# Recycled water use in surface waters guideline

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# 1. Introduction

Recycled water is also known as 'water recycling' or 'reclaimed wastewater'. In this guideline, 'reclaimed wastewater' or 'water recycling' will be referred to as recycled water.

The Victorian Government encourages safe and sustainable recycled water use for non-potable purposes.

Recycled water is defined in the Victorian guideline for water recycling (EPA publication 1910) as water derived from sewerage systems or industry processes and treated to a standard appropriate for its intended use. By carefully managing and optimising recycled water use, Victorians can protect and prevent harm to human health and the environment.

The *Environment Protection Act 2017* (Environment Protection Act) and its subordinate legislation detail the requirements for the treatment of sewage and use of recycled water. As part of these requirements, a permission application must be made to Environment Protection Authority Victoria (EPA) to enable the use of recycled water in surface waters.

This guideline delivers EPA's commitment 'to develop guidance to inform water corporations' applications for recycled water for environmental flows' (Victorian Auditor-General's Office 2021).

## 1.1 Purpose of this guideline

This guideline outlines the permission required and the information you need to provide to EPA when seeking approval to use recycled water in surface waters. The guideline applies to permission applicants who conduct an *A03 Sewage Treatment* activity. This can include water corporations or other facilities that treat sewage and produce and use recycled water.

## 1.2 Background

Victoria's climate is changing. In recent decades, the state has become warmer and drier[1]. These changes are expected to continue.

A warmer and drier climate has consequences for the health of Victoria's waters. Many surface waters already have reduced flows, which has impacted their ecological health. Further reduction of flows can pose significant impacts on the environmental values of these waters. High intensity bushfires and flooding events can also degrade water quality.

The primary purpose of recycled water is to use it as a resource in a safe and sustainable way. The use of recycled water in surface waters is to improve waterway flows to help maintain and support waterway health. This use of recycled water is different from that of a treated wastewater discharge to waterways.

A discharge involves treating and disposing wastewater into surface waters, without consideration of water for the environment or environmental flows. As part of government policy and the Victorian Waterway Management Strategy, for treated wastewater to be considered recycled water for environmental purposes, the right amount of flow, at the right time, must be provided in surface waters to support environmental flows. Environmental flows are explained further in the Department of Energy, Environment and Climate Action's (DEECA) policy documents and resources:

- Part 3, Policy 8.10 of the *Victorian Waterway Management Strategy.*
- What is water for the environment?

### 1.2.1 Waste management hierarchy

The waste management hierarchy is a tool that shows different ways to manage waste from most to least preferred. The hierarchy is central to Victoria sustainably using its resources.

[1] Adapting to climate change impacts, 2022. https://www.water.vic.gov.au/climate-change/adaptation

Under section 18 of the Environment Protection Act, as a principle of environment protection, waste should be managed in accordance with the following order, so far as is reasonably practicable:

1. Avoidance
2. Reuse
3. Recycling
4. Recovery of energy
5. Containment
6. Disposal

The use of recycled water in surface waters is a preferred reuse option over discharge. In some cases, it can contribute to environmental flows to improve waterway health. In other uses, it can maintain or enhance wetland habitats. By modifying and optimising an existing discharge, recycled water use can better meet the environmental needs of a waterway, while protecting the environment and human health.

### 1.2.2 Risk assessment and weight of evidence

To protect environmental values of surface waters, it is important your recycled water meets a high standard of water quality and risk management.

This guideline provides clear information to support you to proactively manage recycled water for safe and sustainable use. A risk assessment and management approach is recognised, nationally and internationally, as an effective and acceptable way to protect human health and the environment.

You can use *Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287)* to assess your risks to human health and the environment. This risk assessment framework will be familiar to you and your ways of working.

Further emphasis in this guideline has been placed on providing a semi-quantitative or quantitative risk assessment, with additional lines of evidence for your risks using a weight of evidence process. We have provided additional information and references to help you understand these concepts.

## 1.3 Scope

This guideline applies to the use of recycled water in surface waters. In this guideline, surface waters are waters other than groundwater, for example: river, stream, lake, estuary, and wetland water.

For the purpose of this guideline, recycled water includes water derived from sewerage systems and does not include water derived from stormwater.

