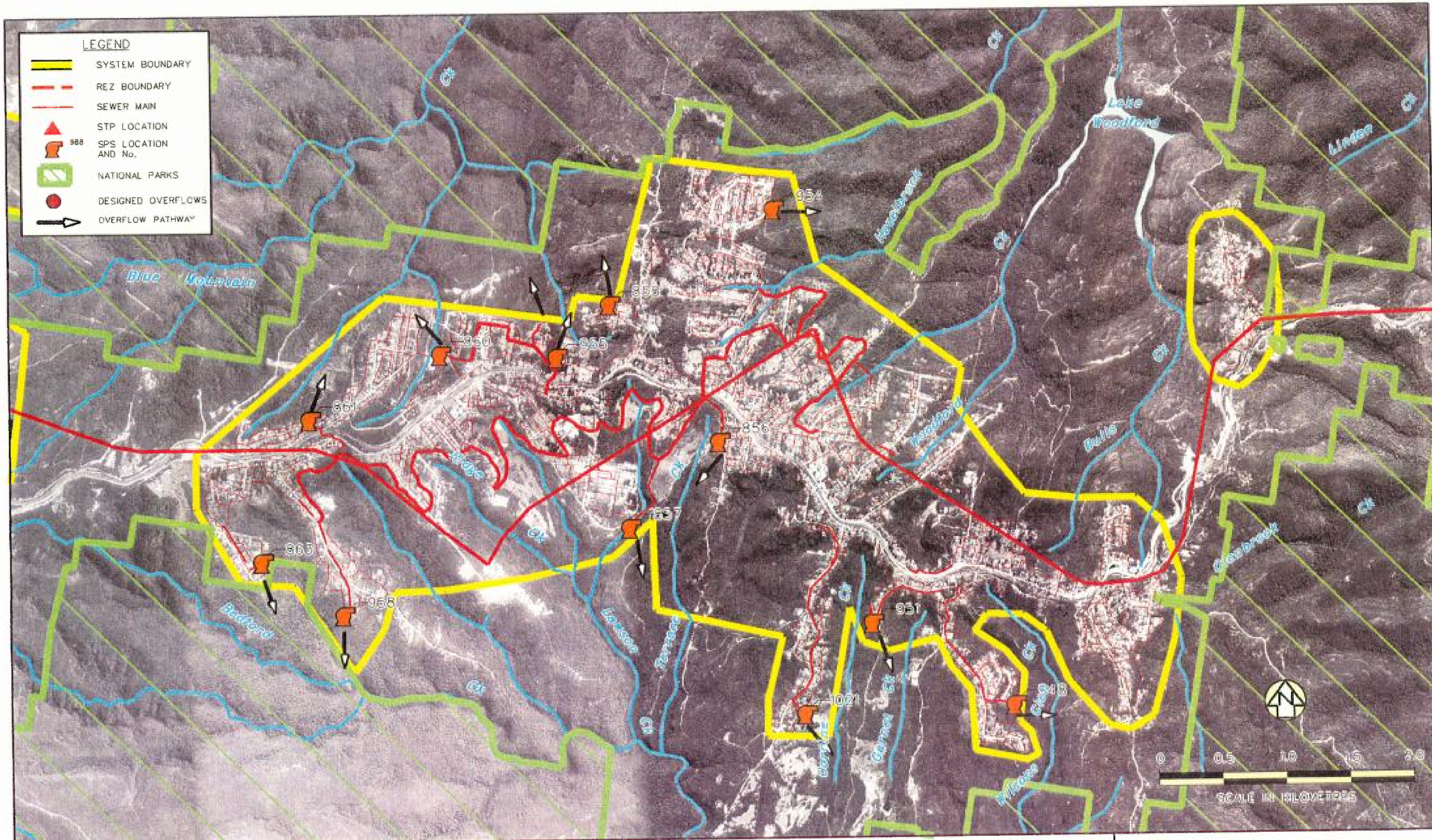
SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 2-2a
WINMALEE SEWERAGE SYSTEM



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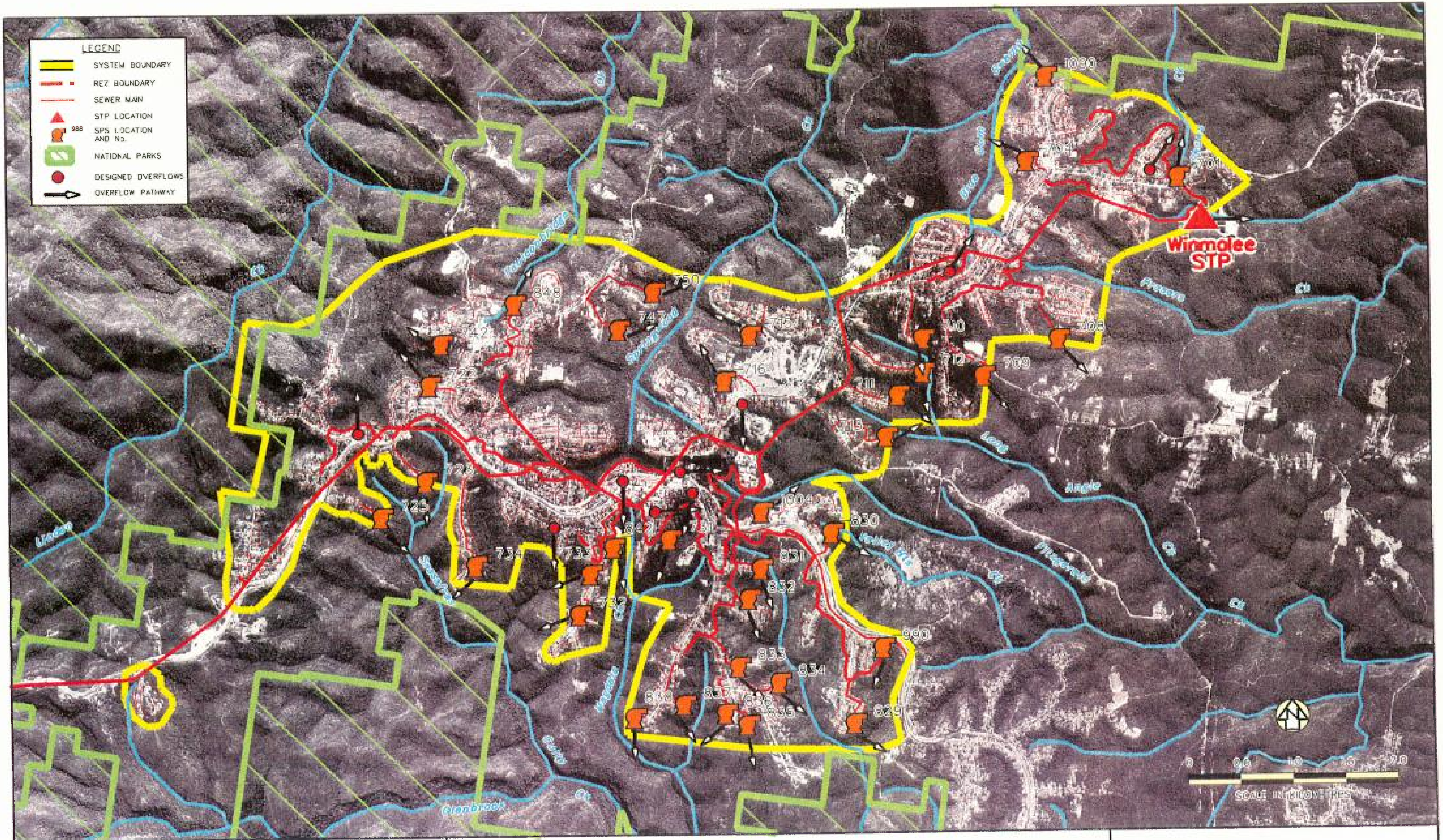
SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 2-2b
WINMALEE SEWERAGE SYSTEM



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SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 2-2c
WINMALEE SEWERAGE SYSTEM

Section 2.4.2 includes further discussion on the extent of these types of overflows within the Winmalee sewerage system.

2.2 Condition of the Winmalee sewerage system

2.2.1 Pipes and access chambers

As stated in Section 2.1 the age of the various areas of the sewerage system varies significantly. It would be expected therefore that the condition of various areas of the system will differ considerably with the age of the system. Older systems such as South Katoomba therefore would be expected to be particularly more susceptible to overflows caused by old and cracked pipes such as chokes and exfiltration.

Trunk carriers in the Winmalee system are generally in good operational condition however it is estimated that between 6 - 14% of rainfall in the catchment finds its way into the sewerage system via illegal stormwater connections, cracked pipes, dislocated joints and poorly sealed access chambers (Sydney Water 1997b).

Since 1990, most of the main carriers in the Winmalee catchment down to 300 mm in diameter have been inspected (Water Board 1993). Sewer inspections in the Winmalee catchment have included:

1. Closed Circuit Television (CCTV) inspections on carriers less than 900 mm diameter
2. inspections of access chambers.

The results of these inspections showed that inflow and infiltration (I/I) and exfiltration sources exist along most carriers, with the main faults being cracked, fractured and broken pipes and pipe joints, and obstructions to flow by roots, rocks and other debris. Several major blockages in the range of 50 to 95 per cent of the pipe area were found. Sub-areas of North and South Katoomba, and to a lesser extent the Winmalee areas, have a higher infiltration potential than the other sub-areas such as Wentworth Falls, Hazelbrook and Valley Heights which show a higher potential for exfiltration. Sewers in Springwood revealed a high degree of root infestation with several showing structural defects.

An inflow and infiltration (I/I) source detection program in the Blue Mountains area, identified 35% of access chambers were inflow and infiltration sources, and 10% showed signs of surcharging. Hydrostatic testing of 25 sections of Sydney Water's sewers in Leura, for example, indicated that 24 sections failed, while nine pipes were unable to fill which would also indicate that exfiltration was occurring in these sections (HTL Watson Environmental 1994).

Relining of a sewer is the most effective treatment to control inflow and infiltration into a sewer and involves inserting a thermal plastic liner into the existing sewer. To date, in situ relining of many sections of carriers within the total catchment to the Winmalee STP have been carried out particularly on the Bullaburra, South Springwood and South Wentworth Falls carriers. Other repairs have also been undertaken on the systems including grouting, spot repairs and general cleaning.

There are a number of sections within the Winmalee sewerage system requiring attention to reduce leakage from the system (exfiltration) as well as Inflow/Infiltration (I/I) into the sewer. These will require further investigation during a second stage EIA to determine the extent of the problem. The Blue Mountains Tunnel also experiences infiltration as the tunnel is unlined and allows entry of natural seepage. This will result in increased flow volumes in the tunnel and consequently through the STP.

The problem infiltration/exfiltration (I/E) areas in this catchment are further discussed in Section 2.4.4

2.2.2 Sewage pumping stations

Storage capacity of an SPS is dictated by the time available after a failure, for maintenance personnel to arrive on site and address the fault, before overflow occurs. In the Blue Mountains, it was determined that the desired storage capacity for SPSs in Winmalee sewerage system is four hours, measured at peak dry weather flow. This is based upon times by Sydney Water personnel to respond and either repair a fault or install backup pumps and backup generators.

There are 21 SPSs in the Winmalee system which have storage of less than four hours, and 11 SPSs which do not have a stand-by pump. Both of these design issues will increase the risk of an overflow event occurring. A number of SPSs including 830, 833, 835, 836, and 856 had less than two hours storage capacity. The pumping and storage capacities of the 61 SPSs in the Winmalee system are summarised in Appendix B.

During 1994, an operational performance assessment was undertaken by Sydney Water, to determine the reliability, serviceability, suitability and physical/operational condition of SPS equipment. This included pumps, motors, valves, power supply, telemetry (which activates alarms in the regional operations centre when a failure occurs at a pumping station), unit control and procedural control instructions and overflows (Water Board, 1994a).

Common faults were found in all of these SPS components, as well as the previously discussed, unsatisfactory overflow storage times based on peak dry weather flow (Water Board, 1994a). Yearly performance reports are compiled by Sydney Water on SPS failures in the Winmalee system.

An SPS ranking method was developed as part of this project to assist with the assessment of overflows caused by SPS failure (refer Methods Document). The method calculates ranking scores for individual SPSs. The SPS ranking scores are based on the consideration of three factors which affect the need for SPS remediation:

1. the quality of the SPS infrastructure
2. the nature of the overflow problem
3. the environmental consequences of an overflow event.

In the Winmalee sewerage system, eight SPSs (836, 872, 830, 857, 835, 837, 873, and 833) were ranked in the top ten SPSs requiring priority for remediation in the Blue Mountains GA (refer to Section 3.4).

SPS failures are discussed further in Section 2.4.5 below.

2.3 Sewage characteristics

2.3.1 General sewage characteristics

Raw sewage consists of the combined discharges from industry, commerce and domestic residences. In addition, raw sewage may contain groundwater and stormwater which can infiltrate and inflow into the sewerage system. Generally, raw sewage contains about 99.9% water and 0.1% solids (Sydney Water 1994b). Sewage can contain not only organic wastes but large amounts of chemicals and nutrients. The quantities of these constituents will vary considerably depending upon the usage of the area. For example, raw sewage sourced from a purely residential area may have significantly different make-up to sewage sourced from an industrial area, which is likely to have a higher concentration of chemicals and metals.

Chemicals in sewage can be derived from non-point sources, such as pesticides and fertilisers used within the sewerage system catchment infiltrating into the lines through groundwater, or from point sources such as discharges of industrial effluent to the sewer. Sydney Water cannot directly control the quantities of chemicals entering the sewer through non-point sources, however, Sydney Water controls point sources of chemicals through a Wastewater Source Control Policy, which is based on a system of trade waste agreements with commercial and industry customers who discharge effluent to the sewerage system. These trade waste agreements specify the volume, concentration and mass of different substances in commercial and industrial effluent that may legally be discharged to the sewer.

Trade waste dischargers are divided into four categories for the purpose of licence agreements:

1. Category One - commercial establishments producing residential-type substances in their trade wastewater streams
2. Category Two - operating small businesses producing low annual loads of residential type substances and low mass loads of non-residential-type substances
3. Category Three - all customers whose discharge cannot comply with the conditions relating to Categories 1 or 2, and whose trade wastewater is treated at a Sydney Water STP providing the equivalent of primary or advanced primary sewage treatment
4. Category Four - all customers whose discharge cannot comply with the conditions relating to categories 1 or 2, and whose trade wastewater is treated at a Sydney Water STP providing the equivalent of secondary or tertiary sewage treatment.

Sydney Water's Source Control Policy focuses on the loads and concentrations of particular substances entering the STPs, and the ability of the STP to reduce these loads to acceptable levels before discharging to receiving waters. Dischargers are therefore required to treat their waste streams to an acceptable level prior to discharge to the sewers. Concentrations at particular points in the wastewater system, corresponding to industrial areas or major trade waste dischargers will be significantly higher than the concentrations received at the STP, due to the dilution of these waste streams with other waste water in the system.

There are no Category Four trade waste discharges into the Winmalee sewerage system. This is reflected in the relatively low concentrations of chemicals detected in the sewage as discussed in Section 2.3.2 below.

2.3.2 Dry weather sewage characteristics of Winmalee sewerage system

Raw sewage inflow volumes into Winmalee STP can vary quite significantly during the year, mainly due to variations associated with high tourist numbers during seasonal and holiday periods and weekends. Flows are monitored by gauges with the results recorded on Sydney Water's flow gauging database. The average dry weather flow (ADWF) to the STP is estimated at 12.6 ML/day.

The dry weather 10, 50 and 90 percentiles of the conventional sewage parameters for Winmalee sewerage system are presented in Table 2.2. Data are listed as 10, 50 and 90 percentile values, ie., 10, 50 and 90% of samples analysed yielded values less than or equal to that listed.

Table 2.2 - Winmalee conventional sewage parameters

	10 Percentile (mg/L)	50 Percentile (mg/L)	90 Percentile (mg/L)
Ammonia (NH_3)	24.9	34.0	41.4
Total Phosphorus (TP)	7.0	9.4	12.1
BOD[1]	97	147	258
Total Kjel. Nitrogen (TN)	35.8	48.7	58.9
Suspended Solids (SS)	132	210	334

Note: Sewage samples collected at STP inlet twice a year in May and November (1990 to 1995).
1. Biochemical Oxygen Demand

To characterise the magnitude and variability of chemicals in sewage discharges, data from existing effluent sampling programs instigated for Operating Licence compliance purposes have been used (Sydney Water 1995c). Raw sewage sampling is regularly conducted at the inlet to the Winmalee STP. Samples are analysed as 24 hour composites for a number of variables nominated in Sydney Water's Environmental Monitoring Plan (Sydney Water 1995a) and defined by Schedule 10 of the Water Board (Corporatisation) Act 1994. The substances in raw sewage which are sought or analysed for, include toxins such as polyaromatic hydrocarbons (PAHs), monocyclic aromatic compounds, metals, organochlorine pesticides, halogenated aliphatic compounds, organophosphate pesticides, herbicides, conventionals and other organics, which can be found in sewage effluent especially from commercial and industrial sources (Sydney Water 1995b).

Chemicals of potential concern in sewage

Although the area served by the Winmalee sewerage system is predominantly a residential land use with only minor industrial development, the raw sewage monitored at the STP does contain a wide range of chemical compounds albeit in low concentrations. Data collected by Sydney Water indicates the following chemicals in sewage:

1. All polyaromatic hydrocarbons (PAHs) were present in concentrations less than the analytical detection limits.
2. Monocyclic aromatic compounds were present in sewage samples, some in concentrations greater than the analytical detection limits including phenol. Phenol was lower than the 100 mg/L guideline for the (ANZECC) Acceptance of Trade Wastes (Industrial Wastes) 1994.
3. Organochlorine pesticides were present above analytical detection limits in one or more samples analysed. No organophosphate pesticides were recorded above the analytical detection limit.
4. The halogenated aliphatic compound chloroform was detected in concentrations above detection limits but were below the 5 mg/L guideline value for the (ANZECC) Acceptance of Trade Wastes (Industrial Wastes) 1994.
5. All metals analysed with the exception of arsenic, cadmium, chromium, nickel and selenium were recorded above analytical detection limits. Petroleum hydrocarbons were present in most sewage samples analysed but were recorded at concentrations lower than the 30 mg/L guideline value specified by the (ANZECC) Acceptance of Trade Wastes (Industrial Wastes) 1994.

Bacteriological quality

Bacteriological properties of sewage are commonly measured by monitoring the densities of faecal coliform and *Clostridium perfringens*. There has been no actual monitoring of biological properties undertaken on raw sewage from the Winmalee sewerage system, however reliable data are available from monitoring at the Penrith STP.

The concentration of faecal coliforms and *Clostridium perfringens* from the Penrith STP are regarded as representative of sewage at the Winmalee STP, as the land uses within both areas are similar (Water Board 1994). Monthly sewage samples are collected from the inlet at Penrith STP and analysed for faecal coliforms (cfu/100 mL) and *Clostridium perfringens* (cfu/100 mL). A summary of the median and 90 percentile concentrations for faecal coliforms *Clostridium perfringens* are provided in Table 2.3. Refer to Section 3.2.2 for safe concentrations for water quality and public health.

Table 2.3 - Bacteriological sewage parameters (Penrith STP)

	Median concentration (cfu/100 mL)	90 percentile (cfu/100 mL)
Faecal coliforms	1.2×10^7	1.6×10^8
Clostridium perfringens	1.3×10^5	4.4×10^5

Note: 23 samples collected on a monthly basis at inlet to Penrith STP

Source: Water Board 1994b

2.3.3 Wet weather sewage characteristics

Sampling and testing of raw sewage have been undertaken at the inlet to the Winmalee STP to assess the quality of the wet weather flows. To date there has been no monitoring at individual overflows within the Winmalee sewerage system.

Sydney Water has conducted an ecological and human health risk assessment (ERA) study for sewerage overflows at eleven sites within Sydney Water's area of operation (refer Appendix C, Volume 2). The study was based upon a number of monitoring sites within the Sydney Water region of which three were located within the Blue Mountains GA, including one site at the outlet of the Winmalee STP. The sewerage overflows were characterised by analysing for a range of chemical parameters as listed in Table 2.4.

The concentration of wet weather parameters measured in the Winmalee STP inlet are generally within the range of wet weather overflow characteristics measured at the ERA monitoring sites.

The results of the ERA study indicate that the concentrations of chemicals analysed at the eleven wet weather overflow sites within the Sydney Water region varied little. The risk evaluation concluded that the potential risk to ecological and human health from wet weather sewerage overflows is negligible.

The wet weather overflow discharge characteristics of the sewerage overflow sites are shown in Table 2.4, together with the average dry and wet weather sewage characteristics in the Winmalee catchment.

Table 2.4 - Wet weather sewage quality

Concentrations

Parameter	Wet weather sewage characteristics identified at Winmalee STP inlet in May 1990[1]	Range of wet weather overflow characteristics for monitored sewerage overflow sites	Average dry weather sewage characteristics in Winmalee catchment[2]
Conventionals			
Ammonia (mg/L)	15	0.003 - 15.5	34
BOD (mg/L)	64	0 - 141	147
Suspended Solids (mg/L)	67	2 - 1570	210
Total Phosphorus (mg/L)	2.8	0 - 6.9	9.4
Metals			
Total Aluminium (µg/L)	0.2	0.005 - 84.6	0.4
Total Arsenic (µg/L)	<0.0002	0.00067 - 0.16	0
Total Chromium (µg/L)	0.002	0.002 - 0.043	0.02
Total Copper (µg/L)	0.04	0.0004 - 2.956	0.11
Total Iron (µg/L)	1.37	0.005 - 41.7	1.38
Total Lead (µg/L)	0.018	0.0003 - 2.16	0.02
Total Mercury (µg/L)	0.0004	0.00005 - 0.0087	0.0004
Total Zinc (µg/L)	0.03	0.005 - 2.281	0.13

Note: 1. Sites sampled as part of the Ecological Human Health Risk Assessment Study
2. Dry Weather Quality included for comparative purposes only

Source: Sydney Water ERA Database - samples from 11 overflow sites for Ecological and Human Health Risk Assessment Study. Sydney Water, 1995a; SWWSC, 1996. (Appendix C Volume 2)

Table 2.4 indicates the following:

1. the wet weather concentrations for ammonia and BOD are approximately one half of the average dry weather concentrations
2. wet weather total phosphorus concentrations are approximately one third that of dry weather
3. wet weather metal concentrations are lower than the average concentrations in dry weather.

These lower readings are a result of dilution effects from increased flows during wet weather events although, the degree of dilution varies significantly for each compound.

Summary of sewage characteristics

The results of the testing of raw and treated sewage for both wet and dry weather conditions indicate the following:

1. STP dry and wet weather discharges are well within Operating Licence conditions
2. Raw sewage tested for a range of chemicals of potential concern indicated low or undetectable levels of these chemicals reflecting the predominantly residential nature of the Winmalee sewerage system

3. Wet weather characteristics of raw sewage are generally within or lower than the average results of the Sydney wide ERA study into sewerage overflows. The ERA study concluded that the potential risk to ecological and human health from wet weather sewerage overflow is negligible.

2.4 Extent of the overflow problem

The extent of the overflow problem in the Winmalee sewerage system has been determined largely from the results of numerical hydraulic sewer modelling and gauging data. Historical records of events from all overflow types have also been examined for the most recent information. The incidence and magnitude of all types of sewerage overflows in the Winmalee sewerage system are discussed in the following Sections.

2.4.1 Wet weather overflows

As discussed previously, wet weather overflows have been defined, for the purposes of this EIS, as those overflows caused by excess infiltration/inflow to the sewerage system. This definition of wet weather overflows is compatible with the assumptions of the hydraulic sewer model (Sydney Water 1997b). It should be noted, however, that overflows during wet weather conditions may be caused by a combination of these and other factors, such as partial pipe blockage, and that it may be difficult to isolate a single causal factor.

The performance of the Winmalee sewerage system during wet weather conditions, including the frequency and volume of wet weather overflows and the percentage of rainfall ingress to the sewers, was determined using the MOUSE numerical sewer models. For details refer to the Strategic Options Report in Appendix A and the Methods Volume for the modelling approach.

The Winmalee sewerage system was modelled as a series of flow gauge catchments referred to as nodes. Each of these flow gauge catchments has measurements of actual performance taken from one or more gauges within the catchment which allows the model to be calibrated by comparison of simulated and gauged hydrographs. There are six nodes generally representing the sub-areas of the Winmalee sewerage system, except for the Springwood sub-area which is partially contained within the Winmalee and Valley Heights nodes. Each node represents a discrete sewer catchment area which discharges into the Blue Mountains Sewerage Tunnel and flows to the Winmalee STP. The six nodes are indicated on Figure 2.3 and represent the areas of:

1. North Katoomba (NK1)
2. South Katoomba (SK1)
3. Wentworth Falls (WF1)
4. Hazelbrook (HB1)
5. Valley Heights (VH1)
6. Winmalee (WM1).

The wet weather sewerage system performance is defined by a number of rainfall events occurring over a ten year period (January 1985 to December 1994). During this period a total of 593 discrete rainfall events occurred, and these events were used to develop a mathematical model to describe the hydraulic behaviour of the sewerage systems in wet weather. The wet weather model attempts to quantify the frequency (events/10 years), quantity (volume/10 years) and duration of overflows. The model is able to incorporate future release areas and populations to predict future wet weather overflow events and can provide an estimate of the cost of reducing the frequency to a pre-determined containment level (refer to the Methods Document).

The wet weather performance of the system is summarised in Figure 2.3.

Out of the 593 discrete rainfall events and based on the current population, the predicted number of overflow events in the ten year period, was 51. This represents the number of individual rainfall events which caused overflows to occur in any of the individual nodes. A total of 102 system overflows occurred within the whole Winmalee sewerage system from these 51 rainfall events (ie. several of these 102 system overflow events could have occurred during one of the 51 rainfall events). The worst performing catchment is North Katoomba with 44 system overflow events. Due to the nature of the model, it is not possible to identify the actual locations of the overflows within each sewerage node.

The wet weather performance of the individual nodes within the system is summarised in Table 2.5.

Table 2.5 - Modelled individual wet weather overflow summary for the 10 year time series.

Location	Type of overflow	Number of events* within each node	Total duration (hrs)	Total volume (ML)
North Katoomba	Reticulation	44	830	155
South Katoomba	Reticulation	19	230	128
Wentworth Falls	Reticulation	5	106	39
Hazelbrook	Reticulation	9	209	97
Valley Heights	Reticulation	12	191	37
Winmalee	Reticulation	13	131	129

Note: * as caused by total of 51 wet weather events from 683 discrete rainfall events which caused overflows within the 6 nodes as predicted
Due to model limitations, the results should be regarded as minimum overflow frequency indicators

Source: Sydney Water 1997b

The system performance was also assessed over the modelled ten year period to determine the yearly variation in overflow performance. Table 2.6 provides a summary of these results from the ten year time series modelling.

Table 2.6 - Modelled yearly wet weather overflow summary for the Winmalee sewerage system

Year	Rainfall events	Number of overflow events	Total duration (Hrs)	Total volume (ML)
1985	52	3	37	3
1986	52	3	82	231
1987	64	7	159	15
1988	63	9	146	96
1989	67	8	143	12
1990	62	10	155	64
1991	58	3	72	31
1992	69	4	71	129
1993	57	0	0	0
1994	49	4	22	2
Total	**593**	**51**	**887**	**583**

Source: Sydney Water 1997b

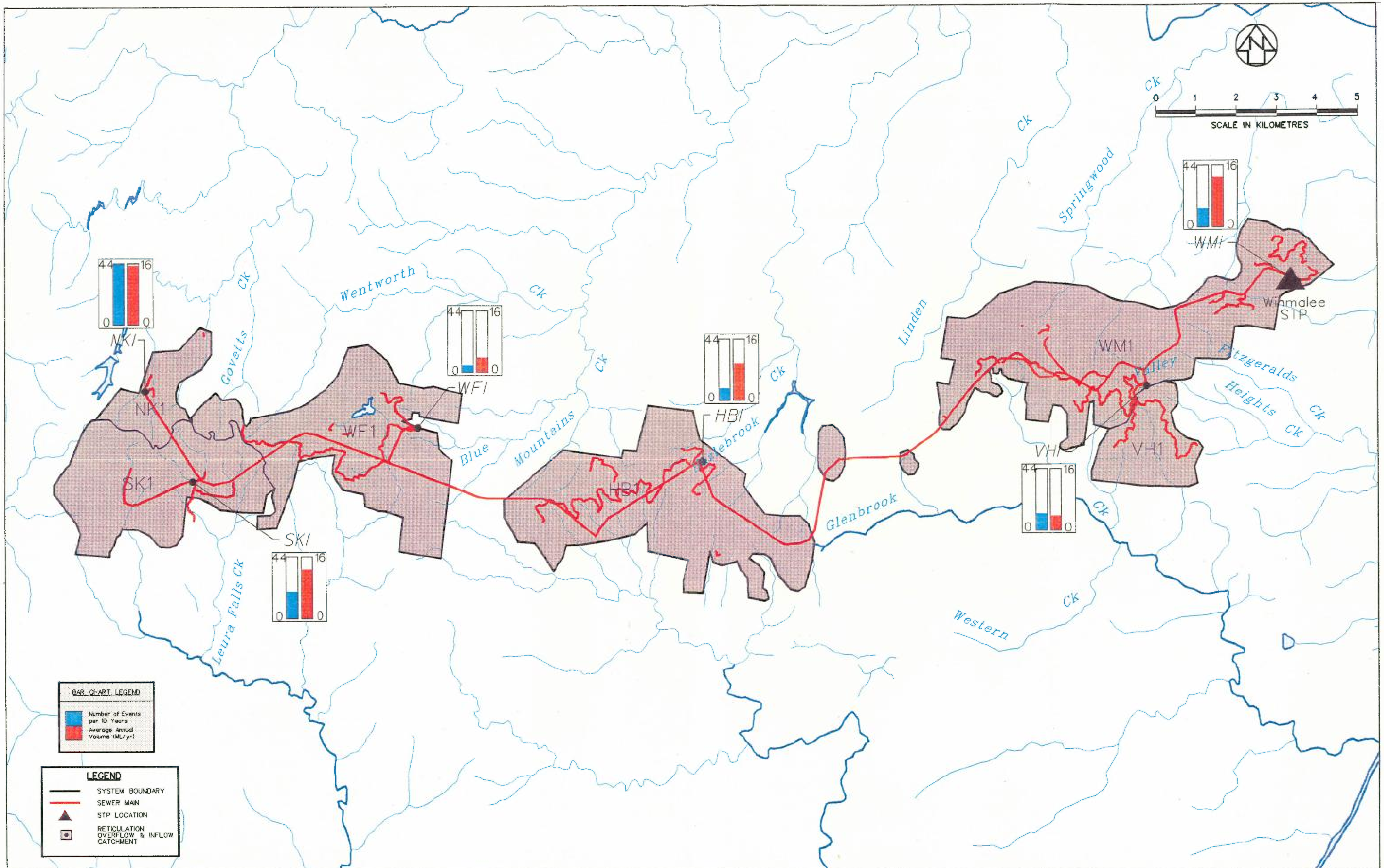

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FIGURE 2-3
MODELLED WET WEATHER OVERFLOW PERFORMANCE

It should be noted that three of the 51 overflow events contributed approximately 72% of the total overflow volume.

