Review of the public health regulatory framework for alternative water supplies in Victoria

Supporting the safe use of sewage, greywater and stormwater

Stakeholder discussion paper
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Water is a fundamental determinant of good health, as well as an important natural resource.

As community interest in more sustainable approaches to water management is increasing, industry and the water sector are exploring innovative ways to conserve, capture, treat and reuse water. The Victorian Government actively encourages greater use of alternative water supplies and the contribution that effective water management can make to liveability.

Use of sewage, greywater and stormwater has the potential to impact on public health, due to the presence of pathogens which can easily be ingested through activities such as toilet flushing and irrigation.

With more Victorian businesses and individuals in urban areas using recycled water, we need an effective regulatory framework that:

- enables innovation
- ensures public health and the environment are protected and community confidence is maintained
- enables Victorians to access comprehensive and clear information about safe and sustainable alternative urban water supplies
- provides clarity and certainty for industry participants to invest in alternative water supply schemes
- acknowledges the need for interjurisdictional consistency
- encourages continuous development and innovation in alternative water use.

In the context of this review, the term ‘regulatory framework’ covers the range of management controls applying to alternative water supplies including Acts, regulations, guidelines and education.

All regulatory frameworks are subject to ongoing review, and the process for reviewing the alternative water supply framework is a dynamic process. In 2009, the Victorian Government published its Review of the regulatory framework for alternative urban water supplies, and it was envisaged that future reviews would be required to support continuing development of alternative water applications (State Government of Victoria 2009).

In particular, the 2009 review found that using treated sewage and greywater indoors for toilet flushing and laundry use was a regulatory gap that needed to be clearly addressed to manage potentially high uncontrolled health risks. More recent reports commissioned by the National Water Commission have also identified deficiencies in Victoria’s current regulatory framework relating to sewage and greywater (Power 2010; PricewaterhouseCoopers Australia 2011).

The 2009 review also recommended that the use of stormwater be supported by relevant guidelines rather than specific regulation. These guidelines include the Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse (NRMMC, EPHC et al. 2009). The increasing use of stormwater in large-scale residential developments, however, highlights the need to assess current management controls.

The current review is guided by the government’s response to the Living Melbourne, Living Victoria implementation plan (the plan) and its commitment to making the most of all the water available in Melbourne and Victoria’s regional centres (Living Victoria Ministerial Advisory Council 2012). This paper makes specific references to relevant aspects of the plan.

The review process is being led by the Victorian Department of Health with EPA Victoria and the Department of Sustainability and Environment, and with input from a stakeholder reference group.

This review will focus on two areas:

1. closed-loop sewage and greywater recycling schemes
2. stormwater harvesting schemes.

This consultation paper is designed to enable all stakeholders to participate in the consultation process. Section 2 of this paper provides details on how individuals and organisations can participate in this process.
Acknowledgements

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- Department of Planning and Community Development
- Department of Sustainability and Environment
- EPA Victoria
- Essential Services Commission
- Melbourne Water
- Municipal Association Victoria
- South East Water
- Western Water
- Yarra Valley Water

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Photos shown on page 11, 31, 33, 35 and 41 appear courtesy of Clearwater.

Photo shown on page 15 appears courtesy of the City of Greater Geelong.
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Introduction
1.1 Purpose of this paper
The purpose of this paper is to:
• review the existing public health regulatory framework for alternative water supplies in Victoria, with a focus on sewage, greywater and stormwater
• explore options for practical, best-practice regulation of these alternative water supplies, including legislative and non-legislative approaches
• facilitate discussion about proposed options.

1.2 The need for action: regulating to protect public health
Water is a fundamental determinant of good health, but it is also a highly effective vehicle for the spread of disease, even in developed societies.

Urban use of recycled water from sewage and greywater introduces a new paradigm in the way water is managed. While the fundamental requirement to protect the public from disease remains, effective water management has evolved beyond simply removing sewage discharges from waterways and the environment. Increasingly this ‘removed’ or treated water is being used as a resource for beneficial purposes such as irrigation and other applications. Similarly, stormwater is becoming a valuable resource to achieve multiple benefits, including improvements in waterway health.

Alternative water supplies such as sewage, greywater and stormwater, by virtue of their origin, can contain harmful substances including microorganisms and chemicals. When not properly managed, schemes that use these supplies can pose serious risks to public health.

Treatment technologies have improved in parallel with innovations in urban planning and design, and evidence continues to show that water plays an important role in broader urban liveability. This has led to higher exposure to alternative water uses in urban settings. It is important that regulatory oversight keeps pace with these developments.

This review aims to strike the right balance between encouraging innovation and uptake of new technology in sustainable water use with the ongoing protection of human health.

It supports the view that maintaining water quality while encouraging effective use of alternative water supplies is best achieved through applying the principle of effective risk management. The ultimate goal as expressed by the National Health and Medical Research Council (2011), is to steer ‘a sensible course between the extremes of failing to act when action is required and taking action when none is necessary’.

1.3 Objectives of the review
The objective of this review is to ensure that the public health regulatory framework for alternative water supplies in Victoria:
• protects public health
• is straightforward, practical and consistent in its application
• seeks to avoid being overly prescriptive, and instead supports innovation
• is efficient and cost-effective for regulators and the water industry, with regulatory requirements proportional to risks and benefits outweighing costs
• maintains confidence in Victoria’s water supplies.

1.4 Structure of the paper
This paper first presents the scope of the review, clearly defining the three alternative water sources of sewage, greywater and stormwater.

The paper then summarises the types of regulation, the processes for determining the appropriate regulatory approach, the principles of good regulation, different regulatory models and the importance of achieving a balance between the benefits and costs.

Separate sections addressing sewage and greywater, and stormwater schemes are then presented. Discussion points are raised and questions posed in each section in order to encourage participation in the review process. Discussion questions are also summarised in Appendix 1.
The paper is structured as follows:

Chapter 1 Introduction

Chapter 2 Provides an overview of the purpose of the paper, including the review process and stakeholder consultation opportunities

Chapter 3 Discusses the scope of the review

Chapter 4 Examines different types of regulation, including principles of good regulation and regulatory models

Chapter 5 Provides an overview of sewage and greywater schemes, including health risks, current guidelines and legislation, the current regulatory inconsistencies and proposed options

Chapter 6 Provides an overview of stormwater schemes, including health risks, current guidelines and legislation, the current regulatory inconsistencies and proposed options

Chapter 7 Discusses costs and benefits
Chapter 2
The review process
The review process

The conduct of this review takes into account relevant preceding Victorian reviews, the Government’s response to the current Living Melbourne, Living Victoria implementation plan (Living Victoria Ministerial Advisory Council 2012) and several similar or related processes being undertaken in other jurisdictions and federally.

The review process acknowledges the diversity of stakeholders with an interest in sewage, greywater and stormwater use in the context of climate change, water security, sustainability aspirations and innovations, and expectations of future demands.

Accordingly, the review process centred on developing a clear understanding of available research and information about regulatory approaches to these alternative water supplies, as well as identifying all relevant stakeholders to be involved in, consulted with, or informed about the review and its outcomes.

2.1 Project governance

The review is being led by the Department of Health with EPA Victoria and the Department of Sustainability and Environment.

A stakeholder reference group has been established with representation from the water industry, local government, and state government, with a charter covering three functions of:

- participation in meetings, appropriate stakeholder consultation workshops and other forums for the purposes of project implementation and stakeholder consultation
- reviewing and providing feedback on the strategic approach and on specific project resources such as the discussion paper
- communicating with – and encouraging participation from – each member’s own key stakeholder group to ensure effective representation of views and expertise.

2.2 Stakeholder consultation

This discussion paper forms the basis of the consultation process and is designed to inform all stakeholders of the scope of the review, the process for its completion, relevant information and evidence about the operating and policy environments and proposed approaches to new regulatory arrangements.

Interested individuals and organisations can provide written feedback directly to the Department of Health as specified in section 2.4, or through participation in one of the several planned consultation sessions.

2.3 Consultation opportunities

The Department of Health will conduct formal, facilitated consultation sessions for interested stakeholders.


Following the consultation process, all feedback provided at meetings and via submissions will be considered and assessed for incorporation into a recommendations report.

2.4 Written submissions

The Department of Health welcomes written submissions and encourages interested stakeholders to provide comments on the issues and questions raised in the discussion paper.

All submissions will be published on the Department of Health website, unless the submitting organisation requests otherwise. If you do not wish your submission to be published please specify this on the cover sheet when you provide your submission. Submissions will also be copied, used and distributed by the Department to internal personnel and consultants engaged by the Department, as required for the review process.

The public consultation period closes on Tuesday 30 April 2013. Feedback should be provided to:

Manager, Water
Department of Health
water@health.vic.gov.au

2.5 Next steps

Stakeholder feedback gathered through the consultation sessions and written submissions will inform the development of arrangements to improve and reform the Victorian regulatory framework.

Recommendations from the consultation period will be provided to the government in 2013.
Chapter 3
Scope of the review
Scope of the review

3.1 Sewage and greywater recycling schemes

In 2009, the Victorian Government published the *Review of the regulatory framework for alternative urban water supplies* (State Government of Victoria 2009). This review, conducted by EPA Victoria, the Department of Health and the Department of Sustainability and Environment, focused on public health and environmental frameworks supporting the use of alternative water supplies. Specifically, the review identified that the use of treated sewage or greywater for indoor uses such as toilet flushing and laundry use (that is, closed-loop applications) was a regulatory gap that needed to be addressed to manage the potentially high uncontrolled health risk associated with these activities.¹

3.2 Stormwater harvesting schemes

The *Review of the regulatory framework for alternative urban water supplies* identified that stormwater recycling in Victoria would most likely be limited to a household property scale or to applications with large storages for opportunistic reuse, for example irrigation of adjacent parkland and sports fields (State Government of Victoria 2009). The review recommended that the use of stormwater be supported by relevant guidance including the *Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009), rather than specific regulation.

Since the 2009 review, additional stormwater applications have been proposed including the use of stormwater in large-scale dual-pipe residential developments. In addition to these new applications, the number of schemes using stormwater for high-exposure end uses (such as unrestricted public open-space irrigation) also appears to be increasing. These new applications have prompted questions about the effectiveness of the current stormwater management framework and whether any changes are needed in the future.

3.3 What is not included

This review is focused specifically on the management of public health risks associated with large-scale closed-loop sewage and greywater recycling schemes and stormwater harvesting schemes. Single household use of these water supplies is not included within the scope of this review. Alternative water sources such as rainwater or industrial water are also excluded, as these have been previously reviewed and are currently managed by guidelines and education.

There is a range of factors which, if not dealt with appropriately, could impact on public health. In particular, the technical competence of those involved in managing schemes and the schemes' long-term ownership arrangements may affect the standard, quality, safety and reliability of services provided.

The implications of these issues are beyond the scope of this review. Many of these issues will be addressed through the government’s Living Victoria program, which is focused on making the most of all the water available in Melbourne and Victoria’s regional centres to conserve potable water for drinking needs and increase the liveability of urban environments (see below for further information).

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¹ Sourced from sewage treatment systems with a design capacity or flow rate of greater than 5,000 litres per day
3.4 Living Melbourne, Living Victoria

In early 2011, the government appointed the Living Victoria Ministerial Advisory Council to provide independent advice on the key changes needed to achieve the government’s aims for urban water, which are to:

- establish Victoria as a world leader in liveable cities and integrated water management
- drive generational change in how Melbourne uses rainwater, stormwater and recycled water
- drive integrated projects and developments in Melbourne and regional cities to use stormwater, rainwater and recycled water to provide Victoria’s next major water augmentation (to be used for non-drinking purposes).

The Ministerial Advisory Council delivered the *Living Melbourne, Living Victoria implementation plan* in late 2011, which included the final recommendations for consideration by government.

The government response to the implementation plan articulated the government’s support for the vision and objectives proposed in the plan for the urban water system, which centres around achieving an integrated, resilient water system that:

- supports liveable and sustainable communities
- protects the environmental health of urban waterways and bays
- provides secure water supplies efficiently
- protects public health
- delivers affordable essential water services.

