Recycled Water  
 Supply

Risk Management Plan

TEMPLATE

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# RMP Template Information

This Risk Management Plant (RMP) template has been created by the Wastewater Management team at the Department for Health and Wellbeing (DHW) in South Australia.

The intent is to guide the development of a RMP describing the treatment of sewage at a Wastewater Treatment Plant (WWTP) and the supply of recycled water for non-potable use.

The structure of the template aligns with the risk management framework of the Australian Guidelines for Water Recycling, 2006 (AGWR).

Appendices A-D provides information to guide the application of Log Reduction Values (LRVs) to both wastewater treatment barriers and on-site preventative measures, applied by the recycled water user. The appendices are for information only and should be removed from the final version of the RMP.

The RMP should be well understood by the operators of the WWTP, as well as other key stakeholders involved in the supply of recycled water from the WWTP.

RMP’s should be reviewed every 2 years. Changes to the treatment process, critical control points or the recycled water end use must be documented in the RMP and approved by DHW prior to taking place.

# Regulatory Requirements

DHW approval is required for both the supply and the use of recycled water in line with the [South Australian Public Health (Wastewater) Regulations 2013](https://www.legislation.sa.gov.au/__legislation/lz/c/r/south%20australian%20public%20health%20(wastewater)%20regulations%202013/current/2013.163.auth.pdf). Approval to supply recycled water is held by the owner of the WWTP or the Water Industry Entity (WIE), while approval to use recycled water is held by the owner of the land, or a responsible party who is managing the land, on which recycled water is being used. It is the supplier’s responsibility to ensure that all connected users have the required regulatory approvals (Refer to Table 6) in place before recycled water is supplied.

To apply for an approval to supply recycled water, submit an online application form (refer to [SA Health/Wastewater Website](https://www.sahealth.sa.gov.au/wps/wcm/connect/Public+Content/SA+Health+Internet/Public+health/Water+quality/Wastewater/Wastewater+collection+for+large+developments+and+towns)) and upload the supply RMP as a supporting document. Where a historical approval has been granted without the submission of a RMP, the owner of the WWTP should develop a RMP in consultation with DHW.

Table 1 below provides a list of the typical responsibilities of recycled water suppliers and to the users. The delegation of responsibilities involved in the recycled water system should be documented in an agreement or contract between the supplier and the user, so there is a clear understanding between the parties.

Table 1: Responsibilities of recycled water suppliers and users

|  |  |
| --- | --- |
| Recycled Water Supplier | Recycled Water User |
| Complying with the DHW recycled water supply approval.  Seeking DHW approval for installation of wastewater infrastructure (Community Wastewater Management Systems (CWMS) only).  Ensuring that connected users have the appropriate regulatory approvals in place prior to supplying recycled water (See the relevant Acts and regulations in Table 7).  Notifying DHW and connected users of incidents or emergencies at the WWTP or collection network that present a potential public health risk. See Section 6 for incident and emergency criteria.  Undertaking routine sampling of recycled water to monitor the quality and verify the treatment performance.  Implementing and updating the supply RMP.  Obtaining any other regulatory approvals (PIRSA, OTR, DEW, EPA) that may be required for treating sewage and supplying recycled water. | Complying with DHW recycled water use approval.  Maintaining and operating the irrigation system.  Ensuring sustainable management of the land and crops irrigated.  Implementing and updating the use RMP.  Educating staff, contractors and visitors attending the irrigation site about recycled water risks and the WHS requirements needed to be applied when handling recycled water.  Obtaining any other regulatory approvals (PIRSA, OTR, DEW, EPA) that may be required for their specific end use. |

RMP Template key:

The formatting, font and styles used throughout the RMP is a guide only and can be edited as needed.

Blue shaded text providing instructions or guidance should be removed before the RMP is submitted the to DHW for review.