Recycled water use for irrigation and land-based applications is not included in the scope of this guideline. These uses are outlined in the Victorian guideline for water recycling (EPA publication 1910) and Victorian guideline for irrigation with recycled water (EPA publication 168).

# 2. Policy and regulatory framework

The Victorian Waterway Management Strategy (VWMS) 2013 provides a detailed policy for managing Victorian Waterways. The Environment Protection Act has specific regulatory requirements that apply to the use of recycled water in surface waters.

## 2.1 Victorian Waterway Management Strategy

The VWMS provides statewide policy for maintaining and improving the health of Victorian waterways. It provides direction for investment and management of waterways and guides regional decision making for Catchment Management Authorities (CMAs).

Victorian government Policy 8.10 of the VWMS (2013) outlines the use of alternative sources of water for environmental purposes. This includes the use of recycled water as a source of environmental water for flow-stressed waterways. The policy explains where recycled water is considered appropriate for environmental flows and lists the requirements that must be considered.

An updated VWMS is expected in 2025, containing further information on scope, roles, and processes for demonstrating that recycled water is appropriate for environmental flows.

To understand more about flow stress and environmental flow targets, refer to Water recovery for the environment.

## 2.2 Environment Protection Act 2017

Environment protection laws in Victoria require you to take proactive steps to manage risks of harm from pollution and waste. The Environment Protection Act and the Environment Protection Regulations 2021 (the EP Regulations) outline the legislative requirements for sewage treatment and the supply and use of recycled water.

The Environment Protection Act takes a preventative approach to managing risks to human health and the environment from pollution and waste in Victoria. This approach focuses on preventing impacts from waste and pollution rather than managing those impacts after they have occurred. For more information, see What the Environment Protection Act 2017 means for Victorian businesses.

The cornerstone of the Environment Protection Act is the general environmental duty (GED). It requires that all Victorians understand and minimise the risks of harm to human health and the environment from their pollution and waste, so far as reasonably practicable. For more information see Industry guidance: supporting you to comply with the general environmental duty (EPA Publication 1741).

### 2.2.1 Environment Protection Regulations 2021

The EP Regulations support the Environment Protection Act by imposing obligations in relation to environmental protection, pollution incidents, contaminated land and waste. The Regulations also prescribe the activities that require an EPA permission under the Environment Protection Act.

### 2.2.2 Permission pathway for use of recycled water in surface waters

To perform prescribed activities, you must have a permission or permission exemption. Permissions are licences, permits or registrations. Permissions are an important part of EPA's broader approach to setting performance standards. They include conditions and ways to support and monitor compliance.

The EP Regulations specify the permission required for each prescribed permission activity. Under Schedule 1 of the EP Regulations, you need approval in an **A03 (Sewage treatment) licence** for the treatment of sewage and use of recycled water in surface waters.

If you are proposing to conduct a new A03 Sewage treatment activity, with use of recycled water in surface waters (e.g. new treatment plant), you will require a development licence and operating licence.

If you have an existing A03 operating licence for your treatment and discharge activities, you will require an operating licence amendment for the use of recycled water in surface waters.

In an A03 licence amendment, EPA will assess your proposed recycled water use in surface waters and if approved, will provide separate conditions for your recycled water use.

This permission approval pathway will be familiar to you if you discharge treated wastewater and use recycled water for other approved uses on your site. The treatment and discharge of wastewater, in addition to the use of recycled water on your site, is permissioned within one A03 Sewage treatment licence.

In certain cases, a development licence application may also be required, under section 44 of the Environment Protection Act, if you are:

- constructing or installing plant or equipment
- developing processes or systems

- modifying (except for general maintenance) plant, equipment, processes or systems for a prescribed development activity where the modification creates a risk of material harm to human health or the environment from pollution or waste (material harm is defined in s.5 of the Environment Protection Act). Refer to EPA's Development licences for more information.

You can read more about how to prepare and submit an application on EPA's permissions webpage.

Specific conditions for recycled water quality requirements will be determined by the outcome of your permission assessment. These requirements will be specific for your recycled water use in surface waters and will be included in your A03 licence. They may differ to your existing wastewater discharge conditions.

Use EPA's Permission Pathway Form (F1021) if you are unsure about which pathway is most suitable for your proposal.