In its response, the government committed to specific actions arising from the implementation plan, including improving regulatory arrangements for alternative water sources. The current review is in line with this commitment, and aims to ensure that water systems continue to be planned and managed to protect public health.

The government also committed to the establishment of the Office of Living Victoria, which was formally created in May 2012 to drive reform through coordinated water and urban planning. Its functions include associated work on building and planning controls to improve water efficiency and liveability outcomes, including through the increased use of alternative water sources.
Chapter 4
Regulation
Regulation

Government intervention can take a number of forms including:

- explicit government regulation through primary legislation (Acts of Parliament) and subordinate legislation (statutory rules such as regulations and other subordinate instruments)
- other regulatory forms and approaches including self-regulation, quasi-regulation, co-regulation and market-based instruments
- other approaches, such as providing information, education campaigns, research, removing legislative impediments, rewarding good behaviour, negative licensing and government investment.

This regulation continuum is illustrated in Figure 1 below (Department of Treasury and Finance 2011).

Figure 1: Regulation continuum

Self-regulation
- Voluntary agreement with an industry
- Characterised by voluntary codes of conduct or standards
- No government enforcement

Quasi-regulation
- Government influences business to comply
- Government assists with development of codes of conduct, accreditation and/or rating schemes
- Ongoing dialogue between government and industry
- No government enforcement

Co-regulation
- Strong partnership between industry and government
- Industry develops own code of conduct or accreditation/ratings schemes with legislative backing from government
- Government enforcement

Explicit government regulation (legislation)
- Industry’s role in formulating legislation is limited to consultation, where relevant
- Compliance is mandatory, with punitive sanctions for non-compliance
- Little flexibility in interpretation and compliance requirements
- Government enforcement

The approach currently used in Victoria to manage stormwater harvesting schemes, as well as sewage and greywater schemes that are not currently captured under the existing legislative framework (i.e. closed-loop schemes).

The approach that currently applies to sewage and greywater schemes under the existing legislative framework.
4.1 Principles of good regulation

The *Victorian guide to regulation* (Department of Treasury and Finance 2011) specifies that regulation should be designed to meet the following key characteristics:

- effectiveness
- proportionality
- flexibility
- transparency
- consistent and predictable
- cooperation
- accountability
- subject to appeal

In addition, the Taskforce on Reducing Regulatory Burdens on Business specifies six principles of good regulatory process (Box 1).

**Box 1: Six principles of good regulatory process**

- Governments should not act to address problems until a case for action has been clearly established. This should include establishing the nature of the problem and why actions additional to existing measures are needed, recognising that not all problems will justify (additional) government action.
- A range of feasible policy options (including self-regulatory and co-regulatory approaches) needs to be identified and their benefits and costs (including compliance costs) assessed within an appropriate framework.
- Only the option that generates the greatest net benefit for the community, taking into account all the impacts, should be adopted.
- Effective guidance should be provided to relevant regulators and regulated parties in order to ensure that the policy intent of the regulation is clear, as well as the expected compliance requirements.
- Mechanisms are needed to ensure that regulation remains relevant and effective over time.
- There needs to be effective consultation with regulated parties at all stages of the regulatory cycle.

Source: (Regulation Taskforce 2006)

4.2 Regulatory models

4.2.1 National considerations

The above characteristics of good regulatory design were considered as part of the National Water Commission’s report *Review of urban water quality regulation in Australia* (PricewaterhouseCoopers Australia 2011). The review examined how existing regulatory arrangements for drinking water and recycled water could be reformed to address concerns and manage the growing complexity of urban water quality issues. The review’s main focus was on the health perspective of urban water.

This review and another report commissioned by the National Water Commission – *Recycled water use in Australia: regulations, guidelines and validation requirements for a national approach* (Power 2010) – provide an overview of the regulatory approaches taken in all Australian states and territories. The reports show that a number of state and territory agencies are involved in regulating recycled water. Typically the responsibility of each agency targets a specific area, for example health departments assess public health aspects and environment departments assess environmental impacts (PricewaterhouseCoopers Australia 2011).

The 2011 review drew on the success of regulatory frameworks to achieve health and safety goals, and attempted to identify a best-practice framework for managing public and environmental health risks. It examined the comparative sectors of food, rail and electricity safety. Although the review concluded that there is no single model for achieving reform, it outlines the following principles for regulation (PricewaterhouseCoopers Australia 2011):

- The goal of urban water quality regulation is to protect human and environmental health.
- Risk management is central to this goal.
- Consistency is important, but flexibility is also needed to address and manage the risks associated with situational factors.
- Governance arrangements should be clear, with broad agreement and recognition of roles and responsibilities across water supply, wastewater and waterway health agencies.
• Decision making about urban water quality should be transparent, timely and accountable, with clear mechanisms to leverage the knowledge and experience of industry and the broader scientific/research community.

• Regulatory frameworks should support regulators to manage the complexity of urban water quality issues, and facilitate multiple supply sources.

• Regulators should adhere to best-practice principles when choosing regulatory approaches to manage risks, taking costs and benefits of proposed actions into consideration (see Box 1).

• Regulators should have adequate resources and competent staff.

These principles have been considered in the development of the proposed options detailed in sections 5 and 6.

4.2.2 The risk management approach

The National Water Initiative, agreed in 2004, encourages the reuse and recycling of water where cost-effective. It resulted in the development of the *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006).

The preventive risk management framework in the *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006) is based on 12 elements:

- commitment to responsible use and management of recycled water
- assessment of the recycled water system
- preventive measures for recycled water management
- operational procedures and process control
- verification of recycled water quality and environmental performance
- incident and emergency management
- employee awareness and training
- community involvement
- research and development
- documentation and reporting
- evaluation and audit
- review and continual improvement.

The National Water Commission promotes the application of best-practice regulatory arrangements, based on the *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006; PricewaterhouseCoopers Australia 2011).

Adopting a risk-management approach reflects principles of modern public health law, permits proactive responses to public health risks, provides a framework for responding to known risks and allows for adaptation in response to risks that may not be contemplated at present (Department of Human Services 2004).

Victorian Government guidelines encourage the use of performance based standards and/or process based regulation to avoid prescriptive rules.

Performance-based standards set out desired objectives or outcomes but do not specify the means by which they are to be met. These standards are suitable for industries subject to changing circumstances and can encourage greater flexibility in dealing with technical matters. This flexibility can, however, lead to uncertainty for regulated entities if they are not sure they satisfy the standards set by the regulations. Performance-based standards may also increase the risk of non-compliance if standards are not uniform across the industry (Department of Treasury and Finance 2011).

Process-based regulation is increasingly adopted when governments need to manage substantial but diverse risks. It is generally best applied when:

- there are a number of substantial risks that need to be managed simultaneously
- there are a range of management measures available
- individual firms within the regulated industry can effectively assess risks and develop tailored solutions to mitigate those risks under their control (Department of Treasury and Finance 2011).

Consistent with the risk-management approach detailed within the *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006), process-based regulation is centred around the key elements of risk identification, risk assessment and risk controls.
Process-based regulation has significant advantages over prescriptive regulation in that it affords greater flexibility to regulated entities in achieving the desired outcomes, and it can be used in situations where circumstances may change over time (such as technology advances). Examples of process-based regulation include requirements to prepare and implement risk-management plans under Victoria’s Safe Drinking Water Act 2003, and requirements to prepare health and environment management plans and recycled water quality management plans for Class A recycled water schemes captured under EPA’s current regulatory framework.

4.2.3 Interjurisdictional regulatory approaches

Sewage and greywater

Given the importance of maintaining public and environmental health, all state and territory governments in Australia currently regulate sewage and greywater recycling. In Victoria, the regulation of sewage and greywater recycling schemes (which are currently captured under the existing legislative framework) is based on the preventive risk management approach detailed in the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006).

The use of the preventive risk management approach is consistent across all Australian states and territories, with the exception of the ACT, which does not currently reference the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006) in its framework (PricewaterhouseCoopers Australia 2011).

Stormwater

States such as Victoria, South Australia and Queensland recommend that stormwater schemes be designed and managed in accordance with the Australian guidelines for water recycling: managing health and environmental risks (phase 2) - stormwater harvesting and reuse (NRMMC, EPHC et al. 2009), but the use of stormwater in such schemes is not currently subject to specific legislative oversight.

However, with an increasing focus on integrated water cycle management and an increasing number of stormwater harvesting schemes being implemented around Australia, oversight of stormwater schemes is now the focus of greater scrutiny. As an example, stormwater regulation is currently being reviewed as part of the New South Wales Government’s Urban water regulation review: discussion paper – joint review of the Water Industry Competition Act 2006 and regulatory arrangements for water recycling under the Local Government Act 1993 (NSW Department of Finance and Services 2012).

While private stormwater harvesting schemes are required to be licensed in New South Wales under the Water Industry Competition Act 2006, council-led stormwater schemes currently do not need to obtain any independent approval for their reuse component. The NSW review highlights this inconsistency and the potential for unregulated schemes to create public health risks due to inadequate treatment, verification and monitoring. As a result of these risks, as well as requests from some councils to be brought within the regulatory framework, the NSW Government is currently considering a risk-based approach to regulatory reform. This may result in an expansion of the breadth of stormwater regulation in NSW.
4.2.4 National consistency in urban water quality regulation

The Review of urban water quality regulation in Australia (PricewaterhouseCoopers Australia 2011) argued that urban water quality regulation in Australia could benefit from greater consistency across the states and territories. The review provides examples to achieve this, including:

- referencing national guidelines such as the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006) in legislation and/or supporting guidelines
- exchanging information to create a basis for interjurisdictional cooperation.

Examples of ways in which Victorian health and environmental regulators are aiming to achieve greater policy and regulatory consistency include:

- reference to the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006) in guidelines which supports Victoria’s current recycled water framework, for example the Department of Health’s:
  - Guidelines for validating treatment processes for pathogen reduction: Supporting Class A water recycling schemes in Victoria (Department of Health Draft 2010)
  - Guide for the completion of a recycled-water quality management plan (Department of Human Services 2008)
- membership on the National Recycled Water Regulators Forum (NRWRF)

The NRWRF consists of agencies responsible for implementation of the Australian guidelines for water recycling: managing health and environmental risks (NRMMC, EPHC et al. 2006; 2009), and for the regulation of recycled water schemes, including the Victorian Department of Health and EPA Victoria.

It provides a forum for officers of state and territory government agencies to discuss the development, implementation and evaluation of strategies to ensure that recycling schemes protect public health and the environment. The NRWRF also aims to improve communication processes between state and territory regulatory agencies regarding health-related regulatory requirements for approval of recycled water schemes, including validation of treatment processes.

The Review of urban water quality regulation in Australia (PricewaterhouseCoopers Australia 2011) cites the NRWRF as an example of how regulators are actively seeking consistency between jurisdictions.

- Development of a national recycled water auditor certification scheme
  Auditing is a key component of the preventive risk-management approach used to manage public health and environmental risks from recycled water schemes, and is a key element in Victoria’s recycled water framework. It has been recognised nationally that there should be a consistent approach to assess the competencies of recycled water auditors across Australia.
  Auditors are an integral part of ensuring that preventive risk management systems are in place and functioning. Individuals undertaking audits of water quality management systems must be appropriately qualified.
  To address this need, RABQSA, in conjunction with the Water Quality Management Systems Sub-Scheme Committee, has developed the Water Quality Management Systems (WQMS) Auditor Certification Scheme.
  As the scheme is national, the WQMS sub-scheme committee includes representatives from the:
  - Water Services Association of Australia
  - Victorian Water Industry Association
  - Department of Health (Victoria)
  - Department of Energy and Water Supply (Queensland)
  - Department of Health (Western Australia)
  - Independent Pricing and Regulatory Tribunal (New South Wales)
  - Department of Health (South Australia).