Inflow and infiltration (I/I) to the Winmalee sewerage system during wet weather are a major cause of wet weather overflows. The modelling indicates that up to 14% of rainfall can enter the sewerage system. The actual percentage is dependent upon a number of system area variables including age and extent of deterioration of the sewerage system, size of the area and that areas response to rainfall (based on vegetative cover, soil type and degree of saturation of the soil etc.) The overflow is dependent upon many factors apart from rainfall characteristics, including rainfall intensity, degree of soil saturation, STP capacity and the storage capacity of trunk sewers and carriers. Newer areas by nature of the newer condition and age of the pipework would be expected to allow a lower percentage of rainfall into the system.

Refer to Chapter 3 for further details on impacts from wet weather overflows.

2.4.2 Partially treated sewage discharged from STP

A partially treated STP discharge occurs during wet weather when the hydraulic or treatment capacity of the STP is exceeded. STP partially discharge flows during wet weather will be highly diluted with stormwater. Hence the concentration of pollutants is low.

The Winmalee STP will provide a continuum of sewage treatment (refer to Figure 2.4) so that the performance of the plant is aimed at meeting the conditions of the receiving environment through compliance with EPA Licence conditions. In this regard, the objectives of the operation of the STP are as follows:

1. during dry weather, the full treatment train must operate to the highest possible treatment level for the best water quality achievable
2. during normal rainfall events, the capacity of one or more components of the treatment train may be at full capacity. However, disinfection and dilution along with fine screening will be provided as a minimum treatment.
3. during intense rainfall events, all components of the full treatment train are likely to be at full capacity. However, effluent fine screening and partial disinfection will be provided as a minimum treatment. Sewage will be highly diluted.

During dry weather the highest possible level of treatment is required and the full treatment process train must operate. During rainfall events, the capacity of one or more components of the treatment process train may be exceeded and during intense rainfall, the full treatment process train operates at full capacity but excess flows receive a reduced level of treatment (partial treatment and disinfection).

The current full treatment capacity of the Winmalee STP (Stage 2) is for flows up to 28.4 ML/day with the soon to be commissioned upgrade of the plant expected to provide up to 43 ML/day. The relationship between STP flows and the level of treatment provided is illustrated in Figure 2.4.

Sydney Water has decided that partially treated sewerage treatment plant discharges should receive at least full disinfection to less than 150 cfu per 100 millilitres up until the first system overflow discharges. This is the adopted base case abatement level, which may be improved upon, should environmental or other requirement deem it necessary.

Sewerage treatment plants are designed to receive flows from small storms and still fully treat and disinfect wastewater within the limits imposed by their discharge licences. Flows above these levels are experienced for about two to six per cent of the time, or about eight to 20 days per year. Disinfection, as currently designed, is less effective at such high flow rates, and faecal coliform levels rise sharply above the acceptable limit of 150 faecal coliform, units per 100 millilitres.

As a result of wet weather loading, the wet weather modelling predicts that, based on flow rate exceedence of the current 28.4 ML/day full treatment capacity, the STP will experience partially treated discharges on 110 events/10 years with a volume of approximately 4,400 ML/10 years. It should be noted that with the additional capacity expected with the current Stage 3 upgrading works, the number of partially treated discharge events would reduce to 28/10 years.

The relationship between STP flows and the level of treatment provided is illustrated on Figure 2.4. A partially treated STP discharge occurs when the full treatment capacity of the STP is exceeded.

Figure 2.4 Winmalee STP treatment process train

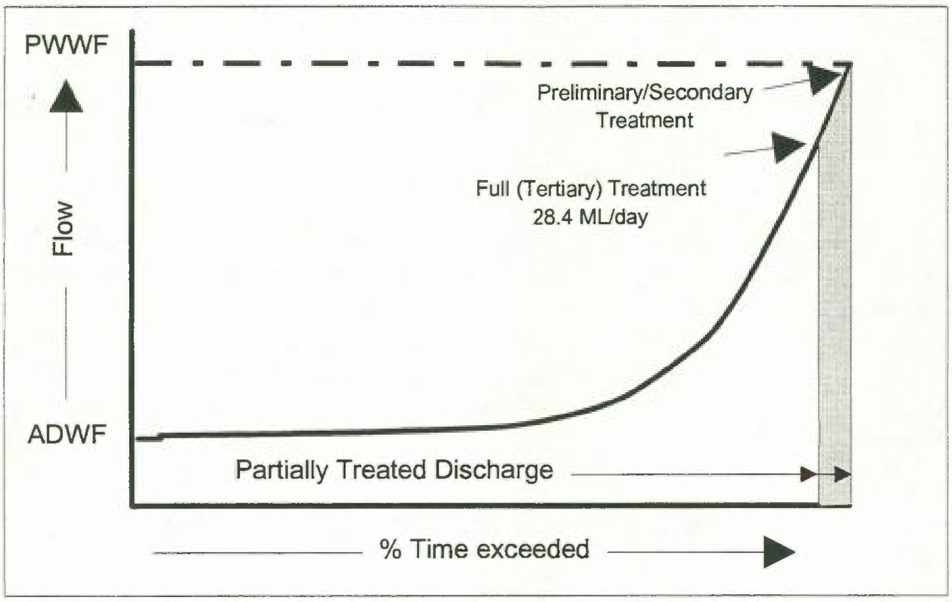

Table 2.7 summarises the existing plant performance with respect to overall levels of treatment.

Table 2.7 - Summary of existing treatment levels for Winmalee STP.

Level of Treatment	Flow able to receive level of treatment	Comments
Preliminary	flow up to 43.2 ML/day	Stage 3 screening and grit removal capacity. Ultimate plant designed to cater for full flow within the normal treatment processes.
Secondary	flow up to 43.2 ML/day[1]	Stage 3 capacity through Continuous Flow Biological Reactor and Secondary Clarification processes. Ultimate plant designed to cater for full flow within the normal treatment processes.
Tertiary	flow up to 28.4 ML/day	Stage 3 capacity through Rapid Mixing and Flocculation, Tertiary Dissolved Air Flotation and Tertiary Filtration. Sludge Thickening and Sludge Dewatering is also available for the full flow capacity. Ultimate plant designed to cater for full flow within the normal treatment processes

Note: 1. Flow able to achieve secondary treatment limited by hydraulic construction at inlet works

Source: Sydney Water 1997a

A program of monitoring the quality of effluent discharged from the licensed discharge point for the Winmalee STP is required as a part of the current STP licence conditions. The standards for effluent from the STP to be achieved under the current licence conditions, together with achieved 50 and 90 percentile values for effluent quality from the plant are shown in Table 2.8. The results indicate that the effluent quality targets of the STP are being achieved.

Table 2.8 - Winmalee licence conditions and STP effluent quality

Parameter	1997/98 licence conditions		Actual STP plant effluent 1996/97	
	50 percentile (mg/L)	90 percentile (mg/L)	50 percentile (mg/L)	90 percentile (mg/L)
SS	10	15	2.0	5.6
BOD	10	15	2.0	3.2
NH_3	5	10	1.0	2.7
TN	20	35	14.7	15.0
TP	2	3	0.7	0.9

Note: SS = Suspended Solids
BOD = Biochemical Oxygen Demand
NH_3 = Ammonia
TN = Total Nitrogen
TP = Total Phosphorus

Source: EPA 1997; Sydney Water 1997c

2.4.3 Surcharges due to chokes

Sydney Water records customer complaints of overflows relating to chokes.

In order to allow identification of the areas worst affected by chokes the number of chokes has been calculated on a per suburb basis. In addition, to allow a reasonable comparison between suburbs, the number of chokes has been "normalised" into chokes per 100 kilometres of sewer as a measure of choke density.

Sydney Water ranked suburbs throughout its area of operations in order of choke density on a system basis, and these have been grouped into one of three categories:

1. low = up to 60 chokes/100 km
2. medium = 61 - 180 chokes/100 km
3. high = more than 180 chokes/100 km.

The choke density in each suburb will be used in conjunction with other information to prioritise subsections of the sewerage system for rehabilitation.

The Winmalee sewerage system was divided into 11 suburbs for this investigation with choke categories as listed below:

1. Katoomba - Medium
2. Leura - Medium
3. Valley Heights - Medium
4. Springwood - Medium
5. Faulconbridge - Medium
6. Hazelbrook - Medium
7. Bullaburra - Medium
8. Winmalee - Low
9. Lawson - Low
10. Wentworth Falls - Low
11. Woodford - Low.

There are no suburbs with a high choke density within the Winmalee sewerage system. Figure 2.5 shows the suburbs within the Winmalee sewerage system, colour coded according to their status of medium or low.

It is possible that the higher densities of chokes can be correlated to the age of the sewerage system and the design standards employed, and certainly some of the oldest sewered areas are represented among the higher choke densities, however, it cannot be assumed that this is purely the reason that some areas are experiencing higher densities of chokes than others. Other factors which may contribute to the occurrence of chokes in a system may include the presence of trees with invasive root systems and defective materials or installation methods during construction.

By comparison, across the entire Sydney Water area of operations, greater than 53 % of sewered suburbs are considered to have low choke density, 40 percent have a medium choke density and seven percent have a high choke density.

Recurring choke problems

A recurring choke is considered to have occurred either when:

1. two chokes occurs at the same location in the space of six months
2. three chokes occur at the same location in the space of two years.

There have been an average 77 recurring chokes per year in the Winmalee sewerage system over the last three years.

Sydney Water considers prevention and rectification of recurring chokes to be a priority in customer satisfaction. Recurring chokes are identified by Sydney Water and rectified as a part on-going program.

Sydney Water has management systems in place to identify and rectify problems resulting in repeat chokes. Recurring chokes are used as an indicator of potential problems in the sewerage system which need to be addressed. When a recurring choke occurs, Sydney Water conducts a site assessment, rectifies the immediate problems and determines whether any rehabilitation or pro-active maintenance is required. In many cases, the problem sewer will either be added to the CCTV inspection program, described in Section 2.2.1, to identify the cause of the recurring choke, or relined in the section affected by the recurring chokes.

Refer to Chapter 3 for further details on impacts of overflows caused by chokes.

2.4.4 Exfiltration

Exfiltration is the leaking of sewage from underground pipes, access chambers and SPSs, into the adjacent ground, thereby potentially impacting upon groundwater and potentially leaching into nearby watercourses. Exfiltration is predominantly a dry weather occurrence (as during wet weather infiltration into the pipes from saturated ground is the more likely occurrence) and generally occur through damaged and cracked pipes and joints.

Sewerage system sub-areas, where infiltration or exfiltration may be occurring can be identified by comparing sewage average dry weather flow (ADWF) data to expected sewage flows based on water consumption data. The quarterly sewage ADWF is calculated from recorded sewage flow data for each gauged sub-area while the expected sewage flow is calculated from metered water consumption per property. This method is used to identify sewers for the infiltration/exfiltration (I/E) rehabilitation program.

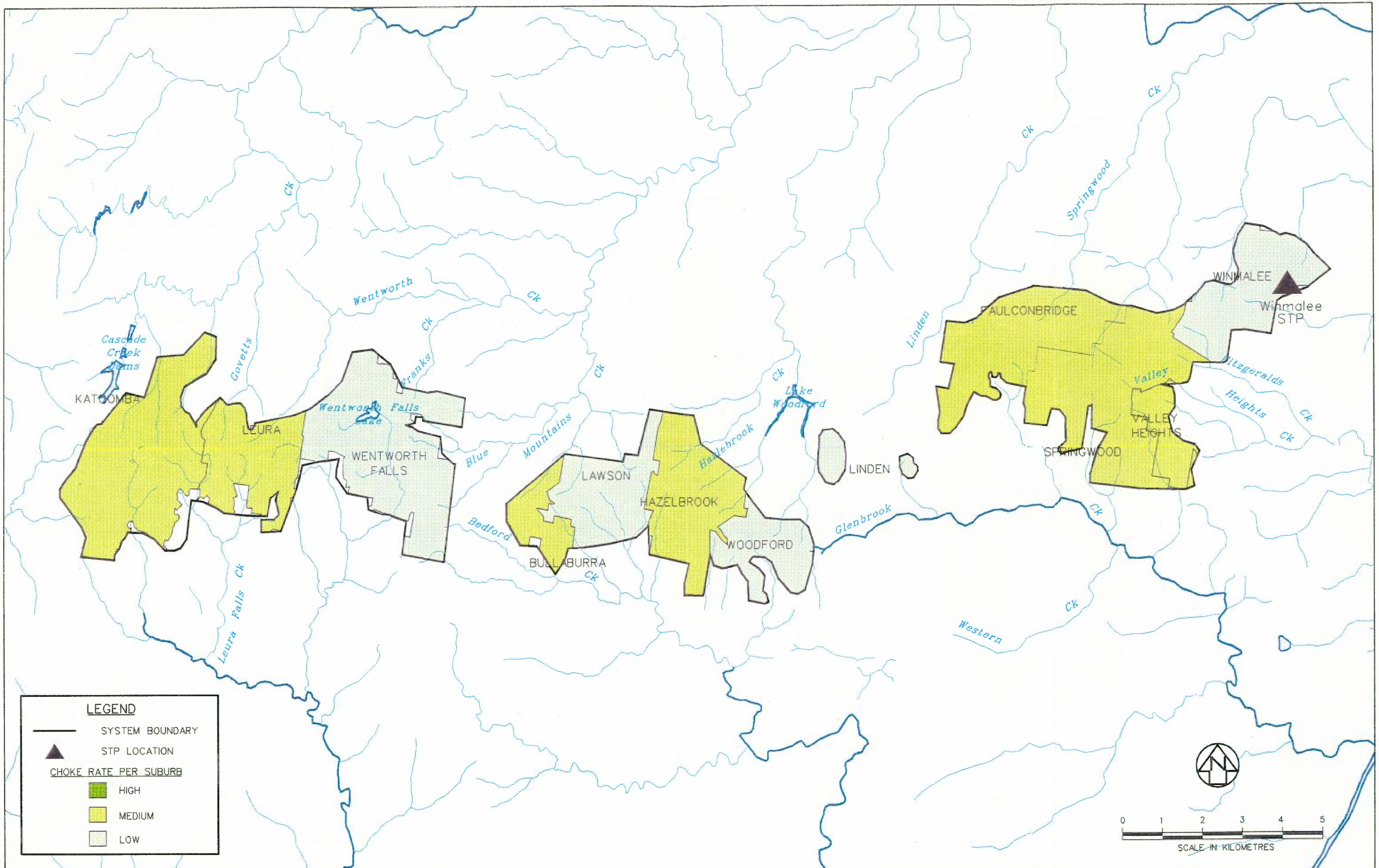

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FIGURE 2-5
CHOKE AREAS

There are four sub-areas where leakage has been identified using this approach, of which three sub-areas have been prioritised as being subject to exfiltration and hence requiring further investigation of potential I/E rehabilitation. These are the Wentworth Falls, Hazelbrook and Valley Heights sub-areas (refer to Figure 2.6). These sub-areas were estimated to have moderate exfiltration potential.

Areas with exfiltration problems can also be identified by examining water quality monitoring data in nearby water courses during dry weather. Median concentrations of faecal coliform bacteria are indicated by values greater than 1000cfu/100 mL in receiving waters during dry weather. Those which cannot be attributed to discharges, such as conventional overflows, are likely to indicate that exfiltration of sewage may be occurring in the area and should require further investigation.

Further to the above I/E identification methods, Sydney Water undertakes monitoring of receiving water zones. In a study of dry weather wastewater discharge to minor surface waters undertaken in Autumn and Winter, 1997, twelve waterways within the Winmalee STP catchment area were sampled during dry weather for the following parameters:

1. conductivity
2. total un-ionised ammonia
3. nitrogen oxides (NOx)
4. total nitrogen
5. total phosphorous
6. faecal coliforms.

Ten waterways were found to be well within the ANZECC guidelines for primary contact recreation and the ANZECC guidelines for protection of aquatic ecosystems. Two waterways, Yosemite Creek and Leura Cascades were found to exceed the ANZECC guidelines for Total Nitrogen. Faecal coliform levels in Leura Cascades exceeded guidelines of 200 cfu/100 ml for primary recreation activities in the autumn, with levels exceeding the guidelines of 1000cfu/100 ml for secondary recreation in the winter. These results for the Yosemite Creek (North Katoomba Sub-area) and Leura Cascades (South Katoomba Sub-area) raises the potential that exfiltration is the likely cause of problems in these sub-systems (AWT EnSight 1997a; 1997b, 1997c). Additional modelling will be required to confirm that exfiltration is the problem.

As the extent of exfiltration problems is difficult to define and locate, and with the potential to affect “sensitive areas”, further investigation is required to determine and define the extent of exfiltration problems in the Winmalee system.

Refer to Chapter 3 for further details on impacts caused by exfiltration.

2.4.5 Overflows caused by SPS failures

The following SPS failures per annum caused by operational failures are estimated by Sydney Water System managers as:

1. seven SPSs experienced one overflow
2. nineteen SPSs experienced an average of three overflows
3. fifteen SPSs experienced an average of six overflows
4. one SPS experienced an average of nine overflows
5. five SPSs experienced an average of 15 overflows.

Although Sydney Water system operators and managers indicate that they are unaware of any SPSs overflowing as a result of insufficient capacity during peak dry weather flow, it was acknowledged that there are several SPSs within the Winmalee system which are operating close to their capacity. This problem is presently being rectified by the Interim SPS Upgrade Program. This program is a current Sydney Water program to upgrade SPSs within the entire Sydney Water area of operations and is a separate program from the SOLP program. SPS 832, 833, 835, 836 and 872 have experienced the highest number of overflows in the Winmalee sewerage system, with overflows generally being caused by insufficient capacity for wet weather flow and/or equipment breakdown.

A total of 214 recorded overflows occur from SPSs in the Winmalee sewerage system on an annual basis, with 181 recorded as occurring within the Blue Mountains REZ and 33 in the Lake Burragorang REZ. A summary of the SPS overflows and locations for the Blue Mountains GA is provided in Table 2.7, Volume 2.

Consultation with Sydney Water system managers and the Blue Mountains City Council indicated that lightning strikes can also cause problems with respect to SPS operation, as they can cause electrical failures of pumping equipment or power supply. To avoid the possibility of overflows in such situations it is important to ensure that telemetry systems exist to provide warning of a breakdown, and a minimum four hours storage capacity is provided to cater for response and rectification times (refer Section 2.2.2)

It should be noted that a number of the SPS overflows occur during wet weather and are incorporated in the predictions made by the wet weather modelling. As discussed in Section 2.4.1, improved model definition is required to determine the frequency and overflow volume from individual locations within each sub-area including SPSs.

Refer to Section 4.1.5 for further details on overflows caused by SPS failure and Appendix B for a full list of SPSs.

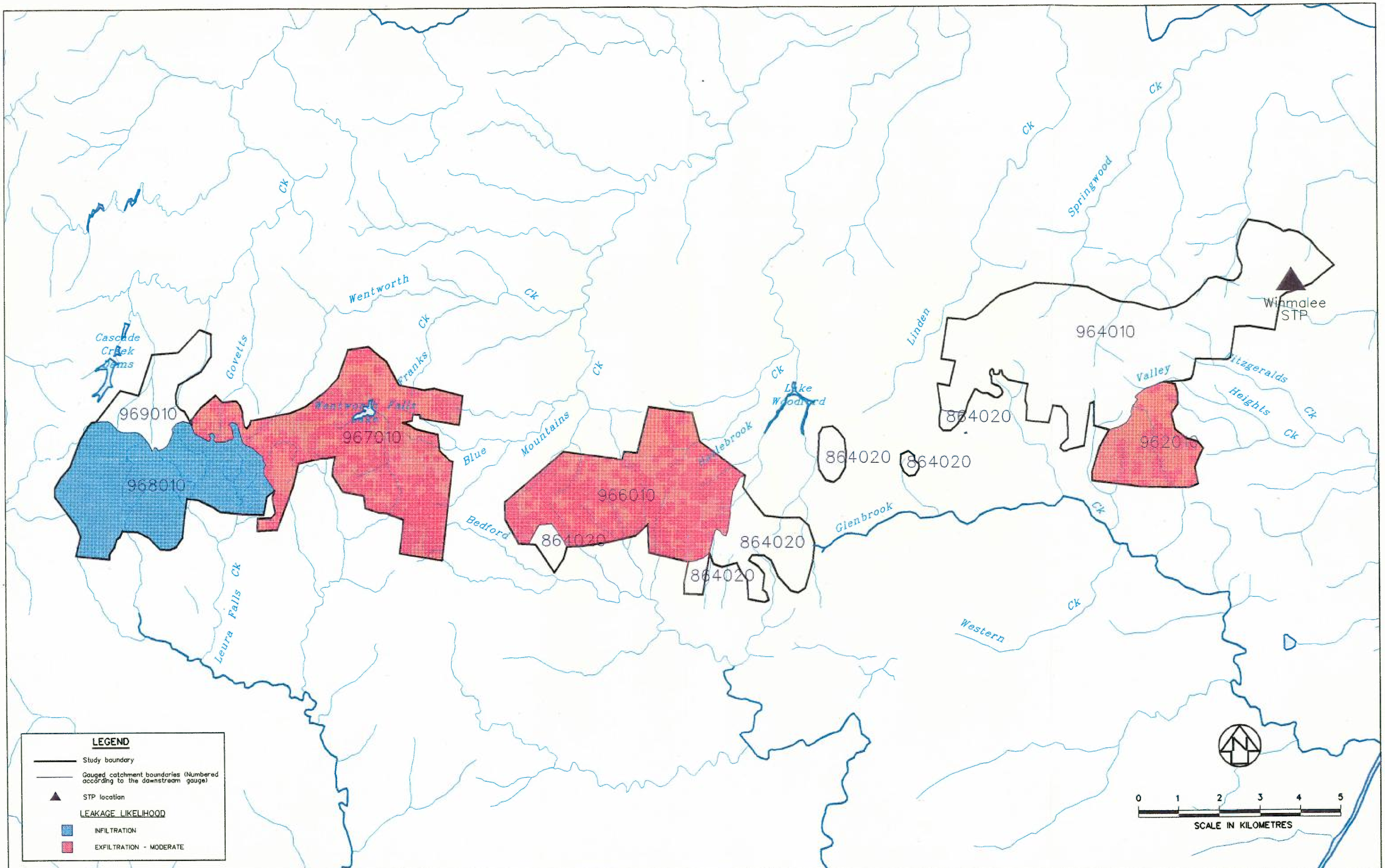
2.4.6 Odours

Emissions of sewage odour may arise from liquid overflows, vents shafts near residential properties or at private rising mains discharging into an access chamber. Emissions of odour close to residential areas may lead to customer complaints

Sydney Water records customer complaints of odour. Four suburban areas in the area served by Winmalee sewerage system have received a number of complaints, higher than the number recorded in the remaining suburbs of the area served by the Winmalee sewerage system and comparable sized suburbs within the total Sydney area of operation. These areas of operation are:

1. Katoomba
2. Springwood
3. Wentworth Falls
4. Faulconbridge.

The number of complaints in a one year period indicates that it is possible that there may be problems within these systems which will require further investigation. Those odour complaints which have been generated from liquid overflows from the system will be addressed as a part of the abatement measures to reduce liquid overflows. It is likely, however, the odours that are caused by problems within the system, such as those emanating from vent shafts and chambers due to long sewage residence time within the system, will need to be specifically identified and rectified. Several have already been identified and rectified, including the vent shaft at the North Katoomba connection to the Blue Mountains Sewage Tunnel, where an odour control device was installed.



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SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 2-6
POTENTIAL INFILTRATION/EXFILTRATION SUB-CATCHMENTS

The low numbers of complaints within the remaining suburban areas of the Winmalee sewerage system indicate that there are no current problems in these systems which are causing emission of odours leading to complaints.

Management practices and responses to complaints, will ensure that any inconvenience caused by odour emissions is minimised, however, complaints within all areas should be closely monitored to ensure no significant increase in the numbers of these complaints.

Refer to Section 4.1.6 for further details on odours.

2.4.7 Summary of system performance

The extent of the overflow problem in the Winmalee sewerage system is summarised in Table 2.9.

Table 2.9 - The extent of the overflow problem in the Winmalee sewerage system

Overflow category	Measure	Performance
Wet weather modelled overflows	% rainfall events resulting in wet weather overflows	9%
	% inflow catchment with rainfall ingress > 10%	2%
	Number of overflow events in 10 years	51
	Modelled overflow volume in 10 years	585 ML
	Most frequently activated reticulation overflow node	North Katoomba
	Number of modelled overflows discharging directly into sensitive areas in 10 yrs [1]	all
	Highest risk ranked designed overflow (against all Sydney wide) [1]	North Katoomba
	Number of STPs in geographic area	3
	Number of partially treated STP discharges in 10 years	110
	Volume of partially treated STP discharges in 10 years[1]	4,400 ML
Surcharges (Chokes and dry weather overflows)	Number and proportion of suburbs in "Low" category	4/11
	Number and proportion of suburbs in "Medium" category	7/11
	% of properties not affected by surcharges	98.4
	Any trunk sewer capacity < 2x PDWF (Yes/No)	no data
	SPS Pump Capacity % with capacity < 2 x PDWF % with capacity 2 - 4 x PDWF % with capacity > 4 x PDWF	 no data no data no data
SPS Failure	Total number of SPSs	61
	Total number of overflows from SPSs(96/97)	214
	Number of SPSs with detention time < than response time	21
	Number of SPSs without alternative power supply	61
	Number of SPSs without standby pumps	11
	Identify highest risk ranked SPS	832, 833, 835, 836, 872, 830, 857, 837, 873, 878
Exfiltration	Number and proportion of potential "Low" exfiltration sub-areas	0/7
	Number and proportion of potential "Medium" exfiltration sub-areas	3/7
	Number and proportion of potential "High" exfiltration sub-areas	0/7
Odours	Suburbs with highest number of odour complaints	Katoomba, Springwood, Wentworth Falls, Faulconbridge

Notes: 1. Only one STP and catchment/ reticulation node was modelled for this system
2. Based on flow rate exceedence of 28 ML/day

2.5 Existing overflow management practices

Management practices used in the Winmalee sewerage system are, in the main, similar to those used in other sewerage systems operated by Sydney Water, as described in Chapter 2, Volume 1.

The Winmalee system has specific problems that need to be addressed. These include:

1. significant increase in sewage flows during seasonal, weekend and holiday periods, due to tourist visits into the area
2. large numbers of old SPSs that do not comply with appropriate SPS design standards in terms of storage capacity, standby pumps and their ability to connect a portable generator, and
3. low temperatures in winter, causing grease to solidify in the SPSs.

Sydney Water has adopted management practices to deal with most of these problems. These include:

1. monitoring of the operation of the system to identify if capacity issues arise due to increased loading from tourist use with the objective of developing methods to accommodate increased flows
2. conducting critical analysis of SPSs and set priorities for upgrading to comply with current design standards
3. frequent flushing of SPSs to prevent grease accumulation and odour.

Sydney Water is implementing a continuous improvement process based upon compliance with long term corporate operating objectives and the USEPA Combined Sewer Overflow Control Policy which is considered as indicative of World Best Management Practices. This improvement process is described in detail in Volume 1.

2.6 Effects of growth

The previous sections described the extent of the Winmalee sewerage system overflows for existing conditions.

The commissioning of the tunnel and the current upgrading of the Winmalee STP will provide sufficient capacity in that carrier and in the STP to cater for population growth to 2021. Population growth in the combined Winmalee system to the year 2021 is likely to increase sewerage loadings, and infiltration and overflow problems. The reticulation system will require augmentation to cater for the increased loadings on the system. This section describes the effect of catchment growth on the Winmalee sewerage system overflows in terms of predicted system performance for the year 2021.

Development in the Winmalee catchment is likely to be accommodated through infill in areas currently zoned for new development or in areas currently nominated as new release areas.

The most likely development scenario for the Winmalee catchment is presented in Table 2.10.

Table 2.10 - Estimated Population [2] in the Winmalee sewerage system catchment 1991- 2021

Sub-area	Area (ha)	Population[1] (Year)	
		1991	2021
North Katoomba	670	3475	6672
South Katoomba	1302	8336	11243
Wentworth Falls	1947	5318	8242
Hazelbrook	1340	5564	9005
Valley Heights	674	2718	3562
Winmalee (pre-tunnel)	3156	12156	16334
New release area 01 Katoomba	30	- (Undeveloped)	904
New release area 02 Lawson	61	- (Undeveloped)	1827
New release area 03 Woodford	149	- (Undeveloped)	4465
New release area 04 Springwood	100	- (Undeveloped)	3016
TOTAL	**9429**	**37 567**	**65 270**

Note: The areas quoted are effective areas used for modelling purposes - ie. not the total actual area of development including open space etc., but assumed sewered areas only

1. residential population plus estimated equivalent population from non-residential customers

2. these population figures do not include allowance for seasonal/tourist influxes of population.