### 2.2.3 Discharges to special water supply catchment areas and Regulation 19

Special water supply catchment areas (SWCAs) are protected under the *Catchment and Land Protection Act 1994*. These catchments have significant value as a source of water supply, both for human consumption and for stock use.

Under Regulation 19 of the EP Regulations, EPA must refuse an application for a development licence, operating licence, pilot project licence or permit if the application specifies an activity involving a new wastewater discharge or deposit to surface waters in a SWCA. This regulation helps protect public health by maintaining healthy water quality. Refer to the Declared special water supply catchment areas for more SWCA information.

If you have an existing A03 licenced discharge in a SWCA and are considering recycled water use in surface waters, identify and evaluate all other potential uses of recycled water that most effectively protect public health and water quality in a SWCA.

### 2.2.4 Environment Reference Standard

The Environment Reference Standard (ERS) is a legislative instrument made under the Environment Protection Act.

The ERS brings together environmental values, indicators and objectives describing outcomes to be achieved or maintained in Victoria. These values and objectives provide a reference point to consider whether a proposal or activity is consistent with the environmental values identified in the ERS.

When determining whether to issue a licence, EPA must take into account impact on human health and the environment, including the impact on environmental values identified in any relevant environment reference standard.

The environmental values of waters from the ERS are:

- water dependent ecosystems and species
- human consumption after appropriate treatment (e.g. drinking water)
- potable water and mineral water supply
- agriculture and irrigation (e.g. irrigation of crops, stock watering)
- human consumption of aquatic foods
- aquaculture
- industrial and commercial
- water-based recreation (primary contact)
- water-based recreation (secondary contact)
- water-based recreation (aesthetic enjoyment)
- Traditional Owner cultural values
- navigation and shipping
- buildings and structures
- geothermal properties.

Refer to Division 3 of the ERS for further detail on environmental values, indicators and objectives. More information about the ERS can be found in the Guide to the Environment Reference Standard (publication 1992).

### 2.2.5 Existing guidelines and state of knowledge

EPA Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287) provides step-by-step information on how to assess the environment and human health risks associated with treated wastewater discharges to surface waters. It can also be applied to the activity of recycled water use in surface waters.

Other guidelines to support your understanding of risks and state of knowledge include:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality
- Australian Guidelines for Water Recycling (AGWR).
- Victorian guideline for water recycling (EPA publication 1910)
- Technical information for the Victorian guideline for water recycling (EPA publication 1911)
- National Health and Medical Research Council: Guidelines for managing risks in recreational water and Guidance on per- and poly-fluoroalkyl substances (PFAS) in recreational water.
- enHealth publication Environmental Health Risk Assessment.
- Food Standards Australia and New Zealand
- Reasonably practicable (EPA publication 1856)
- Emerging contaminants in recycled water (EPA guideline 2054)

## 2.5 Roles and responsibilities

### 2.5.1 Waterway manager and DEECA

In Victoria, there are 10 catchment management regions. Each region has a CMA to coordinate integrated management of land, water and biodiversity. In the Port Phillip and Westernport region, Melbourne Water has the waterway and catchment management responsibilities.

CMAs and Melbourne Water have responsibilities for waterway management under the Water Act 1989. Collectively, they are known as the waterway managers.

DEECA's Waterway Programs Branch within the Water and Catchments Group works to maintain or improve the condition of Victoria's waterways to ensure they continue to provide environmental, social, cultural and economic values. This includes implementing the government's strategic direction for the state's water management as outlined in the Victorian Waterway Management Strategy, Water for Victoria and the Central and Gippsland Region Sustainable Water Strategy.

DEECA's Waterway Programs Branch and waterway manager will only consider recycled water use in surface waters that are flow-stressed and where the recycled water will assist in meeting flow requirements to support environmental values. They will request and verify the following information in your proposal:

- Evidence the receiving surface waters are flow stressed
- Enough data and evidence to show your recycled water can support environmental flow targets (including frequency, magnitude, timing and duration).

DEECA's Waterway Programs Branch and the relevant waterway manager will determine if your proposal to use recycled water in surface waters is in alignment with all relevant DEECA policy.

### 2.5.2 Environment Protection Authority

EPA is Victoria's environmental regulator. As an independent statutory authority under the Environment Protection Act, EPA's regulatory role is to prevent and reduce harm from pollution and waste.