Certification under this scheme will be progressively required for auditors seeking approval to conduct regulatory audits of recycled water management plans in applicable states and territories.
The WQMS auditor scheme was developed to incorporate four grades: Drinking Water QMS Auditor and Lead Auditor, and Recycled Water QMS Auditor and Lead Auditor. The development of a national recycled water auditor certification scheme will complement the current review.

### Questions

1. Do you see benefits in moving towards national consistency in the approach to urban water quality regulation, including certification of auditors?

### 4.3 Determining the appropriate regulatory approach

The Victorian guide to regulation (Department of Treasury and Finance 2011) recommends using a risk-assessment approach to determine appropriate government intervention. Specifically, risk assessments can help identify:

- whether the risks that government intervention is intended to address are of significant magnitude
- the extent to which government intervention reduces the initial risk problem.

Risk assessment involves identifying hazards and the mechanisms that cause them, and estimating the probability that they will occur and their consequences. An assessment of the hazards in alternative water supplies allows for a comparison of the relative public health risk profile of common alternative water supplies harvested for non-potable uses in Victoria (Figure 2).

**Figure 2: Public health risk hierarchy for sources of harvested water for non-potable uses**

- **Lowest risk**
  - Rainwater
- **Stormwater**
- **Greywater**
- **Sewage**

Sources can often be reused directly, without treatment, for purposes where there is a low likelihood of human ingestion.

Sources will typically require treatment before they can be used.
Higher-risk alternative water supplies contain high concentrations of pathogens which, when used for purposes that result in a high probability people will be exposed to them (such as toilet flushing) can have public health consequences if not appropriately managed. The higher the risk posed by the source water, and the higher the exposure scenario, the stronger the case for government intervention. This is reflected in Victoria’s current framework for the use of alternative water supplies, where it has been determined that specific legislation is needed to manage the use of the highest-risk sources of harvested water.

The Victorian Government’s *Review of the regulatory framework for alternative urban water supplies* (State Government of Victoria 2009), the pre-cursor to the current review, used a risk-assessment approach. The review determined that:

- the risks involved in recycling sewage and greywater for internal uses such as toilet flushing were of significant magnitude to warrant controls through government intervention
- the risks involved in stormwater harvesting for a range of limited purposes (such as restricted irrigation of parkland) would be best managed through implementation of guidance prepared and endorsed by government (a form of quasi-regulation).

Section 5 details the proposed options to manage the risks of recycling sewage and greywater, while section 6 revisits options for managing the risks of harvesting stormwater.
Chapter 5
Sewage and greywater
5.1 Problem definition
Sewage and greywater contain high levels of disease-causing microorganisms and chemicals that can pose risks to public health if their use in recycling schemes is not appropriately managed. There are currently inconsistencies in Victoria’s legislative framework for these alternative water supplies which mean that their use in certain contexts is not currently subject to legislative oversight, and may pose high uncontrolled risks to public health.

5.2 Definition of closed-loop schemes
Closed-loop sewage and greywater schemes are defined as those schemes that produce recycled water from sewage or greywater treatment systems with a design capacity or actual flow rate of greater than 5,000 litres per day, for indoor uses such as toilet flushing and laundry use, with no discharge to the environment (that is, no irrigation component).

5.3 What are the risks?
The establishment of sewerage systems to remove disease-carrying wastes from areas of human habitation has been one of the most significant safeguards of public health.

Before the introduction of reticulated sewerage and other sewage management systems in developed countries, infectious diseases such as cholera, typhoid, yellow fever and dysentery claimed thousands of lives. This is still the case in many developing countries with poorly managed or no sewerage infrastructure.

Urban use of recycled water that has been derived from sewage and greywater introduces a new paradigm in the way water is managed, but the fundamental requirement to protect the public from disease remains. This paradigm has been developing since the 1970s with the aim to remove sewage from waterways and the environment, and use it for more beneficial purposes such as irrigation. As treatment technologies have improved, higher-exposure uses have become more prevalent, with residential uses becoming quite common in the mid-2000s.

5.3.1 Microbial hazards in sewage
The predominant risks to health of using sewage for non-drinking purposes are from exposure to microbial hazards. Untreated sewage will always contain microbial hazards, including large numbers of enteric pathogens that can cause gastroenteritis when ingested (NRMMC, EPHC et al. 2006). Microbial hazards include:

- bacteria such as salmonella, Campylobacter and pathogenic Escherichia coli
- viruses such as enterovirus, adenovirus, rotavirus, norovirus and hepatitis A
- protozoa such as Cryptosporidium and Giardia
- helminths such as Taenia and Ascaris

Beyond gastroenteritis, exposure to these pathogens can cause a range of illnesses including dysentery, respiratory illness, nervous disorders, reactive arthritis, myocarditis and haemolytic uraemic syndrome. In some cases these diseases can also be fatal (NRMMC, EPHC et al. 2006).

5.3.2 Chemical hazards in sewage
Sewage can contain a wide range of chemicals including inorganic and organic chemicals, pharmaceuticals, pesticides and potential endocrine disruptors (NRMMC, EPHC et al. 2006).

The presence of chemicals in sewage used for non-drinking purposes at levels that could potentially pose a health risk is not anticipated for the majority of schemes. This is because chemicals in the sewerage system are substantially diluted with other waste, managed through trade-waste controls and degraded by treatment processes. As a result, the concentrations of chemicals of health concern are generally orders of magnitude below levels routinely consumed through dietary exposure or permitted in our drinking water supplies (EPA Victoria 2005).

However for schemes where trade-waste inputs are a significant proportion of influent or in some less-diluted sewage catchments (for example decentralised schemes which involve sewer mining), site-specific assessment of chemicals may be required (EPA Victoria 2005).
5.3.3 Microbial and chemical hazards in greywater

Microbial and chemical hazards in greywater vary over a wide range, particularly in comparison to sewage. This is because chemical and microbial quality depend on human behaviour and individual control of materials discharged into greywater. Pathogens can enter greywater through activities such as washing nappies or other soiled clothing, or through bathing and showering. Chemicals can enter greywater collection systems from detergents, shampoos, soaps and household cleaners, or through disposal of products such as oil, garden chemicals and solvents.

In the worst cases, concentrations of pathogens can be almost as high in greywater as in sewage (NRMMC, EPHC et al. 2006). Typically, however, microbial water quality objectives for greywater schemes are set lower than those for sewage.

5.3.4 Exposure to sewage and greywater

The main route of exposure to pathogens from recycled water is ingestion, including ingestion of droplets produced by sprays. Activities such as municipal open-space irrigation, toilet flushing and car washing result in the production of droplets that can then be ingested by individuals undertaking these activities or individuals passing by when these activities are being undertaken. Consumers can also be exposed to pathogens through consumption of food crops irrigated with recycled water.

Safe use of recycled water requires concentrations of pathogens in sewage and greywater to be reduced to tolerable levels for human exposure. The *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006) express the tolerable risk level in terms of Disability Adjusted Life Years (DALY). DALY is a measure of the health impact of a disease that incorporates both fatal (mortality) and non-fatal (morbidity) outcomes. The tolerable risk adopted in the *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006) is $10^{-6}$ DALYs per person per year, which is consistent with the World Health Organization *Guidelines for drinking water quality* (World Health Organisation 2011). This is equivalent to an annual diarrhoeal risk of approximately one illness per 1,000 people or a lifetime additional risk of cancer of one case per 100,000 people (NRMMC, EPHC et al. 2006).

Quantitative microbial risk assessment is used to determine health-based performance targets (or microbial water quality [treatment] objectives), expressed as log reduction values, which are required to achieve the tolerable level of $10^{-6}$ DALYs per person per year (see box 2 below). The required level of treatment and the associated water quality objectives vary depending on the nature of the end use for the recycled water scheme (that is, the quantity of water people are exposed to).

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**Box 2: Quantitative microbial risk assessment steps**

The establishment of microbial water quality objectives using quantitative microbial risk assessment involves the following four steps (NRMMC, EPHC et al. 2006):

1. **determining hazards that might be present and the associated effects on human health.** This step involves identifying reference pathogens representing each of the major groups of organisms detailed in section 5.3.1 above

2. **establishing the relationship to the dose of the hazard and the incidence or likelihood of illness.** This information is generally obtained from investigations of outbreaks or from experimental studies. Doses associated with infection are generally lower for viruses and protozoa than for bacteria.

3. **determining the size and nature of the population exposed to the hazard, and the route, amount and duration of exposure.** As an example, the *Australian guidelines for water recycling* specify that an individual may be exposed to 0.01 litres of recycled water per year through ingestion of sprays associated with the use of recycled water for toilet flushing

4. **characterising risk by integrating data on hazard presence, dose response and exposure obtained in the first three steps.**

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As an example, ingestion of one to 10 pathogenic virus particles or protozoan cysts can be associated with a high likelihood of infection.
While cross-connection of plumbing is often thought of as the most common way to ingest recycled water, water quality and/or appropriate end use controls are also critical.

Illness can result from exposure to recycled water in circumstances where:

- required microbial water quality objectives are not met and inadequately treated water is supplied to customers
- cross-connections occur between drinking water and recycled water plumbing infrastructure
- recycled water is used inappropriately, for example, filling a swimming pool with recycled water supplied for non-drinking residential use.

Preventive measures must be put in place to meet the tolerable risk level. These measures can include preventing hazards from entering recycled water, removing hazards using appropriate treatment systems or reducing exposure to recycled water. Preventive measures to reduce exposure to recycled water can include:

- controlling methods of application
- setting withholding periods between application of recycled water and use of irrigated areas
- controlling public access during application or use of recycled water.

Preventive measures such as those listed above can result in delineation of recycled water schemes (defined by specified end uses) which have either:

- a high potential for public exposure (that is, high potential for direct contact with or ingestion of recycled water)
- a low potential for public exposure.

For example, a dual-pipe residential scheme that supplies recycled water for toilet flushing, domestic garden irrigation and car washing will result in a high level of exposure to the public and would be considered high risk. A scheme that supplies recycled water for subsurface irrigation of a sports ground should not result in any exposure to the public and would be considered low risk.

Box 3 below includes examples of these end uses.

**Box 3: High and low exposure end-uses**

Examples of end-uses with a high potential for public exposure (where main risks are posed to public health and in some cases the environment):

- dual pipe residential developments for purposes such as car washing, garden irrigation, toilet flushing and use in washing machines
- irrigation of commercial food crops sold raw or unprocessed
- toilet flushing in commercial or community facilities
- municipal open-space irrigation with uncontrolled public access
- firefighting
- use in cooling towers.

Examples of end uses with a low potential for public exposure (where main risks are those posed to the environment or livestock health):

- municipal open-space irrigation with controlled public access
- irrigation of land used for cattle grazing
- irrigation of non-food crops including turf, woodlots and flowers
- irrigation of food crops cooked or processed before sale.

Closed-loop schemes include end uses with a high potential for public exposure and may therefore pose high risks to public health if not appropriately managed.

**5.4 Situation analysis**

**5.4.1 Drivers for sewage and greywater recycling**

Community interest in more sustainable approaches to water management is increasing, and is currently supported by a range of government policies and programs.

Simultaneously, industry continues to explore and develop new and innovative approaches to conserve, treat and reuse water to meet and encourage consumer demand.
In Victoria in recent years, the number of closed-loop sewage (including greywater) recycling schemes has rapidly increased, with installation in a range of building types, including commercial, retail, residential and multipurpose buildings.

These systems are being promoted as sustainable initiatives by a number of government and industry bodies. For instance the Green Building Council of Australia’s Green Star rating system, which is a national tool for sustainable development in the building industry, gives points towards the overall sustainability rating of a development if sewage is recycled and reused onsite.

Data from the Victorian Building Commission shows an overall increasing trend in large-scale developments, particularly in the commercial sector (Building Commission 2012). Many developers will continue to adopt water recycling to obtain a Green Star rating and remain competitive in a marketplace that increasingly values sustainability principles.