### RMP Legend:

*Blue shaded text = Instructions, guidance text or information.*

Orange text = Example text to be edited to suit the WWTP or irrigation area being described in the RMP.

Black text = Text that can remain in the RMP (if desired).

# Introduction

*Provide a brief overview of:*

* *The history of the WWTP including when it was originally commissioned, and any major changes or upgrades that have occurred since construction.*
* *Where recycled water is supplied to currently or where it is proposed to be supplied in the future. Note only summary information is needed in the introduction because detailed information on each use is added into Section 2.1).*

Aim

*List the aims of the document.*

This Risk Management Plan aims to:

* Align with the Australian Guidelines for Water Recycling (AGWR), 2006
* Support the application for the supply of recycled water.
* Document the management and control of the x WWTP to ensure that health and environmental risks associated with supplying recycled water are appropriately mitigated.

Glossary

*Provide a glossary for acronyms used throughout the RMP.*

Table 2: Glossary

|  |  |
| --- | --- |
| **Acronym** | **Description** |
| AGWR | Australian Guidelines for Water Recycling |
| CCP | Critical Control Point |
| Ct | Contact time |
| DEW | Department for Environment and Water |
| DHW | Department for Health and Wellbeing |
| EPA | Environment Protection Authority |
| LGA | Log Government Authority |
| LRV | Log Reduction Value |
| OPM | Onsite Preventative Measure – a measure put in place by the recycled water user to reduce the exposure of the public to the recycled water being used. |
| OTR | Office of the Technical Regulator |
| RMP | Risk Management Plan (aka RWMP) |
| RPZ | Reduced Pressure Zone |
| RWMP | Recycled Water Management Plan (aka RMP) |
| WIE | Water Industry Entity |
| WHS | Work Health Safety |
| WWTP | Wastewater Treatment Plant |
| UV | Ultra-violet |

References

*Provide a reference table for any documents or guidelines used or referred to in the RMP. The entries in the table below are helpful references for wastewater treatment, recycled water supply and recycled water use.*

Table 3: References

|  |  |  |
| --- | --- | --- |
| **Author** | **Title / Link** | **Date** |
| Australia and New Zealand Environment and Conservation Council. | [Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) - Volume 3 - Chapter 9 - Primary Industries](https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol3.pdf). | 2000 |
| National Resource Management Ministerial Council, Environment Protection and Heritage Council | [Australian Guideline for Water Recycling](https://www.waterquality.gov.au/sites/default/files/documents/water-recycling-guidelines-full-21.pdf) – Phase 1 | 2006 |
| G & M Connellan Consultants and IPOS consulting | [Code of Practice Irrigated Public Open Space](https://www.sawater.com.au/__data/assets/pdf_file/0020/40493/Code_of_Practice_Irrigated_Public_Open_Space_201015_standard-UPDATED.pdf) | 2015 |
| SA Local Government Association and SA Department for Health and Wellbeing. | [SA Community Wastewater Management System Design Criteria](https://www.lga.sa.gov.au/__data/assets/pdf_file/0034/554569/South-Australian-Community-Wastewater-Management-System-CWMS-Design-Criteria.pdf) | 2019 |
| WaterVal, Water Research Australia | [Guideline UV Disinfection](https://members.waterra.au/Members/Publications/WaterVal-/Guideline-UV-Disinfection.aspx) | 2017 |
| Office of the Technical Regulator | [Guidelines for non-drinking water in SA - infrastructure](https://www.lga.sa.gov.au/__data/assets/pdf_file/0030/554691/Guidelines-for-Non-drinking-Water-in-South-Australia,-Office-of-the-Technical-Regulator-OTR-Part-1-Infrastructure-2017.pdf) | 2017 |
| Office of the Technical Regulator | [Guidelines for non-drinking water in SA - on-site plumbing](https://www.lga.sa.gov.au/__data/assets/pdf_file/0037/554689/Guidelines-for-Non-drinking-Water-in-South-Australia,-Office-of-the-Technical-Regulator-OTR-Part-2-Onsite-Plumbing-2018.pdf) | 2017 |
| Water Industry Operators Association (WIOA) | [Practical Guides | WIOA](https://wioa.org.au/publications/practical-guides/) to Activated Sludge, Micro filtration and ultra-filtration, chlorine, and chloramine disinfection | various |
| WaterVal, Water Research Australia | [Protocol Chlorine Disinfection](https://members.waterra.au/Members/Publications/WaterVal-/Protocol-Chlorine-Disinfection.aspx) | 2017 |

