Licensing Guidelines for

Sewage Treatment Systems

NSW EPA

ENVIRONMENT PROTECTION AUTHORITY

Important notes

The EPA has prepared these guidelines in good faith. In case of any inconsistency between the guidelines and the licence or legislation, the licence or legislation prevails to the extent of that inconsistency.

Nothing in these guidelines is to be taken as authorising the pollution of waters or the discharge of wastes to *Class P* or *Class S* waters. These guidelines are designed to provide information to assist licensees to operate their systems efficiently and comply with EPA licensing requirements. However, following these guidelines does not in itself demonstrate compliance with any licence conditions.

Published by:

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ISBN 0 7347 7588 1
EPA 2003/58
July 2003

Printed on recycled paper

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1. Introduction

Reforms to environment protection licensing in New South Wales have been significant in recent years. A new integrated licensing system commenced in July 1999. In addition, the introduction of load-based licensing is providing financial incentives for reducing pollution and a stronger focus on what licensing is actually achieving.

In another major development, licences for sewage treatment plants have been extended to cover entire sewage treatment systems and include the overflows from pumping stations and reticulation systems. This new licensing approach aims to minimise the potential harm to public health and the environment from the release of sewage into the environment.

These guidelines have been prepared by the NSW Environment Protection Authority (EPA) to help licensees in non-metropolitan areas, generally local councils and other water authorities, understand the new process for licensing whole sewage treatment systems. The document explains:

- what sewage treatment system licences are
- the potential impacts of sewer overflows on public health and the environment
- the EPA's approach to sewer overflow management and licensing
- techniques to minimise sewer overflows.

Over the last 30 years, discharges from point sources of water pollution, such as sewage treatment plants, have been largely reduced. If further improvements in water quality are to be achieved, diffuse or non-point sources of water pollution will also need to be tackled. Sewer overflows and stormwater pollution are the most significant diffuse sources in urban areas.

Overflows can have significant impacts on *public health.* They can make waterways unsafe for recreational use and contaminate drinking water supplies. Human exposure to pathogens can occur through direct contact or indirectly by the consumption of contaminated seafoods.

Overflows can also have serious *economic* impacts on the fishing industry, in particular oyster-growing, and the suitability of waters for recreational use.

Finally, the *environmental* impacts of overflows include potential toxicity for aquatic life and the stimulation of algal growth. The Final Report of the Public Inquiry into the Management of Sewage and Sewage By-products in the NSW Coastal Zone (Codd 1997) recommended that 'there needs to be further assessment of the environmental and health impacts of sewer overflows'.

At a national level, the National Water Quality Management Strategy's draft *Guidelines for Sewerage Systems – Sewerage System Overflows* provides guidelines for the community, regulators and sewerage authorities in managing the public health and environmental impacts of overflows. The approach and recommendations in this document are consistent with those guidelines, which are currently being finalised following comment from the community.

A separate process has been completed for licensing Sydney and Hunter Water Corporation's sewage treatment systems. The requirements described in this document relate to sewage treatment systems other than those operated by Sydney and Hunter Water.

2. Sewage treatment system licences

What are sewage treatment systems?

The *Protection of the Environment Operations Act 1997* (POEO Act) requires environment protection licences for certain activities listed in Schedule 1 to the Act ('scheduled activities'). The EPA issues these licences.

Sewage treatment systems are a scheduled activity, defined under the Act as:

Sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation system) that have an intended processing capacity of more than 2,500 persons equivalent capacity or 750 kilolitres per day and that involve the discharge or likely discharge of wastes or by-products to land or waters.

What do system licences cover?

Under the previous licensing regime only sewage treatment plants were licensed. However now licences regulate the whole sewage treatment system, including the treatment plant(s) and all associated components of the reticulation system under the licensee's management or control, such as pipes, access chambers, pumping stations, overflow structures and ejection units. The licences regulate both sewage treatment plant discharges and discharges (overflows) from the sewage reticulation system.

Licences do not include service lines to private houses or private sewage systems connected to licensed sewage treatment systems.

Sewage treatment systems may include more than one sewage treatment plant. If a number of plants operated by a licensee share the same discharge point or effluent irrigation area, they may be considered to be part of the same system.

Load-based licensing (LBL) fees are applicable to scheduled sewage treatment systems. In the short term, fees will only be applied to discharges from the treatment plant, in accordance with the current *Load Calculation Protocol* (EPA 2002). However this protocol may be varied in the future to require load fees to be payable for overflows from the reticulation system.

What are the licensing requirements for smaller systems?

Licences are not required for smaller sewage treatment systems below the threshold values noted in Schedule 1 of the POEO Act, if they can be operated without causing water pollution. However, small systems that continue to discharge to waters as a means of effluent disposal (and therefore pollute waters) have a licence to operate. If a licence is issued for a municipal sewage system below the threshold, the new sewage treatment system conditions will still apply.

Where a licensee is able to demonstrate that a non-scheduled system is low-risk in terms of overflows, the EPA may agree that Pollution Reduction Program (PRP) 100, requiring the preparation of a Sewer Overflow Investigations Report, does not need to be included in their licence (see Section 6 for details). The EPA may also decide that it is not appropriate to apply PRP 100 to a licence in other specific circumstances.

Where effluent is disposed of through irrigation, the EPA believes that most of these smaller systems can avoid water pollution by following best practice thus making a licence unnecessary. Where effluent is sent to another party for disposal (such as irrigation by a farmer), the licensee will often be the Appropriate Regulatory Authority (ARA) under the

POEO Act for the activities associated with the disposal. In these cases they should encourage best practice in managing the effluent's disposal. The EPA will remain the ARA where the licensee manages the irrigation of the effluent, such as to playing fields owned by the licensee.

For more information on licensing, refer to the EPA's *Guide to Licensing*, *Part A* and *Part B*, available through Pollution Line (131 555) or via the internet at www.epa.nsw.gov/licensing

3. Sewer overflows

What are sewer overflows?

Sewer overflows (also known as sanitary sewer overflows or SSOs) are discharges to the environment of raw or partially treated sewage from sewerage systems. These releases onto streets and into waterways may come from designed overflow structures, access chambers (otherwise known as manholes), sewage pumping stations, pipes and sewage treatment plants. Sewer overflows can occur in both dry and wet weather. They should be distinguished from combined sewer overflows (or CSOs) which occur in systems designed to carry both sewage and stormwater. These systems are rare in NSW and are primarily found in parts of the Sydney Central Business District.

Sewerage systems commonly have designed overflow points. These act as safety valves to stop sewage backing up into homes and businesses when a sewer is overloaded, a pipe is blocked or there is a problem at a pumping station. Designed overflows generally allow sewage to discharge at a planned location, usually the nearest natural waterway or stormwater drain.

The EPA has developed a model licence for sewage treatment systems, which will control the discharge of untreated or partially treated to the environment, whether from a designed overflow point or elsewhere in the system. In this context, therefore, ‘sewer overflow’ is used to describe discharges from both sources. The model licence will be available on the EPA website.

What causes sewer overflows?

Sewer overflows may occur occasionally even in systems designed to collect and contain all the sewage that flows into them. However when overflows occur frequently or in large volumes, it means something is wrong with the system or the way it is being operated or maintained.

The following problems can cause frequent overflows from sewage systems:

- **Rainfall infiltrating into leaky sewers, which are not intended to carry rainfall or drain properties:** Excess water can flow in through downpipes illegally connected to sewers and broken or badly connected sewer house service lines. This infiltration/inflow can increase flows in sewers during wet weather up to 10 times. These flows often exceed the capacity of sewer pipes and cause overflows at designed overflow points, access chambers and sewage treatment plants.
- **Blocked, broken or cracked pipes:** Tree roots can grow into sewers, which block (or choke) sewers or trap coarse material in sewage, such as grease or fat, causing a pipe blockage and resulting in an overflow. Where sections of pipe settle or shift, pipe joints may no longer match. A build-up of sediment and other material may cause pipes to break or collapse. This can also occur in service lines to houses and other buildings, which further contributes to wet-weather flows. In dry weather, sewage can leak (exfiltrate) out of sewers and house service lines through cracks and joints.
- **Sewers and sewage pumping stations that are too small to carry sewage** from newly developed subdivisions or commercial areas
- **Failure of pumps, other equipment or the power supply at sewage pumping stations:** If the time taken to respond and address the cause of a failure exceeds the storage time in the pumping station, an overflow can occur.

Many of these problems are the products of a deteriorating sewer system or planning which has not allowed for the impacts of additional growth. When sewers are not properly installed or maintained, major problems can develop over time which may be expensive to fix. New development may also need to be delayed until problems are corrected or the capacity of the system is increased.