And while building-scale recycling schemes generally involve treating the sewage from a single building and returning the treated water for internal use, it is likely that future recycled water systems will incorporate cluster developments where wastewater is collected from a number of buildings, centrally treated and distributed back for use.

Importantly, such applications are not confined to new developments, as there is potential for existing buildings to be retrofitted with recycled water systems, for example during refurbishment.

Figure 3: Residential and commercial sector building permits 2005–12 (Building Commission 2012)

![Figure 3: Residential and commercial sector building permits 2005–12 (Building Commission 2012)](image)

Questions

2. Do you have data that demonstrates likely future growth in the use of recycled water within buildings (including consideration of both single buildings and cluster or precinct-scale developments)?

2 The residential sector includes single or attached dwellings, and boarding houses, guest houses and hostels of a small scale (less than four stories high). The commercial sector includes all other building permits including residential over 4 stories high (Building Commission 2012).
5.4.2 Closed-loop schemes currently operating

The department recently engaged the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to undertake a survey to provide information on the nature and prevalence of closed-loop schemes in Victoria (Toifl M. and O’Halloran R. forthcoming). Specifically, the project sought to:

- identify organisations designing, constructing, managing and operating closed-loop sewage and greywater recycling schemes in Victoria
- identify the location, number and types of closed-loop sewage and greywater recycling schemes currently in operation or in the planning phases in Victoria
- identify the current understanding and rate of implementation of federal and state government policies and guidelines that govern the use of recycled water within organisations responsible for the management of closed-loop water recycling schemes in Victoria
- assess the operational reliability and overall water savings achieved by these closed-loop water recycling schemes.

Thirty closed-loop schemes were initially identified in the survey, but nine of these did not meet the criteria for the project. Some had been recently decommissioned because the volume of wastewater processed was not enough to justify the operation and maintenance expenses. Others were identified in buildings currently under construction or were using recycled water for irrigation only.

Of the 21 schemes that met the criteria for closed-loop recycling, 14 completed the survey. Of these, 64 per cent used sewage as the source for recycling while the remaining 36 per cent used greywater.

The survey revealed that these schemes were installed in a range of building types including office buildings (57 per cent), apartment blocks (22 per cent), and universities, exhibition and convention centres and other building types (21 per cent).

Treatment plant reliability

Assessing the reliability of recycled water treatment plants provides an indication of the experience and expertise of the plant designers and operators. The survey results revealed that only two schemes produced recycled water during the week preceding the survey and only one produced water within its specified design capacity.

Furthermore, five survey respondents indicated that their plants had been shut down for more than three months. Five others indicated that they were currently commissioning their recycled water plants, but at least one of these schemes has been in the commissioning phase for over three years. Two respondents did not respond to this question.

Treatment

The multiple-barrier approach is a critical step in preventive risk management and involves the use of multiple preventive measures or barriers to manage hazards. Recycled water treatment plants employ multiple treatment process units (barriers) to ensure that water of the required quality is supplied to customers.

For existing closed-loop schemes, the survey revealed that all schemes used multiple treatment barriers, but the number of treatment barriers varied. For greywater recycling schemes, three or four treatment barriers were typically used (Figure 4).

Figure 4: Treatment barriers used in greywater recycling schemes

3 Details that might identify individual schemes are not included in the project report.
For sewage recycling schemes, two barriers were most commonly used (56 per cent of cases) (Figure 5).

**Figure 5: Treatment barriers used in sewage recycling schemes**

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 barrier treatment</td>
<td>33%</td>
</tr>
<tr>
<td>3 barrier treatment</td>
<td>11%</td>
</tr>
<tr>
<td>4 barrier treatment</td>
<td>56%</td>
</tr>
</tbody>
</table>

### Application of national and state guidelines

Beyond exploring the issue of recycled water treatment, the survey was also designed to collect information relating to guidelines used to inform the design, construction, ongoing operation and maintenance of the schemes. The survey revealed that all but one of the respondents had consulted recycled water guidelines for the design and construction phase.

The guidelines consulted included the *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006) and the *Victorian EPA Guidelines for environmental management: use of reclaimed water* (EPA Victoria 2003). However, the survey was not able to assess the extent to which the risk management approach was implemented.

For instance, two of the schemes did not have management plans and/or standard operating procedures in place for managing their schemes. Additionally, the results from the auditing, Hazard Analysis Critical Control Point (HACCP) and verification monitoring sections of the survey revealed that the risk-management approach detailed in the guidelines was not uniformly implemented.

Fifty per cent of survey participants indicated that they had applied the HACCP system in the design and management of their scheme. HACCP is an internationally recognised approach used to identify and manage risk. It focuses on the prevention of substandard water being delivered for use, by ensuring that the steps, controls, monitoring and verification that are essential for achieving the required water quality objectives are in place. The HACCP approach is detailed in the *EPA Victoria Guidelines for environmental management: dual-pipe water recycling schemes – health and environmental risk management* (EPA Victoria 2005).

**Auditing**

Auditing is a key element in the preventive framework for the management of recycled water quality and use. The *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006) describe auditing as ‘the systematic evaluation of activities and processes to confirm that objectives are being met, including assessment of the implementation and capability of management systems’ (NRMMC, EPHC et al. 2006).

The guidelines further state that ‘periodic auditing of all aspects of the recycled water quality management system is needed to confirm that activities are being carried out according to defined requirements and are producing the required outcomes’ (NRMMC, EPHC et al. 2006).

The survey did not clearly reveal if any of the participating closed-loop schemes currently undergo independent audits. Rather, the responses received to the question about auditing were related more to verification monitoring.

**Verification of recycled water quality**

Verification of recycled water quality is another key element in the preventive risk management framework. It provides an assessment of the overall performance of the treatment system and the quality of recycled water supplied to customers.

During the survey, 43 per cent of participants indicated that they undertake independent verification monitoring.
Survey conclusions
The survey results indicate that key elements of best-practice risk management, including HACCP assessments, auditing, and verification monitoring, are not being uniformly implemented by all schemes.

Questions
3. Do you have any data that you could provide in relation to your knowledge of current closed-loop schemes in Victoria?
4. Are you aware of any examples of problems or incidents that have occurred with closed-loop schemes in Victoria?
5. Do you have experience in managing or operating a closed-loop scheme in Victoria? If so, what is your view of the current framework?

5.4.3 Previous Victorian reviews of relevant water guidelines, policy and legislation
In 2009, the Victorian Government published its Review of the regulatory framework for alternative urban water supplies (State Government of Victoria 2009). The aim of the review was ‘to create a regulatory framework which primarily: protects public and environmental health; facilitates safe and sustainable use of appropriate water supplies; and is easy to understand and navigate’ (State Government of Victoria 2009). The term ‘regulatory framework’ was used broadly in the review to include the hierarchy of potential management controls including Acts, regulations, guidelines and education.

The review process included the establishment of working groups, development of technical reports reviewing existing legislation, development of discussion papers, and a thorough consultation process. A wide range of stakeholders were specifically invited to participate in the review including:

- individuals or organisations who were current or potential users of alternative water supplies
- designers, installers and maintainers of alternative water source schemes and systems
- regulators and authorities responsible for overseeing the use of alternative water supplies
- environmental peak bodies and environmental and community interest groups.

The resulting framework included a spectrum of controls from education-based guidance to support low-risk alternative water source applications to explicit regulation to control higher-risk activities. Specifically, the review identified that water recycling schemes that involve the use of treated sewage or greywater are high-risk activities that need regulatory control. The review also found that the use of treated sewage or greywater\(^4\) for indoor uses such as toilet flushing and laundry use (which are closed-loop applications that require Class A recycled water) was a regulatory gap that needed to be addressed to manage the potentially high uncontrolled health risk associated with these activities.

Beyond identifying the required level of government intervention for various alternative water supply applications, the review also sought public and industry input on how the framework, once finalised, should be administered or managed. The final project report for the review specified that the Department of Health and EPA would work together to address the identified gap relating to closed-loop sewage and greywater recycling.

This regulatory gap is also identified in two recent reports commissioned by the National Water Commission, namely:

- Review of urban water quality regulation in Australia (PricewaterhouseCoopers Australia 2011)
- Recycled water use in Australia: regulations, guidelines and validation requirements for a national approach (Power 2010).

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\(^4\) Sourced from sewage treatment systems with a design capacity or flow rate of greater than 5,000 litres per day
5.5 Current guidelines and legislation

The use of treated sewage and greywater (recycled water) is currently regulated under the Environment Protection Act 1970 (the Act). Under the Act, the regulatory framework depends on the design or actual flow rate of sewage treatment systems.

5.5.1 Design or actual flow rate of 5,000 litres per day or greater

Waste treatment, disposal and recycling premises on or from which sewage effluent, exceeding a design or actual flow rate of 5,000 litres per day, is discharged or deposited, require a works approval and an ongoing licence to operate from the EPA.

Such treatment facilities are termed scheduled premises under the Environment Protection (Scheduled Premises and Exemptions) Regulations 2007. These regulations outline the premises and activities that are scheduled and hence subject to the works approval and licensing provisions of the Act.

The regulations also provide for exemptions from these works approval and licensing provisions for certain, otherwise scheduled activities and premises. Exemption from works approval and licensing is provided for ‘an effluent reuse scheme or activity which meets discharge, deposit and operating specifications acceptable to the Authority’.

The following guidelines define the acceptable discharge, deposit and operating specifications referred to in the regulations. It is important to note that the exemption only extends to the specific reuse scheme and that treatment is still subject to works approval requirements. Compliance with the following guidelines forms a critical component of exemptions from EPA works approval and licensing requirements:

- Guidelines for environmental management: dual-pipe water recycling schemes – health and environmental risk management (EPA Victoria 2005)

These guidelines promote the application of a preventive risk-management framework, consistent with the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006), and identify the performance objectives that must be documented in a health and environment management plan (HEMP). EPA approval of the HEMP is the mechanism for obtaining an exemption from works approval and licensing for the use of recycled water. A critical part of the HEMP for Class A recycled water schemes is the recycled water quality management plan (RWQMP). A RWQMP ensures the treatment plant will produce water that meets the required microbial water quality objectives for the specified end uses of the water.

Under the guidelines, Department of Health endorsement is required for Class A recycled water schemes. The department’s endorsement is particularly focused on the RWQMP. EPA refers RWQMPs for Class A schemes to the Department of Health for endorsement.

The Guide for the completion of a recycled water quality management plan for Class A water recycling schemes (Department of Human Services 2008) assists Class A recycled water scheme proponents to complete an RWQMP. The validation of treatment processes to produce Class A recycled water quality is a key component of the RWQMP. The Draft Guidelines for validating treatment processes for pathogen reduction: supporting Class A water recycling schemes in Victoria (Department of Health 2010) supplement the EPA guidelines and assist Class A scheme proponents in the validation process.
Validation is the process of demonstrating that:

- a treatment system can produce water of the required microbial quality under a defined range of operating conditions
- the system can be monitored in real time to provide assurance that the water quality objectives are continuously met.

Figure 6: Validation of Class A recycled water schemes in Victoria

5.5.2 Design or actual flow rate of less than 5,000 litres per day

EPA works approval and ongoing licensing is not required for small-scale systems which are designed to discharge less than 5,000 litres per day. These systems are covered by Part 9B of the Act, which applies to the installation, operation and management of onsite wastewater systems (referred to as ‘septic tanks’ under the Act) for the purpose of treating and disposing of sewage.

The regulation of small-scale schemes is not considered within the scope of this review.

5.5.3 Responsible authorities within current guidelines and legislation

Under the current framework, several Victorian government agencies share governance responsibilities for oversight of the production and use of recycled water. The involvement of these agencies depends on the specific end uses of the recycled water, as detailed in Figure 7 below.

Figure 7: Responsible authorities within the existing recycled water quality framework

Questions

6. How effective is the current regulatory model (and the preventive risk management approach) in addressing public health risks for sewage and greywater schemes that are currently regulated?