Source: Sydney Water 1997b

This growth represents an increase of 1.7 times the current population and an average annual growth rate of 2.45% over the 30 year period. This growth rate is relatively significant within the region as it is higher than the estimated 1.14% and 1.07% annual growth rates in New South Wales and Sydney, respectively in the recent 1991 - 1996 period (ABS 1997).

Population figures for the system have been modelled based on the estimated permanent population in the system to the year 2021. Accordingly, the figures do not include allowance for seasonal/tourist peak period flows. High seasonal/tourism peaks in some areas of Winmalee sewerage system are anticipated to cause a significant increase in wet weather overflow frequency. These would be expected in areas such as North and South Katoomba and Wentworth Falls, however, increases are less likely away from these traditional tourist areas.

Within the area served by the Winmalee sewerage system, there are a number of new release areas which will be progressively developed for residential purposes and occupied over the short to medium term as listed in Table 2.10 above.

Future wet weather overflow performance

The 2021 performance of wet weather overflows has been modelled using the previous population growth estimates given in Table 2.10. The model assumes that stormwater ingress performance will be maintained for existing catchment areas, but there will be an increased dry weather flow component as a result of population increase. New urban sewered catchment areas are also assumed to have 2% rainfall ingress which will contribute to the total wet weather flow for the existing system and to the STP. This figure is low compared with the estimated maximum of 14% in older sewered areas, as it is reasonable to assume that new sewers will perform better.

The predicted 2021 system performance is summarised in Table 2.11. The number of overflow rainfall events is predicted to increase to 59 in ten years by 2021 for the Winmalee sewerage system without overflow abatement . This compares to a figure of 51 in ten years for the existing conditions (refer to Section 2.4.1)

Table 2.11 - Wet weather overflow performance for future (2021) conditions for the Winmalee sewerage system without any overflow abatement

Location	Modelled Overflow Node	2021 without any overflow abatement in 10 years	
		Number of events	Volume (ML)
North Katoomba	NK1	54	180
South Katoomba	SK1	20	134
Wentworth Falls	WF1	5	41
Hazelbrook	HB1	9	103
Valley Heights	VH1	12	38
Winmalee	WM1	13	150
New release area Katoomba	NR01	10	3
New release area Lawson	NR02	9	2
New release area Woodford	NR03	5	20
New release area Springwood	NR04	5	1
TOTAL		**142**	**672**
STP partially treated discharges#		28	2770

Note: # STP is undergoing capacity augmentation (Stage 3)
Source: Sydney Water 1997b

Discussion of proposed abatement strategies for abatement of wet weather overflows to improve on the predicted performance given in Table 2.11 above is outlined in Chapter 4 of this EIS.

Chapter 3

Environmental Impacts of Overflows

Synopsis

The environmental assessment of overflow impacts is focused primarily on issues that affect large areas of a catchment, or are of catchment-wide concern. Localised impacts are considered only where they affect areas which have been identified as 'sensitive' because of their ecological status, human uses, or cultural values. Overflows are considered to have negligible impact on noise, traffic and land use zoning, although impacts which occur through the implementation of overflow control strategies will be considered in the second stage environmental impact assessment (EIA) prior to any construction.

The assessment of overflow impacts has been carried out in consideration of environmental protection goals recommended by Catchment Management Committees (CMCs) and Community Reference Groups (CRGs). These protection goals include primary contact recreation for most waterways, protection of drinking water supply, protection of aquatic ecosystems and visual amenity. The long-term objective for the Blue Mountains GA is to achieve potable water quality.

Sensitive areas with high biodiversity and community value have been identified to determine if greater overflow containment is warranted to protect their ecological status and value. These include the classified waters, water supply areas, National Park and threatened species habitat.

The impacts on the environment of overflows from the Winmalee sewerage system appear to be localised and are considered to be minor. This is largely due to the relatively small size of this sewerage system and the dominance of other influences on water quality in the area. The major influence on water quality in the area is stormwater runoff from urban areas.

The areas most at risk from overflows are the classified waters inside the Blue Mountains National Park (Class P), or areas used to supply drinking water (Class S Waters).

The terrestrial impacts due to overflows are minor except for potential weed infestation of remnant riparian vegetation and sensitive areas such as sedge swamps and wetlands, as most of the overflows discharge directly to waterways.

Although impacts of overflows from the Winmalee sewerage system are considered to be minor compared to other sources of pollution, a high level of protection is required due to the sensitivity of the area. Chapter 4 describes the proposed strategy for overflow abatement in the Winmalee sewerage system. This strategy focuses on protection of sensitive areas and the community's expectations for the environmental quality of the area.

3. Environmental impacts of overflows

3.1 The sewerage system and receiving environment

Overflows from the Winmalee sewerage system drain to the Blue Mountains and Lake Burragorang Receiving Environment Zones (REZs) within the Blue Mountains Geographic Area (GA) (refer to Volume 2). The location of the Winmalee sewerage system within the Blue Mountains GA is shown on Figure 1.1 of this Volume.

The impacts of overflows within the Blue Mountains and Lake Burragorang REZs are described in Volume 2 of this EIS. This volume identifies the key impacts of sewerage overflows within the Blue Mountains and Lake Burragorang REZs, and attempts to define the relative contribution of overflows from the Winmalee sewerage system.

A major portion of the area served by the Winmalee sewerage system drains north into the Grose River system located within the Blue Mountains REZ, with the balance either draining south into the Kedumba River system which flows to Lake Burragorang within the Lake Burragorang REZ or south and east into tributaries of the Nepean River (Glenbrook and Erskine Creeks) within the Blue Mountains REZ (refer to Figure 2.1).

Urban development served by the Winmalee sewerage system is located along the ridge lines in discrete "villages", including Winmalee, Hazelbrook, Lawson, Bullaburra, Valley Heights, Springwood, Faulconbridge, Wentworth Falls and Katoomba, which skirt both sides of the Great Western Highway. The sewage from these urban areas is transported to the Winmalee STP via the recently commissioned Blue Mountains Sewer Tunnel with the exception of South Katoomba, which is scheduled for connection to the tunnel by mid 1998.

Both REZs are potentially impacted from other sources, particularly stormwater. Issues with regard to the management of stormwater within the area served by the Winmalee sewerage system are controlled by Blue Mountains City Council with input from several organisations including:

1. the Blue Mountains Catchment Management Committee
2. Coxs River Catchment Management Committee
3. Hawkesbury-Nepean Catchment Management Trust (HNCMT).

In addition, Special Areas for the protection of drinking water supplies for the areas draining to Lake Burragorang, Lake Woodford and Cascades are protected by Sydney Water. The HNCMT and the Blue Mountains City Council (BMCC) have identified goals for protection of the environment in the area as discussed in Section 3.1.1 below.

3.1.1 Environmental goals

The Blue Mountains area is an asset of world class conservation value because of its exceptional natural beauty, biodiversity and wilderness values. Due to its close proximity to the major urbanised area of Sydney, the Blue Mountains provide a valuable wilderness and recreational experience for a large local, regional and international visitor population.

The environmental goals for protection of the terrestrial and human environment of the Blue Mountains GA are discussed in Volume 2 (refer to Table 3.1). The HNCMT has divided the Blue Mountains into zones (sub-areas) in order to define goals for protection of the aquatic environment. The Winmalee sewerage system drains into the following zones/areas defined by the HNCMT (HNCMT 1997) and illustrated in Figure 3.1:

1. Grose River Zone - the National Park section of the Grose River Gorge. No urban or rural sections are included in the zone
2. Blue Mountains Ridge Zone - essentially comprising the urban areas from Mount Victoria through to Emu Plains
3. Bedford Creek Zone - Bedford Creek and the catchment between the junction with Erskine Creek and the escarpment along the Great Western Highway
4. Erskine and Glenbrook Creeks Zones - almost wholly within the National Park south of the Blue Mountains Escarpment and containing the catchments of Erskine Creek (excluding Bedford Creek) and Glenbrook Creek
5. Lake Burragorang Zone - consisting of creeks flowing to Lake Burragorang within National Park
6. Blue Mountains Urban Impact Areas - consisting of an area west of Katoomba
7. Sandstone Plateau and Escarpment Area - consisting of an area south west of Katoomba

Aquatic environmental goals identified for the area potentially affected by the Winmalee sewerage system are listed in the following table.

Table 3.1 - Aquatic environment protection goals for the Winmalee catchment

Protection of aquatic ecosystems.
Protection of human consumers of fish and crustacea.
Maintaining visual amenity.
Primary and secondary contact recreation.
Clarification and disinfection of drinking water supply.
Disinfection of drinking water supply (long term goal).
Groundwater without disinfection as drinking water supply.
Protection of water supplies for livestock, farmstead and irrigation.
Protection of industrial water supplies (commercial spring water).

Sources: HNCMT 1997 Coxs River CMC 1995

Overflow abatement strategies for the Winmalee sewerage system will be developed to protect each of these environmental goals (refer to Chapter 4). The primary goal identified for the Blue Mountains GA was potable water quality as it best reflects the desired uses and values of the area (refer to Section 3.1.1, Volume 2).

3.2 Overflow impacts

An overview of existing conditions and overflow impacts within the Blue Mountains and Lake Burragorang REZs is provided in Volume 2 of this EIS. The key impacts, and the relative contribution of Winmalee sewerage system overflows to these impacts, are described below. Sensitive components of aquatic, terrestrial, and socio-economic environments have been given special consideration and are discussed in Section 3.3. The methods by which environmental impacts were identified, and the limitations of these methods are presented in the Methods document.

3.2.1 The extent of the overflow problem

AWT EnSight water quality modelling indicates that on a regional level, the major sources affecting water quality are stormwater runoff from urban areas and STP discharges under dry weather conditions which dominate nutrient loads. STP partially treated discharges in wet weather conditions can impact on recreational water quality (ie. specifically pathogen concentrations affecting primary contact uses such as swimming and boating conditions) but are generally not a major influence on overall water quality.

On a localised level, overflows due to failure of the system have the potential to cause significant impacts. The most common causes of system failure related overflows, include those due to system overload during wet weather, chokes which can cause system overflows during dry weather, exfiltration which occurs during dry weather, and SPS overload or failure.

The number of wet weather overflow events have been predicted for the current conditions and 2021 using the system model developed by Sydney Water (refer to Section 2.4.1). The outputs from the model, based on existing permanent population data, predict that an estimated total of 51 events over ten years would presently occur based on the current system condition and population. This rate of events is estimated to result in an average annual volume of overflow of 58 ML.

It must be noted that the 51 events is the number of events predicted over the system as a whole. One of these events may be the cause of several individual overflow events within the system sub-areas. Under the modelling of the current system and population ,these 51 events/ten years will cause up to 102 individual events/ten years within the sub-areas. Modelling data from Sydney Water (refer to Section 2.4.1) indicates that the majority of the overflow events within the Winmalee sewerage system occur within the North and South Katoomba areas and together they are responsible for more than 60% of these overflow events.

Should Sydney Water not implement overflow abatement works (taking into account population growth as well as the condition of the sewerage systems), the model predicts the number of overflow events would increase to greater than 59 overflow events/ten years by the year 2021, leading to an average annual volume of overflow of 67 ML. The current rate of wet weather events in the ten year period can be maintained to 2021 with the implementation by Sydney Water of an appropriate amount of I/I rehabilitation and overflow abatement strategy (refer to Tables 2.8 and 2.11).

As described in Section 2.1, the Winmalee STP will provide a continuum of sewage treatment which provides a minimum degree of treatment on all flows which pass through the STP. Therefore flows above full treatment capacity will receive a gradual reduction in treatment prior to discharge into the unnamed tributary of the Hawkesbury-Nepean River (refer to Table 2.9).

The Winmalee STP comprises intermittently decanted and aerated lagoons (IDALs) as a part of the treatment process. It is planned that these IDAL ponds will act as stormwater "detention" to capture and control and store excess stormflows which can then be drained and pumped back to the plant inlet for treatment once the peak flows have dissipated.

The number of chokes recorded in the 11 suburbs in the Winmalee sewerage system were assessed as being medium in seven suburbs and low in four suburbs, with an average of 77 repeat chokes per year (refer to Section 2.4.3). The most common cause was blockage of the sewer carrier by tree roots. A combination of operational failure and wet weather conditions is likely to result in critical circumstances leading to a number of these overflows.

Three sub-areas within the Winmalee sewerage system have been identified as having potential exfiltration problems (refer to Section 2.4.4). These are the Wentworth Falls, Hazelbrook and Valley Heights sub-areas. Further assessment of exfiltration is required to confirm the extent of the problem and associated impacts.

There are a total of 49 designed overflow structures in the whole of Winmalee sewerage system, 37 are at SPSs, nine are at carriers and three are at reticulation access chambers.

The Winmalee sewerage system has 61 SPSs which during the past year have experienced 214 overflow events. Sydney Water estimates that, on average, 19 SPSs have overflowed three times, 15 SPSs have overflowed six times and five SPSs have overflowed over 15 times during the past year (refer to Table 2.7, Volume 2). The overflows can either occur during operational failures such as:

1. mechanical/electrical faults
2. interruption to electrical supply
3. inadequate SPS backup (auxiliary pump)
4. or due to inadequate storage and pumping capacity during wet weather flows.

Based on records of odour complaints received by Sydney Water, the suburbs of Katoomba, Springwood, Wentworth Falls and Faulconbridge have been identified as having a greater number of complaints compared to areas in the remainder of the Winmalee Sewerage system and the average number of complaints within Sydney Water's area of operations (refer to Section 2.4.5). This indicates that there may be problems such as retention of sewage within the pipes which are causing these emissions. Further monitoring of the system and the complaints received from the public will be required to confirm the extent of the problem.

The extent of the overflow problem in each sub-area (as defined in Section 2.1)can be further defined by the results of the "Wet Weather Ten Year Time Series modelling data" and a summary of actual events which have occurred and have been investigated and recorded by the AWT EnSight Environmental Response Unit. This does not necessarily represent all significant overflows which may have occurred within the Winmalee sewerage system.

Major overflow events which may result in sewage entering a watercourse are investigated by the AWT EnSight Environmental Response Unit. Water quality samples are taken upstream and downstream of the surcharge point within a few hours of the overflow being reported. In some cases follow up sampling is conducted a few days later.

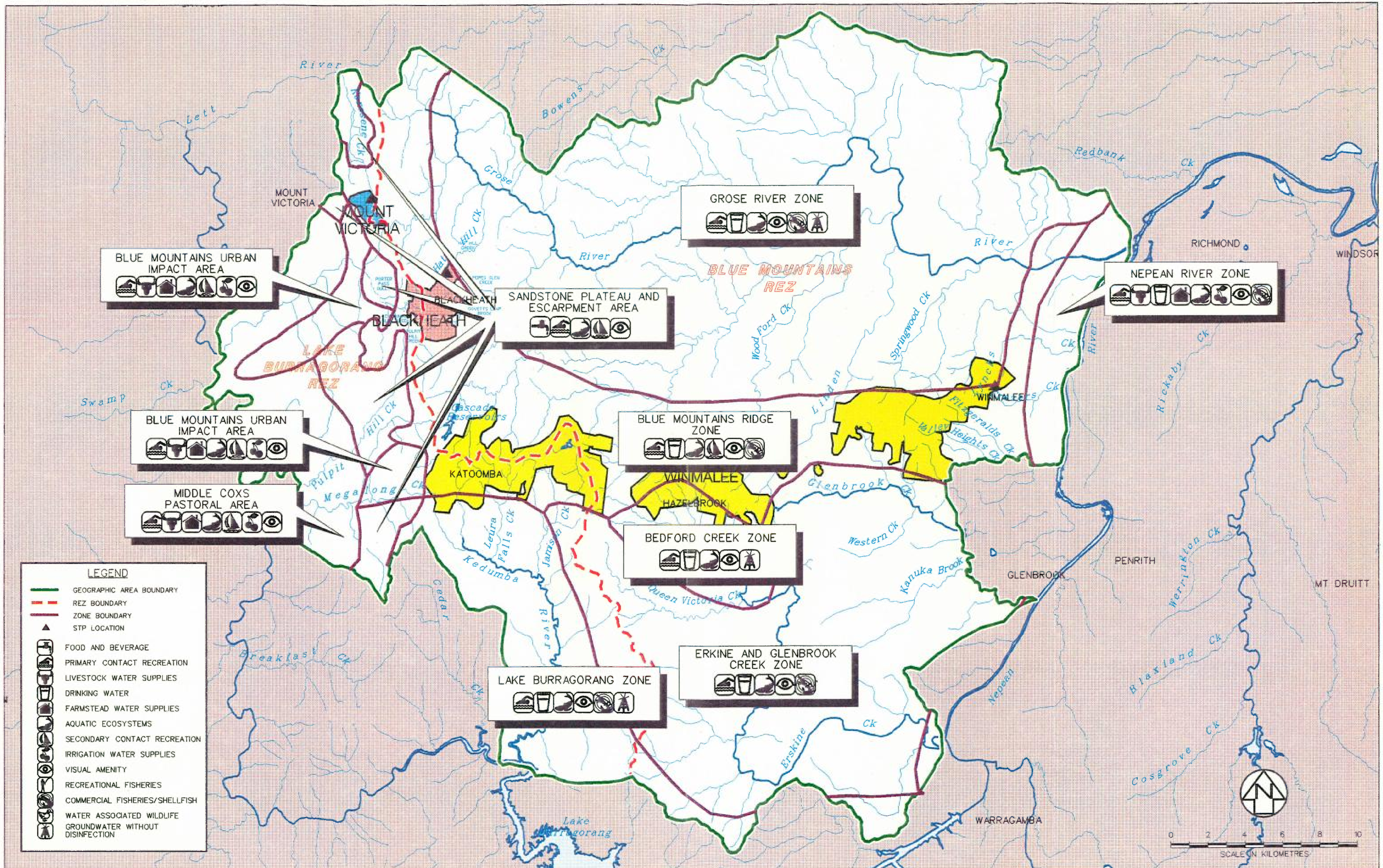
Significant overflow events indicating the major problems within each sub-area are as follows.

Significant overflows in the North Katoomba sub-area

The Wet Weather Ten Year Time Series modelling data (Refer to Section 2.4) indicates that 44 events in ten years are predicted to have occurred within the North Katoomba sub-area.

In North Katoomba, sewerage overflows occur most frequently from access chambers on blocked sewer lines, or from cracked and leaking sewer lines. Sewerage overflow records indicate that a major source of sewerage overflows is from access chambers on a sewer line in the vicinity of Gladstone Avenue and North Street, North Katoomba. The carrier in this area has several sharp bends, and the area appears to be prone to blockages, since all of the significant overflows were situated within close proximity.

The duration of overflow was short on each occasion: three hours in September, 1993; six hours in November, 1993; and 'several hours' in March, 1995 (assumed to be one day). Maintenance crews repaired each fault on the same day they were notified of the overflow. The AWT EnSight Environmental Response Unit arrived at each of the overflow locations within a maximum of three hours of receiving the complaint.



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BLUE MOUNTAINS GEOGRAPHIC AREA

FIGURE 3-1
AQUATIC ENVIRONMENT PROTECTION GOALS

Significant overflows in the South Katoomba sub-area

The Wet Weather Ten Year Time Series modelling data (refer to Section 2.4) indicates 19 events in ten years are predicted to have occurred within the South Katoomba sub-area.

In South Katoomba, sewage overflows occur most frequently from access chambers on blocked sewer lines or from cracked and leaking sewer lines. The duration of overflow was estimated on 13 occasions; six lasted for one to two days; three extended for possibly five days to two weeks; and four were part of a continuous leakage at Leura Park that had been a problem for several years. Many of the overflows were from reticulation and access chambers, mostly affecting water quality in Leura Falls Creek.

Maintenance crews repaired each fault on the same day they were notified of the overflow, except for the work in Leura Park, which required the whole carrier to be replaced and took over a month to repair. The AWT EnSight Environmental Response Unit generally arrived at the overflow location within four hours of receiving the complaint.

Significant overflows in the Wentworth Falls sub-area

The Wet Weather Ten Year Time Series modelling data (refer to Section 2.4) predicted that five events in ten years occurred within the Wentworth Falls sub-area.

In Wentworth Falls, sewage overflows occur most frequently from access chambers on blocked sewer lines or from a cracked and leaking sewer lines.

Records indicate that overflows impacted waters in

1. Valley of the Waters Creek
2. Jamison Creek
3. Water Nymphs Dell
4. Govetts Creek

Significant overflows in the Winmalee sub-area

The Wet Weather Ten Year Time Series modelling data (refer to Section 2.4) predicted that 34 events in ten years occurred within the Winmalee sub-area of which nine incidents occurred in Hazelbrook, 12 in Valley Heights and 13 in Winmalee.

Between July 1990 and December 1995 the AWT EnSight Environmental Response Unit was called out 16 times in response to overflow events that impacted on the immediate receiving waters within the sub-area.

In four overflow events, the sewage surcharge was reported as not reaching the creek. In extreme events the water quality within one kilometre of the creek is significantly impacted as indicated by elevated levels of faecal coliforms and ammonia. In some cases, Sydney Water managed the impact by pumping ponded effluent back into the sewer main and/or flushing the creek with fresh water.

3.2.2 Impacts on the aquatic environment

Introduction

There are many waterways which are potentially impacted by overflows from the Winmalee sewerage system. These include:

1. the Grose River and its tributaries: Wentworth Creek, Woodford Creek, Linden Creek and Springwood Creek; and Erskine Creek and Glenbrook Creek which are tributaries of the Nepean River in the Blue Mountains REZ
2. the Coxs River and its tributaries including Megalong Creek in the Lake Burragorang REZ
3. Kedumba River and its tributaries in the Lake Burragorang REZ.

Most waterways within and surrounding the area served by the Winmalee sewerage system are classified under the *Clean Waters Act 1970* and associated *Clean Waters Regulation 1972.*

The *Protection of the Environment Operations Act, 1997* has been prepared to replace the *Clean Air Act 1961, Clean Waters Act 1970, Noise Control Act 1975, Pollution Control Act 1970,* and *Environmental Offences and Penalties Act 1989.* The new Act is yet to be proclaimed and therefore compliance with the original Act is still required. The new Act is expected to be proclaimed in mid-1998 (refer to Section 3.3.3, Volume 2).

The Regulation prescribes the quality of water which should be met under each classification. The Regulation is legally enforceable as opposed to ANZECC (1992) guidelines which are only advisory (refer to Volume 2 Section 3.6). Waterways classified under this Act and Regulation include the following:

1. Class P Waters - all waters within the Blue Mountains National Park (BMNP) are classified as Class P (Protected Waters) as well as the Coxs River and its tributaries which are outside of the National Park
2. Class C Waters - all waters outside of the BMNP and which flow into Class P waters are classified Class C
3. Class S Waters - waters used for drinking water storage comprising Lake Burragorang and Lake Woodford.

Further to these Classified Waters, there are two Water Supply Special Areas within the area served by Winmalee Sewerage system which are controlled under the *Sydney Water (Catchment Management) Regulation 1995* to protect the quality of drinking water as well as the ecological integrity of these lands (refer to Volume 2 Section 3.6). Drinking water from these catchments is treated in filtration plants with full disinfection. The two areas designated special areas are:

1. Katoomba Special Area - comprising storages and catchments of Upper, Middle and Lower Cascade Dams
2. Woodford Special Area - comprising storages and catchments of Woodford Creek Dam and parts of Hazelbrook, Woodford and Linden.

The immediate receiving waters of the sewerage overflows in the area served by the Winmalee sewerage system are generally Class C Waters. However, nearly all these receiving waters are tributaries of Class P Waters where the regulation states that for Class P - Protected Waters - *"overflows from sewers are not to be discharged".*

Class P, Class S Waters and Special Areas can be situated in very close proximity to urban areas and hence some may be directly impacted by sewerage overflows as well as urban runoff. For example, Class P Waters are actually immediately below the towns of Katoomba and Leura, as the National Park boundary extends up onto the top of the escarpment, and sections of the Woodford Special Area actually contain sewered urban developed areas and are therefore potentially at risk from sewerage overflows.

Localised impacts

Monitoring undertaken following significant overflow events, undertaken by the AWT EnSight Environmental Response Unit, provides an indicator of the localised impacts of sewerage overflows on water quality. The results for the incidents described in Section 3.2.1 are discussed below.

1. North Katoomba - After the overflow events in the Gladstone Avenue and North Street area, as previously described, the results of the AWT EnSight monitoring generally found that the levels of these indicators, recovered to approximately ANZECC Guideline (1992) levels within several hundred metres downstream of the overflow point before Katoomba Creek joins Cascade Creek.
2. South Katoomba - Overflow events in South Katoomba could not be localised in one particular area. The following is a summary of the events which are considered to have created a significant impact on the water quality of the receiving environment.

- Four overflow events from the South Katoomba Carrier SCSK1 discharged raw sewage into the headwaters of the Kedumba River during the period of record (Feb. 1992 - Dec. 1994). Of these, two significantly affected water quality:
  - tree roots caused an overflow for "many days" directly into the Kedumba River from Neale St, Katoomba during February 1992, the wettest month of 1992, when total monthly rainfall peaked at 446 mm. Significant water quality impact was recorded (at a site one kilometre downstream of the overflow point) just upstream of Katoomba Falls, where the habitat of the rare Dwarf Mountain Pine (*Microstrobus Fitgeraldii*) is located (refer to Section 3.2.3)
  - a maintenance crew caused an access chamber surcharge for an estimated one day in July, 1994 as a result of re-lining a reticulation pipe in the area served by the South Katoomba Carrier SCSK1 at Katoomba Falls Road, Katoomba. The water quality impact was significant at a sampling site 200m downstream.
- Leura Falls Creek and its tributaries received sewage from 12 overflow events during the period of record, four of which were part of a continuous leakage problem which was repaired in October, 1993.
- From September to October 1993, four call outs to overflows from leakages in the Leura Falls Carrier SCLP3 at Leura Park documented poor water quality in Leura Falls Creek. Each time the leak was temporarily fixed using bandages, straps, and internal grouting until the entire section of pipeline crossing the creek was replaced with a new pipe in October, 1993. This is the same location that O'Connor (1992) and Currey & Chessman (1995) had reported a suspected continuous leak in the sewer carrier, and was causing consistent poor water quality in Leura Falls Creek upstream of the STP. It is considered that this location had been having a serious impact on the water quality and ecology of upper Leura Falls Creek since at least 1989, and was finally fixed properly in 1993. Sydney Water maintenance crews erected signs to warn against drinking and bathing in the creek. Once the leaks in the carrier were permanently repaired, creek water quality returned to background levels.
- Moderate to significant impacts were recorded for Leura Falls Creek water quality due to one access chamber surcharge from Leura Carrier SCLP3 in Leura Park (a different location to the one described above); one surcharge from a reticulation line on Carrier SCLP3 at Wascoe Avenue, Leura; three from Leura Carrier SCLC7; and four from the South Katoomba SCSK1. These are described below.

- The carrier in Leura Park (SCLP3) leaked for two weeks in July, 1992 and stream water quality had not recovered within 500m downstream of the overflow point during that period.
- The overflow in the reticulation line at 7 Wascoe Ave, Leura lasted about one day in December, 1992 and impacted water quality in Leura Falls Creek for about 100m downstream.
- In October 1992, an overflow event in Leura Carrier SCLC7 at Jersey Avenue and Olympic Parade significantly affected the water quality of Leura Falls Creek, 250m downstream of the overflow point.

- Overflows from smaller reticulation pipes of Carrier SCLC7 significantly impacted the water quality of Gordon Creek (approximately 1.5 km upstream of its confluence with Leura Falls Creek) at two locations:
  - at ponds near 14 Beattie St Katoomba and a further 500m downstream for one day in July 1993
  - at Easter St, one kilometre from the overflow point in December 1994; no estimate of duration was given.
- A collection pipe of South Katoomba Carrier SCSK1 was repaired soon after an overflow event at Clarence and Megalong Streets in December 1995. Sampling carried out in Stormwater Creek (a tributary of Leura Falls Creek) 1.5 hours after the Environment Response Unit was notified, indicated the contaminated water plume had spread 100m downstream from the access chamber surcharge point (just upstream of the Dwarf Mountain Pine habitat).
- Two overflows into Leura Falls Creek occurred within four days from the South Katoomba Carrier SCSK1 at Hope Street, Katoomba in March, 1994. The duration of the first overflow event was one week. Significant water quality impact was recorded 500m downstream of the overflow point. This is one of the locations of the Dwarf Mountain Pine. The second event has no record of duration.

3. Wentworth Falls - Overflow events in Wentworth Falls could not be localised in one particular area. The following is a summary of the events which are considered to have created a significant impact on the water quality of the receiving environment.
   - Data from AWT EnSight callouts indicates that the water quality of a wetland upstream of Valley of the Waters Creek was significantly impacted by an overflow at Scott Ave, Katoomba from the South Wentworth Falls Carrier SCSW7 in February, 1992. Water quality was significantly degraded in the wetland and a further 500 m downstream of the overflow point. Temperate wetlands/hanging swamps such as this are considered to be sensitive habitats due to the high ecological value of their vegetation and associated endangered fauna (refer to Sections 3.2.3 and 3.2.5 below).
   - In July 1992, a power failure caused SPS 868 on Taylor St, Wentworth Falls to overflow for an estimated one week. A spring-fed creek, upstream of Water Nymphs Dell recorded high faecal coliform levels (150,000 cfu/100 ml) at least 500 m downstream of the overflow point (no samples were taken beyond that point). The boundary of Blue Mountains National Park is approximately one kilometre from the pumping station along Water Nymphs Dell. Blue Mountains Creek is approximately two kilometres downstream of Water Nymphs Dell.
   - Two overflow events significantly affected the water quality of Jamison Creek. In September 1992, a power failure caused SPS 867 (Parkes St, Wentworth Falls) to overflow for an estimated one day. The waters of Jamison Creek were significantly impacted (discolouration, high ammonia, and high faecal coliforms) at least one kilometre from the overflow point. It is probable that the water quality of Jamison Creek was affected for a further similar distance downstream, causing pollution at Wentworth Falls and the habitat of the Dwarf Mountain Pine. However, no water quality sampling was taken at this site.