How can sewer overflows be reduced?

Overflows from existing reticulation systems can be reduced by a combination of operations and maintenance practices, and structural measures. These include:

- cleaning and maintaining reticulation systems
- reducing infiltration and inflow by fixing leaking or broken sewers
- enlarging or upgrading sewers, pumping stations and sewage treatment plant capacity
- constructing wet-weather storage to temporarily store overflows.

Overflows should be minimised at their source as much as possible by minimising defects in sewers. Any residual impacts can then be managed by ‘structural’ options, such as increasing the capacity of the downstream system to carry wet-weather flows.

The following actions can be taken to avoid overflows:

- develop a 24-hour emergency response plan
- use telemetry or dial-up systems to provide early advice of failure
- use back-up pumps and controls
- have standby/alternative power available
- ensure that spare parts are readily at hand.

Where the risk of power or equipment failure becomes a concern, it may be necessary to:

- have contingency plans to manage failures
- provide enough overflow storage to allow the contingency plan to be implemented before an overflow occurs
- use mobile pumps and generators.

Overflows from new systems can be minimised through appropriate system planning, design, construction and inspection. In common with many environmental issues, it is cheaper to build systems which minimise overflows in the first instance (pollution prevention) than having to fix them later.

See Appendixes D, E and F for further information on sewer overflow abatement techniques.

4. Impacts of sewer overflows

Public health impacts

Sewer overflows of untreated or partially treated sewage carry a range of disease-causing organisms called 'pathogens'. These include bacteria, viruses, parasitic organisms (protozoa), intestinal worms (helminths) and inhaled moulds and fungi (borroughs). Faecal coliforms are often used as an indicator of pollution by pathogens.

Pathogens may cause diseases ranging in severity from mild gastroenteritis with stomach cramps and diarrhoea to potentially life-threatening ailments, such as cholera, dysentery, hepatitis and severe gastroenteritis. The impact on human health will depend on the duration of exposure to an overflow and the levels of pollutants in the overflow.

People can be exposed to these pathogens through:

- overflows into drinking water sources
- direct contact with overflows in public areas such as lawns, streets or swimming or boating waters
- eating shellfish harvested from areas contaminated by overflows
- inhalation or skin absorption.

Environmental impacts

As well as pathogens, sewer overflows contain a range of environmental pollutants including:

- sediment which causes turbidity
- nutrients, particularly nitrogen and phosphorus
- toxicants, including metals, pesticides and commonly used chemicals
- substances which create a biochemical demand for oxygen
- gross pollutants, including plastic and paper products.

Potential environmental impacts of sewer overflows

Pollutant or effect	Potential impact
Suspended solids	Deposited sediment affects aquatic insect habitats
Turbidity	Reduces water clarity with an impact on fish and aquatic plants
Phosphorus and nitrogen	Stimulates growth of algae and undesirable aquatic plants
Ammonia, metals and pesticides	Toxic to fish and aquatic insects at high levels
Organic matter/biochemical oxygen demand	Reduces dissolved oxygen levels with impacts on fish and aquatic insects
Gross pollutants/litter	Visually unattractive

The environmental impacts of overflows also depend on the type of receiving waters: for example, intermittently open, poorly flushed lagoons, which are often used for shellfish production, are particularly susceptible.

Wet-weather versus dry-weather impacts

Concentrations of some pollutants in sewer overflows in dry weather are often higher than those in urban stormwater. In wet weather, concentrations in overflows are diluted and stormwater pollution may be the more significant contributor to poor water quality.

The impact of overflows in dry weather depends on the location, volume and duration of the overflow. The flow and any tidal conditions in the receiving waterway can also influence the impact of an overflow. Impacts may be limited if the overflow is detected and fixed early. Significant impacts, including fish kills, can occur if overflow volumes are large, in sensitive locations or occur over a long period.

In wet weather, overflows are often the dominant source of bacterial pollutants, in particular. In Sydney, it has been estimated that wet-weather sewer overflows are responsible for around three-quarters of the faecal coliforms in Sydney Harbour. However, definitive comparisons are difficult due to the variability in flows and pollutant levels from both sources.

Are pollutant concentrations generally higher in sewer overflows than in stormwater?

Pollutant	Dry-weather overflows vs stormwater	Wet-weather overflows vs stormwater
Suspended solids	Slightly higher	Can be higher or lower
Total phosphorus and nitrogen	Higher	Slightly higher
Ammonia	Much higher	Higher
Faecal coliforms (bacteria)	*Very* much higher	Much higher
Biochemical oxygen demand	Higher	Slightly higher
Heavy metals, pesticides	Slightly higher	Slightly lower
Gross pollutants (litter)	Higher	Can be higher or lower

5. EPA approach to managing sewer overflows

The EPA approach to managing sewer overflows has two key components.

The first recognises that problem sewer overflows from existing systems will need to be identified and fixed over the medium to long term. The EPA also wants sewage treatment systems as a whole to achieve the best environmental outcome. In some cases this may result in a short- to medium-term emphasis on upgrading a poorly performing sewage treatment plant. Once this has been completed, overflow abatement works can follow.

The second component of the EPA approach involves ensuring that overflow problems are not exacerbated by additions to the reticulation system. This involves ensuring that new reticulation systems, and extensions to existing ones, are planned, designed and constructed to prevent overflows. The new licence requirements reflect the EPA's higher performance expectations from new systems and extensions to existing systems. This approach recognises that it is more effective to design new systems to prevent overflows than to fund actions later to mitigate the impacts. In addition, more funds are generally available for the sound design and construction of new systems, than for subsequent remedial actions by a water authority or local council.

Overflows from existing systems

The EPA recognises that current knowledge on overflows from many systems is limited and therefore supports a staged approach to managing them:

- investigate the extent of the problem
- evaluate and rank the risk of any public health and environmental impacts
- identify potential management options, if required.

If overflows are found to be a significant problem, the EPA will negotiate specific Pollution Reduction Programs with licensees requiring remedial actions over a period of time.

Before any longer term actions are agreed upon, the EPA will expect certain low-cost measures to be implemented to minimise overflows and any possible consequences. These include:

- collecting data on all dry- and wet-weather overflows, to determine the extent of any problems
- notifying affected parties of overflows that are of public health significance
- cleaning up any overflows.

The licence also reflects the EPA's position that pumping stations can be designed to avoid being a source of overflows by providing appropriate storage and backup systems.

The EPA's preferred approach to licensing is to set performance objectives in licences, rather than prescribing procedures to be followed. This enables licensees to implement actions considered the most appropriate to local circumstances to meet the objectives. This approach is reflected in the performance requirements from sewage treatment plant discharges.

Further information on reducing overflows is contained in Appendixes D and E.

Poor system operations and maintenance often cause overflows. If an overflow occurs from the reticulation system, the EPA will consider what action to take as set out in its *Prosecution Guidelines* (EPA 2001), available on the web at www.epa.nsw.gov.au/legal/prosguide.pdf. Factors the EPA will consider in determining whether a prosecution is appropriate include:

- the seriousness of the offence
- the harm to the environment
- any mitigating circumstances
- the degree of culpability of the alleged offender.

Licensees will need to be able to demonstrate that they are acting competently (Licence Condition O1) and operating and maintaining all plant and equipment in a proper and efficient manner (Condition O2). For example, the preparation and implementation of an appropriate operations and maintenance plan will assist to both minimise overflows and demonstrate compliance with these conditions. Further guidance on preparing an operations and maintenance plan is contained in Appendix A.

Discharges from sewers, pumping stations, treatment works or other parts of a sewerage system into Class P waters is prohibited. However, the Clean Waters Regulations 1972 permit such overflows from specified urban areas, subject to EPA approval and in accordance with conditions imposed by the EPA. Discharges of waste are not permitted into Class S waters. Sewage treatment system licences can not authorise any discharges to Class P or S waters that contravene the regulations. The *Atlas of Classified Waters* (SPCC 1980) has details on classified waters.

Overflows from new systems

For new systems, the EPA considers that a combination of design, construction, contingency planning and long-term maintenance should result in a system where overflows occur only in exceptional circumstances. The EPA therefore expects that a new reticulation system should be designed and constructed so that:

- overflows from the reticulation system do not occur as a result of a failure to operate and maintain any part of the system in a proper and efficient manner
- there is no pollution of waters as a result of sewage overflows from new sewage pumping stations in dry weather
- wet-weather overflows from the reticulation system are minimised.

It is also important that new developments are designed to allow for future extensions to the reticulation system which will not adversely affect the performance of the existing system. Extensions may include amplifying existing sewers and pumping stations.

It is important that the licensee has in place procedures to ensure the appropriate construction, inspection and testing of new system components.