7. Has the requirement to prepare health and environment management plans and recycled water quality management plans led to improvements in outcomes?
5.6 Non-uniform regulatory requirements

Under the Environment Protection (Scheduled Premises and Exemptions) Regulations 2007, only recycling schemes that have a ‘discharge or deposit’ to the environment (for example through land irrigation) are captured. For these schemes, EPA will also consider other proposed uses such as toilet flushing or laundry use under its regulatory framework – this means that for dual-pipe residential schemes, the scope of EPA’s regulation covers both the outdoor irrigation, toilet flushing and laundry components.

Closed-loop schemes that only use recycled water for purposes such as toilet flushing or laundry use and return used water to the sewerage system are not considered to have a ‘discharge or deposit’ to the environment and are therefore not subject to regulatory oversight. This means that there are significant differences between the requirements for recycled water schemes that include irrigation versus schemes without irrigation, despite the fact that the public health exposure risk in most cases is equivalent.

The lack of a regulatory framework for closed-loop recycling schemes means that there is no clear oversight to give consumers and the broader community confidence that these schemes are safe and effective.

Further, some potential closed-loop scheme proponents have cited the potential risks to their customers and also their own organisations as barriers for greater development and adoption of these schemes.

Questions
8. Do the current non-uniform regulatory arrangements pose risks or increase compliance costs?
9. Do you see the need for measures to avoid such effects?

5.7 Options

The following options could be developed further to address public health risks from sewage and greywater in closed-loop schemes. They are not intended to convey an agreed position. The department is interested in receiving feedback on both options and any other options that could address the issues raised.

5.7.1 Strengthen the current quasi-regulatory approach through additional industry guidance

The current quasi-regulatory approach could be strengthened through additional industry guidance and tools. This approach could help proponents whose sewage and greywater recycling schemes are not subject to legislative oversight to better understand and apply the risk management framework in the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006).

On the other hand, if elements of the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006) such as auditing and verification monitoring are not being applied due to issues other than a lack of understanding (for example to save on costs), then this option may not adequately address current issues. This option will also not address the issue of inconsistent regulatory requirements between schemes that pose equivalent risks to public health.
5.7.2 Extend coverage of existing legislation

To protect public health and address regulatory inconsistency, one option may be to apply well-targeted regulatory requirements consistently across all sewage and greywater recycling schemes that have a high potential for exposure to the public. Adopting consistent regulatory principles would ensure that equivalent public health outcomes are achieved.

This would mean that closed-loop schemes would be subject to specific legislative oversight and that all large-scale water recycling schemes, not just those with a potential environmental impact, would be regulated. This option would also address the current issue of inconsistent regulatory requirements between schemes that pose equivalent risks to public health.

The following approach and elements could be considered for inclusion in legislation. The approach detailed below, is consistent with a process-based regulatory approach, as detailed in section 4.2.2.

A risk-management approach

The proposed legislative framework could be consistent with a process-based regulatory model based around a risk management approach.

The current framework for recycled water schemes captured under the Environment Protection (Scheduled Premises and Exemptions) Regulations 2007 is an example of process-based regulation, where regulated entities are required to prepare and implement risk management plans, (termed health and environment management plans and recycled water quality management plans).

This form of regulation could be extended to closed-loop sewage and greywater recycling schemes.

Key elements which could be considered as part of a legislative framework

The framework would aim to ensure that scheme proponents take responsibility for protecting health where they supply recycled water for ‘high-exposure’ end uses.

Elements which could be included in a legislative framework include:

- the identification of specific risks to water quality that require control or the provision of water quality standards
- the requirement to develop, implement and review a risk management plan
- the definition and content of the risk management plan
- the requirement that the risk management plan is subjected to periodic audit
- the approval of risk management plan auditors

Questions

10. How effective do you think the current non-legislative approach is in ensuring that closed-loop schemes are designed and managed in a way that is consistent with the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMCC, EPHC et al. 2006) and relevant state-based guidelines?

11. If you currently manage a closed-loop scheme in Victoria, what controls do you currently have in place to manage risks to public health? Do you manage your scheme in accordance with a management plan, consistent with the elements detailed in the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMCC, EPHC et al. 2006)?

12. Should closed-loop sewage and greywater schemes continue to be managed through voluntary application of national and state guidelines?

13. Is more targeted information or education needed (such as in relation to risks, standards, treatment or operational monitoring)? If so, what is needed?

14. Do you think that additional industry guidance alone would address current inconsistencies in the application/adoptions of national and state guidelines (as detailed in section 5.4.2 above)?

15. Is there a need to simply encourage higher performance? What incentives or measures could be considered?

16. How much do you think cost influences the current level of voluntary compliance with the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMCC, EPHC et al. 2006)?
• reporting requirements
• registration
• incorporation of other documents
• inspection powers of relevant authorities
• the requirement that adequacy of the risk management plan is assessed by the suitably-qualified individual, before the supply of recycled water can commence.

Water quality standards
Water quality standards should be fit for purpose, and derived in accordance with the *Australian guidelines for water recycling: managing health and environmental risks (phase 1)* (NRMMC, EPHC et al. 2006). This is the approach used for Class A recycled water schemes which are currently captured under the existing legislative framework.

Fit for purpose means that not all water recycling schemes need to meet the same set of standards. The standards will depend on the use of and potential for exposure to the recycled water. In practical terms this would mean that the health-related water quality standards for watering vegetable crops would be higher than those for flushing toilets.

Risk management plan
The framework could include requirements for the responsible party to develop and operate under a risk management plan. This would reduce the likelihood of harm by identifying and addressing risks early (Department of Human Services 2004). Risk management plans include a detailed assessment of health risks, the preventive measures to reduce risks to acceptable levels and the monitoring that must be undertaken to demonstrate that the system is effective.

The risk management plan could cover everything from the collection of source water, to the controls surrounding the treatment, distribution and end use of the recycled water.

The risk management plan could:
• contain a detailed description of the system
• identify the risks to the quality of the water and the risks that may be posed by the quality of the water
• assess those risks
• set out the steps to be undertaken to manage those risks (including the development and implementation of preventive strategies)

The framework could allow the responsible regulatory agency to specify the content of the risk management plan. The specified content of the risk management plan could remain consistent with the current content of health and environment management plans and recycled water quality management plans under the existing EPA framework.

The framework could specify that the person responsible for the water recycling scheme must:
• prepare a risk management plan for the supply of recycled water
• implement the plan and comply with any requirements set out in the plan
• keep the plan under continuous review with a view to updating and improving it
• revise any aspect for the plan that is found to need revision.
Before the scheme starts supplying recycled water to end users, the adequacy of the risk management plan could be assessed to ensure that public health will be protected.

This activity currently occurs with existing Class A recycled water schemes that are captured under the Environment Protection (Scheduled Premises and Exemptions) Regulations 2007. Before a Class A scheme can start supplying recycled water, the risk management plan for the scheme must be endorsed by the Department of Health, in order to:

- ensure that the water treatment processes have been validated and proven to meet the required standards
- ensure there is appropriate monitoring in place
- ensure that corrective actions will be taken to prevent the delivery of substandard water to end users.

A provision could be included that allows for some aspects of this endorsement or approval function to be undertaken by an appropriately qualified individual or agency external to the responsible regulatory agency, as a fee-for-service activity.

For example the Australian Water Recycling Centre of Excellence is currently exploring the development of a national validation framework for the validation of individual treatment process barriers used in recycled water schemes. Stage 1 of the project resulted in the publication of the NatVal road map report: the road map to a national validation framework for water recycling schemes (Water Quality Research Australia 2011). This provides a proposed framework which includes a certification body that could assess validation reports and certify recycled water-treatment technologies. In essence, this would involve water treatment technology manufacturers requesting to have their products certified under a defined range of conditions.

This provision would allow for flexibility in the event that such a framework is established in the future.

Incorporation of other documents

In an effort to decrease the size and complexity of subordinate legislation (such as regulations), many regulations refer to a pre-existing set of technical standards, rules or guidelines. The legislative framework could allow for the preparation of guidance by the relevant authority or reference existing state or national guidelines. This could include guidance on the required content of risk management plans and the validation of treatment processes.

Auditing and approval of auditors

The framework could include provision for risk management plans be subject to audit by an approved auditor to ensure compliance, at a frequency specified by the responsible regulatory agency.

The relevant authority could approve auditors to ensure they meet specific criteria in terms of knowledge, skills and qualifications.

This currently occurs under Victoria’s Safe Drinking Water Act 2003, where the Secretary to the Department of Health can approve individuals as auditors for the purpose of conducting audits of risk management plans prepared in accordance with the Act and associated regulations.

One of the current auditor approval criteria under the Safe Drinking Water Act 2003 is certification as a Drinking Water Quality Management System Auditor from the personnel certification body RABQSA. A similar requirement could be imposed for auditors undertaking audits of recycled water risk management plans as the RABQSA Water Quality Management Systems (WQMS) Auditor Certification Scheme incorporates certification grades for both drinking water and recycled water auditors.
Reporting
The framework could include requirements for regulated entities to provide reports to the responsible regulatory agency. These could include requirements to:

- lodge an audit report
- provide notifications of incidents that potentially place public health at risk
- provide annual reports.

Registration
Registration is a commonly used regulatory tool that involves a responsible regulatory agency granting permission to a regulated entity to undertake a specified activity (PricewaterhouseCoopers Australia 2010).

To enable regulatory oversight of closed-loop sewage and greywater recycling schemes, powers to prescribe registration of schemes with the responsible regulatory agency could be included in the legislative framework.

The framework could have general provisions that would apply to all registrations. For example, it could provide powers to the responsible regulatory agency to:

- grant, renew, vary, suspend or cancel the registration
- set conditions to which the registration is subject (for example, the preparation of a risk management plan)
- set registration periods.

Inspection powers
Powers under the proposed legislation would need to enable authorised officers to undertake inspections and enforce requirements for any premises or activities for which risk management plans are required. Powers could include:

- issuing directions to remedy deficiencies in risk management plans identified through third party audits
- examining any documents relevant to the premises or activity.
Questions
17. Do you think that legislation is required to manage potential public health risks from closed-loop sewage and greywater schemes? If so:
   a) Should a uniform legislative framework apply to all sewage and greywater schemes which may pose a risk to public health?
   b) In considering the above elements which could be included in a legislative framework, are there any additional elements which should be included?
   c) Should statutory timeframes for approval be incorporated into the framework?
   d) Considering the current framework in terms of responsible agencies and referral agencies, what are your views on how the public health framework should be administered?

18. The framework detailed above is consistent with a process-based regulatory approach, and is consistent with the regulatory approach currently applied to Class A recycled water schemes in Victoria. Should alternative regulatory models be considered to manage risks for high-exposure schemes such as closed-loop systems (for example a performance-based approach)?

19. Would application of legislation across all sewage and greywater recycling schemes which may pose a risk to public health (including closed-loop schemes) provide more confidence in the safety of these schemes and/or provide incentives for investment?

Transition arrangements
To ensure consistency, the framework detailed above could be applied to all schemes which have a high potential for public exposure (that is closed-loop sewage and greywater recycling schemes as well as existing Class A recycled water schemes).

The proposed regulatory framework could be designed to cover all Class A recycled water schemes, including oversight of:

- Class A recycled water schemes that have already been approved under the existing EPA framework
- recycled water schemes that require Class A water and are currently operating but have not previously been subject to legislative oversight (for example closed-loop sewage and greywater recycling schemes)
- new Class A recycled water schemes.

As the proposed elements of the new framework are consistent with current requirements under the existing EPA framework, the changes would not have a significant impact on Class A recycled water schemes that have already been approved.

Transition arrangements could be incorporated into the new framework to enable requirements to be progressively implemented. This is particularly relevant for recycled water schemes which have not previously been subject to legislative oversight.