EPA assesses recycled water permission applications for protection of public health and the environment. The information to provide in your permission application is outlined below in *section 3. Decision-making process for permission.*

### 2.5.3 Department of Health

The Department of Health is involved in setting health standards at a state level and, in some cases, with referrals (see section 3.4) for recycled water in conjunction with EPA.

The Department of Health also has a role in incident and emergency management if your recycled water scheme impacts a drinking water scheme. Under the *Safe Drinking Water Act 2003*, a water supplier or water storage manager must notify the Department of Health if drinking water is unlikely to comply with the standards, could pose a human health risk, or cause widespread complaints. Examples of this include through a cross-connection, or food safety.

Similarly, you must notify the Department of Health where recycled water has potential food safety implications and a recall is considered necessary (under the *Food Act 1984*).

Refer to Drinking water notifications for further details.

### 2.5.4 Chief Veterinary Officer

The *Livestock Disease Control Act 1994* has requirements for applications where recycled water is used on cattle grazing land or for livestock drinking water. This helps mitigate the public health risks from these recycled water applications.

Victoria's Chief Veterinary Officer (CVO) endorses recycled water applications that present a risk to livestock health, or human health through consumption of food. EPA will determine if CVO involvement is required for endorsement or notification. This is explained further in the Victorian guideline for water recycling (EPA publication 1910) and Victorian Government Gazette s712 Approving Purification Standards for Biosolids and Recycled Water.

# 3. Decision-making process for permission

The Environment Protection Act requires EPA to consider several matters when determining whether to issue a permission.

## 3.1 General provisions

The Environment Protection Act outlines the permission application form and contents under section 50. If you are submitting an application for any type of permission, it must:

- be in a form and manner approved by EPA (Refer to EPA's permissions webpage)
- be accompanied by the prescribed fee
- specify the permission type (e.g. development or operating licence) and the application type (e.g. new, amendment)
- specify the prescribed permission activity (e.g. A03 Sewage treatment)
- include any prescribed information.

## 3.2 Permission requirements and supporting evidence

Permission applications need to provide sufficient consideration of, and evidence supporting, compliance with the obligations of the Environment Protection Act and EP Regulations. Under section 74 of the Environment Protection Act, EPA must consider the following when determining whether to issue an operating licence:

- any measures the applicant has taken or proposes to take to comply with the GED when engaging in the activity
- impact on human health and the environment, including the impact on environmental values identified in any relevant environment reference standard, taking into account any other activities being or proposed to be to be carried out by the applicant or any other person
- principles of environment protection
- best available techniques or technologies
- whether the activity is otherwise consistent with the Environment Protection Act and regulations
- any prescribed matter.

EPA must also consider requirements under other legislation including:

- *The Charter of Human Rights and Responsibilities Act 2006*
- *Climate Change Act 2017*
- *Flora and Fauna Guarantee Act 1988 (*duty on public authorities). For more information, refer to Climate change, biodiversity and engagement requirements.

Your application information can be in the form of data, reports and analysis. You will be required to include the following information in your operating or development licence application:

- demonstrate how you are complying with the GED and taking all reasonably practicable steps to minimise risks. Refer to sections 6 and 25 of the Environment Protection Act and publication 1856: Reasonably practicable for more information.
- a detailed assessment of the hazards and risks to human health and the environment by providing an environment and human health risk assessment (EHRA). An EHRA evaluates the likely or actual harm of one or more hazards on the environment and human health. To develop your risk assessment, you can use Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287). It has been developed to support water corporations and other businesses.
- demonstrate your proposal uses technologies, practices and other measures that can meet the relevant principles of environment protection. These principles are listed in Part 2.3 of the Environment Protection Act.
- demonstrate your consideration of best available techniques and technologies (BATT) for your activities.

Refer to the following webpages for more detail about permission applications:

- EPA permissions
- Development licence application guidance (EPA publication 2011).

## 3.3 Grounds for refusal

Applications must be refused by EPA in accordance with provisions of the Environment Protection Act and EP Regulations listed below:

- EPA considers the proposed activity that is the subject of the application poses an unacceptable risk of harm to human health or the environment.
- EPA determines the applicant is not a fit and proper person to hold a development licence.
- For an operating licence application, EPA considers the proposed activity is subject to a prescribed development activity (e.g. development licence) and the applicant does not hold a development licence in respect to the activity.
- If any prescribed circumstances exist (for example under Regulation 19, see section 2.2.3).