- An access chamber overflow attributed to a choke caused by tree roots occurred for an estimated two weeks from Sandbox Rd, Wentworth Falls during March 1994. The waters of Jamison Creek were directly and significantly impacted to at least 500 m downstream of the overflow point. Discharge from the overflow may have affected the water quality of Jamison Creek for a further kilometre or more downstream, thereby impacting Jamison Creek and the Dwarf Mountain Pine habitat in the National Park. However, no water quality sampling was undertaken at this site.

- The remaining two significant overflow events discharged into Govetts Creek from access chambers. In April 1993, the duration of an overflow event at Govetts Creek was estimated to be one week. Water quality was significantly impacted 100 m downstream of the access chamber discharge. However, all water quality parameters tested returned to background ANZECC (1992) guideline levels 500 m downstream of the overflow point. Therefore, the waters of Govetts Creek within the National Park (one kilometre downstream) were not affected.

- A tributary of Govetts Creek was significantly impacted by an overflow event which lasted for one day in August 1995, at 55 Kings Rd, Leura. Poor water quality was recorded for a distance of at least 500 m downstream of the overflow point.

4. Winmalee - The recorded overflow events in the Winmalee sub-area are spread throughout the different suburbs. Between July 1990 and December 1995 the AWT EnSight Environmental Response Unit was called out 16 times in response to overflow events that impacted on the immediate receiving waters within the area served by the Winmalee sewerage system.

The duration of overflow in these events varied from a few hours to several weeks. In four of these overflow events, the sewage surcharge was reported as not reaching the creek. In extreme events the water quality within one kilometre of the creek was significantly impacted as indicated by elevated levels of faecal coliforms and ammonia. In such cases, Sydney Water can manage the impact by pumping ponded effluent back into the sewer main and/or flushing the creek with fresh water.

In three of the overflow events (9/10/93, 12/10/93 and 11/6/94) follow-up sampling was carried out. The results indicate that water quality had improved within the immediate receiving section of the creek within a few days. The pollution load will move down the creek at a rate corresponding to the creek flow. It may be expected to be diluted as it does so and therefore the impact on water quality will decrease with distance from the discharge point.

In summary the above demonstrates that if the overflow identified acted upon promptly impacts on water quality can be dissipated quickly. There are, however, instances where long term impacts have been caused due to problems in the system which took some time to identify. Once identified and rectified the water quality has returned to acceptable standards.

Contribution of overflows to receiving water nutrient loads

To assist with the assessment of overflow impacts, a water quality model was developed to assist in determining the contribution of overflows to receiving water nutrient loads, and the effect of overflows on achieving the stated water quality goals. It should be noted that the modelling data aggregately comprises overflows from Wentworth Falls, North Katoomba, Winmalee, Hazelbrook and Valley Heights in Winmalee sewerage system, as well as overflows from the Blackheath sewerage system.

Water quality modelling results indicate that sewerage overflows make only a minor contribution to the degradation of water quality in the Blue Mountains REZ and Lake Burragorang REZ (refer to Volume 2). The contribution of Winmalee sewerage system overflows to receiving water nutrient loads, and the effect of these overflows on the achievement of water quality objectives, is discussed below.

Water quality modelling indicates that the combined wet weather overflow volumes from Blackheath and Winmalee sewerage systems contributes 0.8% of total phosphorus loads and 0.3% of total nitrogen loads to the Blue Mountains REZ. The major contributors to Blue Mountains REZ nutrient loads appear to be STP dry weather discharge and stormwater runoff, with sewer overflows making a relatively minor contribution.

Estimates of receiving water nutrient loads from wet weather overflows from the sewerage system are presented in Table 3.2.

Table 3.2 - Current and future annual total nitrogen and total phosphorus loads contributed by wet weather overflows from Winmalee and Blackheath sewerage systems

Conditions	Annual average wet weather overflow volume (ML)	Total nitrogen load (T/yr)	Total phosphorus load (T/yr)
Current (1994)	34	0.54	0.14
Future (2021)	49	0.85	0.16

A comparison between wet and dry weather overflow contributions to nitrogen and phosphorous loads is given in Tables 3.3 and 3.4 for existing conditions and Tables 3.5 and 3.6 for 2021.

Table 3.3 - Existing conditions total phosphorous sources (Blue Mountains REZ)

Source	Wet weather (T/y)	Dry weather (T/y)	Total (T/y)
Wet weather overflows[1]	0.14	No dry weather load	0.14 (0.8%)
Catchment runoff/ baseflow[1,2]	8.88	Small component of catchment load source under dry weather conditions. Generally less than 5% contribution	8.88 (49%)
STP discharges[3]	0.8	8.4	9.2 (50%)
Exfiltration	Exfiltration catchments contribute to wet weather stormwater load - small contribution assumed in wet weather	Exfiltration catchments contribute to dry weather baseflow loads. Unknown contribution to catchment baseflow load.	Unknown
Surcharges/chokes	Negligible loads reach waterways, included as component of catchment baseflow load	Negligible loads reach waterways, included as component of catchment baseflow load	Unknown
Total	**9.82**	**8.4**	**18.2**

Notes:
1. Wet weather loads as predicted by the water quality model (AWT EnSight 1997)
2. Modelling undertaken provided a total load sourced from the catchment. There is a component of baseflow/point source load in this calculation. Previous modelling undertaken by Sydney Water indicated that this catchment nutrient load is sourced mainly from larger wet weather events and that dry weather source loads are generally less than 5% contribution
3. Total STP load is estimated from modelling. Dry weather loads are estimated by AWT EnSight

Table 3.4 - Existing conditions total nitrogen sources (Blue Mountains REZ)

Source	Wet weather (T/y)	Dry weather (T/y)	Total (T/y)
Wet weather overflows[1]	0.54	No dry weather load	0.54 (0.3%)
Catchment runoff/ baseflow[1,2]	120.6	Small component of catchment load source under dry weather conditions. Generally less than 5% contribution	120.6 (68.7%)
STP discharges[3]	5.2	49.4	54.6 (31%)
Exfiltration	Exfiltration catchments contribute to wet weather stormwater load - small contribution assumed in wet weather	Exfiltration catchments contribute to dry weather baseflow loads. Unknown contribution to catchment baseflow load.	Unknown
Surcharges/chokes	Negligible loads reach waterways, included as component of catchment baseflow load	Negligible loads reach waterways, included as component of catchment baseflow load	Unknown
Total	**126.3**	**49.4**	**175.8**

Notes: 1. Wet weather loads as predicted by the water quality model (AWT EnSight 1997)

2. Modelling undertaken provided a total load sourced from the catchment. There is a component of baseflow/point source load in this calculation. Previous modelling undertaken by Sydney Water indicated that this catchment nutrient load is sourced mainly from larger wet weather events and that dry weather source loads are generally less than 5% contribution

3. Total STP load is estimated from modelling. Dry weather loads are estimated by AWT EnSight

Table 3.5 - Future (2021) conditions total phosphorous sources

Source	Wet weather (tonnes/yr)	Dry weather (tonnes/yr)	Total (tonnes/yr)
Wet weather overflows[1]	0.16	No dry weather load	0.16 (1.5%)
Catchment runoff/ baseflow[1,2]	8.88	Small component of catchment load source under dry weather conditions. Generally less than 5% contribution	8.88 (8.5%)
STP discharges[3]	0.48	1.64	2.12 (13.5%)
Exfiltration	Exfiltration catchments contribute to wet weather stormwater load - small contribution assumed in wet weather	Exfiltration catchments contribute to dry weather baseflow loads. Unknown contribution to catchment baseflow load.	Unknown
Surcharges/chokes	Negligible loads reach waterways, included as component of catchment baseflow load	Negligible loads reach waterways, included as component of catchment baseflow load	Unknown
Total	**9.52**	**1.64**	**11.16**

Notes: 1. Wet weather loads as predicted by the water quality model (AWT EnSight 1997)

2. Modelling undertaken provided a total load sourced from the catchment. There is a component of baseflow/point source load in this calculation. Previous modelling undertaken by Sydney Water indicated that this catchment nutrient load is sourced mainly from larger wet weather events and that dry weather source loads are generally less than 5% contribution

3. Total STP load is estimated from modelling. Dry weather loads are estimated by AWT EnSight

Table 3.6- Future (2021) conditions total nitrogen sources

Source	Wet weather (tonnes/yr)	Dry weather (tonnes/yr)	Total (tonnes/yr)
Wet weather overflows[1]	0.85	No dry weather load	0.85 (0.3%)
Catchment runoff/ baseflow[1,2]	120.6	Small component of catchment load source under dry weather conditions. Generally less than 5% contribution	120.6 (40%)
STP discharges[3]	6.6	172.5	179.1 (60%)
Exfiltration	Exfiltration catchments contribute to wet weather stormwater load - small contribution assumed in wet weather	Exfiltration catchments contribute to dry weather baseflow loads. Unknown contribution to catchment baseflow load.	Unknown
Surcharges/chokes	Negligible loads reach waterways, included as component of catchment baseflow load	Negligible loads reach waterways, included as component of catchment baseflow load	Unknown
Total	**128.1**	**172.5**	**300.6**

Notes:
1. Wet weather loads as predicted by the water quality model (AWT EnSight 1997)
2. Modelling undertaken provided a total load sourced from the catchment. There is a component of baseflow/point source load in this calculation. Previous modelling undertaken by Sydney Water indicated that this catchment nutrient load is sourced mainly from larger wet weather events and that dry weather source loads are generally less than 5% contribution
3. Total STP load is estimated from modelling. Dry weather loads are estimated by AWT EnSight

To facilitate more accurate input data to future model runs, more specific data is required regarding the receiving water nutrient loads for Winmalee. Chapter 4 provides details recommendations to improve the existing database on overflow events and hence assess their relative environmental impacts

Effect of overflows on meeting water quality objectives

Water quality modelling results presented in Tables 3.3 to 3.6 indicate that wet weather overflows from the Winmalee sewerage system make only a minor contribution to nutrient concentrations in Blue Mountains REZ, and that STP dry weather discharges and urban stormwater runoff are the major sources of contamination (AWT EnSight 1997). Furthermore, the modelling indicates that although there would be a minor decrease in pollutant concentrations in Blue Mountains REZ if all wet weather overflows and wet weather STP discharges were removed, there would be little or no improvement in the percentage of time that nutrient concentrations comply with criteria for the protection of aquatic ecosystems, or the percentage of time that faecal coliform concentrations comply with criteria for primary contact recreation (refer to Section 3.2.4 for discussion of faecal coliform results).

It should be noted, that the water quality modelling results are indicative only of catchment-wide impacts within the major receiving waterways. Impacts not identified by the modelling may occur within localised areas, particularly within minor tributary streams. The main impact of overflows at the localised level is likely to be an increase in bacteriological levels in the waterway immediately following an overflow event. For this reason, it is important that overflow control strategies take into consideration the need to further identify and quantify overflow locations.

Additionally, the water quality modelling data provides no information on the impacts of overflows caused by system failures including chokes, SPS failures, and exfiltration. Response times by Sydney Water to reported choke related overflows and SPS failures are generally adequate and hence minimise potential impacts from system failure related overflows. However, as these types of failures can occur during dry weather, (and hence consist of full strength sewage) in remote areas, the potential exists that they may go unreported and hence unresponded. Therefore, there is still a potentially high risk of impact from these type of failures. The absence of information for choke related overflows and SPS failures should therefore be improved to more accurately define the extent of the problem.

The sewer modelling carried out to date for the Winmalee sewerage system indicates that the exfiltration problem for each sub-area varies from a moderate to negligible exfiltration problem. Due to limitations in the modelling and the lack of adequate water quality monitoring data, the occurrence and associated impacts of exfiltration will require further investigation particularly since discharge volumes and associated pollutant pathways into potentially sensitive environments are currently unknown.

Summary of impacts upon aquatic ecology

Sewerage overflows have the potential impact on aquatic flora and fauna through the introduction of additional nutrients and toxicants into the waterways (refer to Volume 2, Section 3.7 - 3.3.8).

Due to a limited amount of comprehensive data for aquatic flora and fauna in the area, water quality information from within the Winmalee sewerage system has been used to estimate the impact of sewerage overflow on aquatic flora and fauna.

The water quality data indicates that impact from sewerage overflows on a regional basis were minor compared to other sources, such as urban stormwater runoff. However, the AWT EnSight Environment Response Unit has recorded more significant water quality impacts in localised areas following significant overflow events. Provided the overflows are identified and acted upon promptly the impact on water quality can be dissipated quickly and the consequent impact on aquatic environments minimised.

Ecological and human health risk assessment

Sydney Water has undertaken a ecological and human health risk assessment (ERA) for 37 areas potentially impacted by the operation of Sydney Water's sewerage systems. Representative sites have been selected for each GA for the purpose of evaluating the potential impacts of chemical and non-chemical toxicants from wet weather sewerage overflows. In order to assess the contribution of overflows discharge to wet weather receiving water quality, stormwater and STP discharges were evaluated. In addition the benefits, in terms of risk reduction, from overflow abatement were assessed. The following sites were chosen for the Blue Mountains GA (refer to Figure 3.2):

1. Junction of Grose River and Nepean River at Richmond
2. Unnamed Creek downstream of Winmalee STP
3. Hat Hill Creek downstream of Blackheath STP.

These three sites were subjected to an initial risk evaluation which identified potential risks to aquatic life and human health under present conditions. The level of analysis is described in Volume 2, Section 3.3.4. A detailed assessment for each of the three sites is provided in Volume 2, Appendix C.

The risk evaluation indicated that potential risk to aquatic life from sewerage overflows was negligible, however, a potential risk to aquatic life from exposure to chemicals in stormwater and STP dry weather discharges was predicted (Sydney Water, 1996).

Effect of flooding on sewerage system operation and overflows

As discussed in Volume 2 - Section 3.2, the areas serviced by the Winmalee sewerage system in the Blue Mountains GA are not flood prone areas and therefore the affect of flooding on overflows is minor.

3.2.3 Impacts on the terrestrial environment

Impacts on terrestrial ecology

Many valuable terrestrial ecosystems are preserved within the Blue Mountains National Park. In particular, certain vegetation types such as hanging swamps and rainforests are not well represented within the National Park and as a result, have been identified in the Blue Mountains Environmental Management Plan as being of high environmental sensitivity (Mitchell McCotter 1984). Similarly many species of fauna are reliant upon often rare vegetation for habitat and require good water quality for survival.

The potential impacts on the terrestrial environment from sewerage overflows will differ depending upon whether the event occurs in dry or wet weather. Dry weather overflows can potentially have a more localised impact by providing a more concentrated nutrient supply in the soil to encourage the growth of exotic plants. Also, concentrated flows of undiluted raw sewage flowing into a waterbody which, during dry weather is not able to flush, can potentially contaminate a water supply to native fauna.

The impacts of sewerage overflows on terrestrial fauna during wet weather overflows is expected to be minimal as the potential threats to the terrestrial environment are more diluted and are more likely to be able to be flushed through the watercourse.

A detailed discussion of impacts on threatened terrestrial flora and fauna is provided in Section 3.3.1 of this volume and Section 3.4 of Volume 2.

Potentially impacted threatened flora and fauna at high risk from overflows from the Winmalee sewerage system and their status under the *Threatened Species Conservation Act 1995* are listed below:

Flora

1. *Acrophyllum australe* (vulnerable)
2. *Epacris sparsa* (vulnerable)
3. *Eucalyptus benthamii* (vulnerable)
4. *Microstrobus fitzgeraldii* (vulnerable).

Fauna

1. Giant Burrowing Frog (vulnerable)
2. Southern Barrel Frog (vulnerable)
3. Red-crowned Toadlet (vulnerable)
4. Blue Mountains Swamp Skink (endangered).

Locations at which these species have been sighted have been identified as "sensitive areas" for the purposes of this study (refer to Figure 3.2 and Section 3.3), however it should be noted that the habitats occupied by these species are likely to be more extensive than indicated by the individual isolated sightings recorded by NPWS.

The native terrestrial fauna which are most likely to be impacted by sewerage overflow events from the Winmalee sewerage system are those which inhabit the swamps and wetland areas immediately down-slope of discharge points. Significant surcharges into these areas may stand for several weeks resulting in poor water quality and therefore, impacting on the invertebrate food supply.

The impact on non-wetland based terrestrial environments is considered to be low as sewerage overflows impact only a small area in comparison to the home range of most species.

Dry weather overflows such as chokes, SPS overflows and exfiltration, within terrestrial areas may cause weed growth through soil nutrient enrichment, disturbance of the soil surface, and addition of non-native plant seeds which are carried in overflows. These effects are likely to be localised, and the impacted areas are small in comparison to habitat ranges for native flora and fauna. Furthermore, other factors such as urban stormwater runoff, conversion of land for housing, and erosion caused by flood flows, are likely to have far greater impacts on terrestrial ecosystems on the receiving environment of Winmalee sewerage system than those caused by sewerage overflows. These effects are likely to result in increased nutrient and other pollutant loads into terrestrial areas as well as an increasing the likelihood of sedimentation and spread of weed growth.

Refer to Volume 2, Tables 2.5 and 2.7 for summaries of dry weather related overflows - chokes and SPS failures in the Blue Mountains REZ and the Lake Burragorang REZ.

Impacts of overflows on topography, soils and erosion

The soils in the Winmalee sewerage system are variable in erodability (refer to Section 3.4.3, Volume 2). Field investigations indicate erosion problems occur, particularly where access tracks to pumping stations are unsealed and in steep locations. The sewerage overflow discharge volume, duration and frequency are relatively low compared to stormwater flows, and therefore the potential for erosion to occur due to sewerage overflows is considered to be minor. There is, however, potential for erosion to occur at the outlet from the Winmalee STP as high flows can be discharged into a naturally formed and unprotected waterway.

3.2.4 Impacts on the socio-economic environment

Sewerage overflows may affect socio-economic environments through direct exposure of human populations to overflow discharges, or indirectly through their adverse affects on the biophysical environment. The main impacts on socio-economic environments in the Blue Mountains REZ were identified in Volume 2 as follows:

1. risks to human health as a result of exposure to toxicants or pathogens through pollution of water storages or water-based or terrestrial recreation areas
2. potential impacts on recreational values
3. potential impacts on visual amenity of waterways and terrestrial areas
4. potential impacts on community amenity as a result of odour discharges.

Risks to human health

Based on receiving water quality modelling data (AWT EnSight 1997) (refer to Section 3.2.2 and Tables 3.3 to 3.6), the impacts on public health from microbes and blue-green algae growth due to nutrients in the area served by Winmalee sewerage system are likely to be generally low by comparison with the ongoing impacts of STP dry weather discharge, urban runoff and other discharges into the receiving systems.

Water supply storages potentially affected by sewerage overflows from the Winmalee sewerage system include Lake Burragorang and Lake Woodford.

In order to ensure full potential of drinking water supply storages Sydney Water enforce a multi-barrier approach to catchment protection. This includes a range of measures designed to protect water supplies including:

1. the establishment of exclusion zones
2. distance attenuation (careful siting of storages away from urban areas)
3. water filtration and chemical treatment at water reservoirs.

This system provides comprehensive protection from overflow events which typically result in localised impacts in areas remote from water storages.

In the case of Lake Burragorang, the greatest potential impact would be from the South Katoomba sub-area and specifically dry weather discharges from the South Katoomba STP. Due to the distance between the last overflow point in the South Katoomba sub-area and Lake Burragorang and the effect of dilution over this distance, and the fact that South Katoomba STP will shortly be decommissioned, the impact on public health from this area is considered to be low. Once the South Katoomba STP is decommissioned, sewage from the South Katoomba sewerage system will be directed to the Blue Mountains Sewerage Tunnel for treatment at Winmalee STP. Potential impacts from this source will therefore be removed.

With regard to the Woodford Special Area, urban development already exists within the catchment area for Lake Woodford. This drinking water catchment is therefore at potentially risk from sewerage overflows and urban runoff. The significance of this is recognised by Sydney Water and initiatives to remove risks to this Special Area are already been implemented. This includes the recent decommissioning of three SPSs which operated in the area. These have been connected directly to the Blue Mountains Sewage Tunnel, thereby reducing this overflow risk. All drinking water from Lake Woodford area is filtered and disinfected.

An initial risk evaluation of chemicals posing potential health risks was compiled using data on 114 chemicals defined by Schedule 10 of the Sydney Water (Corporatisation) Act 1995. Refer to Volume 2 Section 3.3.7 - Ecological and Human Health Assessment). Results have shown that the majority of these chemicals are not of concern in the measured sewer overflow discharges (refer to Section 3.5.4 Volume 2). The risk assessment involved determining the potential health risks associated with incidental ingestion of contaminated fresh water from the Unnamed Creek downstream of the Winmalee STP. This could occur due to people swimming or undertaking other activities during or shortly after a sewer overflow or stormwater discharge. Potential risks were assessed using short-term drinking water guidelines which protect public health when 1-2 litres/day of water are consumed over several days, and employing a conservative approach assuming no dilution and 100 percent chemical availability.

The initial risk evaluation showed that there was no human health risks from the incidental ingestion of water while swimming or wading in a waterbody (refer to Section 3.5.4, Volume 2 and Appendix C, Volume 2).

Impacts on recreational values

The waterways within the area served by Winmalee sewerage system have the potential to provide many recreational and educational opportunities such as swimming, bird watching activities, provision of scenic features within recreational areas and provision of wildlife habitats. On a broader scale, they also provide further recreational and educational opportunities of a wilderness nature due to the steep topography and scenic gorges in the surrounding area.

The uses of these waterways is dependant upon the depth of water, accessibility, cleanliness, and adjacent land uses. In terms of the impact of the sewerage overflows, it is the quality of the water which is most affected. At present there is a varying degree of quality of the waterways, to which sewerage overflows are a contributing factor, and the waterways cannot be utilised to their greatest potential.

Impacts on recreation values are related largely to human health risks from faecal contamination including primary and secondary contact recreation activities. Water pollution, solids and turbidity may also reduce the visual amenity of an area for recreational use

Overflows can occur at specific built structures, access points, and damaged sections of the sewerage pipe network, which are located at varying distances from either natural or man-made drainage lines. The overflow from these points is a flow of untreated sewage which has odour and possible solid substances. These overflow points and the overflow itself will affect the value of recreational activities depending on proximity to the recreational activity, visual prominence and location adjacent to associated built structures such as SPSs. If the overflow point is part of a SPS, the structure has a higher visual prominence.

There is a lack of quantified data on the impact of overflows and subsequent water quality on recreational values in the receiving environment of the Winmalee sewerage system. Accordingly, the following information focuses on existing recreational values in each sub-area and the potential impact from nearby overflow points.

North Katoomba sub-area

There is a potential environmental impact on the recreational value of the area served by the Winmalee sewerage system, as one overflow point (SPS 936) exists within an area of recreational value. Overflow from this point discharges directly into a tributary of Yosemite Creek which runs through Minni-Ha-Ha Reserve and Picnic area. An overflow occurrence would impact on the recreational value as the site is used for picnicking, bushwalking, and potentially swimming. Beyond this point, the creek drains into the Blue Mountains National Park. There is potentially further impact on the recreational value of the National Park, as the area is used for activities such as bushwalking, swimming, camping, orienteering, viewing from observation areas and ornithological (bird watching) activities.

Within the North Katoomba sub-area, Yosemite and Katoomba Creeks indirectly receive overflow from the sewerage system. These creeks have the potential to provide recreational and educational opportunities such as swimming, ornithological activities, scenic features and the provision of wildlife habitats. On a broader scale, Yosemite Creek and Katoomba Creek flow to a number of waterfalls and into the Grose River, a major wilderness area and popular walking trail environ.

Overflows have the potential to enter the Blue Mountains National Park. The community has a high expectation for the protection of the wilderness and natural beauty values of the National Park and hence the significant potential impacts upon the recreational activities within the National Park are unacceptable.

South Katoomba sub-area

Areas within the South Katoomba sub-area which are potentially affected include Katoomba Falls Reserve and the adjacent section of the Blue Mountains National Park, along the Kedumba River and Leura Falls Creek, respectively. These sites provide a range of recreational activities including bush walking along formal man-made tracks, self-guided bush walking, bird watching, picnicking, swimming, camping and abseiling. The environmental impact upon the recreational values of the South Katoomba sub-area, is potentially high with sewerage system overflow discharging predominantly into areas of public open space used for recreation.

The overflow point at the base of Leura Falls, for example, experiences a significant amount of pressure, from a high velocity of flow. As the overflow point is adjacent to a formal walking track, the pipe structure and odour affects the recreational value of the area.

On a broader scale, the various waterways within the area served by South Katoomba sub-area drain ultimately into the Coxs River which is also used for recreational and educational uses, however as these waters are some distance away from the overflow source, the impact is expected to be dissipated.

Overflows from the sewerage system have the potential to impact on the beneficial uses of the waters. Pollutant loadings on receiving waters (including the discharge of sewerage overflows) result in reduced opportunities for both primary and secondary recreational usage.

Wentworth Falls sub-area

The environmental impact upon the recreational values of the Wentworth Falls system is minimal with three quarters of the sewerage system overflow discharging into areas of limited recreational value. These receiving areas are predominantly bushland adjacent to residential subdivisions, which are not designated as sites for recreational use, and therefore are of minimal recreational value. The overflows are at distances varying from 1- 700 metres from creek lines, all being tributaries of the Coxs and Grose Rivers.

Areas such as Valley of the Waters Creek within the National Park may have their recreational values impacted from overflows due to SPS failure.

Overflows can discharge into areas of public open space which include areas of Blue Mountains National Park, Wentworth Falls Lake, Wentworth Falls Country Club Golf Course, and receiving waterways including:

1. Jamison Creek
2. Blue Mountain Creek
3. Franke Creek
4. Govetts Creek
5. Valley of Waters Creek
6. Gordon Creek.

These waterways have the potential to provide many recreational and educational opportunities such as swimming, ornithological activities, irrigation (golf course), scenic features and provision of wildlife habitats as an educational resource. Wentworth Falls Lake has been found to be subject to high faecal levels possibly from exfiltration from nearby sewer lines (refer Section 3.2). Pollutant loadings on receiving waters (including the discharge of sewerage overflows) result in reduced opportunities for both primary and secondary recreational usage.

Winmalee sub-area

There is minimal environmental impact on the recreational values of the area as sewerage system overflows discharge predominantly into areas of limited recreational value. These receiving areas consist primarily of areas adjacent to residential subdivisions, which are not designated sites for recreational activity, and are therefore of minimal recreational value. The overflow points indirectly discharge into numerous creeks and tributaries of the Grose and Nepean Rivers, and occur at distances varying from 20-700 metres from the creek lines. The potential impact on the recreational value of these creeks is moderate.

Some overflows discharge into areas which are public open spaces used for recreation including Else Mitchell Park, sections of Sassafras Gully Creek and Magdala Creek and the Blue Mountains National Park. Recreational activities within these sites include picnicking, formal walking tracks, swimming, bush walking, informal camping, orienteering, abseiling, ornithological (bird watching) activities, and viewing from observation areas and also provide formal and informal play areas for children.

The receiving waterways within the area include:

1. Dantes Glen
2. Hazelbrook Creek
3. Walkers Glen
4. Springwood Creek
5. Magdala Creek
6. Blue Gum Swamp Creek
7. Birdwood Gully
8. Lawson Creek
9. Shaw's Creek
10. Corrine Creek
11. Linden Creek
12. Sassafras Gully Creek
13. Frasers Creek
14. Bedford Creek
15. Faulconbridge Creek
16. Glenbrook Creek
17. Long Angle Creek
18. Erskine Creek
19. Lynchs Creek.

The impacts of overflows from the Winmalee system on recreational values are considered to be moderate as the majority of overflows drain to waterways within areas used for recreation. Localised impacts may occur however as a result of odour emissions, solids contained in sewerage, or temporary reduction in the water quality of adjacent creek lines. These impacts are likely to be localised and usually short term in duration.

Impacts on visual amenity of waterways and terrestrial areas

Sewer overflows may impair the visual quality of the environment by depositing debris and solids within areas frequented by humans such as residential areas, recreation reserves, waterways and tourist sites. They may also impair the visual quality of the environment indirectly by contributing to weed infestation or algal growth around outlet points. The visual impacts of overflows are, however, generally localised.

The significance of the visual environment within the Blue Mountains region is represented by the Australian Heritage Commission's listing of the area as a place of scenic and conservation value.

Visual impacts within each sub-area will generally vary depending on whether the overflow points are located in the vicinity of both bushland and residential areas. Overflows in locations close to residential areas or in bushland areas with public access will have a high visual impact and are termed as areas of high visual amenity.

Areas of high visual amenity refers to those sites which either have a visually prominent designed overflow structure or receive sewerage overflow, and are recreational sites of high value and/or exhibit a high degree of visual amenity.

Areas of high visual amenity within the Winmalee sewerage system are located within the South Katoomba, Wentworth Falls and Winmalee sub-areas and generally result in moderate levels of visual impact.

Table 3-7 sets out the areas of high visual amenity within the system, the rationale as to its classification, and the relative key impacts associated with each area.