Administration of the proposed legislative framework
Regulators should be of the right size and scope, and no new regulator should be created where an existing one can do the work (United Kingdom Department for Business Innovation and Skills 2010). In line with this principle, the Department of Health could administer the proposed public health framework, with EPA continuing to administer the existing environmental framework. This could involve the Department of Health as the primary regulator of Class A recycled water schemes, with referral of Class A recycled water schemes to EPA Victoria where they involve the application of recycled water to the environment.
Chapter 6
Stormwater
Stormwater

6.1 Problem definition
As stormwater flows over urban surfaces it can pick up a range of disease-causing microorganisms and other chemical contaminants. In the past, stormwater harvesting schemes typically involved restricted irrigation and minimal exposure to the public. Increasingly however, stormwater is being used in more complex schemes, including use in large-scale dual-pipe residential developments, where it is supplied for internal uses such as toilet flushing – uses which have a much greater exposure to the public. These new applications for stormwater have prompted questions about the current reliance on voluntary compliance and whether any changes are needed to Victoria’s current stormwater management framework.

6.2 Definition of stormwater
The Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse defines stormwater as ‘rainwater that runs off all urban surfaces such as roofs, pavements, car parks, roads, gardens and vegetated open spaces’ (NRMMC, EPHC et al. 2009).

In addition to this, Victorian agencies use other definitions of stormwater, tailored for their context (see Box 3).

Box 4: Stormwater definitions
EPA Victoria defines stormwater as ‘surface run-off from rain and storm events that enters the drainage system’ (EPA Victoria 2012).
Melbourne Water defines stormwater as ‘the “excess” rainfall-derived runoff collected from roads, roofs and other land surfaces. Stormwater drains overland or through drainage networks to water ways or the bays. [It is] considered as runoff from both rural landscapes (forested, agricultural, lifestyle and peri-urban properties) and urban landscapes’ (Melbourne Water Draft 2012).

For the public health aspects of stormwater harvesting, this review adopts the following definition, consistent with the Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse (NRMMC, EPHC et al. 2009):

Water that runs off all urban surfaces such as roofs, pavements, car parks, roads, gardens and vegetated open spaces and is captured in constructed storages and drainage systems. This excludes roofwater captured directly by rainwater tanks; water captured in natural rivers, creeks, streams and lakes, and water sourced from private dams for primary production purposes.

The direct capture of water from roofs is excluded from the scope of this review, as noted in section 3.3.

6.3 What are the risks?
Historically, stormwater was considered a nuisance to be diverted away from urban areas via infrastructure designed for its immediate discharge directly to waterways, through a purpose-built system of pipes. As a result, the direct impact of stormwater on human health was limited to recreational uses of waterways or risks from flooding. However, now that stormwater is increasingly being captured for a range of end uses, public health risks need to be taken into account.

Stormwater can contain microbial pathogens from animal wastes as well as human waste from sewer overflows, leaks and from cross-connections. Urban runoff is also typically high in chemical contaminants such as hydrocarbons, organic and inorganic chemicals, heavy metals and nutrients. It is important to note that the risk profile of stormwater is generally significantly higher than that of rainwater captured directly from roofs, due to the range of hazards in urban runoff.

6.3.1 Microbial hazards in stormwater
The biggest risks to health from stormwater are from exposure to microbial hazards typically found in sewage (refer to section 5.3.1). Faecal pathogens from human waste can enter a system in a number of ways, from sewer overflows, septic tank seepage and cross-connections. Pathogens can also be found in animal waste derived from surface runoff.

6.3.2 Chemical hazards in stormwater
Stormwater can contain a wide range of chemicals including inorganic and organic chemicals, hydrocarbons, pesticides, heavy metals and potential endocrine disruptors (EPHC 2006).
Chemicals in stormwater are, however, very diluted and for most schemes are not usually present at levels that pose a health risk. Concentrations of chemicals of health concern in stormwater are generally orders of magnitude below levels routinely consumed through dietary exposure or permitted in our drinking water supplies. However, schemes that capture stormwater from high-risk catchments (such as industrial and manufacturing areas) may need site-specific assessment.

6.3.3 Pollution hazards in stormwater and catchment activities

The composition of stormwater reflects the catchment activities and the type of pollution events that occur. These incidents can contribute to the periodic presence of high levels of chemicals, heavy metals and microbial pathogens in stormwater.

Pollution hazards can be categorised as follows:

- ‘Diffuse or non–point source pollution’ is a result of human activity that disperses a range of pollutants onto surfaces in catchments which then enter the stormwater system in an uncontrolled way. This can include for example, application of fertilisers, herbicides and pesticides to domestic gardens or animal droppings. This source of pollution is extremely variable, especially between storm events and between catchments.

- ‘Point-source pollution’ is usually from industrial or commercial activities and is generally easier to trace due to the regulation of certain industrial premises through EPA Victoria works approvals and licensing provisions. While this is generally controlled by regulation, spills and illegal dumping of chemicals can pose risks that need to be considered.

- Sewer overflows and leaks introduce microbial pathogens that can pose risks to health.

Given stormwater drains across a catchment, activities within the catchment must also be considered. In certain circumstances, stormwater can contain a much more variable range and concentration of pathogens and chemicals than sewage. Large rainfall events or industrial accidents can cause significant unplanned spikes. This variability creates a challenge for managing risks associated with stormwater harvesting schemes.

While the level of risk associated with stormwater is typically lower than sewage and greywater, variability due to catchment activities can increase the risk profile.

6.3.4 Exposure to stormwater

As with sewage and greywater (detailed in section 5.3.4), the main route of exposure to pathogens from stormwater is ingestion, including ingestion of droplets produced by sprays. Activities such as municipal open-space irrigation, toilet flushing and car washing produce droplets that can then be ingested. For irrigation, controls such as subsurface irrigation, or spray irrigation at times when the likelihood of exposure to the water is low (for example at night), can be incorporated to reduce the risk to public health. The following examples of end uses have a low potential for public exposure.

Box 5

Examples of end uses with a low potential for public exposure (where main risks are those posed to the environment or livestock health):

- municipal open-space irrigation with controlled public access
- irrigation of land used for cattle grazing
- irrigation of non-food crops including turf, woodlots and flowers
- irrigation of food crops cooked or processed before sale.
Increasingly in Victoria, stormwater is being used for high-risk end uses, including the introduction of stormwater into dual-pipe residential schemes where public exposure to sprays or droplets cannot be avoided. As a result, appropriate treatment measures are needed to ensure that the water is treated appropriately. The following are examples of high-risk end uses where public exposure to spray or droplets cannot be avoided.

**Box 5**
Examples of end uses with a high potential for public exposure (where main risks are posed to public health and in some cases the environment):
- use in dual-pipe residential developments for purposes such as car washing, garden irrigation, toilet flushing and use in washing machines
- irrigation of commercial food crops sold raw or unprocessed
- toilet flushing in commercial or community facilities
- municipal open-space irrigation with uncontrolled public access
- firefighting.
- Use in cooling towers

### 6.4 Situation analysis

#### 6.4.1 Drivers for stormwater harvesting

The building sector is responding to population growth and climate change by using integrated water cycle management to build more resilient and liveable cities.

The government’s Living Victoria program includes a specific focus on increasing the use of alternative water sources to contribute to the achievement of multiple objectives for the community. These multiple objectives include: conserving potable water for drinking needs, improving urban liveability through integrating stormwater within urban environments, and reducing negative impacts on receiving waterways associated with stormwater runoff.

In addition, increased use of stormwater is being encouraged at a national level. The National Water Commission (2011) has stated that ‘incentives are needed to encourage utilities to invest not only in securing water supply, but also in more innovative, cost-effective and fit-for-purpose services. This includes distribution networks and the treatment of water, wastewater and stormwater’.

#### 6.4.2 Stormwater schemes currently operating

A number of sources were used to obtain data on the number and nature of stormwater harvesting schemes in Victoria.

Information was initially obtained from data compiled by Melbourne Water in early 2010, which identified 41 stormwater harvesting projects in Melbourne (Melbourne Water 2010). The majority of these schemes involved the use stormwater for irrigation, while some newer schemes demonstrated the increasing trend towards the use of stormwater for a number of end uses both inside and outside buildings. While this data included both planned and existing schemes, it was limited to Melbourne Water and metropolitan water retailer information and did not include information on all local government and private schemes, or stormwater schemes in regional Victoria.

A more detailed survey was then undertaken through Clearwater, and data was also collected on stormwater harvesting schemes that had received funding through state and national grant programs.

Information collected was used to confirm the number of schemes planned and in operation, as well as a snapshot of the guidance being used, public health controls and elements of the preventive risk management framework being applied to these schemes.

Questions

20. Do you have data which demonstrates the likely futures trends in the use of stormwater within Victoria?
End uses
A total of 108 schemes were identified from all data sources. Of these, the majority (81 schemes, or 75 per cent) utilised stormwater for irrigation purposes only, while the remainder (28 schemes or 25 per cent) used stormwater for mixed uses, commercial and industrial uses (such as commercial vehicle washing and washdown), cooling towers and toilet flushing alone (Figure 8).

Figure 8: End uses for surveyed stormwater harvesting schemes in Victoria

The survey indicated that some irrigation schemes used irrigation controls (including subsurface irrigation, withholding periods between irrigation and public access, and irrigation at night) to reduce or eliminate public exposure to the water. Others used unrestricted (high-exposure) irrigation, including spray irrigation during public access times.

Application of national and state guidelines
The Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse (NRMMC, EPHC et al. 2009) provide the authoritative reference for managing public health risks associated with the use of stormwater in Australia. Consistent with the approach to managing risks from sewage and greywater recycling schemes, the phase 2 guidelines are premised around the development of a management plan, incorporating elements such as verification monitoring and auditing.

Several stormwater harvesting scheme proponents indicated that they had or planned to follow the phase 2 guidelines in the design and management of their schemes and that they would manage the scheme in accordance with documented management plans. Other scheme proponents used external consultants to design the scheme and they assumed relevant guidelines had been applied. Others referenced a range of other guidelines and standards including plumbing standards, Melbourne Water guidelines and EPA Victoria guidelines. Numerous schemes did not provide a response to questions related to the application of national and state guidelines.

Questions
21. Do you have any data that you could provide in relation to your knowledge of current stormwater harvesting schemes in Victoria?
22. Are you aware of any examples of problems or incidents that have occurred with stormwater harvesting schemes in Victoria?
23. Do you have experience in managing or operating a stormwater harvesting scheme in Victoria? If so, what is your view of the current framework?
6.4.3 Previous reviews

The Review of the regulatory framework for alternative urban water supplies (State Government of Victoria 2009) recommended that the use of stormwater be supported by relevant guidance including the Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse (NRMMC, EPHC et al. 2009), rather than specific regulation. At that time stormwater was generally being harvested and used to irrigate parks and gardens and in some cases access controls were implemented to reduce risks to public health.

Since the publication of that review however, the use of stormwater has attracted significant attention as a means to reduce the pressure on potable water supplies in Victoria and reduce negative impacts on receiving waterways. Recent projects include large-scale dual-pipe residential developments, as well as use in commercial buildings and for large-scale municipal irrigation with uncontrolled public access.

Stormwater is increasingly being viewed as a valuable resource, as its use can achieve both environmental and public health benefits by maintaining green urban spaces as well as reducing nutrient and pollution inputs into waterways. Stormwater harvesting projects with multiple drivers are considered most successful.

6.5 Current guidelines and legislation

In Victoria the use and required quality of stormwater is not subject to legislative oversight, but individuals and organisations responsible for stormwater schemes have a duty of care to make sure their scheme will not place people or the environment at risk. The Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse (NRMMC, EPHC et al. 2009) have established a standard for protecting public health and the environment and therefore these guidelines are adopted for use in Victoria.

For sites involving two or more households, or commercial, industrial and community premises, these guidelines provide the best-practice framework for protecting public health and the environment through managing risks that may be associated with stormwater use.