Prescribed circumstances for refusal include:

- objections to the development licence (on grounds that public health is likely to be endangered) from the Department of Health
- new discharge into special water supply catchment areas.

For further information on grounds for refusal and prescribed circumstances for refusal, refer to section 66, 69, 74 of the Environment Protection Act and Regulation 19 and 22 of the EP Regulations.

## 3.4 Permission referrals

EPA can refer a permission application to any relevant agency. This helps ensure EPA has the best available information to support its assessment.

There are circumstances where EPA is required to refer a development licence application to a prescribed agency. The EP Regulations (Regulation 22) requires that *significant development licence* applications are referred to the Department of Health.

# 4. Risk assessment for use of recycled water in surface waters

A risk assessment gathers and integrates all available data and information on the environmental values of the receiving waterway and the potential hazards to these from the recycled water.

The use of recycled water in surface waters is a complex activity that may involve different risks to a discharge. These risks may arise from lesser amounts of dilution with receiving waters or gaps in available data and monitoring. There may also be current risks to a waterway's environmental values from environmental water shortfalls.

EPA expects a high standard of water quality and risk management for the use of recycled water to surface waters.

When developing your risk assessment, you can follow the EHRA steps as outlined in Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287).

The outcomes of an environmental and human health risk assessment include:

- an estimation of the likelihood of environmental values impacted, the magnitude of the impact and how the impact changes given alternative scenarios (including impacts on potential end users)
- the probability of contracting a specific infection or illness (in the case of a microbial risk assessment) or risk of human exposure exceeding a health-based guideline value (in the case of a chemical risk assessment)
- detailed information and tools that help to better understand how systems work
- targeted management actions and monitoring programs.

EHRA span from qualitative through semi-quantitative to fully quantitative. Your risk assessment could include any combination of these approaches:

- **Qualitative:** qualitative risk assessments are commonly used for screening risks to determine whether they merit further investigation. It is based on subjectivity and the knowledge of the risk assessor/s.
- **Semi-quantitative**: an intermediate level between qualitative and quantitative risk assessments.
- **Quantitative:** quantitative risk assessments are based on extensive data, often including mathematical models.

EHRA can follow a tiered process where an assessment proceeds with increasing complexity and data evidence. This process and information can support your proposal and development of operational risk management protocols. Risk can be described qualitatively (categorising subjectively as high, medium, low), quantitatively (numerical estimate) or semi-quantitatively (a combination of numerical and qualitative assessment for risk estimation).

Your assessment should incorporate relevant detail and risk characterisation to support your application and understanding of risks. This may mean your risk assessment proceeds from a screening level assessment (e.g. comparison of exposure concentrations to indicators and guidelines) through to development of site-specific guidelines (e.g. modification of bioavailability assumptions or accounting for local conditions). It may also proceed to a detailed risk assessment, which may incorporate numerical models to refine exposure estimates or direct biological measurements for relevant ecosystem receptors. The purpose of this tiered approach is to reduce uncertainty in the assessment by considering more realistic exposure conditions and receptors.

Although this guideline focuses on the risk to surface waters from recycled water use, there may be flow on effects to groundwater and land. As part of a holistic risk assessment, the potential interactions between surface waters, groundwater and land should be identified and the risks to the environmental values of each segment assessed as needed. Refer to Hydrogeological Assessment Guidelines for Groundwater Quality (EPA publication 668.1) for more information.

## 4.1 Weight of evidence

To help you better understand your risks, a weight of evidence (WoE) process can be used in your risk assessment. The WoE process incorporates consideration of multiple lines of evidence.

ERS describes WoE as a process to collect, analyse and evaluate a combination of different qualitative, semi-quantitative or quantitative lines of evidence. This is used to make an overall assessment of impact on environmental values and water quality. It helps you better understand your risks and informs your risk management.

A screening assessment of recycled water contaminants against ERS indicators or derived site-specific guideline values provides an initial assessment of the risks of harm. This is typically your first line of evidence where you:

- Define hazards (e.g. contaminants, toxicants) for your recycled water.
- Identify environmental values and define the relevant indicators (e.g. chemical, physical and ecosystem indicators) using applicable guideline values from the ERS and ANZG.
- Compare the contaminant concentrations measured in the recycled water with the identified indicators to assess risk of harm.