Table 3-7 - Areas of high visual amenity in the Winmalee sewerage system

Nominated sensitive environment	Rationale	Key impact/s
Gates Avenue	High visual access of overflow and overflow point within picnic area. High frequency and duration of view of overflow.	Visual amenity Recreational value
Blue Mountains National Park	High visual access of overflow and overflow points. Potentially high frequency of view of overflow and overflow points.	Visual amenity Recreational value
Fletcher Street	High visual access to overflow point on footpath of residential area High visual access to overflow within street reserve Potentially high duration of view of overflow	Visual amenity
Waratah Road/Wentworth Falls Lake	High visual access to overflow High frequency and duration of view of overflow	Visual amenity Recreational value
Wentworth Falls Country Club Golf Course	High visual access to overflow within golf course fairway High frequency of view of overflow	Visual amenity Recreational value
Else Mitchell Park, Springwood	Potentially high frequency and duration of view of overflow and overflow structure (WI10F002)	Reduced recreational value
Bee Farm Road Carrier/ Sassafras Gully	Potentially high frequency and duration of view/odour (BF10F001)	Reduced recreational value
Picnic Glen Reserve	Potentially high frequency of view/odour	Reduced recreational value

Impacts on community amenity as a result of odours

Odour discharges, when detected, may reduce the amenity of the surrounding area for human occupation and thereby affect a range of human uses including residential, recreational and commercial. Odour complaints received by Sydney Water provide an indication of the impact of odours on community amenity within sewerage system areas.

Thirty-three complaints were received in 1996/1997 in the Winmalee sewerage system. While odour impacts are possible in all liquid overflow conditions, it is clear from historical data in Winmalee that odorous emissions do not appear to be associated particularly with liquid overflows but with gaseous odour likely to be generated by excessive residence of sewage within the system leading to septic conditions.

Odours were detected from the inlet vents associated with the pumping station in the vicinity of the decommissioned Springwood STP and a vent shaft associated with the Blue Mountains Tunnel at North Street, Katoomba, Sydney Water have recently completed to the installation of a catalytic converter on that vent.

As discussed in Section 2, odour complaints from the area served by the Winmalee Sewerage system are above the average for the Blue Mountains GA and also on a Sydney wide basis.

3.3 Impacts on sensitive areas

Sensitive areas are sites or components of the environment which are considered to be of particular importance because of their ecological, conservation, cultural heritage, recreational, social or commercial values. Examples of areas which may be classified as sensitive are listed in the Methods document. Sensitive areas which have the potential to be impacted by overflows from the Winmalee sewerage system are summarised in Table 3.8. The location of sensitive areas are shown in Figure 3.2.

Sensitive areas have been given special consideration within the EIS process so that options to mitigate impacts on these areas can be incorporated into overflow abatement strategies. Particular attention has been given to the identification and assessment of areas where overflow impacts may constitute a breach of legislation. Sensitive areas include:

1. sites containing species, populations, or ecological communities listed in Schedules 1 or 2 of the *Threatened Species Conservation Act (TSCA) 1995*, or critical habitat for such species

2. sites containing Aboriginal or non-Aboriginal cultural heritage sites or areas containing registered Aboriginal or non-Aboriginal cultural heritage items or relics

3. legally protected conservation areas such as national parks and water supply Special Areas

4. waters classified under the *Clean Waters Act (CWA) 1970* as Class P (Protected) or Class S (Specially Protected).

The potential for overflows to impact on identified sensitive areas was assessed using the process outlined in the Methods document. In summary, this process involved the identification of sensitive areas which have the potential to be impacted because of their proximity to current or future overflow discharges and the associated overflow impact zones.

Areas surrounding the Winmalee sewerage system are considered to be environmentally sensitive as discussed above and summarised in Table 3.8 and Figure 3.2. It is not possible to accurately identify sources or extent of impact with the amount of data currently available. Due to the high level of sensitivity and the lack of data on overflow impacts, a risk management approach has been adopted in order to identify priority for overflow abatement measures. This is further discussed in Chapter 4.

Table 3.8 is a summary of the sensitive areas potentially impacted by overflows within the Winmalee sewerage system and the potential sources of these impacts. Detailed descriptions follow in Sections 3.3.1 to 3.3.4.

Table 3.8 - Sensitive areas potentially impacted by overflows within the Winmalee sewerage system

Sensitive area	Nature of sensitivity	Potential sources of impact*
Threatened species	Species that are rare, endangered or threatened under the Threatened Species Conservation Act 1995 (refer to Section 3.3.1). Fauna such as Blue Mountains Swamp Skink, Giant Burrowing Frog, Golden-eyed Barred Frog, Red-crowned Toadlet and Southern barred Frog, and Flora such as *Microstrobos fitzgeraldii, Phebalium lachnaeoides, Epacris spansa, Eucalyptus Benthamii, Eucalyptus copulans, Pultenaea glabra, Acrophyllum australe, Acacia pubescens* and *Persoonia acerosa*	1. Exfiltration 2. Chokes 3. SPSs 865, 866, 936, 929, 869, 872, 829, 874, 875, 858, 955, 860, 861, 951, 1021, 948, 848, 725, 723, 731, 732, 733, 842, 838, 893, 837, 1004, 701, 833, 838, 873, 836, 835, 831, 832, 834 and 829 overflows near threatened species sites 4. Designed overflow structure Number NF 90F003 and SK 10F001 overflows near threatened species sites. 5. Wet and dry weather overflows located near threatened species sites.
Blue Mountains National Park	1. Protected under National Parks and Wildlife Act, 1974, 2. Important flora and fauna habitats, such as Blue Mountains Sedge Swamps 3. Tourist and recreational value (refer to Section 3.2.4) 4. Classified waterways (refer to Section below)	1. Exfiltration from sewers bordering National Park 2. Chokes 3. All SPSs and designed overflow structures have the potential to overflows through the National Park 4. Wet and dry weather overflows entering stormwater system which drains to National Park.

Sensitive area	Nature of sensitivity	Potential sources of impact*
	5. Proposed World Heritage listing (refer to Section 3.3.4).	
Blue Mountains streams and lakes	1. Class C waterways - head water of waterways outside the National Park boundary, such as Gordon Creek, Leura Falls Creek and Wentworth Falls Lake; Class P waterways - downstream of Class C waterways inside the National Park boundary, include such creeks as Kedumba River, Jamison Falls, Govetts Creek, Blue Mountain Creek and Water Nymphs Dell. Class S waterways - Lake Burragorang, Katoomba and Woodford Special Areas (refer to Section 3.3.4), 2. Tourist and recreational value (refer to Section 3.3.4).	1. Exfiltration 2. Chokes 3. All SPSs and designed overflow structures have the potential to impact directly or indirectly on the Blue Mountains waterways 4. STP partially treated discharges discharge into an un-named creek which flows into the Hawkesbury - Nepean River. 5. Wet and dry weather overflows entering stormwater system which drains to streams and lakes
Environment protection and residential bushland conservation zones*	1. Semi-natural bushland areas with environmental significance (refer to Section 3.3.4) These include such areas along Peckman's Plateau, Katoomba Park and Ovals, Gordon Falls Reserve, Yosemite Park and remnant bushland along various creeks	1. Exfiltration 2. Chokes 3. All SPSs and designed overflow structures have the potential to overflow near conservation zones 4. Wet and dry weather overflows located near conservation zones.
Community lands*	1. Environmental and/or recreational value (refer to Section 3.3.4) These include areas such as Wentworth Falls Country Club Golf Course, Picnic Glen Reserve and Else Mitchell Park.	1. Exfiltration 2. Chokes 3. All SPSs and designed overflow structures have the potential to overflows near these Community Lands 4. Wet and dry weather overflows located near Community Lands.
Sydney Water special areas - Katoomba and Woodford Special Areas	1. Protected under the Water Board (Corporatisation) Act, 1994 through Plans of Management (refer to Section 3.3.4)	1. Exfiltration 2. Chokes 3. Wet and dry weather overflows located near these special areas.
Proposed wilderness area	1. Proposed nomination of Grose River Valley, protected under the Wilderness Act 1987 (refer to Section 3.3.4).	1. Exfiltration from sewerage system bordering Grose River Valley 2. Chokes 3. SPS 1090, 704, 701, 715, 716, 840, 747, 750, 848, 742, 722, 954, 858, 955, 859, 860, 861, 869, 870, 871, 872, 868, 928, 873 and 936 overflows into the Grose River system 4. Wet and dry weather overflows located near Grose River system.

Note: * Due to the extensive nature of these areas, they are not marked on Figure 3.2.

3.3.1 Threatened and vulnerable species

The following sections describe the threatened flora and fauna species potentially impacted by overflows from the Winmalee sewerage system.

The potential for impacts on endangered or vulnerable flora and fauna species, populations, and ecological communities has been assessed as part of this EIS under the requirement of the *TSCA 1995*. Endangered species, populations, and ecological communities are listed in Schedule 1 of the *TSCA 1995* while vulnerable species are listed in Schedule 2. The NPWS database of rare and endangered flora and fauna has been used to identify the locations where Schedule 1 or 2 species have been recorded in the area served by the Winmalee sewerage system.

Where potential for overflows to impact on Schedule 1 or 2 species has been identified, overflow abatement options to eliminate the potential the potential for impact have been incorporated into the abatement strategies (refer to Chapter 4). The need for further overflow abatement to protect endangered and vulnerable species will be evaluated based on the outcomes of performance assessment monitoring.

The extent to which overflows from the Winmalee sewerage system contribute to the degradation of sensitive native vegetation communities and terrestrial fauna habitats of the Blue Mountains REZ is considered to be significant. Fewer impacts would occur in the Lake Burragorang REZ, however, they are likely to be significant within sensitive areas at Bedford, Jamison, Leura Falls Creeks and Kedumba River. Sewerage overflows in the Winmalee sewerage system which drain into the Grose River may potentially affect the proposed Grose Wilderness.

The most important overflows with regard to threatened flora and fauna are those which occur from SPSs as listed in Table 3.4. Exfiltration and choke events may potentially impact on threatened species with the Gordon, Leura Falls, Kedumba, Hazelbrook, Bulls, Glenbrook, Wilson Glen and Lawson Creeks and Lake Woodford catchments .

Flora

Designed overflows have affected the following sensitive environments:

1. *Eucalyptus sclerophylla* woodland (SPS 861, 848)
2. *Syncarpia glomulifera-Eucalyptus puncata* open forest (SPS 710,830)
3. *Eucalyptus deanei- Syncarpia glomulifera* tall open forest (SPS 708, 731)
4. Sedge swamp (SPS 948).

The following High risk threatened species (see Volume 2), are considered to be potentially affected by overflows from the Winmalee sewerage system:

1. Dwarf Mountain Pine (*Microstrobos fitzgeraldii*) (records and habitat)
2. *Acrophyllum australe* (records and habitat)
3. *Epacris Sparsa*
4. *Eucalyptus Benthamii*.

The following threatened species recorded in the Winmalee sewerage system are considered to be low risk species and the impact of overflows on these species is, therefore, unlikely to be significant.

1. *Acacia Pubescens*
2. *Acacia bynoeana*
3. *Phebalium lachnaeoides*
4. *Eucalyptus copulans*
5. *Pultenaea glabra*
6. *Persoonia acerosa*
7. *Zeria involucrata.*

(Note: for definition of high and low risk species, refer to Section 3.4 , Volume 2).

Precise locations of these species are not known however it is possible colonies of these species may exist within the Blue Mountains GA. Therefore colonies could be impacted by nutrient enrichment or weed invasion if located in close proximity to overflows.

The plume of weeds from SPS 873 has impacted on significant vegetation (Smith and Smith 1995) on land which is zoned 'Bushland Conservation' . SPS 865 has created increased weed growth in a 'Bushland Conservation' zone. SPS 874 has created a weed plume which impacts on flora within the National Park and which has also been classed as significant vegetation (Smith and Smith 1995).

The Dwarf Mountain Pine (*Microstrobos fitzgeraldii*) is endemic to the Blue Mountains area. The total known population of 455 individual plants grow on rock ledges in the spray of waterfalls between Wentworth Falls and Katoomba. Wentworth Falls has the largest population of 102 individual plants, and also has the largest number of plants exposed to polluted water. The Katoomba Falls population contains 55 individuals, at Leura Falls there are 80, and at Gordon Falls 20 (Jones undated).

In the Wentworth Falls area there has, to date, been no weed invasion of the sites occupied by Dwarf Mountain Pine however, extensive dieback of some individual plants has reduced population numbers since 1989. At Katoomba Falls and Leura Falls weed invasion is the principal impact on this species, with some dieback occurring. It is probable that pollution in Gordon Creek, Leura Falls Creek and the Kedumba River have affected Dwarf Mountain Pine sites in the vicinity of South Katoomba. Pollutants in the spray of waterfalls have the potential to alter the permeability of plant leaves and cause desiccation, toxicity, and susceptibility of the plant to pathogens and parasites. Increased nutrients in the spray water may also promote the growth of algae on the plants (Jones undated). It is probable that pollution in Jamison Creek has impacted on the Dwarf Mountain Pine at Wentworth Falls.

Sensitive areas which are located within the Blue Mountains National Park and which are affected by overflows in the North Katoomba area, include Katoomba Creek, Yosemite Creek and Minni-Ha-Ha Reserve including Minni-Ha-Ha Falls. Overflows during wet weather, from access chambers and sewer pipes have impacted on the Blue Mountains National Park at Lyrebird Dell and Katoomba Falls Valley. This area contains significant flora as mapped by Smith and Smith (1995).

Flora habitats contained in Brittle Gum woodland, escarpment and rock outcrops, montane heath, tall open forest, rainforest, blue mountains sedge swamps are significant (Smith and Smith 1995). The sedge swamps provide potential habitat for the Blue Mountains Swamp Skink. Impacts of overflows at these sites are likely to include addition of nutrients to the soil and weed propagules to the sensitive environments.

Impacts of designed overflows also occur in Blue Mountains City Council "Residential" Bushland Conservation and Environmental Protection zones which contain sensitive environment and serve in many areas as important buffer protection to the Blue Mountains National Park.

Fauna

The following species listed in Schedules 1 or 2 of the *Threatened Species Conservation Act 1995*, or the critical habitat of high risk species (refer to Volume 2), are considered to be potentially impacted by overflows from the Winmalee sewerage system:

1. Blue Mountains Skink (records and habitat)
2. Giant Burrowing Frog (records and habitat)
3. Golden-eyed Barred Frog (potential habitat)
4. Red-crowned Toadlet (records and habitat)
5. Southern Barred Frog (potential habitat).

There are other threatened species recorded in the Winmalee sewerage system but these are considered to be at low risk, and the impact of overflows on these species is unlikely to be significant.

3.3.2 Aboriginal heritage

The NPWS Aboriginal Sites Database lists Aboriginal sites within the Winmalee sewerage system (refer to Volume 2, Section 3.6.2 and Appendix G), however none of these sites are located within the area served by Winmalee sewerage system. Many more Aboriginal sites are not catalogued. Whilst it is possible for there to be sites of Aboriginal heritage significance located within an area affected by sewerage overflows, they would not be expected to be impacted by overflows.

3.3.3 Non-Aboriginal heritage

There are many non-Aboriginal sites listed within the vicinity of the Winmalee sewerage system (refer to Volume 2, Section 3.6.2). Whilst it is possible for there to be sites of significance located within an area affected by sewerage overflows, they are not likely to be directly within the flow paths and hence would not be expected to be impacted by overflows.

3.3.4 Legally protected conservation areas

The legally protected areas in the vicinity of the area served by the Winmalee sewerage system include:

1. Blue Mountains National Park
2. Blue Mountains streams and lakes (Classified Waters)
3. Blue Mountains City Council areas zoned "Environmental Protection" and "Residential Bushland Conservation"
4. Community lands
5. Sydney Water Special Areas
6. Proposed Blue Mountains Wilderness Area.

Blue Mountains National Park

The Blue Mountains National Park has been recognised as being worthy of World Heritage Conservation Status. The Federal Government is currently considering an application for World Heritage nomination. Because of the very high environmental values required to achieve World Heritage listing, it is recognised that it is important to obtain and maintain 'high water quality in these streams consistent with the needs for both conservation of aquatic environments and recreational enjoyment' (Water Board, 1991). The sewerage overflows from all SPSs, chokes and exfiltration and STP partially treated discharges have the potential to impact on the Blue Mountains National Park, especially in localised areas.

Blue Mountains streams and lakes (classified waters)

All waterways affected by sewerage overflows in the area served by the Winmalee sewerage system flow through the Blue Mountains National Park and are classified under the *CWA 1970*. Detailed definitions of classified waters and Special Areas are contained in Section 3.2.2. Class 'C' controlled waters are outside the Blue Mountains National Park and flow into Class 'P' waters, which are generally located within the National Park. Exceptions to this include waterways draining to Lake Woodford and tributaries of the Coxs River (including Megalong Creek) to the west of Katoomba which are Class 'P' waters outside the Blue Mountains National Park.

Sydney Water Special Areas

Sewerage overflows from the Winmalee sewerage system could indirectly impact on two areas of Class 'S' Specially Protected Waters under *Clean Waters Act 1970*. The area surrounding these Class S Waters are protected under the *Sydney Water (Catchment Management) Regulation 1995*. These areas are:

1. the Katoomba Special Area which includes the storages and catchments of Upper, Middle and Lower Cascade Dams
2. the Woodford Special Area which includes the storages and catchments of Woodford Creek Dam and parts of Hazelbrook, Woodford and Linden

Urban development has been allowed in a section of the Woodford Special Area. There were three SPS overflows which potentially overflowed into this catchment, namely SPSs 852, 853 and 854. These have all been recently decommissioned. There is, however, still the potential for impact from chokes and exfiltration. As discussed in Section 3.2.4 Sydney Water employs a multi-barrier approach to ensure full protection of drinking water catchments. All drinking water from these storages are filtered and disinfected prior to use.

No urban development has occurred in the catchment of the Katoomba Special Area and thus there is no risk from sewerage overflows to this area.

Blue Mountains City Council's environmental protection and residential bushland conservation zones

There are several areas in the area serviced by Winmalee sewerage system zoned "Environment Protection" and "Residential Bushland Conservation" by the Blue Mountains City Council. These zones identify areas with special significance in the council area and are protected under the current Blue Mountains Local Environment Plan 1991. They include areas such as Peckman's Plateau, Katoomba Park and Ovals, Gordon Falls Reserves, Yosemite Park and remnant bushland along various creeks. Currently information on the performance of the system suggests that all such areas are potentially affected by chokes, exfiltration, partially treated STP discharges and SPS overflows.

Community lands

Community lands are areas such as parks and reserves that are protected under a Community Land Plan of Management prepared by the Blue Mountains City Council. They are inclusive of areas such as Wentworth Falls Country Club Golf Course, Picnic Glen Reserve and Else Mitchell Park. Sewerage overflows in the vicinity of these areas may have high visual and recreational impacts. Sewerage overflow from chokes, exfiltration, from reticulation and SPSs may have potential impacts on these areas.

Proposed wilderness area

The Grose River Valley has been nominated as a proposed wilderness area by the Confederation of Bushwalking Clubs, NSW (refer to Figures 3.2 (a), (b), (c) for proximity of proposed Grose Wilderness Area to the area served by Winmalee sewerage system. The land in the Grose River Valley is currently being assessed to determine whether it should be identified and declared as the Grose Wilderness under the *Wilderness Act 1977.* Sewerage overflows from the Winmalee sewerage system have the potential to adversely impact the water quality in many creeks and tributaries of the Grose River, which flow within the proposed wilderness area and may comprise the wilderness qualities of this area and thus the proposed declaration (refer Figure 3.2).

3.4 Overflow ranking

3.4.1 Introduction

Methods to rank or prioritise overflow problems have been developed to address each of the overflow types identified in Chapter 2. These ranking and prioritisation methods were designed to assist with the comparison of overflow problems across Sydney Water's area of operations.

For wet weather overflows, a ranking method was developed based on the combined assessment of the magnitude of the overflow problem and the sensitivity of potentially impacted environments. This method, referred to as the 'wet weather overflow ranking method', was used to calculate ranking scores for three categories of modelled wet weather overflow:

1. wet weather overflows from designed structures
2. wet weather overflows from reticulation areas
3. partially treated STP discharges.

A similar ranking tool was developed for the assessment of overflows caused by SPS failure. Referred to as the 'SPS ranking method', it was designed to calculate ranking scores for individual SPSs based on the combined assessment of the asset quality, the magnitude of the overflow problem, and the sensitivity of potentially impacted environments.

To address the problems of choke-related overflows and exfiltration, a method was developed for the prioritisation of sewer inflow catchments. This method involved the determination of remediation priority rankings for inflow catchments based on the combined assessment of choke frequency, net infiltration/exfiltration (I/E), percentage rainfall ingress and the presence of sensitive areas.

The assessment of odour problems involved the ranking of sewered suburbs in terms of the frequency of odour complaints relation to sewerage system emissions.

The overflow types are ranked in descending order of the ranking score. The highest ranking is one, which has the highest potential risk. The overflow ranking assessment processes are described further below and full details are provided in the Methods document.

The results of each overflow assessment process have been used to assist with the development of overflow management strategies and the prioritisation of remediation actions (refer to Chapter 4). This section presents the results of overflow ranking and other problem assessment processes for the Winmalee sewerage system.

3.4.2 Wet weather overflow ranking

The wet weather overflow ranking method calculates ranking scores for modelled wet weather reticulation nodes and ranks the overflows in descending order of these scores, within three discrete categories:

1. designed structure nodes
2. reticulation nodes
3. partially treated STP discharge nodes.

Within the Blue Mountains GA, only reticulation nodes and partially treated STP discharge nodes were modelled. Comparisons of ranking and scores should not be made between wet weather overflow categories because of the distinctly different characteristics of the respective overflow nodes.

Reticulation nodes represent a modelled inflow catchment for a sewer reticulation area, and discharge data for a node represents the sum of untreated wet weather discharges which may occur anywhere within that inflow catchment. Modelled nodes in the partially treated STP discharge category represent wet weather STP discharges which receive a reduced level of treatment.

Wet weather overflow rankings are designed to reflect the magnitude of environmental impacts which could result from a wet weather overflow event. Wet weather overflow ranking scores are calculated as the sum of an overflow score (based on assessment of overflow volume and frequency) and an environmental sensitivity score (based on the potentially impacted environment). The environmental sensitivity score is determined via the assessment and scoring of three component environmental dimensions - aquatic ecosystems, terrestrial ecosystems and human health - and is taken as the highest score obtained for any one dimension.

Within the Winmalee sewerage system, six reticulation nodes were ranked as defined within the system modelling (refer to Section 2). The results of the wet weather overflow ranking are summarised in Table 3.9. The North Katoomba node received the highest overflow discharge score of all reticulation nodes in the Winmalee sewerage system. Wet weather overflows from the North Katoomba reticulation area are predicted to occur 44 times in an average ten year period and amount to an average annual volume of 15.5 ML. South Katoomba is the next highest ranking reticulation node. Wet weather overflows from all reticulation areas in the Winmalee sewerage system impact on sensitive terrestrial aquatic environments and received high environmental sensitivity scores. Sensitive environments which are potentially impacted by wet weather reticulation overflows include the Blue Mountains National Parks species protected under the *Threatened Species Conservation Act 1995* (such as the Blue Mountains Swamp Skink) and waters classified as protected (Class P) under the *Clean Waters Act 1970.*

Individual areas were assessed on the potential impact from ten overflows and flagged as below:

1. threatened species occurring with the boundaries of the impacted ecosystem, and have the potential to be adversely affected by overflows (TSCA1)
2. threatened species occurring with the boundaries of the impacted ecosystem, but have no potential to be adversely affected by overflows (TSCA2)
3. overflows discharging to Class S or Class P waterways (CWA1)
4. overflows which do not discharge to Class S or P waterways, but which have the potential to adversely impact on Class S or P waterways (CWA2).

The Winmalee and Valley Heights nodes have been ranked the lowest within the Winmalee system as they impact on a smaller percentage of identified sensitive environments than the other reticulation nodes.

Winmalee STP was ranked second out of the three Blue Mountains systems for partially treated wet weather STP discharges and third on a Sydney wide basis due to the sensitivity of the receiving environment. Although the discharge volume from the Winmalee STP is substantially higher than the other two systems, due to the larger area of operation and population served, the extent of potentially impacted sensitive areas is lower than the other two systems. This is due to the large capacity and high level of treatment of the Winmalee STP and the comparatively less sensitive nature of the receiving environment into which it discharges. The partially treated wet weather STP discharges from the Winmalee STP will not directly impact on Class P Waters and are not considered to have the potential to impact on protected species or critical habitat. Full ranking results for Winmalee STP are contained within Appendix C.

These wet weather overflow ranking results have been used to assist with the overflow problem definition for the Blue Mountains GA (refer to Section 3.8, Volume 2). Full details of the wet weather overflow ranking method are presented in the Methods document. The complete results of wet weather overflow ranking for the Sydney region are presented in Volume 1, Appendix G.

The results of wet weather ranking for the modelled reticulation nodes are summarised in Table 3.9.

3.4.3 SPS ranking

The SPS ranking method calculates ranking scores for individual SPSs then ranks the SPSs in descending order of these scores. SPS rankings are designed to reflect the magnitude of the problem relating to overflows caused by SPS failure.

Where operational failures are predicted to result in overflow, the individual SPS ranking score is calculated as the sum of three scores:

1. an asset score (based on assessment of asset quality and the likelihood of operational failure and overflow)
2. an overflow score (based on assessment of overflow volume and frequency)
3. an environmental sensitivity score (which is determined as described for wet weather overflows in the previous section).

For SPSs where operational failures are predicted to result in overflow, the individual SPS ranking score is calculated as the sum of three scores - an asset score (based on assessment of asset quality and the likelihood of operational failure and overflow), an overflow score (based on assessment of overflow volume and frequency) and an environmental sensitivity score (which is determined as described for wet weather overflows in the previous section).

For SPSs where operational failures are not predicted to result in overflow, the individual SPS ranking score is calculated as the sum of the asset score and overflow score only.

Full details of the SPS ranking method are presented in the Methods document and the complete results of SPS ranking for the Sydney region are presented in Appendix C and in Volume 1.

In addition to the wet weather flagging system, the SPS flagging system also includes the flagging in the following categories:

1. SPSs with no telemetry (T1)
2. SPSs without fail safe 'Above Top Water Level' (AWTL) alarm activation (A1)
3. SPSs with an ineffective contingency plan (C1).

There are 61 SPSs in the Winmalee sewerage system. Results for the highest ranked SPSs are shown in Table 3.10 and a complete list of scores and corresponding reasoning is contained in Appendix C

Within the Winmalee system, the SPSs which discharge into areas of National Park and classified waters are ranked high. Those SPSs located near sensitive areas containing threatened species of high risk from overflows have also been given a high rank. The top eight ranked SPSs within the Winmalee Sewerage system are included in the top ten for both the Blue Mountains GA and on a Sydney wide basis. This ranking has been used in the development of the overflow abatement strategies, identifying a high priority for SPS upgrades in the Winmalee sewerage system.

These ranking results confirm the poor performance by some of Winmalee SPSs combined with a sensitive receiving environment.

3.4.4 Prioritisation of sewer inflow catchments in terms of choke and leakage problems

The first step in the process of prioritising sewer inflow catchments involves the determination of inflow catchment classifications for leakage severity based on the combined consideration of percentage rainfall ingress and net I/E. The second step in the process involves the determination of initial inflow catchment rankings based on the combined consideration of leakage severity and choke frequency. The final step in the process involves the modifications of initial rankings based on the presence of sensitive areas.

The inflow catchment priority rankings are designed to provide an indication of the need for remediation and to assist with the allocation of investigation priorities. The priority ranking ranges from one to five, with one being the highest priority. Full details of the inflow catchment prioritisation process for choke and pipe leakage problems are provided in the Methods document.

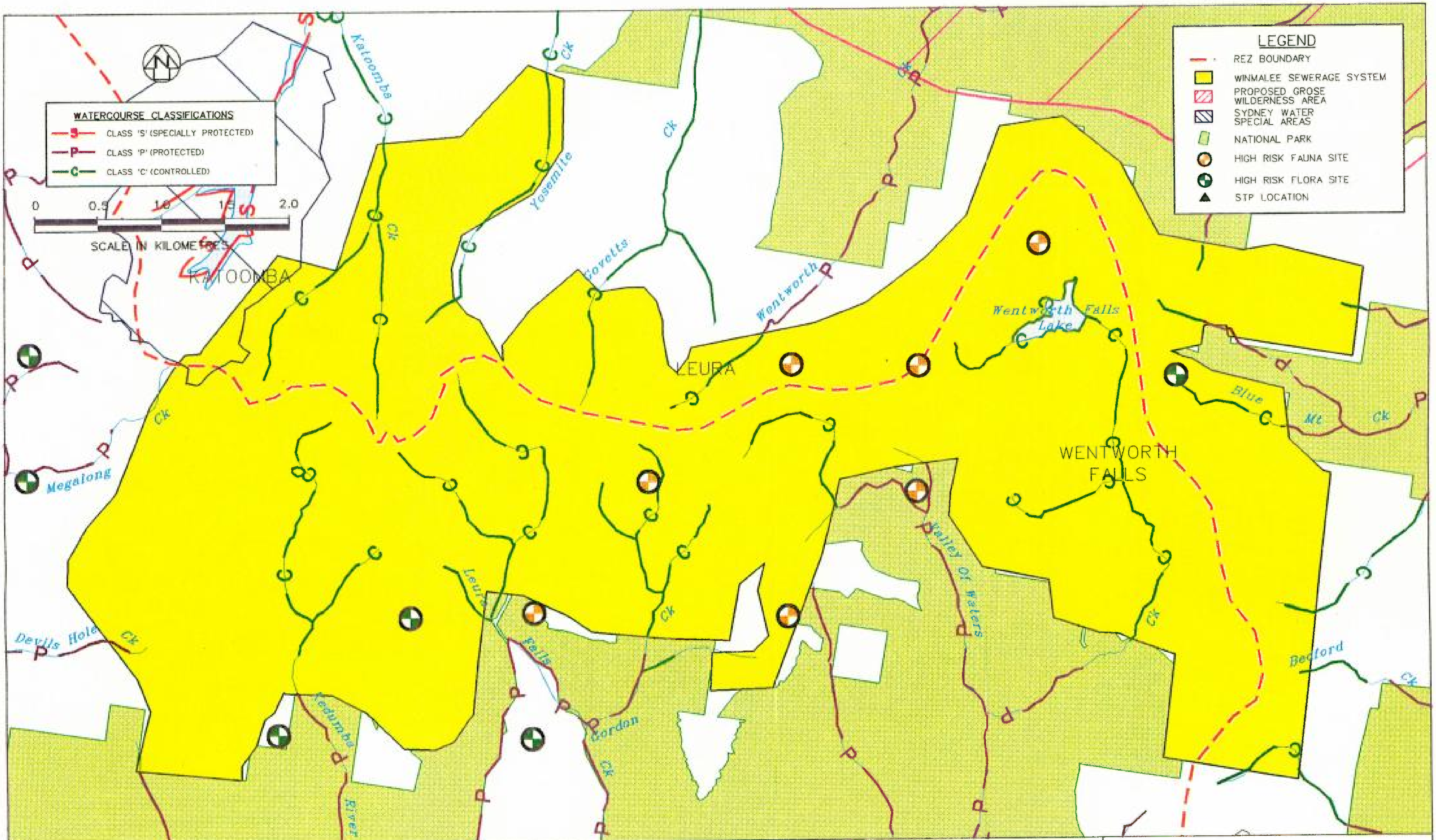
The complete results of inflow catchment prioritisation for choke and pipe leakage problems across the Sydney region are presented in Appendix G of Volume 1.