Environmental objectives for sewer overflows

Ideally, the objectives for managing sewer overflows should aim to meet or maintain the water quality objectives of the receiving waters. However, this approach cannot generally be directly applied. This is because of difficulties in relating the loads of pollutants from overflows directly to the loads of pollutants in the receiving waters.

Licence objectives for sewer overflow management are therefore commonly based on the performance of the sewerage system, generally supplemented by a consideration of the sensitivity of receiving waters. These performance objectives often relate to the frequency of chokes and other dry-weather overflows, and wet-weather overflows.

The EPA may ‘benchmark’ performance against that of well-managed systems. A higher standard will generally be expected where overflows are likely to discharge to sensitive receiving environments, such as popular bathing locations, shellfish production areas, Class P or S waters (under the Clean Waters Regulations 1972) and wetlands, like those declared under State Environmental Planning Policy 14.

The Ministry of Energy and Utilities (formerly the Department of Land and Water Conservation) reports on the number of confirmed sewer chokes, dry-weather sewer overflows and the response time to sewer chokes for most licensees in NSW. This information is summarised below for 1998–99 and 2000–01.

Performance measure	20th percentile	50th percentile (median)	80th percentile
Confirmed sewer chokes (per 100 km of sewer) (2000–01)	15	30	75
Dry-weather sewer overflows (per 100 km of sewer) (2000–01)	0	6	15
Confirmed sewer chokes attended to in 5 hrs (%) (1998–99)	100	100	100

The Water Services Association of Australia (WSAA) reports on the performance of the large water authorities around Australia. For the 1998–99 financial year, the average number of chokes and breaks reported from the 16 authorities was 52 per 100 kilometres of sewer, with a range of 14 to 114. Tree roots caused 72% of these. The data from both the Ministry of Energy and Utilities and WSAA exclude chokes and overflows in house service lines.

Climatic conditions, particularly rainfall patterns, can influence the frequency of chokes. A long-term average may therefore provide more representative information.

There is little data available on the frequency of wet-weather overflow events (more than one individual overflow may occur in each event). This highlights the need to record these events, as required by the licence. Sydney Water found an annual average of 20 wet-weather overflow events per system from its 27 sewage treatment systems.

6. Sewage treatment system licences

Conversion of licences

Following the introduction of integrated environment protection licensing under the *Protection of the Environment Operations Act 1997*, licences made under the previous legislation were 'converted' to the new Act. In many cases the converted licences were also subsequently reviewed.

Until recently, the converted and/or reviewed sewage treatment system licences only included specific conditions relating to discharges from the sewage treatment plant. With the decision to license whole sewage systems, conditions are now also being attached to the operation of reticulation systems.

As part of the process of extending sewage treatment licences, a number of conditions relating to the sewage treatment plant will be updated to ensure their effectiveness and that operations are relatively consistent across the State. Existing licences will be varied by updating the relevant conditions on the current licence, adding any new conditions and deleting any current conditions considered no longer relevant.

Sewage treatment plant licence conditions

A number of changes will be made to conditions in the sewage treatment plant sections of system licences. The majority of these changes are relatively minor, essentially updating the conditions in current licences. There are, however, a number of new and deleted conditions which will apply to some licences. The more significant changes that may apply are discussed below.

Condition L7.1: The first of these is a prohibition on discharges in dry weather through any secondary outfalls at treatment plants, where they exist. These outfalls are primarily designed to convey wet-weather flows and often discharge into areas that are inappropriate for receiving dry-weather flows. If this condition is breached, the EPA will follow its *Prosecution Guidelines* (EPA 2001) to determine whether prosecution or other regulatory action is appropriate.

Licence conditions are based on the assumption that under normal operations it will be possible to meet both environmental and occupational health and safety requirements. The EPA does not consider that occupational health and safety issues should be a reason for breaching this condition.

Condition M7: Licensees will be required to keep a record of bypasses at the sewage treatment plant. Bypasses occur in both wet and dry weather when sewage remains untreated by one or more processes at the plant. Information on bypasses will be useful in determining whether operations or maintenance practices need to be improved or an upgrade of the plant is required.

Reticulation system licence conditions

A number of changes will also be made across the licence to include management of the sewage reticulation system in the licence requirements. These changes will entail updating current conditions as well as adding some new conditions. The more significant changes that may apply are discussed below.

Condition O2: The 'premises', as described by **Condition A2** in licences, has been extended to include the reticulation system owned and operated by the licensee. As a result, the requirements relating to proper and efficient operation and maintenance of plant and equipment (Condition O2) covers both the sewage treatment plant and the reticulation system, including pumping stations, sewers and overflow points.

[Sewage ejection units (also known as 'grinder pumps') covered by the Local Government (Approvals) Regulation 1999, which form part of the reticulation system are not included as pumping stations for the purposes of sewage treatment system licences.]

In some cases special sewage management arrangements are made with regard to ownership and operation of a system or parts of a system. These may make it unclear whether the system, or parts of the system, is covered by the licence. Any concerns about this should be discussed with the EPA at the time the licence is being varied.

Condition L1.3: The EPA recognises that there are conditions under which a sewage overflow may be difficult to avoid. The system licence acknowledges this in Condition L1.3 which allows for some overflows to occur, provided all conditions of the licence, including those relating to operation and maintenance, have been met.

Condition O7: As Section 5 notes, the EPA expects all new sewage pumping stations to be designed so they will not overflow in dry weather and pollute waters. The EPA may consider modifying this condition in remote areas where response times to overflows are long and the public health and environmental impacts of an incident will be less serious.

Condition O8: New connections to an existing reticulation system must be planned, designed and constructed to prevent as far as practicable the potential for overflows from both the new and existing systems. This is particularly relevant in areas with significant urban growth.

Condition M9: For many systems, the full extent of sewer overflows is unknown. This condition requires licensees to keep a record of all reported or observed overflows, including pumping station overflows, leakages and chokes from the system, and overflows at the treatment plant. This information will allow trends in system performance to be detected. While many of these overflows may be small and have little impact, the EPA believes that all should be recorded to provide a comprehensive picture of system performance.

Condition G4: An important part of system management is to rapidly and effectively clean up after overflows to minimise their harm to the environment. This particularly applies to dry-weather overflows, where the degree of environmental impact is especially dependent on the response time. Condition G4 requires the licensee to use all practicable measures to minimise the impact of the overflow on public health and the environment.

System Performance Reports

All licences require an Annual Return to be submitted to the EPA. The Annual Return is a declaration to the EPA by the licenseewhether they have complied or not with the requirements of the licence and includes a monitoring and complaints summary and a statement of compliance.

A supplementary Annual System Performance Report is also required by **Condition R5** in system licences. This second report must include monitoring details on all pollutants with specified concentration limits in the licence. System Performance Reports also require data on the disposal of biosolids and a summary of bypasses and overflows from pumping stations and failed pipes.

Much of this information is already reported annually to the Ministry of Energy and Utilities (formerly the Department of Land and Water Conservation). The EPA has attempted to align its data requirements with those of the Ministry to assist licensees in collecting the information. However, licensees will still be required to report separately to the EPA as part of the annual reporting process to allow comprehensive and timely assessment of the performance of the whole system.

The data on overflows should be for the current reporting period and the four preceding periods, if available. This will enable trends in system performance to be identified. Licences allow three months for new recording systems to be put in place.

Sewer Overflow Investigations Reports

Pollution Reduction Program (PRP) 100 requires the preparation of a Sewer Overflow Investigations Report, which examines the extent of sewer overflows from the reticulation system and treatment plant. The data recorded under Condition M9 should assist in this investigation.

The report will include a risk assessment of overflows from the sewage treatment system. Licensees will be required to assess the likelihood of an overflow from a particular point in the system, together with an assessment of the risk to public health and the environment should an overflow occur. This will assist in designing programs to address overflows with the highest risks. Licensees will be asked to propose necessary remedial actions that reflect the unique circumstances of their systems, including any economic and social considerations. There may not be any need for capital works.

The report will also need to assess whether any sewage pumping stations that were unable to meet the no dry-weather overflow requirement (Condition L7.1) should be upgraded.

It is expected that licensees will be able to prepare the report in-house. Licensees for larger systems with more than 4000 connected residential dwellings will have three years to prepare the report while licensees for smaller systems will have four years. Appendix B has advice on preparing these reports.

The EPA is preparing a pro-forma Sewer Overflow Investigations Report for use by licensees. The pro-forma will give licensees an idea of the scope and level of detail expected by the EPA. The pro-forma will be available to licensees in both print and electronic form. The EPA will seek input from licensees before finalising the pro-forma.