The ERS is a reference tool and does not set compliance limits. Impacts on environmental values can often be the results of cumulative effects of pollution from many diffuse sources. The ERS is a tool that can be used to assess the impacts on human health and the environment that may result from a proposal or activity or from existing environmental conditions on a site. The ERS gives you a valuable reference and informs you in minimising risks of harm to human health and the environment from pollution and waste so far as reasonably practicable.

Further assessment and additional lines of evidence are important where recycled water contaminants exceed relevant ERS indicators, including species protection default guideline values (DGVs), or when indicators or guideline values are not available. In this case, assess additional lines of evidence to provide a more detailed and site-specific risk assessment for the likelihood and degree of harm. Additional lines of evidence can include:

- Chemical and physical indicators, toxicants and other stressors based on monitoring of the sources and concentrations in the environment. This includes understanding ambient conditions in the receiving waterway and water quality information that is reflective of recycled water mixing with ambient conditions. This information is used for comparison against water quality guidelines or site-specific guideline values.
- Microbial indicators and pathogen surrogates based on monitoring of sources and treated wastewater or literature data and plant performance in removing pathogens (log reduction values)
- Bioavailability assessments to demonstrate how readily contaminants are absorbed by organisms.
- Bioaccumulation assessments for an indication of concentration of contaminants in organisms.
- Toxicity for organism-level effect. The use of laboratory ecotoxicity tests to measure the potential effects on sensitive test organisms. This can involve direct toxicity assessment (DTA) or whole of effluent toxicity (WET) tests.
- Biodiversity (populations and communities of organisms) for ecosystem-level effects. Biomarkers for an indication of cellular/sub-cellular effects.
- Health impacts to food production irrigation or livestock watering downstream.
- A risk comparison of your proposed recycled water use to your existing discharge (if applicable). This helps demonstrate how you've decreased your risks when compared to your existing licenced discharge.

The lines of evidence to consider can vary and depend on key contaminants, site specific considerations and the amount and type of available data. Reviewing your lines of evidence can help you determine if you have suitable data for your risk assessment. Where there are information gaps, or if your early assessment has identified potentially higher risks of harm, it may be helpful to seek additional monitoring or assessments to address these gaps.

Include a comprehensive consideration of indicators and contaminants in your assessment. Chemicals and pathogens present in wastewater can vary depending on the source of wastewater. Refer to the section 3.1.6 and Appendix C in Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287) for further information.

Refer to The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) and Sediment quality assessment: a practical guide for further details on weight of evidence.

### 4.1.1 Bioavailability

Bioavailability describes how much of a contaminant or toxicant is available for uptake by organisms. Bioavailability assessments are commonly done in the laboratory. It is one of the easiest lines of evidence to obtain and commonly the first one collected. Bioavailability estimates can be conducted where there is good knowledge of water quality in the receiving environment.

Chemical organic matter complexes are less bioavailable than the freely dissolved forms of contaminants. Toxicity of contaminants in water can be reduced by the presence of organic matter and other ions.

### 4.1.2 Bioaccumulation

Bioaccumulation is a process where the concentration of a chemical in an organism exceeds concentrations in the environment (e.g. water or soil). Bioaccumulation occurs through:

- bioconcentration – absorption from the ambient environment
- biomagnification – transfer from food.

For bioaccumulative toxicants, ANZG recommends adopting a species protection level higher than would normally be assigned to a location. This means a 99% species protection level would be used for slightly to moderately disturbed waters. You should consider health risks to humans in waters that support aquaculture or foraging activities including recreational fishing.

### 4.1.3 Ecological toxicity assessments

The focus of a toxicity assessment is to identify relevant health effects and establish the concentration–response relationships for toxicants under site-specific exposure conditions. It can involve a desktop assessment or a laboratory study.

In a desktop assessment, toxicity thresholds, including guideline values (e.g. ANZG DGVs) or published dose-response data (for toxicants without guideline values), can be used to understand whether toxicity is likely to occur.