Within the Winmalee sewerage system, there are seven inflow catchments. The results of the prioritisation process are summarised in Table 3.11, and Appendix C contains a complete list of inflow catchment prioritisation results for the system. Of the seven inflow catchments investigated, four catchments receive the highest priority, these are North Katoomba, South Katoomba, Woodford and Valley Heights. In the first instance the extent of the infiltration/exfiltration problem will need to be defined by further monitoring of the area for water quality impacts. Priorities for remediation will then be able to be applied depending upon the environmental sensitivity of the affected area. These inflow catchment prioritisation results have been used to assist with the overflow problem definition for the Blue Mountains GA (refer to Section 3.8, Volume 2).

3.4.5 Odour problem assessment

Sewered suburbs have been ranked in terms of frequency of odour complaints relating to sewerage system emissions.

As discussed in Chapter 2, the extent of odour impacts is not considered significant and is usually as a result of odours emanating from access chambers and vent shafts due to long residence time within the system. These issues are usually dealt with by Sydney Water on an individual basis rather than on an area wide basis.



Sydney WATER

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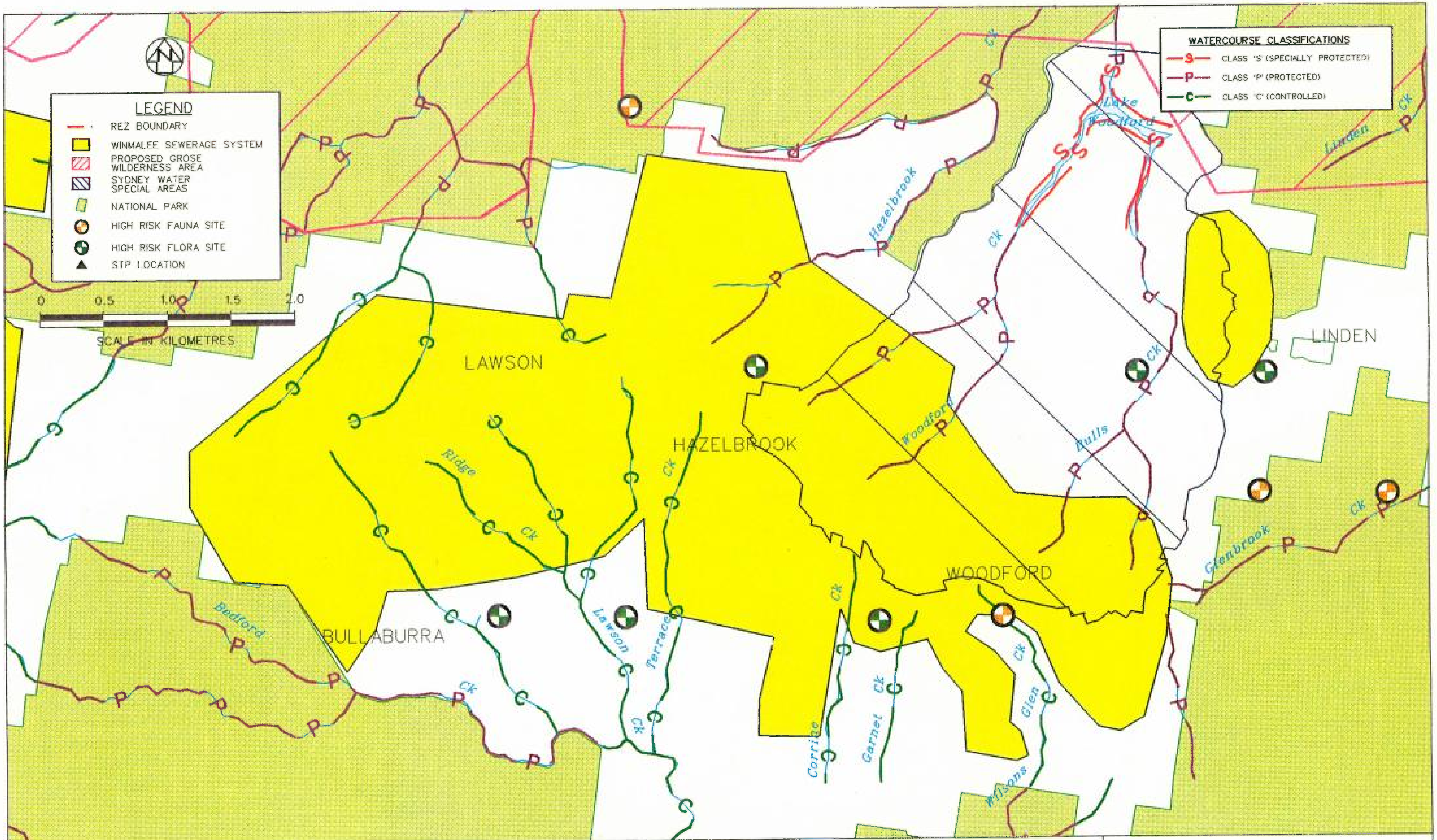
SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 3-2a
SENSITIVE AREAS

USER: gsw DATE: 02-MAY-1998 10:48 PTB: a4.ptb FILE: i:\solp\14082bm\winmalee\wmfig3_2a.dgn

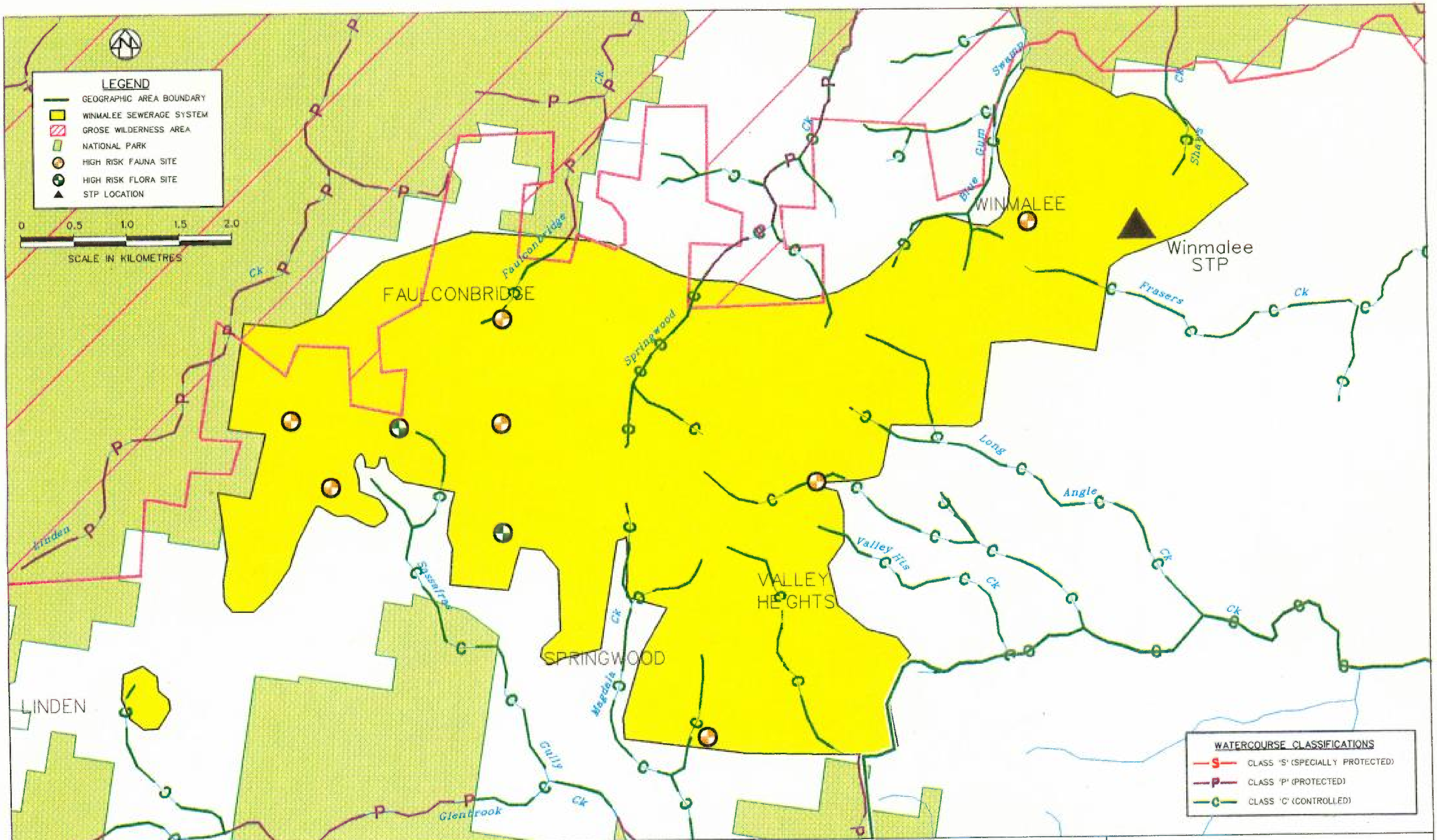


Sydney WATER

SYDNEY WATER CORPORATION LIMITED
ACN 063 279 649

SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 3-2b
SENSITIVE AREAS



Sydney WATER

SYDNEY WATER CORPORATION LIMITED
ACN 063 279 649

SEWERAGE OVERFLOWS LICENSING PROJECT
WINMALEE SEWERAGE SYSTEM

FIGURE 3-2c
SENSITIVE AREAS

Table 3.9 - Summary of wet weather overflow ranking results for modelled reticulation areas in the Winmalee sewerage system

Reticulation Area/Inflow Catchment		Impacted REZs	Overflow Ranking			Scores			Flags[2]	Potential to Impact Sensitive Area (Y/N)
Model Node Number	Location		System	GA	Sydney Wide	Overflow Discharge	Environmental Sensitivity	Overflow Ranking Score[1]		
NK	North Katoomba	Blue Mountains	1	1	7	10	48	58	TSCA1, CWA1	Yes
SK	South Katoomba	Lake Burragorang	2	2	10	6	48	54	TSCA1, CWA1	Yes
HB	Hazelbrook	Blue Mountains	3	4	19	3	48	51	TSCA1, CWA1	Yes
WF	Wentworth Falls	Blue Mountains, Lake Burragorang	4	4	19	3	48	51	TSCA1, CWA1	Yes
WM	Winmalee	Blue Mountains	5	7	24	6	40	46	TSCA1, CWA1	Yes
VH	Valley Heights	Blue Mountains	6	8	25	5	40	45	TSCA1, CWA1	Yes

Note: 1. Wet weather overflow ranking score = overflow score + environmental sensitivity score

2 TSCA1 - The potentially impacted area contains a high risk threatened or vulnerable flora or fauna species listed under the *TSCA 1995* (refer to Section 3.3.1

CWA1 - The reticulation node discharges to a Class S or P waterway

Table 3.10 - Summary of SPS ranking results for the Winmalee sewerage system

SPS	Location	Impacted REZs	SPS Ranking			Scores				Flags[2]	Potential to Impact Sensitive Area (Y/N)
			System	GA	Sydney Wide	Asset	Overflow Discharge	Environmental Sensitivity	SPS Ranking Score[1]		
836	Winmalee	Blue Mountains	1	2	2	17	34	96	147	TSCA1, CWA2	Yes
872	Winmalee	Blue Mountains	2	2	2	17	34	96	147	TSCA1	Yes
830	Winmalee	Blue Mountains	3	4	4	29	12	96	137	TSCA1	Yes
857	Winmalee	Blue Mountains	4	5	5	29	10	96	135	TSCA1	Yes
835	Winmalee	Blue Mountains	5	6	6	17	34	80	131	TSCA1	Yes
837	Winmalee	Blue Mountains	6	6	6	29	6	96	131	TSCA1, CWA2	Yes
873	Winmalee	Blue Mountains	7	8	8	17	10	96	123	TSCA1	Yes
833	Winmalee	Blue Mountains	8	10	10	21	34	64	119	TSCA2	Yes
704	Winmalee	Blue Mountains	9	11	11	16	6	96	118	TSCA1, CWA2	Yes
871	Winmalee	Blue Mountains	10	12	12	16	3	96	115	TSCA1	Yes

Note: 1. SPS overflow ranking score = overflow score + environmental sensitivity score

2. TSCA1 - The potentially impacted area contains a high risk threatened or vulnerable flora or fauna species listed under the *TSCA 1995* (refer to Section 3.3.1)
TSCA2 - The potentially impacted area contains a low or medium risk threatened or vulnerable flora or fauna species listed under the *TSCA 1995* (refer to Section 3.3.1)
CWA1 - Overflows from the SPS discharge directly into a Class S or P waterway
CWA2 - Overflows from the SPS do not discharge directly to a Class S or P waterway but have the potential to adversely impact on a Class S or P waterway

Table 3.11 - Prioritisation of inflow catchments in terms of choke and pipe leakage problems - summary of results for the Winmalee system

Inflow catchment	General Area (REZ)	Problem Classification				Priority Rankings		
		Exfiltration potential	Percentage rainfall ingress[1]	Leakage Severity[2]	Choke Density[3]	Initial Priority[4]	Additional factors/presence of sensitive areas	Revised remediation priority[5]
96901	North Katoomba (Blue Mountains)	Nil	Medium	Moderate	Medium	3	Catchment is in a sensitive area (Class P Water) Water quality in Yosemite Creek indicates possible sewerage overflow Close to Cascade Dams, part of the Blue Mountains water supply	1
968010	South Katoomba (Lake Burragorang)	Nil (infiltration)	Medium	Low	Low	3	Catchment is in a sensitive area (Class P) Water and in the Lake Burragorang catchment - (Class S). Water Quality in Leura Cascades indicates possible sewerage overflow	1
967010	Wentworth Falls (Blue Mountains, Lake Burragorang)	Moderate	Low	Low	Low	4	Catchment is in sensitive area (Class P Water).	2
966010	Lawson, Hazelbrook (Blue Mountains)	Moderate	Low	Low	Medium	4	Catchment is in sensitive area (Class P Water).	2
864020	Woodford (Blue Mountains)	Nil	Low	Low Low	Medium	5	Catchment is within Woodford Lake catchment, part of the Blue Mountains water supply (Class S Water).	1
962010	Valley Heights (Blue Mountains)	Moderate	Low	Low	Medium	3	Catchment is in sensitive area (Class P Water).	1
964010	Winmalee, Faulconbridge (Blue Mountains)	Nil	Low	Low Low	Medium	4	Catchment is in sensitive area (Class P Water).	2

Notes:
1. Rainfall ingress classification: Up to 10%- low, 10 - 15% Medium, above 15% High.
2. Leakage severity
3. Choke density is measured on a suburb basis rather than on an inflow catchment basis. Where there is more than one suburb in a catchment, the worst performing suburb has been used to determine priorities.
4. Initial priority is an indicator of system performance. For methodology refer to Methods Document.
5. Revised remediation priority is the remediation priority modified by environmental considerations.

Table 3.12 - Summary of odour problem assessment results for the Winmalee system

Suburb	Location (REZ)	Odour Complaint Frequency
Katoomba	Blue Mountains, Lake Burragorang	8
Springwood	Blue Mountains	7
Wentworth Falls	Blue Mountains, Lake Burragorang	4
Faulconbridge	Blue Mountains	3
Hazelbrook	Blue Mountains	1
Lawson	Blue Mountains	1
Leura	Lake Burragorang	1
Winmalee	Blue Mountains	1
Woodford	Blue Mountains	1
Total		**29**

Chapter 4

System Overflow Management Strategy

Synopsis

The environmental objectives and values for the Blue Mountains GA identified in Volume 2 have been used to assist in the evaluation and selection of a strategy to protect the Blue Mountains from overflows from the Winmalee sewerage system. This chapter describes the actions for the Winmalee sewerage system that form part of the overflows strategy for the Blue Mountains GA. Options have been evaluated for each of the five overflow types to ensure an acceptable performance standard is maintained.

The impacts of overflows from the Winmalee sewerage system are localised in nature. The overflow abatement strategy is therefore focussed on protection of the identified sensitive areas.

Water quality modelling of the streams within the area served by the Winmalee sewerage system has identified that the major sources of pollution are from stormwater (urban and rural run-off). Modelling has indicated that removal of all wet weather overflows does not result in any significant water quality improvements compared to the base case abatement level (maintaining current system performance).

Works are being identified for the Winmalee sewerage system to reduce the risk of failures from SPSs that have insufficient detention time as part of the SPS Risk Reduction Program. This program is separate from the actions under the SOLP program, however the actions under the SPS Risk Reduction Program are a critical part of the strategy to achieve the minimum performance objectives (base case).

The three sub-catchments identified as potentially having moderate exfiltration will be added to the interim I/E programme. There are no specific works required to reduce chokes. Any future evidence of repeat chokes or high choke densities will be investigated in accordance with the existing management response program.

Options that would limit wet weather overflows to ten events in ten years have been proposed to provide additional protection above the minimum performance objectives for areas potentially impacted by overflows from the Winmalee sewerage system. Structural options for overflow abatement will be assessed as part of the second stage detailed EIA process.

Best Management Practices will continue to be updated and implemented for all sewerage systems as part of the overflows management program and the continuous improvement process. Additional monitoring has been recommended to better characterise the locations and extent of impacts from overflows.

The overflow abatement actions have been integrated into a management plan for the Winmalee sewerage system. Management practices will be updated and implemented as part of the continuous improvement program based on the United States Environmental Protection Agency (USEPA) sanitary sewer overflow control policy. The total cost of the management plan is estimated to be $94.5 million over the next 25 years. Minimum performance objectives of the plan have been prioritised with the aid of overflow ranking across the whole of Sydney Water's area of operations, and will be progressively implemented over the 25 year planning period.

4. System overflow management strategy

4.1 Overflow abatement objectives

There are three sets of requirements that together define the overflow abatement objectives. They are:

1. long term corporate performance targets, covering the whole of Sydney Water service area
2. minimum performance objectives (otherwise known as base case)
3. environmental goals for the receiving environmental zones (REZs), as discussed in Volume 2.

These requirements were applied to each type of overflow, and the most stringent requirements were adopted as abatement objectives for the Winmalee sewerage system. The Winmalee sewerage system's contribution to achieving the Sydney long term performance targets is also discussed.

4.1.1 Sydney wide long term performance targets

Sydney Water has adopted long term objectives for the performance of the total sewerage asset across its entire area of operation, as listed in Table 4.1.

Table 4.1 - Sydney wide long term performance targets

Overflow type	Long term objective
Discharge through overflow structures	80-90% reduction in events per 10 years average across Sydney in wet weather 15 discharges per year across Sydney in dry weather
Overflows due to chokes	No internal surcharge due to Sydney Water capacity in wet weather Less than 10 internal surcharges per year due to Sydney Water across Sydney in dry weather. Greater than 96% of customers experience no surcharges Individual customers experiencing less than two events in six months; guarantee no repeat for two years. All suburbs are in the low choke category (less than 60 chokes/100 km a year)
Partially treated STP surcharge	STP discharge will not cause receiving water to exceed ANZECC water quality guidelines for primary contact recreation in wet weather.
Exfiltration	Meet ANZECC water quality guidelines for Primary & Secondary contact recreation in dry weather
Odour	Eliminate repeat offensive odours

4.1.2 Minimum performance objectives (base case)

The minimum performance objectives for each overflow type is to maintain the current system performance allowing for population growth to the year 2021. In other words, the minimum performance objectives require that growth in the catchment will not cause deterioration of the system performance. The minimum performance objectives for the Winmalee sewerage system are shown in Table 4.2.

Table 4.2 - Minimum performance objectives

Overflow type	Indicator	Current performance of Winmalee sewerage system
Wet weather overflow	Maintain the number of modelled overflow events per ten years	51
Choke related overflows	Maintain the number of high choke suburbs	0
	Maintain the number of medium choke suburbs	7
SPS failure	Maintain the number of individual SPS overflow events	214[1]
Exfiltration	Maintain the number of gauging catchments with high likelihood of exfiltration	2 (from water quality data)
	Maintain the number of gauging catchments with medium likelihood of exfiltration	3 (from leakage report)
Odours	Maintain the number of odour events per sewerage system	27
Partially treated STP discharge	STP wet weather discharges will receive at least effluent screening and full disinfection for all flows up until the first overflow operates in the system	110 (minimum performance objective = 51)

Note: 1. Estimate by Sydney Water system managers

4.1.3 Environmental objectives

Environmental and overflow abatement objectives have been identified for the Blue Mountains and Lake Burragorang REZs in Volume 2, Chapter 4, of this EIS. The benefits and costs of additional overflow abatement levels (above the minimum performance objectives) have been evaluated and the most appropriate overflow abatement strategy selected.

The main focus of the environmental objectives discussed in Volume 2 is the adoption of wet weather containment limiting the frequency of wet weather overflows to 10 events in 10 years for the sewer reticulation in Winmalee sewerage system. In recognising the sensitivity of the entire area the same objectives are adopted for all Sydney Water assets in the Blue Mountains GA, except for the Winmalee STP which targets 20 partially treated discharge events in 10 years. This target is to achieve a partial discharge effluent quality that is appropriate for environmental conditions. The Winmalee STP discharges into a different less sensitive environment the Hawkesbury/Nepean system, rather than the Blue Mountains National Park. The target of full disinfection down to 20 events, and partial disinfection in 20 events is considered an appropriate reflection of that receiving environment especially as neither nutrients or toxicants are a major issue during these events.

Given the limitations of the predictive modelling and water quality monitoring to date, this objective is considered a precautionary approach with the level of containment being adopted to satisfy community expectations for the environmental quality of the Blue Mountains, protection of drinking water catchments and Classified Waters and the principles of ESD. The data available suggest that overflows do not cause a significant catchment wide impact, therefore the strategy for the Winmalee sewerage system incorporates localised abatement actions.

4.2 Strategies for Winmalee sewerage system

This section defines the following:

1. overflow of abatement objectives for each overflow category given the Sydney wide long term performance targets

2. the minimum performance objectives
3. the outcomes of the Blue Mountains and Lake Burragorang REZs assessment in Volume 2
4. the protection of sensitive areas
5. other system performance objectives including the SPS risk reduction program and the I/E program.

The assessment of the Blue Mountains and Lake Burragorang REZs shows that on a regional basis the impact of sewerage overflows is not significant. The more significant impacts from overflows occur on a local scale and hence the maximum benefits can be achieved for the whole of the Blue Mountains GA by strategies revolving around localised abatement actions.

4.2.1 Wet weather overflows

Sydney Water has developed a mathematical model to describe the hydraulic behaviour of the sewerage systems in wet weather (Sydney Water 1997a; 1997b; 1997c from Volume 2). The wet weather model attempts to quantify the frequency (events/10 years), quantity (volume/10 years) and duration of wet weather overflows and estimate the cost of reducing the frequency to a pre-determined containment level (refer to Methods document).

The modelling indicates that although the Winmalee system has the capacity to handle all dry weather flows, the system overflows, on average, 51 times in a 10 year period, (approximately once every 2 months on average). It is possible, however, that the model under estimates the number of overflows (Sydney Water (a), addendum), and hence the overflow frequency should be taken as a minimum.

The overflows occur as a result of the high levels of inflow and infiltration during wet weather, and insufficient capacity of the system. Without improvements to the sewerage system and/or management procedures, the increased loads, as a result of population growth in the catchment, would increase the number of overflow events to 102 in 10 years by 2021. Therefore to achieve the minimum performance objectives of no increase in the number of overflow events (ie. 51), system improvements would be required (such as I/I reduction).

Based on data available for determining environmental impacts associated with overflows and the high value the community places on the environmental sensitivity of the Blue Mountains, it is considered that an appropriate precautionary approach is to adopt a significantly higher level of wet weather containment than minimum performance objectives to achieve both short and long term environmental goals for the Blue Mountains and Lake Burragorang REZs. Analysis in Volume 2 of this EIS of the benefits and costs of additional system-wide wet weather overflow abatement indicates that overflow frequency should be reduced to 10 events in a 10 year period.

The strategy to achieve these objectives is to adopt a series of actions to achieve reduction from the current 51 events to the future 10 events in 10 years. The actions required to fulfil this strategy are defined in Section 4.3. This strategy will achieve an 82 percent reduction in the number of overflow events, consistent with Sydney long term performance target of 80-90% reduction in the number of overflow events Sydney wide.

4.2.2 Partially treated STP discharges

The Winmalee STP is located outside the Blue Mountains National Park and discharges treated effluent into an unnamed creek which runs parallel to, and to the north of Frasers Creek. It is a creek that would normally not contain a permanent water flow. STP discharges flow directly into of the Nepean River from this unnamed creek.

For current containment performance (refer to Chapter 2), all events where less than full treatment occurs are given in Table 2.10, regardless of the disinfection performance. This (may) considerably overstate the actual number of events when partially treated discharges are deemed to be sewerage overflows (that is when they exceed 150 cfu per 100 millilitre).

Future containment performance goal, (refer to Chapter 4) requires that only those events which will exceed 150 faecal coliforms per 100 millilitre will be considered as overflows from STPs. The future containment performance may be achieved by either storage or disinfection.

The objective adopted for partially treated STP discharge for Winmalee is 20 partially treated discharges in a ten year period, as discussed in Volume 2. This is a reduction of 67% from the current frequency of 110 discharges in ten years.

On the basis of the current data, it is not possible to establish whether this discharge frequency is sufficient to meet the long term objective, which requires that receiving water (which in this situation is the Nepean River rather than the unnamed creek to which the STP directly discharges) meets water quality criteria for primary contact in wet weather. The water quality of the Nepean River is influenced by other pollutant sources. For example, levels of faecal coliforms in the Nepean River may be sourced from other upstream STPs (such as Penrith, Mt Riverview and Glenbrook) or urban stormwater runoff. If these other external sources are not addressed in conjunction with the Winmalee STP abatement strategies, may not ensure that water criterion are achieved.

Therefore the strategy recommended to achieve these objectives would be to adopt a series of actions to achieve the objective of 20 partially treated STP discharges in 10 years and to continually monitor the health of the river to determine if the minimum performance objectives is sufficient or if influenced by other pollutant sources such as urban stormwater runoff. The series of actions required to fulfil this strategy are defined in Section 4.3.

4.2.3 Choke related overflows (surcharges)

The Winmalee system generally meets all the Sydney long term performance targets with regard to choke related overflows. The general performance of the area is as follows:

1. to maintain or improve the percentage of customers not affected by surcharges, which at 98.4% is well above the Sydney Wide Performance Target of 96%
2. guarantee no repeat in two years for individual customers experiencing greater than two events in six months, - no current data is available on this parameter
3. number of choke complaints: the suburbs of North Katoomba, Leura, Valley Heights, Springwood, Bullaburra, Hazelbrook and Faulconbridge are all in the medium choke category (60-180 chokes/100 km per year). All other suburbs are in the low category
4. internal surcharges - no occurrences of internal surcharges are known.

Chokes in the system can occur during dry and wet weather and abatement actions recommended for the reduction of both wet weather and dry weather overflows and exfiltration will assist in the reduction of chokes in the system. The strategy to achieve minimum performance objectives will be a combination of actions from the other recommended strategies to address other overflow types plus actions as listed in Section 4.3.

4.2.4 Exfiltration

The Sewer Leakage Project identified three catchments (Wentworth Falls, Hazelbrook and Valley Heights) within the Winmalee system as having moderate exfiltration. In addition, dry weather water quality modelling of several waterways within the area served by Winmalee sewerage system showed high levels of faecal coliform in creeks in South Katoomba and North Katoomba, possibly attributable to exfiltration.

The Sydney wide long term performance target is to avoid failure of swimming and/or boating water quality during dry weather. Analysis of water quality samples during dry weather as described in Section 2.4.3 shows some of the waterways do not meet those criteria, with exfiltration the suspected cause.

As data does not conclusively prove the existence of exfiltration, a major part of the strategy to abate exfiltration problems is to undertake further investigations to positively identify the exfiltration catchments. It is recommended that these catchments be placed on an Infiltration/Exfiltration program. If investigations indicate an exfiltration problem the program will recommend system rehabilitation to ensure that the Winmalee system performs in accordance with the long term performance target .

4.2.5 Overflows caused by SPS failures

There are 61 SPSs in the Winmalee sewerage system. A total of 214 overflows were estimated in these SPSs in 1996/97.

Overflows from SPSs in Winmalee occur mostly as a result of a failure (eg power failure, pump breakdown). Some of the SPSs have no standby equipment and/or limited storage capacity, causing the SPS to overflow before maintenance personnel have reached the site. The recommended strategies are:

1. upgrade the pumping capacity of SPSs to match the wet weather inflow
2. upgrade storage and standby equipment to reduce the level of risk to provide containment capacity to within the appropriate response time of 4 hours, as adopted for the Blue Mountains area.