Version history

*Provide a version table which identifies updates to the RMP.*

Table 4: Recycled Water Management Plan Version Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Revision** | **Author** | **Company** | **Description** |
| 01/01/2024 | 0.1 | Joe Bloggs | Water Company | First Draft |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1. Commitment to responsible use and management of recycled water quality

## 1.1 Recycled Water Responsibilities

*Provide an overview of the key stakeholders involved in managing the recycled water irrigation system and a summary of the responsibilities and key contacts in Table 5.*

Table 5: Responsible parties involved in the recycled water supply from X WWTP.

|  |  |
| --- | --- |
| **Stakeholders** | **Responsibility** |
| **Water Industry Entity supplying the recycled water.**  Water Industry Entity (WIE) | Owner and operator of the X WWTP, sewage and recycled water network.  Contact:  Name  Water Utility - Operations Manager  04587 412 213  [name@WIE.com.au](mailto:name@WIE.com.au) |
| **WWTP Maintainer**  Mechanical and Electrical Workshop | Maintainer of the X WWTP equipment and network infrastructure in X town.  Contact:  Name  Workshop Manager  0400 222 222  [name@workshop.com.au](mailto:name@workshop.com.au) |
| **Recycled Water User:**  User 1 | Recycled Water user at the oval and gardens in town X.  Contact:  Donna Dell  Parks and Gardens Manager  (08) 8777 3201  [doona.dell@council.com.au](mailto:doona.dell@council.com.au) |
| **Recycled Water User:**  User 2 | Recycled Water user at the lucerne farm.  Contact:  Farmer Name  Farm address  (08) 8123 1231  [farmer.joe@lucerne.com.au](mailto:farmer.joe@lucerne.com.au) |

## 1.2 Regulatory Requirements

*Identify the regulatory requirements for recycled water supply and use.*

Recycled water supply and use requires regulatory approvals to ensure that the irrigation of recycled water is safe and sustainable. Table 6 provide a list of legislation relevant to recycled water supply and use in South Australia. Table 7 provides a list of the regulatory approvals held by the supplier of recycled water and the user/s of recycled water.