Public notification of bypasses and overflows

Discharges of untreated or partially treated sewage from bypasses of treatment plants and sewer overflows can pose health risks to the public. This may occur directly through contact with contaminated water or by contamination of seafood, such as shellfish. The public has a right to know about any such risks.

Condition R4 is a new licence condition requiring the public to be notified when there has been a bypass or an overflow that may result in a significant risk to public health. For incidents of public health significance, the Department of Health and the EPA's Pollution Line must be advised. Safe Food (NSW Shellfish Program) must be notified in the case of incidents affecting shellfish production areas. The Department of Health has developed a protocol that defines incidents of public health risk.

Pollution Reduction Program (PRP) 101 in the new licence requires the development of a formal Incident Notification Protocol. This is designed to ensure that incidents that may have public health and environmental consequences are reported to the relevant organisations and affected communities as effectively as possible.

The EPA recognises that how public reporting occurs will reflect local circumstances and does not want to be prescriptive about the protocol. Instead, licensees are required to liaise with the local Department of Health and other organisations to develop procedures reflecting the local environment and issues. Licensees will have six months to prepare the protocol. Use of the protocol will supersede the notification requirements of Condition R4.

Further guidance on preparing an Incident Notification Protocol is contained in Appendix C.

Changes to non-scheduled sewage treatment licences

A number of licences are held for smaller, non-scheduled sewage treatment systems because they discharge effluent to waters. Overflows from these smaller reticulation systems also have a potential impact on public health and the environment.

To be consistent with the approach for larger systems, the EPA is intending to vary these licences so that any problems from overflows can be identified. It is proposed to include conditions in these licences requiring the preparation of an annual report on overflows from their reticulation systems as well as providing estimates of projected population growth.

Where licensees are confident that sewer overflows from such a system do not pose a threat to public health or the environment, PRP 100 requiring preparation of a Sewer Overflow Investigations Report may not need to be included in the licence. This should be discussed with EPA regional staff before the licence is varied.

7. Conclusions

The licensing of sewage treatment systems provides an opportunity to manage discharges from both sewage treatment plants and sewage reticulation systems through an integrated environment protection licence. Treatment plants have been regulated for many years and licensees are familiar with the EPA's requirements. The inclusion of discharges (or overflows) from reticulation systems in licences is new and the level of understanding of their impacts around the State less well known.

Sewer overflows, which can be a significant source of water pollution, have received little attention in the past. The extent of overflow problems statewide is generally not well known. The EPA is therefore initially requiring licensees to investigate the magnitude of overflow problems within their systems where this information is not already available. This will enable comparisons to be made of the impacts from treatment plants and overflows when any further Pollution Reduction Programs are being considered. The EPA is interested in the greatest public health and environmental gains from any expenditure.

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Appendix A:
Preparing a reticulation system operations and maintenance plan

The preparation of an operations and maintenance plan is an important step in minimising overflows. While not required by EPA licences, these plans may assist licence holders to comply with Condition O2, which requires proper and efficient operation and maintenance of plant and equipment.

Operations and maintenance plans should be regarded as ‘live’ documents, which are actively consulted, reviewed and revised. System managers should adopt a model of continuous improvement and progressively refine the plans and actively monitor their effectiveness.

There are a number of specific licence conditions that these plans can address, including:

- public notification of bypasses or overflows (Condition R4)
- clean up and emergency response (Condition G4).

Plans can include:

- operational strategies, rules and procedures for both normal operation and emergency situations when public health and the environment are at risk
- preventative and breakdown maintenance strategies and procedures such as:
  - proactive maintenance activities in known problem areas in the system
  - routine clean-out of pipes
  - sealing or maintenance of access chambers
  - maintenance to prevent or minimise deterioration of sewer lines
  - maintenance of sewer pipe capacity during dry-weather conditions by, for example, reducing chokes
  - maintenance of sewage pumping stations
  - responses to overflows, chokes, sewage pumping station failures and offensive odour incidents.

Plans may evolve. For example, an initial plan could describe actions to be taken to meet licence requirements and a description of existing operations and maintenance practices. Future versions of the plan could include improvements to existing practices that are found to be necessary to reduce overflows. Reference to Appendixes D and E may be helpful.

The EPA encourages local councils to work together to develop these plans. Many elements will be common between systems. Joint ‘technical’ plans could be prepared, with an overview ‘management’ plan which suits the requirements of each licensee.

The NSW Local Government Water Industry Directorate (2000) has produced an Operations and Maintenance Manual for both sewer reticulation and submersible sewage pumping stations. These make excellent starting points for the development of plans.

To ensure that plans are implemented appropriately, licensees should also consider:

- how plans will be made available to personnel responsible for implementing them
- related training procedures for appropriate personnel, including the frequency of training
- the process for reviewing and revising plans
- how plans link to licensees’ Strategic Business Plans and Asset Management Plans.

Appendix B: Preparing a Sewer Overflow Investigations Report

Overview

The EPA is preparing a pro-forma Sewer Overflow Investigations Report to demonstrate the level of information that the report required by Pollution Reduction Program 100 should include. The pro-forma will be provided to all licence holders to assist them in preparing their reports.

Although the final reports may vary considerably across the State, the following should provide context:

- There is scope to vary the report according to the characteristics of the system, e.g. size, location, climate, population growth, environmental sensitivity.
- The report should identify ‘hot spots’ in the system, where the the risks or potential impacts of overflows are greatest.
- The report should include a risk assessment for the reticulation system in general, any designed overflow points and all pumping stations for both dry and wet weather, and the sewage treatment plant in wet weather only, and an evaluation and ranking of the resultant risk to public health and the environment.
- The report should include both preventative strategies (to minimise future problems) and restorative actions (to fix current problems), although it is cheaper in the long term to prevent problems.
- A first step in preparing the report should be to assess the scope of problems where these are not already known, using the monitoring data required by the licence and any additional information on the state of the system and likelihood of overflows. This will help define the level of detail necessary for the report.
- Problems will vary with location: inflow may be more of a problem in high rainfall areas, exfiltration in low rainfall areas.
- The EPA does not expect extensive modelling or water quality monitoring, especially in small systems. Wherever possible, existing data should be used.
- The report is intended to result in the optimal/targeted use of resources in operating and managing the system, tailored to suit local characteristics. Therefore, indicative costings of any proposed longer term actions should be included.

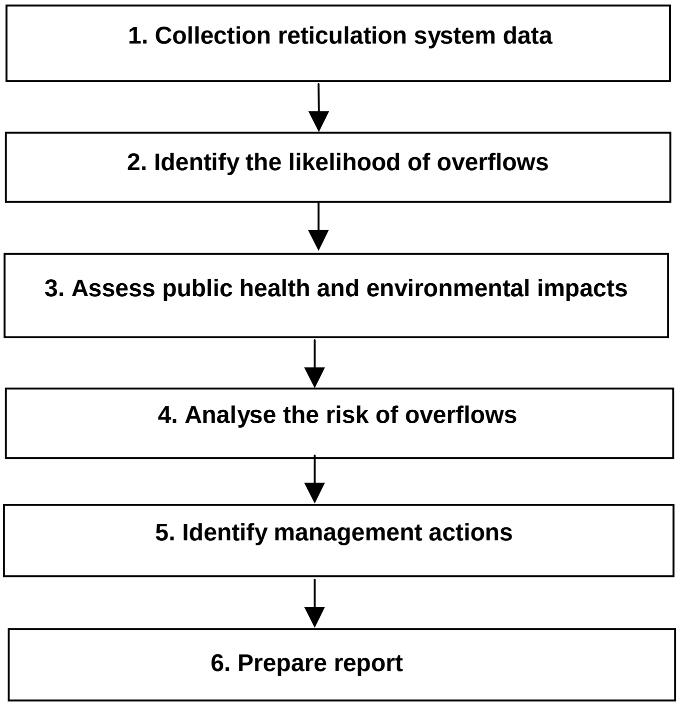
The report could be prepared following the steps outlined below. Overall, the process can be similar to what is commonly used to prepare other environmental management plans to meet EPA requirements, such as urban stormwater management plans.

The EPA expects that the process of developing a plan will be tailored to the characteristics of each system. For example, a relatively short report based on a desk-top assessment may be appropriate for a small system with little history of overflows and no sensitive receiving waters. By contrast, a more detailed report would be expected for a large system with a history of overflows discharging to sensitive waters. The process described below is a guide only and relates to the preparation of a more detailed report and should be modified if a less detailed report is required.

Further guidance on risk assessment can be found in Australian Standard/New Zealand Standard HB 203:2000, *Environmental Risk Management Principles and Process.*

Report preparation process

An example report preparation process is illustrated below and the steps are outlined in further detail.