6.6 Non-uniform regulatory requirements

Where stormwater is used within dual-pipe residential developments, some scheme proponents have raised issues around non-uniform regulatory requirements. Currently Class A dual-pipe recycled water schemes (derived from sewage or greywater) are approved by EPA Victoria and are endorsed by the Department of Health. However there is no legal instrument that specifies the approval or endorsement of similar stormwater harvesting schemes. There are currently several planned dual-pipe residential developments in Victoria that will use stormwater, including schemes where Class A recycled water will be blended with treated stormwater. In this case, the stormwater aspects of the scheme would be managed through voluntary compliance with guidelines, while the sewage or greywater aspects would be subject to specific legislative oversight.

6.7 Options

As detailed in Section 4, government intervention can take a number of forms including explicit government regulation through primary and subordinate legislation, or other regulatory forms including self-regulation, quasi-regulation, co-regulation and market-based instruments.

The current stormwater harvesting framework in Victoria falls into the quasi-regulation category, which relies on voluntary compliance rather than government enforcement.

The following two options could be developed further to address public health risks from the use of stormwater. They are not intended to convey an agreed position, but the department is interested in receiving feedback on both the presented options and any other options that could address the issues raised.

Questions

24. Do you have experience in planning or managing a stormwater dual-pipe residential scheme in Victoria? What is your view of the current non-legislative approach?

25. Does the blending of treated stormwater with Class A recycled water pose any particular challenges in terms of non-uniform regulatory requirements?
6.7.1 Strengthen the current quasi-regulatory approach through additional industry guidance

This approach may assist proponents in better understanding and applying the risk management framework in the *Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009).

However, if the current framework is not being applied due to issues other than a lack of understanding (for example to save on costs), then this option may not be adequate. This option will also not address the issue of inconsistent regulatory requirements for dual-pipe residential developments, including those which involve the blending of stormwater with Class A recycled water.

Questions

26. How effective do you think the current non-legislative approach is in ensuring that stormwater harvesting schemes are designed and managed in a way that is consistent with the *Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009) and protective of public health?

27. If you currently manage a stormwater harvesting scheme in Victoria which involves end uses with a high potential for public exposure (such as unrestricted irrigation of public open spaces and sports fields or toilet flushing), what controls do you currently have in place to manage risks to public health? Do you manage your scheme in accordance with a management plan consistent with *Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009)?

28. Should stormwater harvesting schemes continue to be managed through voluntary application of national and state guidelines?

29. Is more targeted information or education needed (for example in relation to risks, standards, treatment or operational monitoring) from a public health perspective? If so, what is needed?

30. Is the management framework as set out in the *Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009) being implemented by existing stormwater recycling scheme proponents? If not, is there a problem in that stormwater recycling scheme proponents do not know how to comply with the public health aspects of the guidelines?

31. Is compliance monitoring needed to ensure that the *Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009) are being implemented? If so, could there be a role for a relevant industry body to assist in monitoring compliance (e.g. encouraging independent third party auditing of schemes and voluntary reporting of audit outcomes)?

32. Is there a need to simply encourage higher performance? What incentives or measures could be considered?

33. How much do you think cost influences the current level of voluntary compliance with the *Australian guidelines for water recycling: managing health and environmental risks (phase 2) – stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009)?
6.7.2 Extend coverage of existing legislation

Beyond the current quasi-regulatory approach, explicit government regulation (through legislation) could be used to manage public health risks from stormwater harvesting schemes with a high potential for public exposure, such as:

- use in dual-pipe residential developments for purposes such as car washing, garden irrigation, toilet flushing and use in washing machines
- toilet flushing in multi-residential, commercial or community facilities (such as apartment buildings, office buildings, public buildings)
- municipal open-space irrigation with uncontrolled public access
- firefighting
- use in cooling towers.

The Discussion paper: a framework for alternative urban water supplies (State Government of Victoria 2006) emphasised the importance of establishing a regulatory framework that balances regulatory rigour with the level of risk.

Where risks are relatively low, the scheme might only need to be registered and managed in accordance with guidelines.

Where the risk is high the system might need detailed assessment and up-front approval (such as the risk management framework which currently applies to Class A recycled water schemes in Victoria).

A range of controls in the form of legislation linked to guidance could also be considered to address:

- technology and design
- installation and operation.

The following questions are posed for consideration:

Questions
34. Is explicit government regulation (legislation) required to manage risks associated with high-exposure stormwater schemes that may pose a risk to public health? If so:
   a) What scope of activities should be covered by legislation?
   b) What requirements should be incorporated into the legislative framework (considering elements such as scheme registration and ongoing audits; up-front assessment and approval of risk management plans)
   c) Should a similar risk-based framework be applied to both recycled water (derived from sewage and greywater) and stormwater?

35. Can you provide any examples where legislation may have assisted in the design or management of a stormwater harvesting scheme?
Chapter 7
Costs and benefits
Costs and benefits

7.1 Costs
Cost considerations include compliance costs, costs which may be incurred due to a lack of certainty around risk management requirements and the cost associated with failure of alternative water supply schemes.

7.1.1 Costs of failure: case studies
The cost associated with failure of alternative water supply schemes can have immediate impacts on public health – local to large scale – but also on community confidence in the safety and security of alternative water supplies.

While incidents and outbreaks occur infrequently in developed countries, a number of well-documented case studies from both Australia and overseas demonstrate how water can act as a vector for disease and the associated cost impacts when water supplies are contaminated.

Östersund outbreak
In November and December 2010 there was a water-borne outbreak of cryptosporidiosis (a parasitic infection that commonly presents as gastroenteritis) in Östersund, Sweden. This outbreak was attributed to sewage inadvertently contaminating the drinking water supply. As a result of the contamination, customers were required to boil their drinking water for 84 days (Health Stream 2012).

A report by the Swedish Institute of Communicable Disease Control provides an account of the outbreak investigation and recommendations for changes to surveillance, prevention and outbreak response procedures. The second report by the Swedish Defence Research Agency examines the impact and costs of the outbreak for government agencies and private businesses (Health Stream 2012).

The contamination of the water supply in Östersund led to an estimated 27,000 people becoming ill and a cost of 220 million Swedish Kronor or $31 million Australian dollars to the community (Health Stream 2012).

Gold Coast, Australia
Recent Gold Coast examples include:

- the cross-connection of recycled water with drinking water supplies in a major Gold Coast development project affecting 630 homes in 2009. It has been reported that a number of legal firms are preparing class actions against Gold Coast City Council.
- a cross-connection to a building used by council workers leading to 375 people being exposed to contaminated water in 2008. It has been reported that 73 of those exposed suffered illnesses possibly related to their exposure (NSW Department of Finance and Services 2012).

While these examples resulted from issues related to plumbing (which is outside the scope of this review), they demonstrate the potential costs to society of major outbreaks of disease, and also the costs associated with legal action, in the event that individuals or organisations seek damages.

7.1.2 Compliance costs
In considering compliance costs, it is important to distinguish the costs imposed by regulation and the cost of producing a fit-for-purpose product, as in other regulated industries (such as aviation, food production, pharmaceutical).

Inherently, the higher the risk posed by the source water to public health and the environment, and the higher-exposure scenario, the higher the production cost for the proposed end product. This high production cost has been cited by some closed-loop scheme proponents as the reason for decommissioning, as the volume of wastewater processed was not enough to justify the operation and maintenance expenses.

Nonetheless, it is critical that health risks are appropriately managed by ensuring that recycled water quality is fit for purpose at the start of a scheme and throughout its operation.
As detailed in sections 4.3.2 and 5.5.1, the Australian guidelines for water recycling: managing health and environmental risks (NRMMC, EPHC et al. 2006; 2009) and the Guidelines for environmental management: dual-pipe water recycling schemes – health and environmental risk management (EPA publication 2005) are based on a preventive risk management framework to manage public health risks. This includes preparing management plans including elements such as validation of treatment processes, verification monitoring, annual reporting and auditing.

Results from both the closed-loop and stormwater surveys, detailed in sections 5.4.2 and 6.4.2, indicated that elements such as the preparation of management plans, verification monitoring and auditing were being implemented by some scheme proponents.

Questions
36. For schemes that apply the risk management framework within the Australian guidelines for water recycling: managing health and environmental risks (NRMMC, EPHC et al. 2006; 2009), the department is seeking feedback on the costs associated with voluntary compliance with the various elements of the guidelines, such as:
- preparation of management plans, including validation and HACCP analysis
- verification monitoring
- auditing (for example internal, external third party auditing).

7.1.3 Costs associated with regulatory uncertainty
Preliminary consultation with some stakeholders suggests that in some cases treatment processes have been overdesigned due to the absence of public health regulatory involvement. Results from the stormwater harvesting survey also indicate that in some cases unnecessary treatment barriers have been installed in schemes that do not involve any exposure of the water to the public. This may be resulting in unnecessary costs.

Questions
37. Do you think that uncertainty may be contributing to unnecessary costs? If so, what measures could be put in place to address these costs?
38. To what extent is demand for recycled water or stormwater limited by uncertainty about its safety?

7.2 Benefits
The main benefits of any regulatory action will be avoided health impacts from exposure to pathogens in alternative water supplies which are above the established tolerable risk level. It is important that the public health regulatory framework for alternative water supplies in Victoria strikes an appropriate balance between these benefits and costs.

Indirect benefits which may result from improved confidence in the quality of alternative water supplies in Victoria could include increased use of these supplies, which will assist in:
- reducing pressure on drinking water supplies
- reducing water quality impacts and localised flooding associated with stormwater flows
- reducing sewage discharges
- maintaining and enhancing public open spaces and sporting facilities, with flow on public health benefits
- reducing the urban heat island effect
- contributing to the liveability and sustainability of our cities and towns.

Questions
39. Are there any additional benefits which may result from regulatory action?
7.3 Cost–benefit analysis

Any proposed changes or additions to the legislative framework for alternative water sources resulting from this review process will be assessed on a cost–benefit basis.

The preparation of a regulatory impact statement (RIS) is a well-established and critical feature of the regulation-making process in Victoria and provides another opportunity for public consultation (Department of Treasury and Finance 2011). The RIS process set up under the Subordinate Legislation Act 1994 provides an effective means to:

- assess and communicate the costs and benefits of regulatory responses
- make risk management processes explicit to the public (Department of Human Services 2004).

Government scrutiny of regulatory approvals also extends to the making or amending of primary legislation (i.e. Bills that become Acts if approved by Parliament) where there is potential for regulatory impacts. A business impact assessment (BIA) must be prepared where the responsible Minister determines that a legislative proposal (either entirely new legislation or amendments to existing legislation) has potentially ‘significant effects’ for business and/or competition in Victoria (Department of Treasury and Finance 2011).
Chapter 8
References
References


United Kingdom Department for Business Innovation and Skills (2010). Assessing our regulatory system - the Hampton Review.

Water Quality Research Australia (2011). NatVal road map report - the road map to a national validation framework for water recycling schemes.

Appendix 1  
Summary of discussion questions

Section 4 Regulation
1. Do you see benefits in moving towards national consistency in urban water quality regulation, including certification of auditors?

Section 5 Sewage and greywater
2. Do you have data that demonstrates likely future growth in the use of recycled water within buildings (including consideration of both single buildings and cluster or precinct scale developments)?
3. Do you have any data that you could provide in relation to your knowledge of current closed-loop schemes in Victoria?
4. Are you aware of any examples of problems or incidents that have occurred with closed-loop schemes in Victoria?
5. Do you have experience in managing or operating a closed-loop scheme in Victoria? If so, what is your view of the current framework?
6. How effective is the current regulatory model (and the preventive risk management approach) in addressing public health risks for sewage and greywater schemes that are currently regulated?
7. Has the requirement to prepare health and environment management plans and recycled water quality management plans led to improvements in outcomes?
8. Do the current non-uniform regulatory arrangements pose risks or increase compliance costs?
9. Do you see the need for measures to avoid such effects?
10. How effective do you think the current non-legislative approach has been in ensuring that ‘closed-loop’ schemes are designed and managed in a way that is consistent with the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006) and relevant state-based guidance?

11. If you currently manage a ‘closed-loop’ scheme in Victoria, what controls do you currently have in place to manage risks to public health? Do you manage your scheme in accordance with a management plan, consistent with the elements detailed in the Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006)?