Table 6: Recycled water legislation and regulation

|  |  |  |
| --- | --- | --- |
| **Components** | **Stakeholders** | **Responsibility** |
| **Regulatory and formal requirements** | DHW | Department for Health and Wellbeing: Regulators of public health protection who grant approval to supply or use recycled water as per [South Australian Public Health Act 2011](http://www.legislation.sa.gov.au/LZ/C/A/SOUTH%20AUSTRALIAN%20PUBLIC%20HEALTH%20ACT%202011.aspx) and [SA Public Health (Wastewater) Regulations 2013](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjtoe7E7tD_AhXByjgGHU9tDHsQFnoECBMQAQ&url=https%3A%2F%2Fwww.legislation.sa.gov.au%2F__legislation%2Flz%2Fc%2Fr%2Fsouth%2520australian%2520public%2520health%2520(wastewater)%2520regulations%25202013%2Fcurrent%2F2013.163.auth.pdf&usg=AOvVaw325QxYz7QD3vMJ-wnBsP67&opi=89978449). |
| EPA | Environment Protection Authority: Regulators of environmental protection as per the [Environment Protection Act, 1993](https://www.legislation.sa.gov.au/LZ/C/A/Environment%20Protection%20Act%201993.aspx). |
| OTR | Office of the Technical Regulator: Regulators of water and sewerage infrastructure standards and matters included in the Safety, Reliability, Maintenance, and Technical Management Plan ([SRMTMP](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjkkP3T69D_AhVXxzgGHSy1BT0QFnoECBQQAQ&url=https%3A%2F%2Fwww.energymining.sa.gov.au%2F__data%2Fassets%2Fpdf_file%2F0006%2F844134%2FPreparing-SRMTMPs-Water-industry.pdf&usg=AOvVaw3Pq6E4QyuKK3Z__z77ByW6&opi=89978449)) as per the Water Industry Act, 2012. |
| DEW | Department for the Environment and Water: Provider of licences for water extraction from the River Murray and Water Affecting Activities for use of ‘effluent’ while carrying on a business as per the [Landscapes SA Act, 2019](https://www.legislation.sa.gov.au/LZ/C/A/LANDSCAPE%20SOUTH%20AUSTRALIA%20ACT%202019.aspx).  Administrators and advisors of the [Water Industry Act 2012](https://www.legislation.sa.gov.au/__legislation/lz/c/a/water%20industry%20act%202012/current/2012.10.auth.pdf) responsible for regulating the water industry including water planning, pricing and management of water, sewerage and stormwater services, facilities and schemes.  Refer to[Department for Environment and Water - Legislation](https://www.environment.sa.gov.au/about-us/legislation) for further details. |
| PIRSA | Department of Primary Industries and Regions, South Australian. Regulators of the [Livestock Act, 1997](https://www.legislation.sa.gov.au/lz?path=%2FC%2FA%2FLIVESTOCK%20ACT%201997). Approval is required by PIRSA when supplying recycled water to crops consumed by livestock. |
| ESCOSA | Essential Services Commission of South Australia. Regulators of the [Water Industry Act 2012](https://legislation.sa.gov.au/LZ/C/A/WATER%20INDUSTRY%20ACT%202012.aspx). responsible for the economic regulation of water and sewerage services in SA including industry licensing, consumer protection and retail pricing. |

Table 7: Regulatory approvals for the supply of recycled water from Town X WWTP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Approval owner** | **Regulator** | **Approval ID** | **Date** | **Type** |
| WIE | DHW | x12345 | 01/01/2023 | Recycled water supply approval |
| WIE | EPA | V1249 | 01/04/2023 | EPA Licence |
| User 1 | DHW | W1234 | 02/05/2023 | Recycled water use approval |
| User 2 | DHW | D1234 | 08/06/2023 | Recycled water use approval |
| WIE | PIRSA | Letter | 22/03/2023 | Approval to supply recycled water to livestock |

# Assessment of the recycled water system

## 2.1 Intended uses and source of recycled water

### Source:

*Provide a summary of the following:*

* *the type of influent received at the WWTP (sewage, STEDS effluent or a mix),*
* *the sewage/STEDS catchment area*
* *the trade waste connections within the catchment area.*

### Use:

*Provide information on the current or intended future recycled water users. Include a statement about the typical months when recycled water is used.*

There are 3 connected recycled water users in town X which use the recycled water for irrigation. Typically, irrigation occurs between September to April. Details of the connected users are provided in Table 8 below.

Table 8: Recycled Water users irrigating with recycled water supplied from the X WWTP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Recycled Water User** | **Use** | **Location** | **Irrigation Type** | **DHW Use**  **Approval Number** |
| Sports Club | Oval Irrigation | 16 Smith St, Township | Spray – pop ups | z12345 - 30/01/23 |
| Council | Parks and garden irrigation | 20 Irrigation Ave, Township | Spray - Parks  Gardens - Drip irrigation | Y23456 – 11/11/23 |
| Farmer | Lucerne irrigation | 708 out of town Rd, Township | Pivot irrigation | V12454 – 14/07/23 |

## 2.2 Routes of exposure

*Identify the health and environmental exposure pathways.*

People and the environment can be exposed to recycled water via intended or unintended pathways.