Step 1: Collect reticulation system data

This step involves collecting relevant information about the reticulation system, particularly the sewers and sewage pumping stations. For analysis purposes, it will be useful to divide the reticulation system into a number of sewage catchments. Generally there will be at least one catchment upstream of each pumping station. Ideally, the catchments should be relatively homogenous, with similar size and population, and system age. It will be useful to define these catchments early in the process, so that details of overflows from the reticulation system can be allocated to a sewer catchment when they occur.

Information on each sewer catchment could include:

- the estimated equivalent tenements/population
- estimated sewer flows (average and peak dry-weather flows, peak wet-weather flows)
- average age of the sewer pipes and pipe material
- sewer pipe size range
- estimated length of sewers
- average sewer depth
- indicative soil conditions, e.g. expansive clays, sandy loam
- indicative vegetation characteristics above sewers, e.g. grass, deep-rooted trees
- the location of any designed overflow or flow relief structures in the reticulation system, excluding those in pumping stations and a description of the destination of an overflow from these structures.

Information on sewage pumping stations could include:

- number of pumps and pumping capacity
- wet/dry well storage volumes (effective storage)
- storage times at average dry-weather flow
- alarm/telemetry details
- details of any flow relief or overflow facility, including a description of the destination of an overflow from these structures
- rising main details, e.g. length, diameter, age, pipe material.

Some larger systems may have additional information available which would be useful for this report including:

- modelling of the sewerage system to determine its capacity
- quality characteristics of sewage in both dry and wet weather.

Step 2: Identify the likelihood of overflows

The licence requires details to be recorded of each observed or reported overflow from particular parts of the sewage treatment plant and the reticulation system. This information will assist in assessing the likelihood of overflows, as part of the risk assessment. The EPA expects that at least two years of monitoring data collected in accordance with this licence requirement would be used in the analysis. It can be supplemented by data collected prior to this licence condition coming into effect and the results of any sewerage system modelling that has been undertaken.

The overflow monitoring data should be collated into the following categories on an annual basis:

Component	Dry weather	Wet weather
Sewage treatment plant	n/a	No. of overflows
Sewage pumping stations	No. of overflows	No. of overflows
Reticulation system (for each catchment)	No. of overflows/100 km of sewer	No. of overflows/100 km of sewer
Reticulation system (for any designed overflow structures)	No. of overflows	No. of overflows

The overflow data and other relevant information can be used as part of a qualitative assessment of the likelihood of overflows for each component, in accordance with the following table. The assessment would usually be done on an average annual basis.

Level	Classification	Description
A	Almost certain	The event is expected to occur in most circumstances. For example: – overflows have occurred numerous times a year, and/or – overflow rate is well above benchmark average
B	Likely	The event will probably occur in most circumstances. For example: – overflows have occurred a few times a year, and/or – overflow rate is above benchmark average
C	Moderate	The event should occur at some time. For example: – overflows have occurred at least once year, and/or – overflow rate is around the benchmark average
D	Unlikely	The event could occur at some time. For example: – overflows have been recorded once, and/or – overflow rate is below the benchmark average
E	Rare	The event may occur only in exceptional circumstances. For example: – overflows have not been recorded, and/or – overflow rate is well below benchmark average

The resulting assessment of the likelihood of overflows can be presented in a table, as in the example below. For the reticulation system the likelihood could be assessed against an average for the whole system such as the figures in 'Environmental objectives for sewer overflows' in Section 5.

Component	Likelihood of overflows in dry weather	Likelihood of overflows in wet weather
Catchment 1	C	D
Catchment 2	C	C
Sewage pumping station 1	E	D
Sewage pumping station 2	D	B
Designed overflow point	D	C
Sewage treatment plant	n/a	C

Step 3: Assess public health and environmental impacts

Public health and environmental impacts will commonly be assessed at two levels:

- When looking at the reticulation system, assessment will be across the whole area served by the system or by catchment for a large or diverse system to gauge the impacts of uncontrolled and unexpected overflows from the reticulation system.
- When looking at designed overflow points and pumping stations, assessment will be locally in the vicinity of flow relief structures to gauge the impacts in areas where overflows are more likely.

Useful information on the environment potentially affected by overflows may include:

- data on peak flow rates, pipe size and response time which may assist in estimating sewer overflow volumes
- data on flow rates and water volumes of affected waterways to assist in determining the impact of overflows
- data on water quality and aquatic ecosystems

- data on ground water
- information about shellfish-growing areas
- information on the flow characteristics of receiving water bodies, e.g. flow rates for watercourses, tidal characteristics for estuaries, flooding data
- information on urban bushland areas potentially affected by sewer overflows, including any rare or endangered communities or species
- archaeology or heritage
- aquatic recreational areas, e.g. popular bathing areas
- land-based recreational areas likely to be affected by overflows, e.g. sporting fields
- other potential high public health risk exposure areas, e.g. child care centres
- information on other sources of pollution, e.g. point sources, urban stormwater
- climatic data, particularly rainfall patterns.

For smaller systems, some of this data may not be readily available. In these circumstances, the report could be prepared based on available data, supplemented by scientific and engineering judgement. If warranted, the report could include future action to collect important additional data to refine the assessment of risk.

This information can be used as part of a qualitative assessment of the public health and environmental impacts of overflows, in accordance with the following table.

Level	Classification	Description
1	Insignificant	The overflow is extremely unlikely to drain to a local sensitive environment* and • where the overflow reaches waters, the volume of sewage likely to enter the waterway is insignificant with regard to the volume and flow of receiving waters, or • where the overflow reaches land, it is likely to be contained in an area with little chance of public exposure within the maximum response time**.
2	Minor	The overflow is extremely unlikely to drain to a local sensitive environment* and • where the overflow reaches waters, the volume of sewage likely to enter the waterway may be significant with regard to the volume and flow of receiving waters, or • where the overflow reaches land, it is likely to be contained in an area where public exposure is minimal given the maximum response time**.
3	Moderate	The overflow is unlikely to drain to a local sensitive environment* and • where the overflow reaches waters, the volume of sewage likely to enter the waterway is significant with regard to the volume and flow of receiving waters, or • where the overflow reaches land, it may travel to an area where public exposure is low within the maximum response time**.
4	Major	The overflow is likely to drain to a local sensitive environment* and • where the overflow reaches waters, the volume of sewage likely to enter the waterway is high with regard to the volume and flow of receiving waters, or • where the overflow reaches land, the public exposure risk is likely given the maximum response time**.
5	Catastrophic	The overflow is likely to drain to a local sensitive environment* and • where the overflow discharges to waters, the volume of sewage likely to enter the waterway is high with regard to the volume and flow of receiving waters, or • where the overflow discharges to land, the public exposure risk is high given the maximum response time**.

* A ‘sensitive’ environment includes:

- a drinking water catchment or domestic groundwater source, or
- shellfish-growing area, or
- protected water bodies, ecological communities or conservation areas defined by legal and non-legal instruments, such as local environmental plans (LEPs), State environmental planning policies (SEPPs), national parks, world heritage parks, and Class P or Class S waters, or
- waterways used for primary contact recreation, or
- a recreational area or other area with high public exposure or associated health risk.

** Maximum response time should be based on the length of time taken for the licensee to detect the overflow, or for the overflow to be reported, and the time taken for the licensee to attend the site and secure against public contact.

Other useful information on the impacts of overflows may include:

- the results of water quality studies demonstrating environmental impacts from sewer overflows
- other information that identifies a link between sewage pollution and a public health or environmental impact.

The resulting assessment of the impacts of overflows can be presented in a tabular format, as in the example below.

Impact	Public health and/or environmental risk
Catchment 1	1
Catchment 2	2
Sewage pumping station 1	2
Sewage pumping station 2	4
Designed overflow point	3
Sewage treatment plant	1

Step 4: Analyse the risk of overflows

Following an assessment of the likelihood of overflows and their potential impacts, a risk analysis can be performed to estimate the level of risk, based on the following table.

Likelihood	Impacts				
	Insignificant (1)	**Minor (2)**	**Moderate (3)**	**Major (4)**	**Catastrophic (5)**
Almost certain (A)	Significant	Significant	High	High	High
Likely (B)	Moderate	Significant	Significant	High	High
Moderate (C)	Low	Moderate	Significant	High	High
Unlikely (D)	Low	Low	Moderate	Significant	High
Rare (E)	Low	Low	Moderate	Significant	Significant

The resulting level of risk can also be presented in a tabular format, as noted in the example below.