Laboratory studies are better suited to the assessment of toxicity from mixtures. Toxicity testing of whole samples of wastewater is referred to as direct toxicity assessment (DTA). A DTA exposes test organisms to wastewater under controlled laboratory conditions. The assessment process quantifies measurable effects, such as survival, growth and reproductive success in the tested wastewater relative to that in control and reference toxicant solutions. This assessment can be for short term (e.g. acute effects) through to chronic (changes to behaviour, reproduction etc.) impacts. Laboratory toxicity testing provides the most direct assessment of the bioavailability and toxicity of wastewater in a specific receiving environment.

### 4.1.4 Ecological assessment

Ecological assessment is a field study examining the response of ecological communities to toxicants in a receiving environment. This assessment should consider understanding:

- ecological communities present in the surface waters
- the impacts to waters from recycled water use.

Ecological assessment should include:

- an evaluation of the general water quality and water chemistry of the receiving environment.
- the characterisation of habitat and organisms present in the area.
- the identification of any visible degradation or stressors present.

In some cases, a detailed ecological assessment can be helpful, where aquatic communities present in the receiving environment are subject to detailed survey and quantitative evaluation.

### 4.1.5 Human health

Recycled water can contain a wide range of contaminants that pose risks to human health. This includes disease-causing microorganisms (pathogens) and chemical substances.

Potential health risks must be assessed and minimised to acceptable or tolerable risk levels. This assessment includes consideration of continual improvement to minimise health risks over time. Your assessment is used to identify possible exposure pathways and evaluate the health risks associated with ingestion (including from food), inhalation and dermal exposure. Include cumulative risks from your assessment regarding existing activities within the catchment.

EPA has developed information for microbial human health risk assessment of wastewater discharges. Refer to Appendix C of Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287) for information on developing your microbial risk assessment.

Where recycled water has chemical contamination (such as wastewater from industrial sources), refer to **Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287),** enHealth publication Environmental Health Risk Assessment and relevant publications listed in section 2.2.5 of this guideline.

### 4.1.6 Traditional Owner cultural values

For Traditional Owners, Country is embedded with culture, stories, and songlines. This includes ceremonial places and sites of significance. The responsibility to prevent the risk of harm to human health and the environment from pollution and waste extends to consideration of interests of Traditional Owners and impacts to landscapes, waterways and cultural heritage.

Early engagement with Traditional Owners will help you understand the significance and value of waterways and landscapes. Assessing risks of harm against the Traditional Owner cultural environmental value for water requires careful consideration of the interconnections of water, land and air.

To recognise Traditional Owner cultural values in the ERS, assessment of Traditional Owner cultural values of water should consider relevant state programs, strategies, or national guidance to inform objectives.

The links provided below offer some examples of the application of Traditional Owner cultural values for waters:

- Cultural conservation of freshwater turtles (in Barmah-Millewa Forest)
- Watering to enable basket weaving on Yorta Yorta Country
- Jacksons Creek biik wurrdha Regional Parklands Plan
- *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017*

For more information on the assessment of Traditional Owner cultural values, refer to Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287).

## 4.2 Risk management and monitoring

The development of risk controls is not intended to be the end of the risk management process. Ongoing evaluation through monitoring and continuous improvement is required under the GED to ensure ongoing compliance.

You are required to have a risk management and monitoring program (RMMP) as part of your permission for use of recycled water in surface waters. Your management of recycled water should be clear in your RMMP and cover your:

- preventive risk management systems and controls
- communication and engagement with stakeholders like employees, contractors, end-users, and the community
- notification arrangements to EPA, Department of Health, and waterway managers for any incidents that potentially place the environment or public health at risk or affects the safety of the recycled water scheme
- frequent review and continuous improvement in managing recycled water with a multiple-barrier approach.

For more detailed information on managing risks including notifications, refer to:

- EPA RRMP for developing your RMMP.

- The Victorian guideline for water recycling (EPA publication 1910 and Technical information for the Victorian guideline for water recycling (EPA publication 1911) for more information on risk management, notification recommendations, and monitoring of recycled water.

# 5. Risk assessment example

This example describes an application for use of recycled water in surface waters. It aims to help you understand the information to provide in a permission application for this activity.

This example is a summary and intended to use as a guide only. Your own application and supporting information will include more detail.

## 5.1 About the example

A regional water corporation (the water corporation) manages a sewage treatment plant in the Central Foothills and Coastal Plains geographical area. They have an existing EPA *A03 Sewage treatment* licence. The facility treats and discharges 6 ML/d of municipal generated wastewater to a nearby Victorian waterway located outside of a SWCA. Through engagement with their regional CMA and DEECA, the water corporation understands the nearby major waterway is flow stressed. They work with their regional CMA and DEECA to meet government policy objectives in Part 3, Policy 8.10 of the Victorian Waterway Management.