###### Intended recycled water pathways include:

* Spray irrigation of lawns and gardens
* Pivot irrigation of lucerne
* Drip irrigation of native vegetation.

##### Unintended recycled water endpoints include:

* Watercourses or stormwater drains via irrigation runoff or pipeline bursts and leaks.
* Groundwater via infiltration of irrigated water into the underlying aquifer
* Drinking water supply via cross connection of recycled water network with drinking water supply.

##### Routes of human exposure include:

* Ingestion or skin contact of recycled water sprays.
* Ingestion of contaminated groundwater
* Ingestion of contaminated drinking water supply due to recycled water cross connection.
* Skin contacts with contaminated water courses.

##### Environmental endpoints include:

* Intentional: soils and plants
* Unintentional: groundwater and surface water catchments.

## 2.2 Recycled water system analysis

### Wastewater Treatment

*Provide an overview of the treatment processes used to produce recycled water from sewage. Include information on the treatment processes under the headings below (preliminary treatment, primary treatment etc). Remove any headings not applicable to your system. Include an explanation on how each barrier functions and where possible include photos or diagrams to explain the treatment process.*

*Include a site map and/or schematic/diagram of the overall treatment process and flow path.*

*Include a table which compares the design WWTP flow rates with the Annual Average Flow (AAF) and Peak Monthly Flow (Highest monthly flow) measured over the past 5 years (Refer to Table 11 below).*

Table 11: X WWTP Flows

|  |  |  |  |
| --- | --- | --- | --- |
| **WWTP Design Flow Rates (ML)** | | **Measured inflow over past 5 years (ML)** | |
| Average Dry Weather Flow (ADWF) or  Hydraulic Design Load (HDL) | Peak Dry Weather Flow (PDWF) or  Peak Design Flow (PDF) | Annual Average Flow (AAF) | Peak Monthly Flow (Highest monthly flow over 5 years) |
|  |  |  |  |

#### preliminary treatment:

[Examples include screens, grit removal, macerators]

*Include basic description/overview of the process.*

#### Primary Treatment:

*[examples include primary sedimentation, septic tanks, Imhoff tanks]*

*Include basic description/overview of the process.*

#### Secondary Treatment: activated sludge plants –

*[Examples include Bioreactors & Clarifiers, Sequencing Batch Reactors (SBR), IDEA, Oxidation Ditches, Membrane Bioreactors, Moving Bed Bioreactors and Trickling Filters]*

*Include basic description, aeration type and control, clarification type and control.*

#### Secondary Treatment: Lagoons

*[Examples include primary, aerated, facultative, maturation, or storage lagoons]*

*Include a description of the lagoon system including:*

* *The location of lagoon aerators (if installed).*
* *A diagram or photo illustrating the flow path, inlets, and outlets of the lagoon system.*
* *A table including the lagoon water heights (min. and max.) and lagoon volumes (See Table 12).*
* *A table including information on flow rates and detention times (see Table 13).*
* *Methods to prevent short circuiting e.g., baffles, lagoon configuration and location of inlet and outlets.*
* *Water balancing to prevent the lagoon overflow during high flow/winter periods.*
* *Detention time controls i.e., describe how detention time is monitored and controlled.*

Table 12: Lagoon type, water heights, and volumes of the X WWTP Lagoons

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Lagoon Number** | **Lagoon Type** | **Recycled water supplied from this lagoon** | **Operational Water level\* (m)** | **Freeboard/ Max water height (m)** | **Volume (ML) at the operational water level** |
| Lagoon 1 | Aerated | No | 1.5 | 1.6 | 24 |
| Lagoon 2 | Facultative | No | 1.5 | 1.6 | 25 |
| Lagoon 3 | Facultative | Yes | 1.1 | 1.6 | 23 |
| Lagoon 4 | Evaporation Lagoon | No | NA | 1.3 | NA |
| Total lagoon volume (prior to recycled supply) at minimum water height.  i.e., the minimum operational volume in the lagoons prior to recycled water supply | | | | | 72 |

\*For initial lagoons such as lagoon 1 and 2 in this example, include the level that the lagoon overflows into the subsequent lagoon. For the lagoon where effluent water is extracted for recycled water supply, use the minimum height that water can be drawn down to.