Component	Dry-weather risk	Wet-weather risk
Catchment 1	Low	Low
Catchment 2	Low	Moderate
Sewage pumping station 1	Low	Moderate
Sewage pumping station 2	High	Significant
Sewage treatment plant	n/a	Low

Step 5: Identify management actions

Proposed management actions can be based on the level of risk. For example:

- **High risk:** further detailed investigation and assessment of management options is required; immediate review and adjust operations and maintenance to reduce the consequences, likelihood and exposure; clean-up and notification procedures become high priority.
- **Significant risk:** further investigation may be required and assessment of management options; in the short term, operations and maintenance adjusted to reduce the consequences, likelihood and exposure.
- **Moderate risk:** medium-term assessment of possible management options; focused operations and maintenance in the interim.
- **Low risk:** manage by routine procedures/work practices.

The risk management approach enables the setting of priorities for action to reduce the risk level. Reducing the impacts of an overflow may be complex, because they relate to the environment in which the overflow occurs, which may be difficult to manage. A more appropriate approach is to focus on reducing the likelihood of an overflow.

To assess the most appropriate management action, the underlying causes of the overflow problems need to be investigated. This applies principally to the high-risk elements of the system and, to a lesser extent, medium-risk areas. Potential causes may not be immediately obvious and may require further investigations. They can include:

- infiltration/inflow into sewers
- inadequate storage volumes and response times to alarms at pumping stations
- failing alarm systems at pumping stations
- sewers with insufficient capacity to convey the design flows
- inadequate operations and maintenance of sewerage systems
- inappropriate trees planted over sewers
- poor sewerage system planning, including not accounting for the impact of new connections on the frequency of downstream overflows
- poor sewer design standards and construction specifications and inspection procedures of new sewers.

Australian experience suggests that a ‘Pareto’ effect often exists in wet-weather overflows, where the cause of about 80% of overflows can be attributed to 20% of the system. Using resources to target this 20% is commonly the most effective way of minimising overflows. It is therefore important to fully investigate all options for remedial work to select the most economic and effective solution. There is rarely a single source of infiltration/inflow into a system. The problems are commonly the result of a multitude of small problems.

Actions to address sewer overflow issues fall into two categories:

- non-structural management practices, e.g. improved management, operations and maintenance, as described further in Appendix D
- structural actions, which include rehabilitating degraded sewers, installing additional sewers and upgrading pumping stations, as discussed in Appendix E.

Where practical, a ‘source control’ approach should be adopted to sewer overflow abatement. This essentially involves targeting problems in the reticulation system, rather than amplifying downstream trunk sewers which can be achieved by a combination of improved operations and maintenance, and rehabilitating degraded reticulation sewers and house service lines.

Both short and longer term actions should be identified. Short-term actions are generally non-structural and can be implemented at moderate cost. Longer term actions commonly centre on structural issues, which may need further investigation, design and environmental impact assessment before they are implemented. These actions may also be more costly than non-structural actions.

Potential actions can be evaluated by assessing:

- any adverse environmental impacts
- effectiveness in addressing the issue, including the ability to address multiple issues
- ability to complement other potential management practices
- the proportion of the problem/issue addressed by the option
- technical and administrative viability
- whether any legal requirements are satisfied
- consistency with policies on other related issues, e.g. public health
- expected community acceptance
- estimated capital cost
- estimated operations and maintenance costs.

Cost/performance relationships of a set of control alternatives can assist in deciding which actions to take. An analysis can reveal where incremental pollution reduction starts to diminish compared with increased costs of implementation.

A ranking system can be a valuable technique for allocating priorities to management options. Scores can be allocated to the costs and benefits of identified options to determine a priority. Although this may be a relatively simplistic and subjective process, it is ‘transparent’ and avoids unstated assumptions. While this is a potentially valuable management tool, judgement will need to be applied when interpreting the results.

Step 6: Prepare report

The report should detail the risk analysis and include an implementation schedule (or program) for actions to address the higher risk overflows.

Public comments can be sought on a draft report. This may be particularly useful if additional income is required to implement any proposed long-term actions.

Appendix C: Preparing an Incident Notification Protocol

When a sewage overflow occurs, it is important that the licensee responds appropriately to minimise its impact on public health and the environment. An emergency response protocol will be an important part of the licensee’s management, operations and maintenance practices and is discussed further in Appendix D. However notifying those people and organisations who may be affected by the overflow will be equally important in minimising its impact, particularly in protecting public health.

Sewage treatment system licences require licensees to notify all parties likely to be affected where a bypass or overflow poses a risk to public health (Condition R4). This condition lapses after the licensee develops and adopts an Incident Notification Protocol, as required and described in Pollution Reduction Program (PRP) 101.

Licensees should consider how to respond to overflows from parts of the system outside their ownership or operation which pose a threat to public health or the environment.

PRP 101 aims to ensure that those members of the community who could be affected by a bypass or an overflow are informed as quickly as possible after one occurs. This does not mean that the community needs to be notified of every bypass or overflow, only those with a significant risk to public health. Similarly, in a declared State of Emergency it may be appropriate to adopt the relevant recognised emergency procedures, providing they address the need to protect public health from any overflows. These are the types of issues that should be considered in developing the protocol.

Many licensees will already have systems in place to advise the community and organisations about incidents of public health significance. However, in some cases these systems may not be formalised or not all relevant staff may be aware of the procedures to follow.

The EPA acknowledges that licensees are in the best position to assess the risks from bypasses and overflows in their areas and develop processes for notifying the local community. The conditions of PRP 101 are therefore not prescriptive. It is up to each licensee to liaise with the local community and organisations to reach agreement on when people are to be informed about bypasses or overflows.

Many licensees in coastal areas will be aware of the significant impact sewage overflows can have on commercial shellfish production in their estuaries. Safe Food NSW has developed a notification protocol for licensees to use to ensure that shellfish producers are able to respond to sewage overflows. These notification and monitoring procedures will form an important part of the Incident Notification Protocol for licensees in these areas.

Appendix D: Sewerage system management, operations and maintenance practices

Organisation management

Effective sewerage system management needs to be clear about how to deal with overflows. There need to be management systems in place which address:

- sewerage system planning
- preparation and implementation of overflow abatement plans
- system maintenance with possibly separate responsibilities for inspection and maintenance
- maintenance of records relating to overflows
- acceptance of new connections to the system.

It is also important that there is a defined chain of communication in the event of a serious overflow. This may include reporting the overflow to the appropriate authorities and the public.

Another important aspect of organisational management is staff training. This primarily applies to management organisation staff and contractors. Training should include operations and maintenance, system planning and inspection procedures for new connections. It should also highlight individual responsibilities and outline resources available to assist individuals carry out their roles. Multi-skilling of staff will mean that the effectiveness of operations and maintenance activities are not compromised when personnel are away or ill. Refresher training would also ensure that skills and knowledge are not lost over time.

Appropriate training of relevant consultants and developers should also be considered.

Sewerage system planning

Sewerage system planning is an important component of effective overflow minimisation. It involves designing the system to convey projected flows and assessing the impact on system capacity of redevelopments in existing areas. Planning is discussed further in Appendix F.

Managing new sewerage connections

System managers should have clear requirements for the design, construction, inspection and testing of new systems. This should also include a prohibition on stormwater connections to the sewerage system. These requirements could be contained in a standard agreement with developers. It is important that the system manager does not accept new connections that are substandard and which will require a high level of management to minimise future overflows.

Further details on minimising overflows from new system connections are contained in Appendix F.

The financial implications of new connections should also be considered. New connections may require downstream sewers or treatment plants to be amplified. While new ratepayers will contribute to ongoing costs, consideration should be given to a charging scheme that recovers some or all of the capital costs of any required system augmentation.

Sewerage system operations

Sewerage systems can be operated in a way that maximises the storage available in the system for wet-weather flows. This is most commonly achieved by operating the pumping stations to optimise storage within the sewer pipes and pumping station wet wells. This can either minimise or eliminate wet-weather overflows in an emergency or direct wet-weather overflows away from sensitive locations. Dynamic hydraulic modelling of the system is generally required to develop appropriate operating rules. Supervisory control and data acquisition (SCADA) systems are generally used for the remote control of pumping stations.

There is a range of system input (or demand-side) management techniques that can be implemented to either minimise overflows or their impacts. These pollution prevention techniques include:

- controlling trade waste inputs
- customer education
- reduction of dry-weather flows.

Sewage from industrial areas often has higher levels of pollutants than domestic sewage. Therefore, overflows from these areas have a potentially higher environmental impact. Solids, grease and corrosive substances can block pipes or damage sewers. Trade waste agreements should be in place to ensure that discharges to the system contain minimal levels of pollutants. Further details on trade waste issues are provided in the *Guidelines for Sewerage Systems: Acceptance of Trade Waste* (ANZECC 2001).