12. Should ‘closed-loop’ sewage and greywater schemes continue to be managed through voluntary application of national and state guidelines?

13. Is more targeted information or education needed (e.g. in relation to risks, standards, treatment or operational monitoring)? If so, what is needed?

14. Do you think that additional industry guidance alone would address current inconsistencies in the application/adoptions of national and state guidelines (as detailed in section 5.4.2 above)?

15. Is there a need to simply encourage higher performance? What incentives or measures could be considered?

16. How much do you think cost influences the current level of voluntary compliance with Australian guidelines for water recycling: managing health and environmental risks (phase 1) (NRMMC, EPHC et al. 2006)?

17. Do you think that legislation is required to manage potential public health risks from ‘closed-loop’ sewage and greywater schemes? If so:
   a) Should a uniform legislative framework apply to all sewage and greywater schemes which may pose a risk to public health?
   b) In considering the above elements which could be included in a legislative framework, are there any additional elements which should be included?
   c) Should statutory timeframes for approval be incorporated into the framework?
   d) Considering the current framework in terms of responsible agencies and referral agencies, what are your views on how the public health framework should be administered?
18. The framework detailed above is consistent with a process-based regulatory approach, and is consistent with the regulatory approach currently applied to Class A recycled water schemes in Victoria. Should alternative regulatory models be considered to manage risks for high exposure schemes such as closed-loop systems (for example a performance-based approach)?

19. Would application of legislation across all sewage and greywater recycling schemes which may pose a risk to public health (including ‘closed-loop’ schemes) provide more confidence in the safety of these schemes and/or provide incentives for investment?

Section 6 Stormwater

20. Do you have data which demonstrates the likely futures trends in the use of stormwater within Victoria?

21. Do you have any data that you could provide in relation to your knowledge of current stormwater harvesting schemes in Victoria?

22. Are you aware of any examples of problems or incidents that have occurred with stormwater harvesting schemes in Victoria?

23. Do you have experience in managing or operating a stormwater harvesting scheme in Victoria? If so, what is your view of the current framework?

24. Do you have experience in planning or managing a stormwater dual pipe residential scheme in Victoria? What is your view of the current non-legislative approach?

25. Does the blending of treated stormwater with Class A recycled water pose any particular challenges in terms of non-uniform regulatory requirements?

26. How effective do you think the current non-legislative approach is in ensuring that stormwater harvesting schemes are designed and managed in a way that is consistent with the Australian guidelines for water recycling: managing health and environmental risks (phase 2) - stormwater harvesting and reuse (NRMMC, EPHC et al. 2009) and protective of public health?

27. If you currently manage a stormwater harvesting scheme in Victoria which involves end uses with a high potential for public exposure (such as unrestricted irrigation of public open spaces and sports fields or toilet flushing), what controls do you currently have in place to manage risks to public health? Do you manage your scheme in accordance with a management plan, consistent with the elements detailed in the Australian guidelines for water recycling: managing health and environmental risks (phase 2) - stormwater harvesting and reuse (NRMMC, EPHC et al. 2009)?

28. Should stormwater harvesting schemes continue to be managed through voluntary application of national and state guidelines?

29. Is more targeted information or education needed (e.g. in relation to risks, standards, treatment or operational monitoring) from a public health perspective? If so, what is needed?

30. Is the management framework as set out in the Australian guidelines for water recycling: managing health and environmental risks (phase 2) - stormwater harvesting and reuse (NRMMC, EPHC et al. 2009) being implemented by existing stormwater schemes? Is there a problem in that stormwater recycling scheme proponents don’t know how to comply with the public health aspects of the guidelines?

31. Is compliance monitoring needed to ensure that the Australian guidelines for water recycling: managing health and environmental risks (phase 2) - stormwater harvesting and reuse (NRMMC, EPHC et al. 2009) are being implemented? If so, could there be a role for a relevant industry body to assist in monitoring compliance (e.g. encouraging independent third party auditing of schemes and voluntary reporting of audit outcomes)?

32. Is there a need to simply encourage higher performance? What incentives or measures could be considered?
33. How much do you think cost influences the current level of voluntary compliance with the *Australian guidelines for water recycling: managing health and environmental risks (phase 2) - stormwater harvesting and reuse* (NRMMC, EPHC et al. 2009)?

34. Is explicit government regulation (i.e. legislation) required to manage risks associated with stormwater schemes which may pose a risk to public health (i.e. high exposure schemes)? If so:
   a) What scope of activities should be specifically covered by legislation?
   b) What requirements should be incorporated into the legislative framework (considering elements such as scheme registration and ongoing audits; up front assessment and approval of risk management plans etc.)
   c) Should a similar risk-based framework be applied for both recycled water (derived from sewage and greywater) and stormwater?

35. Can you provide any examples where legislation may have assisted in the design or management of a stormwater harvesting scheme?

Section 7 Costs and Benefits

36. For those schemes which currently apply the risk management framework within the *Australian guidelines for water recycling: managing health and environmental risks* (NRMMC, EPHC et al. 2006; 2009), the department is seeking feedback on the costs associated with voluntary compliance with the various elements of the guidelines, such as:

- Preparation of management plans, including validation and HACCP analysis
- Verification monitoring
- Auditing (e.g. internal, external third party auditing)

37. Do you think that uncertainty may be contributing to unnecessary costs? If so, what measures could be put in place to address these costs?

38. To what extent is demand for recycled water or stormwater limited by uncertainty about its safety?

39. Are their any additional benefits which may result from regulatory action?
## Glossary of terms and abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative water supplies</td>
<td>Water supplies including rainwater, stormwater, greywater, sewage and industrial water which are used for non-drinking purposes.</td>
</tr>
<tr>
<td>Bacteria</td>
<td>A phylum of single-celled organisms.</td>
</tr>
<tr>
<td>Class A recycled water</td>
<td>A health-based microbiological standard for recycled water derived from sewage and greywater, which is required for end uses where there is a high risk of direct human exposure to or incidental ingestion of water. Class A recycled water schemes can include use in dual-pipe residential developments and the irrigation of public open spaces where access is unrestricted.</td>
</tr>
<tr>
<td>Closed-loop schemes</td>
<td>Schemes that produce recycled water from sewage or greywater treatment systems with a design capacity or actual flow rate of greater than 5,000 litres per day, for indoor uses such as toilet flushing and laundry use, with no discharge to the environment (that is, no irrigation component).</td>
</tr>
<tr>
<td>COAG</td>
<td>Council of Australian Governments</td>
</tr>
<tr>
<td>DALY</td>
<td>Disability Adjusted Life Year</td>
</tr>
<tr>
<td>Dual-pipe scheme</td>
<td>An urban water recycling scheme where an alternative water supply is provided to householders for certain uses via a reticulation system that is separated from the drinking water supply. Sometimes referred to as a ‘third pipe’ scheme.</td>
</tr>
<tr>
<td>EPA Victoria</td>
<td>Environment Protection Authority Victoria</td>
</tr>
<tr>
<td>EPHC</td>
<td>Environment Protection and Heritage Council</td>
</tr>
<tr>
<td>Exposure</td>
<td>Contact of a chemical, physical or biological agent with an organism (for example, through inhalation, ingestion or dermal contact).</td>
</tr>
<tr>
<td>Greywater</td>
<td>Wastewater from the hand basin, shower, bath, spa bath, washing machine, laundry tub, kitchen sink and dishwasher, excluding faecal waste and urine from toilets. While kitchen water is included in the definition of greywater, it is generally too greasy and oily to be reused without significant treatment (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td>Hazard</td>
<td>A biological, chemical, physical or radiological agent that has the potential to cause harm (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td>Hazard analysis critical point (HACCP) system</td>
<td>A systematic methodology to control safety hazards in a process by applying a control two-part technique: first, an analysis that identifies hazards and their severity and likelihood of occurrence; and second, identification of CCPs and their monitoring criteria to establish controls that will reduce, prevent, or eliminate the identified hazards (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td>Helminth</td>
<td>A worm-like invertebrate of the order Helminthes. A parasite of humans or other animals (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td>HEMP</td>
<td>Health and environmental management plan. A plan covering the use of recycled water that details the management of health and environmental risks (EPA Victoria 2005).</td>
</tr>
<tr>
<td>Industrial water</td>
<td>Wastewater derived from industrial sources or processes.</td>
</tr>
</tbody>
</table>

NRMMC: National Resource Management Ministerial Council
EPHC: Environment Protection and Heritage Council
EPA Victoria: Environment Protection Authority Victoria
### integrated water cycle management
A multi-disciplinary and multi-objective approach for the sustainable use of available water resources.

### log10 reduction value (LRV)
Used in reference to physical-chemical treatment of water to remove or inactivate microorganisms such as bacteria, protozoa and viruses (Department of Health 2010).

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>NRMMC</td>
<td>Natural Resource Management Ministerial Council</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NRWRF</td>
<td>National Recycled Water Regulators Forum</td>
</tr>
<tr>
<td>non-potable water</td>
<td>Water of a quality not suitable for drinking and food preparation.</td>
</tr>
<tr>
<td>operational monitoring</td>
<td>The sequence of measurements and observations used to assess and confirm that individual barriers and preventive strategies for controlling hazards are functioning properly and effectively (Department of Health 2010).</td>
</tr>
<tr>
<td>pathogen</td>
<td>A disease-causing organism (for example, viruses, protozoa and bacteria).</td>
</tr>
<tr>
<td>protozoa</td>
<td>A phylum of single-celled animals.</td>
</tr>
<tr>
<td>QMRA</td>
<td>Quantitative Microbial Risk Assessment</td>
</tr>
<tr>
<td>QMS</td>
<td>Quality Management Systems</td>
</tr>
<tr>
<td>rainwater</td>
<td>Water collected directly from roof runoff. Can be collected in a tank for use.</td>
</tr>
<tr>
<td>raw water/source water</td>
<td>Water in its natural state, before any treatment; or the water entering the first treatment process of a treatment plant (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td>recycle</td>
<td>Using harvested water for the same or a different function, after treatment.</td>
</tr>
<tr>
<td>recycled water</td>
<td>Water generated from sewage or greywater and treated to a standard that is appropriate for its intended use.</td>
</tr>
<tr>
<td>risk management</td>
<td>The systematic evaluation of the water supply system, the identification of hazards and hazardous events, the assessment of risks, and the development and implementation of preventive strategies to manage the risks (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td>RWQMP</td>
<td>Recycled water quality management plan. A plan that covers the production of recycled water at a treatment plant. The validation (body of evidence) supporting the capability of the treatment plant to achieve the specified water quality objectives must be contained within this plan.</td>
</tr>
<tr>
<td>runoff</td>
<td>Surface overland flow of water exceeding the infiltration capacity of the soil.</td>
</tr>
<tr>
<td>sewage</td>
<td>Material collected from internal household and other building drains. Includes faecal waste and urine from toilets, shower and bath water, laundry water and kitchen water (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td><strong>stormwater</strong></td>
<td>Water that runs off all urban surfaces such as roofs, pavements, car parks, roads, gardens and vegetated open spaces which is captured in constructed storages and drainage systems. This excludes roofwater captured directly in tanks, water sourced directly from natural rivers, creeks, streams and lakes, and water from private dams for primary production purposes.</td>
</tr>
<tr>
<td><strong>validation</strong></td>
<td>The substantiation by scientific evidence (investigative or experimental studies) of existing or new processes and the operational criteria that demonstrate the pathogen-reduction capability of the process to effectively control hazards (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td><strong>verification</strong></td>
<td>An assessment of the overall performance of the treatment system and the ultimate quality of water being supplied to customers (Department of Health 2010).</td>
</tr>
<tr>
<td><strong>virus</strong></td>
<td>Molecules of nucleic acid (RNA or DNA) that can enter cells and replicate in them (NRMMC, EPHC et al. 2006).</td>
</tr>
<tr>
<td><strong>WQMS</strong></td>
<td>Water Quality Management Systems</td>
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