Table 13: Lagoon detention time calculations at annual average flow and peak monthly flow

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Unit** |
| Total Lagoon Volume at minimum water height | 72 | ML |
| Annual Average Flow (AAF) | 1030 | kL/day |
| Peak Monthly Flow\* | 1410 | kL/day |
| Detention time (AAF) | 70 | days |
| Detention time (Peak Monthly Flow) | 51 | days |

\*The highest volume recorded over a month, (converted into kL/day) over the past 5 years.

#### tertiary treatment:

*[Examples include Media Filters, Sand Filters, Disc Filters, Ultra-Filtration (UF) Membranes, Micro Filtration, Screens, Pressure Media Filters, Dissolved Aeration Floatation Filtration (DAFF)]*

*Include an overview of the system including a brief overview of any chemical dosing, backwashing, or other important cleaning mechanisms.*

#### DISINFECTION: CHLORINATION

*[Examples include chlorine gas, sodium hypochlorite, calcium hypochlorite, electro-chlorination]*

*Include information on the type of chlorine applied, dosing control, contact time, monitoring of chlorine residual or contact time (Ct).*

*If intending to claim virus reduction via chlorination include the online instrumentation that will continuously monitor free Cl residual, Contact time (Ct), pH, temperature, and turbidity in line with the Waterval* [*Protocol for Chlorine Disinfection, 2017*](https://members.waterra.au/Members/Members/Publications/WaterVal.aspx)*.*

#### DISINFECTION: UV DISINFECTIon

*Include information on the UV disinfection system installed including the following:*

* *The model and manufacturer of the UV disinfection system*
* *How the system is controlled*
* *The UV dose rate, UV Transmissivity and flow rate limits which align with the specific validation of the installed unit.*
* *The maximum UV lamp hours*
* *Include a diagram or photo of the UV system.*
* *A table of the technical specifications (usually found in the operational manual or operating philosophy).*

#### Recycled Water Supply:

*Explain how the treated effluent (following disinfection) is stored and distributed to connected recycled water users.*

*If recycled water is supplied to third parties, where does the WWTP operators’ responsibility end? Who controls the irrigation?*

*Include a map or diagram showing where the recycled water users are located.*

## 2.3 Assessment of water quality data

*For existing WWTPs, list what data will be used to evaluate the quality and performance of the wastewater treatment process e.g., laboratory data (external or on-site testing), online trends from SCADA and operational records from the past 5 years.*

*For new WWTPs, include the design water quality criteria that sets the expected recycled water quality range e.g., Total BOD <20mg/L, Suspended Solids <30mg/L, Ammonia as N < 1mg/L, Nitrite & Nitrate as N < 10 mg/L, Total Phosphorous <1mg/L, UV Dose > 58mJ/cm2, Total Cl >1mg/L, Free Cl Ct >9mg.min/L at pH<8, turbidity <2NTU and temperature>10˚C.*

## 2.4 Hazard identification and risk assessment

### 2.4.1 Hazards

*Identify the hazards in recycled water that could potentially affect human or environmental health. What might happen and how might it occur?*

The major health hazards for recycled water include:

* Microbiological pathogens (viruses, protozoa, bacteria, helminths), and
* Chemicals: inorganic and organic chemicals, pesticides, endocrine disrupters, pharmaceuticals, and disinfection by-products.