## 5.2 Consultation with DEECA and waterway manager

The water corporation consults with DEECA and their regional waterway manager. The following information is verified:

- the receiving surface waters are flow stressed
- there is data and evidence to show their recycled water flows can support environmental flow requirements (including frequency, magnitude, timing and duration)

## 5.3 Permissioning pathway under the Environment Protection Act

The water corporation understands their regulatory requirements for the use of recycled water in surface waters. This includes the expectation to demonstrate a decreased risk compared to their existing A03 *Sewage treatment* licence discharge requirements.

At this point, the water corporation knows they will have to make upgrades to their infrastructure. These upgrades include additional treatment infrastructure and storage capacity. This will help them produce and manage recycled water that supports the environmental values of the waterway. Based on these upgrades, they will require an A03 *Sewage treatment* development licence application.

## 5.4 Risk assessment information

The water corporation proceeds with an assessment of the risks of harm to human health and the environment from their proposed use. They use **Guidance for environmental and human health risk assessment of wastewater discharges to surface waters (EPA publication 1287)** to help with the development of their risk assessment which includes:

- identification of environmental values in the waterway as water dependent ecosystems and species; Traditional Owner cultural values, agricultural uses and water-based recreation (aesthetic enjoyment and secondary contact, including boating).
- collation of information and monitoring data of the recycled water and waterway.
- identification of the potential hazards from recycled water (e.g. contaminants, toxicants, pathogens, emerging contaminants), and hazardous events (e.g. system failures, wet weather), with conceptual models showing the key impacts between hazards and environmental values, including cumulative impacts on environmental values from other catchment activities and pollution sources.
- engagement with Traditional Owners to understand and identify potential impacts to cultural values of waters.

The risk analysis used a weight of evidence process for:

- identification of recycled water contaminants that are below or above ERS indicator objectives.
- for contaminants above the ERS objectives, a documented and a more detailed assessment is provided with additional lines of evidence, including bioavailability and ecotoxicity analysis, and a weight of evidence process.

- a comparison of the proposed recycled water use against the current discharge water quality and risks.
- a quantitative microbial risk assessment (QMRA) conducted with hazard identification, exposure assessment and health effects assessment. An estimate of the degree of risk for reference pathogens was produced.

**Risk characterisation and management**

Risk ratings were assigned to each of the environmental values using a semi-quantitative approach. The water quality screening assessment identified:

- toxicants arsenic, copper, cadmium, chromium, lead, manganese, nickel and zinc and ammonia below 95% species protection guideline values and considered low risk
- total phosphorous below ERS 75th percentile environmental objectives for all samples
- total nitrogen concentrations above ERS 75$^{th}$ percentile indicator of 1.1 mg/L

The outcomes of the QMRA assessment demonstrates health-based targets are met at the point of recycled water release. The QMRA study confirms the treatment process will achieve a DALY<10-6. This means there will be adequate log reduction values (LRV) for the recycled water use in surface waters.

Traditional Owner cultural values were tested through engagement and found to be adequately supported. These values were included in their risk management and monitoring.

Based on these findings, additional lines of evidence using a weight of evidence process were gathered and assessed. A direct impact to macroinvertebrate communities was determined to be unlikely.

Whole of effluent ecotoxicity testing was conducted with the proposed recycled water. These results showed that the recycled water was not acutely toxic to test-organisms and had no chronic effects with lesser amounts of dilution for recycled water. Flows provided to the receiving waterway are shown to support habitat for native fish species.

The water corporation updates their existing RMMP. They include additional monitoring and controls. As part of their operations and RMMP, the water corporation decides to use a Hazard Analysis and Critical Control Point approach. This shows appropriate treatment steps, controls, monitoring, and verification processes are in place.

Ongoing monitoring will be conducted to ensure treatment is adequate and environmental values are maintained. This includes reviewing and keeping up to date with new and evolving knowledge of emerging contaminants in recycled water. The water corporation will also work with DEECA and their regional waterway manager to develop an appropriate, site-specific monitoring program for their recycled water flows.


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