4.2.6 Odours

Data collected by Sydney Water indicates that four suburbs where found to have an above average number of odour complaints within the Winmalee sewerage system (refer to Section 2.4.6). Odours can be either related to liquid overflow events or to problems related to the system such as odours from vents and chambers. Strategies adopted for the abatement of overflows will be complimentary to strategies adopted to reduce the instances of liquid overflows and chokes, as well as employing structural actions to rectify deficiencies in the system which may be causing septic odour problems from the system.

The strategy adopted for odour containment in Winmalee is a series of actions aimed at achieving a maximum of 3 complaints per individual asset per year, as per the Sydney long term performance target.

4.2.7 Summary of objectives and strategies to meet the objectives

Table 4.3 summarises the specific strategies adopted for the six overflow types. In addition, there are other 'inherent' obvious strategies that are directed at protecting public health and reducing impact of overflows once they occur.

Table 4.3 - Summary of strategies

Overflow type	Adopted objectives	Adopted strategies
Wet Weather overflows	Maximum of 10 events in 10 years	Actions as per Table 4.12
Partially treated STP discharge	Maximum of 20 events in 10 years	Actions as per Table 4.12
Choke related overflows	All suburbs to be in the low range (less than 60 chokes per 100 km per year)	Better reporting. Actions as per table 4.12
Exfiltration	Surface water quality suitable for swimming/boating in dry weather	More positive identification of the problem. Actions as per Table 4.12
Overflow caused by SPS failures	All SPSs comply with design standards for new SPSs	Upgrading SPS pumping and storage Actions as per Table 4.12
Odours	Maximum 3 odour complaints per individual asset per year	Better reporting of problem. Actions as per Table 4.12

4.3 Actions to achieve overflow abatement strategy

The abatement of sewer overflow impacts can be accomplished by undertaking a variety of actions such as increasing sewer capacity, relocation of overflows, on-line or off-line storage, demand management and in-line treatment targeted at each of the main overflow areas. For this project, each of these ways has been termed an action. The selected actions make up the proposed management plan which comprises the strategy to achieve the objectives, as described in the following section.

It is important to note that the actions described in this EIS are only indicative of the measures that may be used. These actions will be decided following more detailed modelling and environmental monitoring, with final actions being decided during the second stage Environmental Impact Assessment (EIA) which will look specifically at the impacts of implementing structural works arising from the actions. Selected for specific locations.

Actions fall into three general categories:

1. detect overflows - improve information on prediction of overflows, impact of overflows and identify and record overflows and their impact
2. prevent overflows - prevent, or reduce the frequency of, overflows
3. minimise impact - reduce the impact of overflows, once they occur.

The proposed actions for each type of overflow are discussed, including Sydney Water to the minimum requirements specified by USEPA guidelines a recognised international benchmark for water quality worldwide.

4.3.1 Wet weather overflows

Wet weather overflow are surcharges from the reticulation system (including SPSs) due to excess inflow of stormwater and/or insufficient of capacity. Overflows from SPSs during wet weather are also addressed in the Section 4.3.5 below.

Actions to achieve the wet weather overflow strategy include:

1. Detection of overflows

- Conducting more comprehensive sewer and water quality modelling. The current sewer modelling (Sydney Water (a) is likely to underestimate the overflow events, especially in North and South Katoomba. This is because of the low resolution of the modelling (whole sub-areas were modelled as a single node without sub-nodes such as SPSs) and because no allowance was made to the significant tourist population during holiday periods which causes higher than normal peaks to the system. Additional modelling should include the SPSs and allow for tourist population flow peaks to better predict the performance of the system. This will provide more accurate data for water quality modelling (Sydney Water 1997a).

- Investigation of the location of unknown overflow events.
- Recording details of overflow events. Predictions of overflows from the sewer modelling need to be corroborated by recording actual overflow events and correlating with actual rainfall events; and the actual recording of the overflows is required to measure the performance of the system against the adopted strategy.
- Increasing the amount of water quality data collection, especially in local streams to more accurately quantify and evaluate the relative impact of overflows.

2. Prevention of overflows
   - Reduction of overflow frequency can be reduced by either reducing infiltration and inflow (I/I), increasing the system capacity, providing storage for the excess flow, or a combination of these actions. The actual actions will be determined following further data collection and interpretation. The wet weather modelling (Sydney Water 1997 a) and subsequent estimates from Sydney Water indicate that the cost of reducing the number of overflow events to 10 in 10 years is $54.1 million.
   - Identifying the impact of (if any) wet weather overflows from within private property. Private sewers (the section of the sewer from the property boundary trap to the private residence or commercial/industrial/institutional facility) can contribute some of the inflow and infiltration. Although it is unknown at this stage to what extent this may be. It is possible that reducing I/I from private sewers is more cost effective than reducing it from Sydney Water sewers.
   - Sydney Water has no authority over the private sewers. It is possible to implement a 'pink slip' system, requiring property owners to carry out a compulsory inspection of their private sewer periodically, or when the property is sold. Such an action will require changes to legislation.
   - Investigating ways to improve sewer design and installation, to prevent inflow and infiltration in new areas.
3. Minimising the impact of overflows
   - Continue ongoing improvements on current procedure of cleaning the site after the overflow, including removal of debris and flushing the area with fresh water.

The actions for addressing wet weather overflows are listed in Table 4.4.

Table 4.4 - Actions to detect, prevent and minimise the impact of wet weather overflows

Category	Actions	Benefits	Relevant USEPA requirement
Detect overflows	Additional sewer and water quality modelling	More accurate prediction of overflows and their impact	A process must exist for identifying overflows
	Improve procedures for recording overflows	Confirm modelling results Confirm compliance with strategy	A summary description of known overflow events occurring in the last 24 months Monitoring to effectively characterise overflow impacts and the efficiency of overflow controls
	Improve and increase procedures for the collection of water quality data	Understand impact on local streams	Monitoring to effectively characterise overflow impacts and the efficiency of overflow controls
Prevent overflows	Reduce I/I	Reduce the flow in sewers during wet weather to achieve the adopted containment	Pro-active maintenance in known problem areas including: proper sealing or maintenance of access chambers, regular maintenance of deteriorating sewers, remediation of poor construction and a long term replacement or rehabilitation program
	Consider options for compulsory inspection of private sewers by property owners	Reduce flow in sewers	As above
	Augment system for additional population	Avoid further overloading the existing system	Maximisation of flow to the sewage treatment plant for treatment
	Improve sewer design and installation	Avoid I/I in new areas	Procedures must be developed for new sewer and service lateral installation to the system
Minimise impact	Continue containment of overflows	Prevent sewage from reaching water courses	Pollution prevention
	Continue cleaning after overflow	Reduce visual impact and risk to public health	Procedures must exist to stop and respond to overflow events

4.3.2 Partially treated STP discharges

Actions to achieve the partially treated STP discharge strategy include:

1. Detection of discharges

   - Monitoring of partially treated STP discharge through the STP Licence. Predictions of overflows from the STP modelling need to be corroborated by recording actual overflow events. The actual recording of the overflows including disinfection performance of the STP is required as a condition of the STP Licence. The continued monitoring of effluent quality and gauging of flows through the STP will be needed to measure the performance of the system against the adopted strategy.

   - Investigating impact of partially treated discharge on receiving water quality by detailed water quality modelling, to determine what additional containment or disinfection, if any, is required to meet the long term objective of not exceeding swimming criteria in receiving water.

2. Preventing discharges

- Providing storage at the STP to store excess flow for treatment after wet weather. This action is estimated to have a similar cost to disinfection of excess flow, but has the potential to provide higher environmental protection, as all flows up to the target of 20 events per ten years will receive full treatment.
- Winmalee STP is currently undergoing augmentation. When complete, partially treated STP discharge is expected to be reduced to 28 events in ten years. Additional works will be required to reduce the frequency further to 20 events in ten years.
- It should be recognised that actions as previously discussed to reduce wet weather overflows will reduce the flow into the STP, and reduce partially treated STP discharge frequency.

Actions to address STP discharges are listed in Table 4.5.

Table 4.5 - Actions to detect, prevent and minimise the impact of partially treated STP discharges

Category	Actions	Benefits	Relevant USEPA Requirement
Detect discharges	Record overflow events and disinfection performance	Confirm modelling results	A summary description of known overflow events occurring in the last 24 months
	Model impact on receiving waters	Meet Sydney wide long term performance target	Monitoring to effectively characterise overflow impacts and the efficiency of overflow controls
Prevent discharges	Provide additional storage capacity at STP	Store excess wet weather flow and provide full treatment after wet weather	Measures to stop and mitigate the impact of overflow events
	Reduce flow to STP (part of other strategies, such as I/I reduction)	Reduce flow to the STP during wet weather	

4.3.3 Choke related overflows (surcharges)

Under normal operating conditions the Winmalee sewerage system has sufficient hydraulic capacity to transport both existing and future dry weather flows to the STP. However surcharges from the sewerage system occur during dry and wet weather as a result of chokes.

Seven suburbs in the Winmalee sewerage system have a medium density of chokes. Grouting of pipes will be required to reduce the choke density in these suburbs to low. All suburbs will be monitored to ensure that they remain in the low category.

It is noted that grouting and relining of pipes, that may be adopted to reduce wet weather overflow, can reduce choke related overflows.

Actions to achieve the choke related overflow strategy include:

1. Detect surcharges

- Record choke related overflows. This will provide an indication of the environmental impact of choke related overflows; and enable Sydney Water to monitor the performance of the system against the adopted strategy.
- Continue to improve methodology for identifying repeat chokes. The Sydney wide long term objective guaranteeing no surcharges for two years to customers who have experienced two surcharges in six months requires that repeat chokes are monitored.

- Develop methodology for assessing cost benefits. Develop methodology for identifying the effectiveness and quantifying the cost and benefits of the methods to reduce chokes, such as proactive root cutting in reticulation pipes, grouting and relining. This will enable Sydney Water to adopt the most cost effective method, and to budget for choke reduction.

2. Prevent surcharges

- Grout pipes in the seven suburbs with medium density of chokes to reduce the choke frequency to low.

- Encourage planting of trees with less invasive roots. Implement community education providing advice on appropriate types of trees to plant. Approximately 90 percent of the chokes are caused by intrusion of tree roots into the sewer. There is an opportunity for long term reduction in chokes by encouraging the public, local council and developers to plant trees with less intrusive root systems.

- Proactive sewer inspection and cleaning. As part of its critical assets program, Sydney Water is inspecting large sewers (greater than 300 mm diameter) proactively. That is, not waiting for a choke to occur. This practice should continue and, in areas identified as having high choke density, be extended to smaller sewers.

3. Minimise impact of surcharges

- Improve public reporting on chokes. Sydney Water relies heavily on public reporting of chokes, but it is possible that overflows in roads or other public areas may not be reported promptly. An education campaign to encourage the public to report overflows will enable repeat chokes to be identified, reduce Sydney Water response time and reduce the impact of overflows.

- Continue with current procedures of containing overflows by bunding the area; returning the sewage to the sewer, and/or pumping the sewage to a road tanker and transporting it to other parts of the system until the choke is cleared.

- Continue with current procedure of cleaning the site after the overflow, including removal of visual solids and flushing the area with fresh water.

The actions are summarised in Table 4.6.

Table 4.6 - Actions to detect, prevent and minimise the impact of choke related overflows (surcharges)

Category	Actions	Benefits	Relevant USEPA requirement
Detect surcharges	Improve recording of choke related overflows and their impact	Enable assessment of the impact of chokes Ensure that the strategy is met.	A summary description of known overflow events occurring in the last 24 months
	Develop model for assessing the cost benefits of options	Enable Sydney Water to prioritise abatement targets	
Prevent surcharges	Grout pipes in suburbs of medium choke rate.	Reduction in choke incidents	Pro-active maintenance in known problem areas including: regular maintenance of deteriorating sewers remediation of poor construction and long term replacement or rehabilitation program
	Continue proactive inspection of large pipes, and possibly extending to smaller pipes	Identify and remove partial blockages before they cause surcharges	As above
Minimise impact	Improve public reporting	Prompt reporting will reduce the duration and impact of overflows	A process must exist for identifying overflows
	Continue with containment of overflow	Prevent sewage from reaching water courses	Pollution prevention
	Continue cleaning after the event	Reduce visual impact and risk to public health	Procedures must exist to stop and respond to overflow events

4.3.4 Exfiltration

Sydney Water has established an interim infiltration/exfiltration (I/E) program as described in Chapter 4.3. The program is designed to investigate the impacts of exfiltration and options to reduce exfiltration when it is detected. This is a program already adopted by Sydney Water and is a separate program to the recommended actions under SOLP. However the I/E program will be an essential part of the strategies required to abate overflow into the environment.

Two parameters have been used to assess the performance of the system with respect to overflow:

1. leakage indicator, as defined by the leakage project (Sydney Water (b)
2. environmental indicator - dry weather water quality (where available).

Table 4.7 shows the process for identifying and developing actions for exfiltration.

Table 4.7 - Action matrix for exfiltration

Leakage indicator Environmental indicator	**Leakage OK**	**Leakage analysis indicates exfiltration**
Indicator OK	Category (1) No action required - routine review of leakage indicator only	Category (2) Undertake routine dry weather sampling if no water quality data available. No further action required if dry weather water quality data complies with water quality objectives
Indicator above threshold (ie. median > 1000 cfu/ 100 ml - secondary recreation median > 150 cfu/100 ml - primary recreation)	Category (3) Investigation as to source of contamination - Catchment to I/E Program if no other major sources are identified.	Category (4) Catchment to I/E Program for initial investigation at mini-catchment gauging level

Three catchments were identified from modelling of sewage flows as having moderate exfiltration by the leakage project. These were:

1. Wentworth Falls
2. Hazelbrook
3. Valley Heights

Further to this modelling water quality monitoring was undertaken to assess the possibility of exfiltration from other catchments by testing for indicators in waterways during dry weather. The results indicate that for the Yosemite Creek (North Katoomba Sub-area) and Leura Cascades (South Katoomba Sub-area) exfiltration problems in the sewer system are possible.

The sub-areas in the Winmalee system correspond to the categories in the action matrix as shown in Table 4.8.

Table 4.8 - Categories for Sub areas in Winmalee

Category in Action Matrix	Sub-catchment	Actions
1	964010 - Winmalee	No action required
1		Leakage not identified, but areas within the catchment of Lake Woodford should be further investigated to ensure no leakage into Special Area for drinking water catchment.
2	967010 - Wentworth Falls 966010 - Hazelbrook 962010 - Valley Heights	Undertake water quality testing. If contamination detected include in I/E programme.
3	969010 - North Katoomba 968010 - South Katoomba	Investigate source of contamination. If no source identified, include in I/E programme.
4	nil	

Actions to achieve the exfiltration strategy of:

1. improving data to clarify problem catchments
2. identify appropriate works to be undertaken in the I/I program
3. monitoring of results

include:

1. Detect exfiltration
   - Monitoring of water quality of streams during dry weather to detect exfiltration leakage from nearby systems.
   - Investigate catchments suspected of having exfiltration problems as a priority as shown in Table 4.8.
   - Improve water quality data, to gauge if there is impact from exfiltration. This is particularly important for the parts of the system within the catchment of Lake Woodford which are part of the Blue Mountains water supply.

2. Prevent exfiltration

   - If there is evidence from water quality monitoring that exfiltration is impacting on water quality objectives then the section of the system will be included on the I/E program on a priority basis across Sydney Water catchments.

3. Minimise impact of exfiltration

   - All actions to detect and prevent exfiltration required
   - Monitor results of exfiltration work

The actions are summarised in Table 4.9.

Table 4.9 - Actions to detect, prevent and minimise the impact of exfiltration

Category	Actions	Benefits	Relevant USEPA Requirement
Detect exfiltration	Record exfiltration occurrences and other relevant data (eg water quality)	Enable assessment of the impact of exfiltration. Ensure that the strategy is met	A summary description of known overflow events occurring in the last 24 months
	Investigate as per Table 4.7	Determine impact of exfiltration	Monitoring to effectively characterise overflow impacts and the efficiency of overflow controls
	Monitor water quality in local water courses	Protect water supply catchments Ensure that the strategy is met	A process must exist for identifying overflows
Prevent exfiltration	If exfiltration identified (refer to detect exfiltration above), proceed with pipe rehabilitation under the I/E program	Seal pipes to prevent escape of sewage	Pro-active maintenance in known problem ares including: regular maintenance of deteriorating sewers remediation of poor construction and long term replacement or rehabilitation program
Minimise impact	All actions to detect and prevent exfiltration. Monitor results of exfiltration work	Seal pipes to prevent escape of sewage	Pro-active maintenance in known problem ares including: regular maintenance of deteriorating sewers remediation of poor construction and long term replacement or rehabilitation program

4.3.5 Overflows caused by SPS failures

The prioritised list of SPSs which require upgrading is contained within Section 3.4

In addition to overflows from SPSs during wet weather, overflows from SPSs in Winmalee are caused mainly from failure of equipment and power interruptions. Insufficient storage capacity and lack of standby pumps in some of the SPSs means that overflows can occur before maintenance personnel can arrive on site.

Actions to achieve a reduction in SPS related overflows include:

- Upgrading the pumping capacities to match the wet weather inflows
- Upgrading storage and standby equipment to match appropriate response times are as follows

1. Detection of overflows by:

   - Recording overflows caused by SPS failures. This will provide an indication of the environmental impact of SPS failures; and enable Sydney Water to monitor the performance of the system.

   - Regularly reviewing the pumping capacity and storage capacity of SPSs, to ensure their capacity complies with the requirement, as loadings increase.

2. Prevention of overflows by:

   - Increasing storage capacity. Storage needs to be increased to minimum of 4 hours, to enable service personnel, in case of SPS failure to reach the SPS before the overflow occurs.

   - Increasing pumping capacity. Some of the SPSs in Winmalee have insufficient pumping capacity for wet weather flows. The pumping capacity needs to be increased to comply with current design standards.

   - Providing standby pumps. To reduce the risk of overflow 14 of the 61 SPSs, which have only one pump, need to be upgraded to ensure that at least one unit is available as standby.

   - Provision for connecting a portable generator. Sydney Water uses portable generators to operate SPSs in case of power interruption. The SPSs in Winmalee do not have provision for connection of a portable generator. It is particularly important in the Blue Mountains that all SPSs be provided with facilities to connect a portable generator (including appropriate access) as the area is potentially subject to a high lightning strike rate which can cause power interruptions.

   - Continuing with frequent flushing of SPSs. Due to the low ambient temperatures which are experienced in the Blue Mountains, especially in winter, grease can accumulate in the stations leading to blockages in pumps which can cause overflows. Sydney Water has already adopted maintenance procedures that include frequent flushing of the SPSs in the Blue Mountains to remove the grease and these measures should be maintained.

   - Improving and upgrade telemetry. Sydney Water is in the process of upgrading the telemetry to a SCADA system that will provide reliable information on failures or abnormal conditions, and enable remote control and monitoring of the SPSs.

3. Minimising the impact of overflows by:

   - Installing overflow pipes with litter and grease removal pits. Most SPSs have no overflow structure, and no SPS has facilities to remove litter and grease from the sewage in the case of overflow. All stations should be fitted with an overflow pipe to direct the overflow to a more acceptable location, and with an appropriate grease removal system such as a pit to screen the overflow and trap to contain the grease. This action should minimise the visual impact of overflows as well as improve water quality in the receiving water.

   - Continuing with current procedures of containing overflows by bunding the area; returning the sewage to the sewer, and/or pumping the sewage to a road tanker and transporting it to other parts of the system until the problem is fixed.

   - Continuing with current procedure of cleaning the site after the overflow, including removal of visual solids and flushing the area with fresh water.

   - Regularly updating contingency plans for SPSs. All SPSs have contingency plans, and Sydney Water should update these regularly to ensure that they are current and applicable.

   - Advising the public in case of a major overflow that may affect amenity of tourist destinations.

The options to reduce overflows from the SPSs in Winmalee are summarised in Table 4.10.

Table 4.10 - Actions to detect, prevent and minimise the impact of SPS failures

Category	Actions	Benefits	Relevant USEPA requirement
Detect surcharges	Improve recording of overflows caused by SPS failures and their impact	Enable assessment of the impact of overflows	A process must exist for identifying overflows
		Monitor system performance	A summary description of known overflow events occurring in the last 24 months
	Regularly review SPS capacities	Ensure that SPS can handle loadings	
Prevent overflows	Upgrade storage capacity to 4 hours PDWF	Reduce the risk of overflow in case of equipment failure or power interruption	Maximum use of the collection system for storage
	Upgrade SPS pumping capacity to wet weather requirements	Reduce the risk of overflow during wet weather	Prohibition of overflows during wet weather
	Provide standby pumps to SPSs currently lacking this equipment	Reduce the risk of overflow in case of pump failure	As above
	Install provision for connecting standby generator	Reduce the risk of overflow in case of power interruption	As above
	Continue with frequent flushing of SPSs to prevent grease accumulation	Reduce the risk of overflow from grease blocking the pumps	Proper operation and maintenance programs must be provided for maintenance of pump stations
	Continue to upgrade telemetry	Reduce the risk of overflow	A process must exist for identifying overflows
Minimise impact	Install overflow structures and litter/grease pits to all SPSs	Direct overflow to a point of less impact, and reduce visual impact	Control of solid and floatable materials in overflows
	Continue with containment of overflow	Prevent sewage from reaching water courses	Pollution prevention
	Continue cleaning after the event	Reduce visual impact and risk to public health	Procedures must exist to stop and respond to overflow events
			Measures to stop and mitigate the impact of overflow events
	Regularly update contingency plans for SPSs	Improve response in case of failure	Procedures must exist to stop and respond to overflow events
	Inform public of major pollution	Reduce impact on community	Public notification to ensure that the community receives adequate notification of overflow occurrences and impacts

4.3.6 Odours

There are no current specific structural works required to reduce odours from the Winmalee sewerage system. There are four suburbs in the Winmalee sewerage system which have been identified as having above the Sydney average number of odour complaints. Investigations into these occurrences indicate that not all odour complaints can be attributed to known liquid overflow events. This would indicate that the causes of these odours has generally been system based and most likely attributable to excessive residence of sewage leading to septicity. Odours can only be acted upon after complaint from the community and hence by encouraging more rigorous community reporting, odours, and if there are structural causes, can be rectified more effectively.

Actions to reduce the volume of liquid overflows and chokes will also have a complementary effect on odour generation. Other actions to achieve the odour abatement strategy of achieving a maximum 3 complaints per individual asset per year are:

1. Detection of odours

    - Record odour related overflows. Improve methodology of identifying odour complaint related to liquid or non-liquid events. This will provide an indication of the environmental impact of odour related overflows; and enable Sydney Water to monitor the performance of the system against the adopted strategy.

    - Improve existing system of identifying and reporting repeat odours. This will assist in the identification of areas prone to odours so that the objective as stated above can be achieved.

    - Model for cost benefits. Develop model for identifying the effectiveness and quantifying the cost and benefits of the methods to reduce odour, such as proactive flushing and cleaning in reticulation pipes to break up odour causing fat deposits. This will enable Sydney Water to adopt the most cost effective method, and to prioritise actions for odour reduction.

2. Prevention of odour

    The performance of the system will be monitored through the database (described above), to ensure it does not deteriorate. Management practices to prevent overflows include:

    - Proactive sewer inspection and cleaning. As part of its critical assets program, Sydney Water is inspecting large sewers (greater than 300 mm diameter) proactively. That is, not waiting for a odour complaint to occur. This practice should continue and be extended to smaller sewers.

    - Should the odour frequency exceed one complaint per year, inspection and proactive cleaning and flushing (before they cause overflow) will be adopted to reduce the odour frequency. These problem areas should be investigated if the odour problem is repeated to determine whether a structural solution for the asset is required..

3. Minimising impact of odours

    - Improving public reporting on odours. Sydney Water relies heavily on public reporting of odours. An education campaign to encourage the public to report overflows will identify areas of repeat odour problems, reduce Sydney Water response time and reduce the impact of odours.

    - Inspecting pipelines in non urban areas, especially in areas likely to have public access. Odours from pipes and manholes in bush areas may go unnoticed for a long time and may indicate other problems which may be causing liquid overflows, such as chokes or exfiltration. Regular inspections of pipes in non-urban areas would ensure that these odours are detected and mitigated and other problems identified.

The actions to reduce odours are summarised in Table 4.11.

Table 4.11 - Actions to detect, prevent and minimise the impact of odour

Category	Actions	Benefits	Relevant USEPA requirement
Detect odours	Improve recording of odours and their impact	Enable assessment of the impact of odours	A summary description of known overflow events occurring in the last 24 months
	Improve methodology for identifying odours related to liquid and non-liquid overflows.	Ensure that the strategy is met.	
	Improve methodology for identifying repeat odour complaints	Meet Sydney wide long term performance target	As above
	Develop model for assessing the cost benefits of options	Enable Sydney Water to budget for abatement targets	
Prevent odours	Continue proactive inspection of large pipes, and possibly extending to smaller pipes	Identify and remove partial blockages before they cause odour complaints	Pro-active maintenance in known problem areas including: regular maintenance of deteriorating sewers, remediation of poor construction and long term replacement or rehabilitation program
	Only if chokes exceed one complaint per year in the future: proactive flushing and cleaning in reticulation pipes in areas of high odour incidents Installation of odour treatment should be investigated	Reduction in odour incidents	Review and modification of pretreatment requirements to ensure that overflow impacts are minimised
Minimise impact	Improve public reporting	Prompt reporting will reduce the duration and impact of overflows	You must have a process for identifying odours
	Inspect non-urban pipe routes	Identify overflows that are not reported by the public	As above

4.3.7 Source Control

Reducing water usage and contaminant levels in the sewage would reduce the impact of overflows for all four liquid overflow options (chokes, SPS failure, exfiltration and wet weather overflows).

As stated in Section 2.3.1, Sydney Water's Source Control Policy focuses on the loads and concentrations of particular substances entering the STP, and requires waste dischargers to treat waste streams to an acceptable level prior to discharge to the sewers. Not only will this benefit the treatment process at the STP, but will also mean that the potential toxicity of an overflow could be reduced. Although the Source Control Policy is an existing Sydney Water Policy and not a new action under the SOPL program, the Source Control Program is an integral part of the strategy to abate the environmental impacts of overflows. The actions under this policy which can be adopted as part of the strategy are as follows:

1. Demand management - reduction in water consumption by customers, both residential and commercial (relevant mostly to dry weather overflows). Demand management can reduce the dry weather sewage volume, thus reducing the quantity and impact of overflow, especially during dry weather.
2. Sydney Water has an ongoing demand management program, and as part of this program residents of Winmalee have been provided with devices to reduce the amount of water used in toilet flushing.
3. Reduction in oil and grease. Sydney Water, to date, has focussed on commercial customers, but an opportunity exists for an information campaign advising the community of the environmental

impact of oil and grease, and urging residential customers not to dispose of oils into the sewerage system.

4. Reduction in phosphorus. As for oil and grease, Sydney Water, to date has focussed on commercial customers in relation to trade waste. Reduction in phosphorus in sewage may be achieved through a similar information campaign, and endorsement of low phosphorus detergents.

The source control actions are listed in Table 4.12:

Table 4.12 - Actions to minimise the impact of all types of liquid overflows

Category	Actions	Benefits
Minimise impact	Demand management	Reduce quantity of overflows, especially in dry weather
	Reduce oil and grease in domestic sewage	Reduce impact on waterways from all types of overflows
	Reduce phosphorus in domestic sewage	Reduce impact on waterways from all types of overflows

4.4 The integrated strategy to deliver the preferred option

4.4.1 Existing overflow abatement program

This section discusses how the proposed strategy integrates with the existing overflow programs (I/E program and SPS Risk Reduction program). These programs of works and investigations by Sydney Water are part of an interim program to abate overflows which are presently being implemented until the SOLP program actions are implemented. These are summarised as follows:

1. Sydney Water is conducting an interim Infiltration/Exfiltration (I/E) program on 31 project areas which have exhibited high faecal bacteria levels and constitute identifiable public health risks. No interim I/E Program project areas have been presently selected in the Winmalee catchment for the initial investigations since the catchment is not considered to be a problem area compared to other potential infiltration/exfiltration sub-catchments around Sydney. However if the methods used prove to be efficient in the detection of I/E problems, this methodology can be adopted and customised for use in Winmalee.

2. Sydney Water has also initiated an SPS risk reduction program to investigate potential impacts of overflows from SPS failures. The risk assessment includes estimated overflow volume, environmental factors, telemetry, power supply, pump availability, control/redundancy and history of failure. All of Sydney Water's SPSs have been ranked as part of the program and works have been identified to reduce the risk of SPS failures. The SPSs in Winmalee have been ranked as high risk due to the sensitive environment and their inadequate standard and are within current works programs for upgrading.

3. Investigations are proceeding to trial a number of innovative "treat/discharge" technologies with private sector technology providers for localised overflow abatement. Potential improvements could be obtained locally, particularly with respect to sensitive areas. These technologies will be evaluated following assessment of their performances for treatment of overflows, and if relevant may be adopted in the Winmalee system.

4. A five year capital works program has been developed for all sewerage systems. The program is designed to maintain and upgrade the system assets and is updated annually. Improving the reliability and increasing the storage capacity of the SPSs in Winmalee is part of the program. In the longer term, plans are being developed to increase the capacity of the Winmalee system to cope with additional loads from population growth in the area and backlog sewer areas. Other works on the capital works program include replacement of old or under-capacity pipes and upgrade of telemetry. Overflow abatement works recommended as part of this process will be undertaken over the next 25 years according to their priority. Higher priority works will be integrated into the existing five year program.

4.5 Summary of actions

The proposed actions for Winmalee sewerage system are summarised in Table 4.13.