For environmental health, chemical hazards pose the greater risk and Table 4.2 in the AGWR, 2006 identifies 9 key chemical hazards (listed below) that should be considered when irrigating with recycled water:

Boron, cadmium, chlorine disinfection residuals, hydraulic loading (water), nitrogen, phosphorous, salinity, chloride, and sodium.

Table 14 provides a list of possible hazardous event that could occur which could lead to health or environmental risks.

Table 14: Hazardous events and controls

|  |  |
| --- | --- |
| **Task** | **Hazardous event** |
| Collection of sewage | * Sewerage burst. * Pump Station overflow * High sewage flow event * Flooding |
| Treatment of sewage | * Treatment failure * Toxic inflow/shock causing microbiological die-off. * Blockage/pipe burst. * Power failure * SCADA failure * Equipment/instrument failure * Disinfection failure |
| Storage of recycled water | * Toxic algal bloom growth * Regrowth of pathogens in tanks * Stagnant/septic conditions in tanks |
| Distribution of recycled water | * Pump station failure * Network bursts/leaks * Biofilm growth |
| Irrigation with recycled water | Public Health:   * Ingestion of sprays/irrigated produce * Contact with recycled water e.g., irrigated grass. * Backflow of recycled water into drinking water via cross connection   Environment:   * Excessive irrigation causing run-off and pooling. * Nutrient build-up in irrigated soils * Salinisation of soils * Contamination of waterways or groundwater |

### 2.4.2 Risk assessment

*Assess the risks associated with the supply of recycled water to the intended users and provide discussion under the subheadings below.*

*For information on recycled water risk assessments, refer to -* [*Overview of the Australian Guidelines for Water Recycling: Managing Health and Environmental Risks 2006 (waterquality.gov.au)*](https://www.waterquality.gov.au/sites/default/files/documents/overview-water-recycling-guide-21a.pdf)

#### 2.4.2.1 Health Risk Assessment:

**Microbiological Risks:**

*Identify the Log Reduction Values (LRV) required for connected and proposed recycled water users.*

*LRVs are used to express the reduction of pathogens via a wastewater treatment process or an on-site preventative measure (OPM). The AGWR outlines the required LRV for a particular end use e.g., Municipal irrigation, based on a calculation of tolerable risk to the public (Refer to Section 3.3 of the* [*AGWR 2006*](https://www.waterquality.gov.au/sites/default/files/documents/water-recycling-guidelines-full-21.pdf) *for further details).*

*Table 15 includes the LRVs required for the 5 recycled water use categories defined in the AGWR. Delete the categories not applicable to this specific supply site being described in this RMP. For uses that fall outside of these categories e.g., industrial use, consultation with DHW is required to determine what LRVs are required.*

Microbial hazards for human health include enteric viruses, protozoa, and bacteria.

For X WWTP, recycled water is supplied to a sporting oval, to the council’s parks and gardens for irrigation and to a farmer for pivot irrigation of lucerne. Irrigation of ovals, parks and gardens is categorised as municipal irrigation, while irrigation of lucerne is categorised as a non-food crop.

The LRVs required for these end uses, are listed in Table 15 (AGWR, 2006).

Table 15: Required Log Reduction Values (LRVs) for supplying recycled water to the irrigation area/s.

|  |  |  |  |
| --- | --- | --- | --- |
| **Recycled Water Use Categories as defined in the AGWR (2006)** | **Log Reduction Values (LRV)** | | |
| **Virus** | **Protozoa** | **Bacteria** |
| Dual Reticulation, toilet flushing, washing machines, garden use, fire hydrants | 6.5 | 5.0 | 5.0 |
| Municipal Use: open space, sports grounds, golf courses, dust suppression | 5.0 | 3.5 | 4.0 |
| Commercial Food Crops | 6.0 | 5.0 | 5.0 |
| Non-food crops – trees, turf, woodlots, flowers | 5.0 | 3.5 | 4.0 |
| Landscape Irrigation – trees, shrubs, public gardens | 5.0 | 3.5 | 4.0 |