Community education campaigns can highlight what not to put down a domestic sewer. This includes grease, oil, sanitary pads and disposable nappies. The use of low-phosphorus detergents could also be encouraged. Providing facilities for the collection of liquid waste can be combined with a campaign to encourage customers not to dispose of this waste into the sewerage system. An education campaign can also focus on appropriate trees to plant above sewers to minimise root infestation. Another aspect of community education is encouraging the inspection and maintenance of private sewers. These sewers are often as long as those owned by the sewerage system manager.

Reducing dry-weather flows provides additional capacity for wet-weather flows. Reducing demand for potable water will reduce discharges to sewage in dry weather.

Sewerage system maintenance

Maintenance planning

Sewerage systems are a significant and valuable part of Australia's infrastructure. They represent an asset valued at billions of dollars. The costs involved in carrying out appropriate operations and maintenance to minimise overflows should, therefore, take account of the value of the sewerage system and the higher future costs if the asset is allowed to deteriorate. Maintenance and rehabilitation add value to the original investment by extending its life. Although the costs of sewer rehabilitation vary between systems, they can be expected to be highest in those systems where regular preventative maintenance programs have not been implemented.

Maintenance activities can be placed in three categories:

- **Corrective (or reactive) maintenance:** This relates to the use of a piece of equipment until it fails and requires repair and replacement. This approach is generally used for non-critical assets. Corrective maintenance cannot be scheduled.

- **Emergency maintenance:** This is a form of corrective maintenance that is applied to a critical asset that has failed, resulting in a risk to public health or the environment.
- **Preventative maintenance:** These are routine scheduled activities performed before failure of an asset. They extend equipment life, reduce overall maintenance costs and increase system reliability.

There are a number of elements of appropriate maintenance planning, including:

- an initial operational review
- scheduling of routine inspections
- scheduling of routine maintenance
- emergency maintenance
- reporting and record-keeping
- formal procedures for maintenance activities
- training of maintenance staff.

If a sewerage system manager does not have a formal maintenance plan in place, an operational review of the system can be undertaken before a plan is prepared. This review can involve assessing existing facilities, operating conditions and maintenance practices.

The system manager should have maps or a mapping system of its sewerage system, such as a geographical information system or GIS. The map should be based on work-as-executed plans, where available. This should show the location of designed sewer overflows, as well as streets and other landmarks, so that maintenance crews can locate elements of the system when required.

Overflow Abatement Plans can also provide important information for the review. These include the sensitive areas subject to overflows, information on system characteristics, such as sewer condition, and pumping station data.

A schedule should be developed for routine inspections of the sewerage system. The priorities for these inspections should be clearly stated. A risk-based approach could be employed in developing this schedule and the schedule itself periodically reviewed, to ensure that it is effective in meeting its goals and improving overall system performance. Management should review the findings of routine inspections to determine if any further action is required. Reactive inspections should investigate the cause of public complaints.

A schedule should also be developed for routine or preventative maintenance of the system. Preventative maintenance is an important component of asset management, as it reduces the rate of deterioration of the asset and the need for more costly reactive maintenance. It is intended to prevent or delay the failure of an asset. A routine maintenance schedule should be linked to an inspection schedule. Procedures should be in place to ensure that problems identified during inspections receive the necessary maintenance or repair actions.

The schedule should state the frequency and type of maintenance to be undertaken. A risk-based approach could also be used for maintenance scheduling. More frequent maintenance should be undertaken on sewers likely to overflow to sensitive waters. This schedule should also be reviewed periodically (possibly based on the results of overflow reports) and revised as necessary. There should be a procedure for checking that scheduled maintenance has actually been done.

Reactive or emergency maintenance occurs when a component of the system fails unexpectedly. The aim of this maintenance is to return it to service as soon as practicable and remove any risk to public health and the environment. The system manager should have written procedures in place in the event of a failure that necessitates reactive maintenance.

Although reactive maintenance is not planned, it is important that maintenance planning takes it into account.

A record-keeping system should be included in the operation and maintenance plan. Reports of inspections of the system should include information on when elements of the system were inspected and what, if any, maintenance was performed, including details of the problem, the action taken, whether any further action is required and personnel involved. A procedure should be in place to report any significant maintenance issues to management. In larger systems, this information could be included in the GIS for the system.

System managers should have written policies, procedures or protocols for system operations and maintenance. These can be used in training personnel and monitoring activities. This will ensure consistency and comparability of maintenance activities, as well as cost-effectiveness. They should be reviewed periodically and revised if required.

Training of operations and maintenance staff is discussed above. An appropriate blend of formal classroom and on-the-job training should be used.

Maintenance of sewers

Sewers are generally inspected using closed-circuit TV and visual inspection of large-diameter pipes. This inspection can identify blockages, cracks, tree roots and accumulated sediment. Defects should be recorded using a consistent technique to assist in maintenance and repair. In areas where overflows are unlikely to be reported by the public (e.g. bushland areas), the route of the sewer can be walked to check for any dry-weather overflows. Access chambers and designed overflow structures should be visually inspected for defects, possibly aided by mirrors on an adjustable pole. The overflow pipes from overflow structures should be checked for obstructions and the performance of any gas check valve also checked.

Sewer maintenance techniques include:

- root cutting using a remotely operated cutting tool inserted at an access chamber
- chemical cleaning to reduce root infestation
- removal of blockages by rodding
- sewer flushing to remove accumulated sediment.

Sewer rehabilitation and repair techniques are described in Appendix E.

Maintenance of pumping stations

Sewage pumping station inspection and maintenance techniques include:

- inspection of telemetry and instrumentation
- checks of the operations of valves and penstocks
- mechanical and electrical inspection
- pump capacity testing
- removal of sediment/grit accumulated in wet wells
- cleaning of wet wells so that the build-up of grease and fat does not interfere with level control devices, as this can cause pump failures and overflows.

Overflow emergency response

While the goal of effective sewerage system management is to prevent overflows, it is important that there are procedures to follow to minimise the impacts of overflows if they do occur.

All sewage overflows have the potential to cause harm to public health and the environment. A quick response is the key to minimising these risks and damage to property. An important component of an emergency response protocol will be procedures to ensure that affected organisations and members of the community are notified. The requirement to prepare an Incident Notification Protocol is outlined in Section 6: Sewage Treatment System Licences.

An emergency response protocol should be developed and implemented in all sewerage systems. To support the protocol, the system manager should ensure that the following are in place:

- adequate training of personnel
- provision of appropriate equipment, e.g. bypass pumps, generators, bypass pipelines
- access to operations and maintenance plans and system maps
- prescribed actions to contain overflows, and prevent overflows during repairs
- protocols for remedial work and the debriefing of staff and others involved
- reporting procedures to notify management, regulators and stakeholders
- processes for communicating with the community.

Appendix E: Managing overflows by structural measures

This section describes a range of structural techniques that can be used to minimise the environmental impacts of sewer overflows. A combination of these techniques is likely to be the most appropriate approach to minimising the impacts of overflows in the longer term. The most appropriate techniques can selected during the overflow investigations process, when the costs and benefits of different approaches can be evaluated. These investigations may include sewer gauging, smoke testing, closed-circuit TV inspection, visual inspections and, in larger, more complex systems, water quality monitoring. Modelling of the sewerage system can also be a useful technique to identify the best combination of techniques.

Sewer pipe repair

Sewer pipes that are broken, cracked or have joint defects can be repaired thus minimising infiltration/inflow and leakage. The most common techniques involve 'trenchless technology', where the costs and disruption are less than open excavation. There are a number of approaches:

- for minor defects, grouting of the sewer to fill cracks and joint defects
- lining of sewers with a pipe made from high-density polyethylene or polyvinyl chloride
- 'pipe bursting', which involves breaking the pipe by a tool pushed or dragged through the pipe and a new pipe inserted.

Lining can rectify most defects in sewers, although the cost is considerably higher than grouting. The effective life of lining is longer than grouting.

In some circumstances, such as broken or collapsed sewers, open excavation and replacement may be required. This is also often required at the junctions with service lines on lined pipes.

Access chamber repair

Defective access chambers can be repaired by measures such as:

- spraying the inside of the access chamber with a urethane or epoxy resin or cementitious material
- installing an epoxy resin liner
- installing a fibreglass insert
- reconstructing part or all of the access chamber, e.g. if the cone is offset.

Cracked access chamber lids and surrounds can be replaced. Watertight covers can be installed if the access chamber receives surface runoff.

House service line repair

House service lines can be repaired by lining or replacement through open excavation.

Elimination of cross-connections

Cross-connections between the stormwater and sewerage systems are usually corrected by physically disconnecting the stormwater pipe from the sewer, and connecting it to the stormwater system. Downpipes from roofs are the most common illegal connection to sewers.