Table 4.13 - Summary of preferred actions for Winmalee sewerage system

Overflow Type	Objectives to be achieved by the strategy	Actions to be undertaken as part of the strategy		
		Detect overflows	**Prevent overflows**	**Minimise impact**
Wet Weather overflows	Maximum of 10 events in 10 years	Additional sewer and water quality modelling Record overflows[1] Collect water quality data	Reduce infiltration/inflow Consider compulsory inspection of private sewers[1] Augment system for growth Improve design & installation[1]	Continue to contain overflows Continue to clean after overflows
Partially treated STP discharge	Maximum of 20 events in 10 years	Record discharges from STP[1] Model impact on receiving waters	Provide storage Reduce flow to STP (I/I reductions)	Clean after overflows
Choke related overflows	Reduce/maintain all suburbs at low choke category	Improve recording[1] Improve repeat choke identification[1] Cost/benefit model[1]	Grout pipes in seven suburbs in the medium choke category. Education on appropriate tree planting[1] Continue inspection & rehabilitation of pipes[1]	Improve public reporting[1] Inspect non-urban pipe routes
Exfiltration	Surface water quality suitable for Primary/Secondary Contact Recreation in dry weather	Undertake routine leakage analysis[1] Investigate catchments (refer to Table 4.7) Monitor quality in local creeks	If exfiltration confirmed - include in I/E program	
Overflow caused by SPS failures	All SPSs comply with Sydney Water design standards for new SPSs	Improve recording[1] Review capacities	Upgrade storage Upgrade pumping capacity Provide standby pumps to all SPSs Install provision for generator Continue frequent flushing Continue telemetry upgrade	Install overflow structures with litter/grease removal Continue to contain overflows Continue to clean up after overflows Update contingency plans
Odours	Maximum 3 odour complaints per year	Improve data collection[1] Identify odour associated with liquid overflows[1] Improve repeat odour complaints identification Cost/benefit model	Proactive inspection of pipes Proactive flushing and cleaning of reticulation pipes Investigate the installation of odour treatment in area of high odour complaints.	Improve public reporting
All liquid overflows				Demand management[1] Reduce oil & grease[1] Reduce phosphorus[1]

Notes: 1. These actions are likely to be part of Sydney wide program

4.6 The proposed management plan

4.6.1 Environmental performance monitoring and audit

Procedures are in place to respond effectively to overflow and initiate corrective actions, however, the environmental implication of overflows have not been comprehensively documented. This report has drawn conclusions based on the available information, and finds that impacts from sewerage overflows are minor compared to stormwater and STP dry weather discharges. To ensure this situation continues and to facilitate future planning and system management an Environmental Performance Monitoring and Audit program is proposed.

The environmental monitoring follows a trigger and action system, whereby a trigger is the reception of complaints or identification of an overflow event and an action is the identification of an overflow event to an ecologically sensitive environment.

For further discussion on the environmental monitoring program refer to Volume 2, Section 4.5.3.

4.6.2 Costing and funding

Table 4.13 identifies the estimated cost for components of the preferred strategy. The total estimated cost for the Winmalee System over the next 25 years is $94.5 million (based on 1996 costs). This will be funded from Sydney Water's existing rates, rates from new customers and developer charges for new infrastructure.

Only actions specific to Winmalee, and those directly related to overflow reduction (SOLP) are listed in Table 4.13. Actions that are Sydney wide, and actions that are part of Sydney Water normal operations and maintenance budgets, are not included.

Sydney Water has undertaken a survey to determine the community's willingness to pay for abatement works. Although the costs of the proposed options will primarily be covered by existing rates, the community's acceptance is critical to the successful implementation of the proposed management plan. The community must remain involved in the process so that the significant costs associated with the abatement strategies are justified by the value placed on the receiving environment by the community.

The time frame for the SOLP project covers the period up to 2021. Due to the high environmental sensitivity of the Blue Mountains overflow abatement measures aimed at improved data collection, monitoring and improved management practices will be implemented immediately. Structural works to abate wet weather overflows are programmed for the period 2006 to 2010. All SPS upgrades will be completed by 2005.

Existing management and rehabilitation works such as the I/E program will also assist in identifying overflows and prioritising works. It is further recommended that the exfiltration catchments identified in Chapter 2 are added to the infiltration/exfiltration programmed already underway.

Table 4.14 - Proposed abatement measures for the Winmalee sewerage system

Overflow type	Overflow abatement	Cost ($,000)
Wet weather reticulation	Increase containment level to 10 events in ten years, improve data collection and monitoring, reporting of overflows, water quality and sewer modelling, I/E rehabilitation and overflow clean-up procedures.	54,100
Partially treated STP discharges	Increase containment to 20 events in ten years, improve data collection and monitoring, reporting of overflows, water quality and sewer modelling, provision of storage at STPs and overflow clean-up procedures.	N/a[6]
Surcharges due to chokes[2]	A low rate of chokes for seven identified suburbs, improve data collection and reporting, I/E reduction and clean-up procedures, routine monthly inspection of some lines in remote bushland areas.	11,500
Overflows from SPS failures[3, 4]	SPS to be upgraded to design standards suitable for the Blue Mountains, improved data collection, reporting and response time, construction of designed overflow structures with litter and grease containment, adequate storage to contain overflows given the proposed maintenance response time of 4 hours, pump capacity, telemetry and access, overflow clean-up procedures.	20,100
Exfiltration[5]	All sewerage system catchments to have a low exfiltration potential, improved data collection and reporting, I/E rehabilitation.	8,750
Odours[1]	All suburbs to have a low rate of complaints, improve data collection and reporting, routine flushing of sewers and SPSs.	
Total		**94,450**

Note:

1. Some components are included in Sydney wide programs and not part of SOLP.
2. Activities likely to be part of a Sydney Water-wide project, that will cover also the Winmalee system.
3. A major upgrade is required for 31 SPSs that have insufficient storage and/or no standby pump. That upgrade, at $600,000, is assumed to include a connection for portable generator and litter/grease removal pit.
4. The 30 SPSs that have sufficient storage and a standby pump, require connection to a portable generator and a litter/grease removal pit.
5. SOLP estimated the reduction of exfiltration from moderate to low at $2.25M per catchment. There is overlap with the chokes reduction (item 3 in this table). The amount budgeted for choke reduction was therefore deducted from the estimate for exfiltration reduction.
6. The wet weather containment (item 2.2) includes allowance for STP containment. As Winmalee STP is near new, and the required containment level at the STP is 20 overflows in 10 years.

General: There is likely to be some overlap between works required to reduce wet weather overflow (I/I reduction) and works required to reduce chokes and exfiltration. This estimate does not allow for these overlaps.

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Chapter 5

Assessment of Environmental Benefits of Preferred Strategies

Synopsis

This Chapter describes the benefits gained from implementation of the preferred strategy for the Winmalee sewerage system as described in Chapter 4, and the justification of the overflow abatement strategy for the Winmalee sewerage system in terms of biophysical, social, economic and ESD criteria. This chapter focuses on the benefits to Winmalee sewerage system, while the benefits to the Blue Mountains GA are described in Volume 2 of the EIS,. The overall benefit to the Winmalee sewerage system from implementation of the preferred option is generally ensuring that efforts to protect aquatic and terrestrial ecosystems are being made, particularly as the Blue Mountains is a sensitive area.

Benefits to the aquatic environment as a result of the preferred strategy in Winmalee sewerage system are based on compliance with regulatory requirements and satisfaction of community expectations. The water quality modelling indicates that overflow abatement does not translate to improvements in water quality on a catchment-wide basis. However, localised reductions in pollutants loads from overflows is required to protect the quality of the identified sensitive aquatic environments (including water supply areas). The overall risk of overflows is expected to be reduced through the implementation of the continuous improvement process.

Benefits to the terrestrial environment include the reduction of nutrient enrichment of soils and the reduced likelihood of weed introduction in competition with native vegetation around overflow points. Visual amenity and recreational opportunities are also expected to be improved in the vicinity of sewerage overflows. The risk to sensitive local terrestrial environments such as threatened species habitat would be expected to reduce due to the reduction of nutrient and toxicity impacts in the receiving environment.

Public health benefits are expected to result from the reduced occurrence of overflows in bushland, recreational areas, urban areas and waterways. Human activities such as primary and secondary contact recreation will be undertaken with reduced risk of contact with pollutants from overflows. Overflows potentially impacting local drinking water supplies will be reduced to improve compliance with legislation and comply with Plans of Management which include the reduction of processes which potentially impact on water supplies. Other legally protected conservation areas will be protected in accordance with Sydney Water's legal requirements.

The preferred strategy for the Winmalee sewerage system is required to restrict the number of overflow events to acceptable levels and reduce the risk of local impacts to the biophysical environment. The level of abatement proposed provides a positive net benefit and satisfies community expectations for the environmental quality of the Blue Mountains, particularly the protection of water supplies.

As there is uncertainty about the impacts of overflows, sewerage overflows must be reduced in accordance with the precautionary principle. The preferred option will not perpetuate current conditions or exacerbate conditions for the next generation. The environmental quality of the Blue Mountains area will therefore be enhanced for future generations (principle of inter-generational equity). The impact of untreated sewage discharges in some receiving environments in the Blue Mountains is not ecologically sustainable. In accordance with the principle of conservation of biological diversity, the preferred option includes a program to progressively reduce such overflows and reduce the risk to threatened or valuable habitats.

5. Assessment of environmental benefits of preferred strategies

5.1 Benefits of the preferred strategies

The preferred strategies recognise for the Winmalee sewerage system that:

1. the total extent of environmental impact from sewerage overflows is not fully understood, especially on a localised basis
2. the current impacts on a regional basis are minor as compared to the impacts from other sources such as urban stormwater runoff and STP dry weather discharges.

There are, however, many recognisable values which can clearly benefit by the implementation of the strategy. These values include:

1. classified waters protected by legislation under the Clean Waters Act 1970 and Special Protection Areas covered by Sydney Water (Catchment Management) Regulation 1995
2. a recognised environmental sensitivity especially given the proximity of the Blue Mountains National Park
3. high community expectations on the need to protect the values and "icon" status of the area
4. valuable wilderness areas
5. areas extensively used for recreational purposes
6. legally protected conservation areas.

The preferred strategies, therefore, adopt a precautionary approach to overflow abatement The implementation of the strategy from which sewerage overflows are minimised and thereby mitigating potential environmental impacts.

The overflow abatement objectives, the preferred strategies for overflow abatement, and the proposed management plan to achieve these objectives are outlined in Chapter 4. The objectives of the preferred strategies consider the environmental goals for Winmalee (refer to Section 3.1.1) set by Sydney Water with respect to the protection of drinking water supplies, as well as the Hawkesbury-Nepean Catchment Management Committee Trust, Blue Mountains Catchment Management Committee and Coxs River Catchment Management Committee.

The identified environmental goals are required to meet legislation targets and Sydney Water's long term objectives, its Environmental Plan and ESD Policy Statement (1996).

The preferred strategies will improve upon the minimum performance objectives for

1. partially treated discharges from Winmalee STP
2. wet weather containment
3. all other overflow types.

The first priority is to improve modelling, environment monitoring and data collection. Improved data on performance and impact will be a significant benefit for future planning, sewerage system management, and to prioritise system-wide improvements as policy on these issues can be based on reliable data (refer to Section 4.5.3, Volume 2).

5.2 Benefits to the aquatic environment

5.2.1 Water quality

The results of water quality modelling indicate that sewerage overflows from the Winmalee sewerage system are not a major source of contamination in waterways downstream of the Winmalee sewerage system, when compared to STP dry weather discharges and urban stormwater runoff. These two sources have had the greater contribution to the degradation of water quality in Blue Mountains streams.

Over the past five years, the STPs of North Katoomba and Wentworth Falls have been decommissioned and sewage from these areas now flow directly into the Blue Mountains Sewage Tunnel for processing at the Winmalee STP. Thus STP discharges have been removed from local streams with a subsequent improvement to the water quality. Similar benefits will be expected upon the de-commissioning of the South Katoomba STP, which is scheduled for mid 1998.

The results of the water quality modelling (refer to Section 3.2.2) indicate that, if all sewerage overflows were removed, there would be little or no improvement, on a regional scale, in the number of days suitable for primary or secondary recreation use of the waters, based on bacteriological quality. The modelling also shows that the percentage of contribution load of total phosphorus and total nitrogen is relatively minor (0.71% & 0.33% respectively) compared to loads attributable to stormwater runoff and STP dry weather discharges (refer to Section 3.2.2). Therefore the current contribution from the overflows to the nutrient concentrations and recreational values, is considered minor in a regional sense.

The preferred strategy at the STP for partially treated discharges, through to 2021, will benefit the Nepean River by ensuring that the impact of discharge into the Nepean River will not increase, even though the population will significantly increase by 2021 (refer to Section 2.6).

Many streams within the vicinity of the Winmalee sewerage system are protected through legislation and environmental regulation. One of the legislative requirements for Class P and S Waters dictates that no sewerage overflows are to discharge into these classified waters. These requirements for classified waters cannot be met without exception as it would be unrealistic to expect a sewerage system (especially one that is already established) to be completely free of overflows. As there are classified waters adjacent to the Winmalee sewerage system which are potentially impacted from existing sewered urbanised areas, there will always be a risk of overflows from these systems. The potential impact to these areas by pollution sources such as stormwater runoffs are likely to have a greater effect upon these waterways than impacts from sewerage overflows.

The preferred strategy, therefore, for overflow abatement in areas which benefit classified waters are:

1. to identify particular problem locations based upon a pro-active monitoring process, and actual overflow events and customer complaints
2. to undertake remedial works and to instigate where required structural works to prevent recurrence of the problem
3. to improve maintenance and emergency response practises to improve the system performance over and above the target level for the remainder of the sewerage system, to levels that reflect the sensitivity of the area.

The Woodford Special Area (drinking water supply catchment area for Lake Woodford) and which includes Class S Waters, requires a high level of abatement to protect the quality of water supply. The catchment in the Woodford Special Area were identified as being potentially affected by overflows from three SPSs (SPS 852,853 & 854). These have now all been decommissioned and hence the risk removed. The additional safeguards, especially investigation and remediation of potential exfiltration areas, will benefit this sensitive waterway by reducing, even further, the chance of sewerage overflows affecting drinking water quality.

One of the major benefits, at a local scale, for the Winmalee sewerage system is that the level of pathogens and nutrient discharges into receiving waters will be reduced due to the upgrade of SPSs and the STP. Depending on the outcome of further data collection and interpretation, the storage and pumping capacity of some SPS, will be increased. The resulting efficiency of the SPSs will increase sewerage flow into the STP. The upgrading of Winmalee STP will increase the volume of sewage subjected to of full treatment. This will assist in the protection of aquatic habitats, classified waters and improve the quality of the drinking water supply.

The preferred strategies will improve upon the minimum performance objectives (ie. base case) for:

1. wet weather containment
2. partially treated discharges from Winmalee STP
3. other overflow types (with the exception of chokes).

Aquatic ecology

The improved water quality from implementing the preferred strategy will be of benefit to the flora and fauna of these waterways and fauna which use these waterways for habitat and food and water supplies including endangered species populations and ecological communities listed in Schedule 1 or 2 of the Threatened Species Conservation Act (TSCA) 1995 (refer to Section 3.3). The reduction in overflows will benefit aquatic habitats in several ways:

1. By ensuring that the habitats have good water quality, the reduction in overflows will assist in the maintenance of the habitat in its natural state, thereby providing conditions which will encourage the continued health of flora and fauna communities including those of threatened species.
2. Water and sediments in the creeks and rivers will receive less nutrients, particulate matter and heavy metals. This will discourage the proliferation of weed and algal growth in the riparian environment in the water, banks and bars, reduce the transport of pollutants via particulate matter and reduce the risk of establishing habitats for exotic species.
3. The protection of these habitats will encourage maintenance of food sources for native fauna species.

5.3 Benefits to the terrestrial environment

Overflow events can affect terrestrial environments, including sensitive sedge swamp and wetland areas, which are habitats for native fauna including threatened species as listed in Schedule 1 and 2 of TSCA 1995. The major impacts are likely to be from dry weather overflows caused by system problems, such as chokes, SPS failures and exfiltration, which can discharge undiluted flows at random on the terrestrial environment (refer to Section 3.2.3).

The implementation of the preferred strategy (refer to Table 4.7) will improve the condition of those terrestrial habitats which are currently being impacted by sewerage overflows as these localised environments are generally at a greater risk from dry weather overflows. The reduction in overflows will benefit terrestrial habitats in several ways:

1. Native plant species can be sensitive to increase in nutrients within the soil. Nutrient enrichment in soils surrounding a sewerage overflow therefore may create an area where weeds can replace native species, leading to a localised loss of bio-diversity. Sewerage overflows can also act as a vehicle for the transportation of exotic seeds into bushland areas. A reduction in overflows, will therefore reduce the propagation of weed growth in natural bushland habitats. This will benefit these areas by maintaining bio-diversity, and food sources and habitats for native terrestrial fauna.

2. A reduction in dry and wet weather overflows into sensitive areas such as sedge swamps and wetlands will benefit native terrestrial fauna which use these areas as a habitat. This includes listed threatened species (refer to Section 3.3.1), in particular, Blue Mountains Swamp Skink, Red-crowned Toadlet, and Giant Burrowing Frog. The benefits include the maintenance of a clean water and food supply.
3. A reduction in overflows will reduce exposure of native fauna to pathogens and chemicals.

Overflow abatement should be a part of an integrated program of abatement measures. To maximise the benefits from the implementation of the sewage overflow abatement strategy, the overflow abatement strategy programs should be complemented by similar programs to address issues such as:

1. contaminants from urban stormwater runoff
2. effects of further urbanisation on loss of bushland areas
3. land erosion and sedimentation of waterways from high surface runoff.

Such programs would be the responsibility of organisations such as the Blue Mountains City Council and National Parks and Wildlife Services.

5.4 Benefits to the socio-economic environment

The main socio-economic benefits from a reduction in sewerage overflows within the Winmalee sewerage system include:

1. Improved protection of waterways designated for a high level of protection, such as drinking water catchments (Class P and S) and Special Areas. This is identified as the primary environmental goals for the Blue Mountain GA, which require increased protection of the Class S waterways and the surrounding catchment area. As discussed in Section 5.2, the impact of sewerage on water quality is minor on a regional scale, hence, due to the large distance between the area served by the Winmalee sewerage system and Lake Burragorang (up to 15 kilometres), the impact on Lake Burragorang is considered low. However, there is a potential for impact on local drinking water catchments such as the Woodford Special Area. The aims of the preferred strategy is to increase the protection required for this area. Abatement of other pollution sources, such as stormwater runoff, will be required to fully meet the primary environmental goals. In order to ensure full protection of drinking water supply storages, Sydney Water enforces a multi-barrier approach to catchment protection. Refer to Section 3.2.4 for details.
2. An improvement in the visual amenity of the Winmalee area. The public places a high value on the Blue Mountains area as a national natural "icon" and the tolerance of anything that would detract from the natural beauty and "wilderness" values of the area is extremely low. Any reduction in deposition of rubbish and floatables from overflows, and the weed infestation associated with regular overflow points will be seen as being a benefit to maintaining the visual amenity of the Winmalee area.
3. An increase in the recreational value of the environment. Localised impacts from sewerage overflows will occur to areas used for recreational purposes, such as bush walking and water contact activities. These include the Blue Mountains National Park as well as local parks and recreation fields located within residential areas. Localised effects are usually a result of temporary reductions in the water quality and can be a potential risk to human health through primary or secondary recreational contact. The community will benefit by a minor improvement in the number of days that water quality levels for primary and secondary contact recreation activities in these waterways meet the acceptable standards due to a reduction in bacteriological levels immediately following an overflow event.
4. Meeting the expectations of the community in terms of protection and conservation of the area. The community places a high value on the area and as such would expect that efforts were being made to protect the Blue Mountains environment. The overall benefit to the community will be in improved water quality and reduction in overflows, which will result in an improved community value for the environment surrounding the area served by the Winmalee sewerage system.

5. Economic benefits from an increase in tourism, as a flow-on effect from the preservation and improvement of the values placed on the visual and wilderness qualities of the Blue Mountains.

5.5 Justification of the preferred strategies for overflow abatement

The EP&A Reg 1994 requires that this EIS include the reasons justifying the carrying out of the development or activity in the manner proposed, having regard to the biophysical, economical and social considerations and the principles of ESD.

The Winmalee overflow abatement objective and the overflows management plan have been developed to meet the targets identified for overflows as part of the overall objective for the Blue Mountains GA. The targets are focussed on the environmental values and uses of the Winmalee catchment, the protection of sensitive areas and the maintenance of the principles of Ecologically Sustainable Development (ESD). Justification of the Blue Mountains GA overflows strategy is discussed in Volume 2, Chapter 6.

The management plan includes a combination of structural and non-structural options which are listed in Table 4.12.

Structural options will be subject to a second stage EIA process which will more precisely define the issues and refine the structural option to improve the abatement potential. Non-structural options are focused on recommended management practice in accordance with USEPA guidelines, (a recognised international benchmark), and will be part of a continuous improvement process.

All of the above structural and non-structural options are designed to:

1. meet legal requirements and Sydney Water's Operating Licence and Environment Plan
2. reduce overflows in a cost-effective manner
3. protect sensitive areas
4. minimise the impacts of overflows when they do occur
5. maintain the principles of ESD.

The area surrounding the Winmalee sewerage system is considered sensitive with the potential to be significantly impacted by overflow events (refer to Chapter 3). The overflow management plan for the Winmalee area is therefore based upon the protection of these highly sensitive areas and the maintenance of the principles of ESD.

The proposed integrated overflow strategies for Winmalee sewerage system outline a process of continuous improvements to reduce impacts of wet and dry weather overflows. It proposes to increase the level of wet weather containment to ten event per ten year and partially treated STP discharges to 20 events per ten years over the period from 2006 to 2010. In addition, the strategy proposes improvements to all other types of overflows to protect of the values of the area.

The process of continual improvement will include best management practices and both short and long term strategies that combine both structural and non-structural actions which can be implemented progressively over the next 25 years.

Adoption of the Precautionary Principle dictates that due to the limitations of the sewer and water quality modelling, there is a need for the implementation of continued and improved modelling in the future. Hence, whilst there is uncertainty relating to the impact of sewerage overflows in both wet and dry weather in the Winmalee sewerage system, the difficulties in evaluating these uncertainties have not precluded an assessment process and the development of abatement strategies.

The Inter-generational Equity Principle is demonstrated by implementing the proposed integrated overflow strategy of the Winmalee sewerage system, the condition will actually improve rather than deteriorate over the next 25 years. This will ensure that the standards of the system are maintained for the next generation as well as assisting to preserve the environmental quality of the Blue Mountains area for the next generation.

The Conservation of Biological Diversity is demonstrated by the implementation of the proposed integrated overflow strategy, which embraces conservation of biological diversity in all areas of the Blue Mountains by ensuring that a high level of abatement is exercised. This will ensure that threatened or valuable habitats are not affected by overflows.

The Improved Valuation and Pricing of Environmental Resources is demonstrated in the economic evaluations of the sewerage overflow abatement measures, undertaken in accordance with the NSW Guidelines for Economic Appraisal. The findings of these investigations indicated that the costs of the preferred wet weather overflow strategies of ten events/ten year for wet weather containment and 20 events/ten years for partially treated STP discharges are justifiable, based upon community expectations and the environmental benefits gained.

In summary, the justification of the preferred strategies for Winmalee sewerage system are based on the high environmental values of the Blue Mountains environment and the high community expectation to preserve these values. From the outputs of existing modelling and environmental monitoring data, it is apparent that sewerage overflow has minimal impact on a regional scale. Hence, the precautionary approach of improvement above the minimum performance objective was adopted to all other types of overflow. More modelling and monitoring are needed to further verify whether the levels of abatement are appropriate to mitigate local impacts.

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Chapter 6

Conclusion

6. Conclusion

The minor impact on catchments draining from the Winmalee sewerage system (refer to Volume 2). Although overflows from reticulation and SPSs were found to contribute to faecal pollution in the Grose River, Nepean River and Kedumba River, their contribution was minor in comparison to that caused by stormwater runoff and STP dry weather discharges.

On a localised level, many sensitive areas in the Blue Mountains were identified as having the potential to be impacted from overflows from the Winmalee sewerage system (refer to Section 3.3). These include Class P and S Classified Waters especially within the Blue Mountains National Park, and Special Areas covering drinking water catchments and threatened species habitat.

The potential for the greatest impacts occurs in smaller streams, wetlands and sedge swamps which can be habitats for native fauna, including some listed in Schedule 1 and 2 of the Threatened Species Conservation Act. Dry weather overflows have the potential to create the greatest impacts upon these sensitive areas, as the overflow is not diluted by stormwater prior to discharge into a receiving waterway. The main impact of overflows at the localised level would be a reduction in water quality due to microbiological contaminants, toxicants and elevated nutrient levels present in raw sewage.

The Blue Mountains is a sensitive environment which must be protected to satisfy legal requirements and community expectations for the quality of the area as well as Sydney Water's corporate objectives. The primary environmental protection goal identified for the streams in the Blue Mountains GA was the protection of potable water quality. This reflects the values placed on the area by the community and the expectation that a high environmental quality will be maintained. In accordance with the principles of ESD, overflow abatement above minimum performance corporate objectives ie. base case is recommended. This high level of containment, together with an action plan is designed to detect, prevent and minimise the impact of overflows.

For all systems within the area served by the Winmalee sewerage system, a standardised level of system performance to maintain overflows has been adopted. The degree of performance, called the minimum performance objective has been assessed to reflect the sensitivity, both in environmental and in community values, of the receiving environment (Chapter 4). They also reflect sound ESD principles (Chapter 5).

The preferred option for abatement of overflows in the Winmalee sewerage system includes the following:

1. a reduction in wet weather overflows to ten events per ten years
2. a significant reduction in the number of partially treated STP discharges at Winmalee from 110 in ten years to 20 in ten years
3. to achieve a low density of chokes for all suburbs
4. to gather further information and evaluate appropriate upgrades to address overflows from SPS failures
5. to achieve a low rate of exfiltration for all areas
6. to achieve a low rate of complaints relating to odour for all suburbs.

The benefits of implementing the proposed strategies (Chapter 5) include:

1. improvement in water quality to
   - protect drinking water catchments (Special Areas) and Classified Waters
   - protect aquatic and terrestrial ecosystems

- primary and secondary contact recreation users
- visual amenity of the area
- community value of the area

2. economy of the area through an increase in tourism reduction in the number of overflow events on present numbers to 2021 even though the population of the area is expected to significantly increase
3. maintaining and enhancing the high value that the community places on the Blue Mountains area as a natural "icon", and preserving the "wilderness" qualities of the area.

It should be noted, however, that to ensure that improvements in water quality are achieved, the strategies recommended under this program must be implemented and integrated with other programs of pollution reduction that address pollution of these waterways from other sources such as urban stormwater runoff. This study recognises the lack of accurate data relating to the environmental impact of overflows, thus, methods for overflow data collection and management have been recommended. The proposed database will facilitate future planning and system-wide management (refer to Section 4.5.3, Volume 2).

6.1 Proposed timetable for improvements

The year 2021 has been used as the study time-frame boundary. The NSW Government recently announced the $3.01 billion Waterways Package which focuses on waters around Sydney. Included in the package is $1.6 billion for the abatement of sewerage overflows.

The components of the overflow abatement program for the sewerage systems in the Blue Mountains GA will be implemented over the period from 2006 to 2010. The immediate focus of the program is to maintain and improve recommended management practices to reduce overflows caused by system failures in dry weather. This is expected to be completed by 2005.

Existing maintenance and rehabilitation works such as the Interim Infiltration/Exfiltration program are key components of the overflow management process as they address the cause of the problem, not the effect. Continuous improvement of these management practices will further reduce overflows. Some structural works will be implemented in the short (less than five years) to medium term (five to ten years), including Winmalee STP Stage 3 upgrade.

The timetable for improvements takes WaterPlan 21 into consideration. WaterPlan 21 sets timetable targets and water quality objectives for five, ten, 15 and 25 years. The plan targets to eliminate sewage induced algal blooms in the Hawkesbury-Nepean River by 2002.

6.2 Actions arising for Sydney Water

Part of the proposed program for overflow abatement will include reporting of the following to the EPA:

1. results of the system performance and environmental indicators monitoring
2. elements of the strategies completed
3. improvement in overflow performance
4. proposed revisions to the remaining strategy components based on results to date
5. proposed revisions to the compliance monitoring program.

The proposed management plan for Winmalee is structured around the strategies and actions discussed in Chapter 4 and forms part of the overall preferred overflow abatement strategy for Grose River, Nepean River and Kedumba River. Table 4.12 outlines the actions under the preferred strategy for the Winmalee sewerage system.

Components of the management plan have been selected to achieve a balance between non-structural and structural options that can be implemented progressively over the next 25 years. The proposed management plan is to form part of Sydney Water's total quality assurance system. The immediate focus of the plan is on best management practices to reduce overflows, particularly due to system failures in dry weather.

Many of the recommended management practices have already been adopted by Sydney Water to minimise the frequency and impacts of dry weather overflows. Continuous improvement of these management practices will further reduce dry weather overflows at minimal expense. The delivery timetable for the proposed management plan is outlined in Chapter 4, Table 4.13.

An action plan has been recommended to increase the amount and accuracy of the available data on overflows events (refer to Volume 2, Section 4.5.3). The plan includes the following components:

1. regular inspections
2. regular reporting
3. routine monitoring
4. a contingency/response plan
5. requirements for record keeping on overflow incidence, impacts and actions taken.

The additional data derived form the action plan will aid in the future planning and management of the Winmalee sewerage system.

It is concluded that the proposed management plan is justified as an appropriate response to mitigating the environmental impacts associated with sewerage overflows from the Winmalee sewerage system, and that the environmental, social and economic benefits to the community will considerably outweigh the corresponding costs.

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