Another source of stormwater inflows to sewerage systems are gully drains under outside taps. They may be constructed without a surround (or bund) to prevent stormwater runoff from flowing into the gully and entering the sewerage system.

Relocation of designed overflows

Designed overflows that discharge to sensitive locations can be sealed and/or moved to less sensitive locations. A similar approach can be adopted for overflows discharging from sewage pumping stations.

Construction of wet-weather storages

Storages can be constructed inline or offline within the sewerage system to temporarily store wet-weather flows. These storages generally drain back to the sewerage system when flows in the system have reduced. Storages can also be provided at the treatment plant.

Amplification of sewers

Sewer amplification can be used to reduce wet-weather overflows. This commonly occurs in the trunk section of the sewerage system. The additional hydraulic capacity can be used to convey the wet-weather flows to the treatment plant or to a designed overflow structure in a less sensitive location.

If the wet-weather flows are conveyed to the treatment plant, a degree of treatment of the flows is likely prior to discharge. However, a comparison should be made of the costs and benefits of this approach compared with minimising wet-weather flows by sewer repair. This should include an assessment of the additional sewage treatment and maintenance costs for the extra sewer capacity.

If the treatment plant has a primary and a secondary outfall, wet-weather flows are sometimes discharged through the secondary outfall. These outfalls often discharge to a more sensitive location than the primary outfall. The additional flows may also increase the frequency at which lower treatment level discharges occur from the treatment plant. Upgrading of the treatment plant may be required to avoid this occurring.

Upgrading of sewage pumping stations

There are a number of approaches to reduce overflows from sewage pumping stations including:

- providing additional storage volume
- installing additional pumps
- upgrading the pump or pumps and the rising main
- providing an additional power supply to the pumping station
- upgrading the alarm system, including installing a telemetry system, possibly on a staged basis, with priority for large pumping stations, pumping stations that discharge to sensitive locations or those that overflow frequently.

SCADA systems can continuously monitor the operating status of pumping stations.

Treatment of wet-weather overflows

Treatment facilities can be provided at designed wet-weather overflow structures. Various levels of treatment could be provided, ranging from primary treatment, e.g. screening and grit removal, to secondary treatment with disinfection.

Appendix F:
Minimising overflows from new sewerage systems and extensions to existing systems

This section discusses how new sewerage systems can be designed, constructed and inspected to minimise their overflow potential. It is not intended to be a design guide for new systems. Large system operators and other organisations commonly have technical guides for the design of sewerage systems.

This section discusses:

- the sizing of elements of the sewerage system (sewers, sewage pumping stations)
- the location of overflow pipes and designed overflows
- the construction of new sewerage systems.

Sewerage system sizing

Design flows

Sewerage systems are generally designed to convey dry-weather flows and wet-weather flows. The likely dry-weather flows are commonly calculated using a relationship between flow and the population served by the sewer (often expressed as equivalent persons or tenements). Wet-weather flows are commonly estimated to be a function of the catchment area contributing to the sewer, a multiple of the dry-weather flow or a function of the length of the sewer.

This approach assumes that overflows will occur during major wet-weather events significantly above the design flow. The frequency of the wet-weather overflows is, however, not explicitly stated. An alternative approach, which may be suitable for large systems, is to use a computer model of the sewerage system to calculate the frequency of overflows, given particular rainfall patterns. Design for wet-weather flows differs widely across the country, reflecting the varying impact of rain events.

It is important that both components of the design flow take into account future conditions. The dry-weather flows should accommodate future upstream developments. If this does not occur, the additional flows from growth can cause downstream overflows because of reduced capacity to convey wet-weather flows.

The failure to account for these flows when designing elements of the system, such as pipes and pumping stations, can result in an increasing frequency of wet-weather overflows over time.

Sewers

Sewers should be designed to minimise slime growth and siltation, which reduce capacity and may result in overflows. They should also be designed to minimise long-term erosion, which may lead to failure and a consequent overflow.

The sizing of sewers to convey design flows is often undertaken using design charts or tables. In larger systems, it may be appropriate to use hydraulic models of the sewerage system to account for the storage available in the trunk sewers, which can reduce design flows. It is important that the hydraulic sizing of the system accounts for head losses at access chambers. Models of structures with complex hydraulic behaviour may be necessary in order to identify unexpected flow restrictions or head losses.

To minimise the chances of blockage, pipe diameters for reticulation systems should not decrease in a downstream direction, even if this results in excess hydraulic capacity. This may be acceptable in larger diameter trunk sewers, where blockages rarely occur.

Which pipe material to use should take into account structural soundness and resistance to corrosion. Joints should also be designed to minimise the intrusion of tree roots and infiltration of ground water. Generally pipes should be flexible with as few joints as possible.

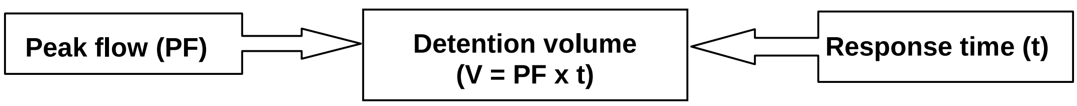
Access chambers

Access chambers should be designed to minimise the potential for infiltration/inflow and should not collect surface runoff. This can be minimised by not locating them with conventional covers in drainage paths or flood-prone areas. Sealed or bolt-down covers could be used in these conditions.

Sewage pumping stations

Sewage pumping station storage volumes commonly have two components. The first caters for the design inflow, balancing storage volume and pumping rate. In addition, pumping stations normally have an emergency storage capacity so that station breakdowns are less likely to result in an overflow. The emergency storage capacity should be sufficient to allow for a realistic response time to remedy the cause of the overflow. The level of additional capacity and back-up facilities provided also relate to the potential impact of pollution from an overflow.

Detention time for the emergency storage is the period between the first pumping station alarm and overflow to the environment. Detention times commonly range between 2 and 8 hours at the design flow. Where the response time is short or the environmental impacts of an overflow are likely to be relatively minor and the equipment is well maintained, a shorter detention time could be adopted. Longer detention times are appropriate when response times are long, e.g. where there are access difficulties or when the environmental impact of the overflow may be significant. The relationship between response time and detention volume is illustrated in below.



In sensitive areas, detention ponds or other above-ground storage may also be provided. Flows from pumping stations can be designed to overflow to other sewerage systems in the event of station failure. For larger pumping stations, where very large storage volumes would be required for detention ponds, alternative design and operational approaches could be considered to reduce the risk of overflow.

In addition to mechanical and electrical faults within the pumping stations, power failure is another frequent cause of overflow. Dual power supplies or emergency generators are often installed on major or critical stations to reduce the risk of overflows.

Pumps installed within pumping stations should be designed to permit the passage of solids. This involves appropriate impeller and pump characteristics.

For vacuum systems an alternative power source should be provided to operate the pumping station during times of power failure. In addition, an emergency storage volume should be provided at the interface valve pit/access chamber on the gravity sewerage system.

To minimise the response time, telemetry and dial-up systems are preferred to audible or visual alarms.

Location of pumping station overflow pipes and designed overflows

Sewage pumping stations are often designed with an overflow pipe. This is intended to direct any overflow away from the pump's electrical components. It is important that any overflow from a pumping station is carefully located to minimise any environmental impacts caused by the overflow. If this is not feasible, the location of the pumping stations should be planned to ensure that overflow impacts are minimised. Alternatively, a larger storage volume with a longer detention time should be provided.

A similar situation applies to the location of designed overflows. These should direct overflows to locations where the environmental impact is expected to be minimal and measures put in place to ensure they are quickly identified and cleaned up and the system maintained. If this is not possible, a storage with an alarm system could be installed.

Construction and inspection

It is important that the construction specifications for new sewerage systems require the system to be built to prevent future overflows as far as practicable. This includes addressing potential issues such as:

- defects in access chambers, e.g. joints in pre-cast access chambers, offset cones
- settlement of sewers or access chambers, possibly resulting in joints opening in sewers
- root ingress through pipe joints
- appropriate tree planting above sewers
- sufficient cover above pipes to minimise the risk of breakage or encasing or bridging the pipe
- ensuring no cross-connections with stormwater pipes.

These apply to both the reticulation system operated by the system manager and private house service lines.

Appropriate management practices should be implemented to ensure that new systems are constructed in accordance with the design and specifications. The system should also be constructed in accordance with a quality assurance system.

It is important that new sewerage systems are inspected to detect any defects that may result in future overflows. Inspections can include:

- visual inspection of access chambers and sewers to identify any defects and to ensure that access chamber covers fit tightly into their surround
- an assessment of the alignment of sewers to detect defects such as displaced pipes
- a water or air test of gravity sewers.