*Identify the LRVs achieved via wastewater treatment barriers and by on-site preventative measures applied by the user. Refer to Appendix A: Guide to applying default Log Reduction Values for wastewater treatment barriers, and Appendix B: on-site preventative measures.*

*The application of LRVs should be negotiated and confirmed with DHW during the concept design phase of new projects. For historic systems where the LRV application is unknown, consultation with DHW is required to determine how LR’s can be applied.*

Table 16 provides the LRVs of the recycled water system (WWTP and recycled water application) at town X. The LRVs meet the minimum required for each recycled water use category, indicating that recycled water is suitable for its intended purpose.

Table 16: Log Reduction Values applied to wastewater treatment barriers at the X WWTP and to user-applied on-site preventative measures.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Barrier type** | **Location** | **Barrier** | **Log Reduction Value** | | |
| **Virus** | **Protozoa** | **Bacteria** |
| **Wastewater Treatment Barriers** | X WWTP | Primary treatment in residential Septic Tank (STEDS) | 0.0 | 0.0 | 0.0 |
| Lagoon detention > 50 days | 1.0 | 1.0 | 1.0 |
| Chlorine Disinfection | 0.0 | 0.0 | 1.0 |
| **Total LRV for the WW Treatment Barriers:** | | | **1.0** | **1.0** | **2.0** |
| **Onsite Preventative Measures** | Spray irrigation of a Sporting Oval | Restrict public access during irrigation | 2.0 | 2.0 | 2.0 |
| No access after irrigation until dry | 1.0 | 1.0 | 1.0 |
| > 25m buffer distance | 1.0 | 1.0 | 1.0 |
| ***LRV required for Municipal Irrigation, AGWR 2006*** | | | ***5.0*** | ***3.5*** | ***4.0*** |
| **Total LRV: Oval irrigation (Onsite Preventative LRV + WWTP LRV)** | | | **5.0** | **5.0** | **6.0** |
| **Onsite Preventative Measures** | Spray irrigation of parks and gardens | Restrict public access during irrigation | 2.0 | 2.0 | 2.0 |
| No access after irrigation until dry | 1.0 | 1.0 | 1.0 |
| Spray drift control | 1.0 | 1.0 | 1.0 |
| ***LRV required for Municipal Irrigation, AGWR 2006*** | | | ***5.0*** | ***3.5*** | ***4.0*** |
| **Total LRV: Parks and Gardens (WWTP + OPM LRV)** | | | **5.0** | **5.0** | **6.0** |
| **Onsite Preventative Measures** | Pivot Irrigation of lucerne for fodder production\* | Restrict public access during irrigation | 2.0 | 2.0 | 2.0 |
| No access after irrigation until dry | 1.0 | 1.0 | 1.0 |
| > 25m buffer distance | 1.0 | 1.0 | 1.0 |
| ***LRV required for Non-food Crop, AGWR 2006*** | | | ***5.0*** | ***3.5*** | ***4.0*** |
| **Total LRV: Fodder (WWTP + OPM LRV)** | | | **5.0** | **5.0** | **6.0** |

\*Irrigation of recycled water for livestock purposes is regulated by PIRSA and requires adequate helminth reduction as per the guidance in Table 3.9 of the AGWR 2006. In this WWTP example, helminth reduction is achieved by having > 25-day detention in a lagoon. Recycled water must not be used in pig production.

**Cyanobacteria Risk:**

*Assess the risks caused by cyanobacteria growth in wastewater lagoons or recycled water storages.*

Cyanobacteria, also called blue green algae, are photosynthetic bacteria that commonly grow or ‘bloom’ in wastewater lagoons and recycled water storages. These water bodies have favourable conditions which support the growth of cyanobacteria, including warm temperatures, high nutrients, and low turbulence.

Cyanobacteria blooms usually appear as a blue/green paint-like layer or scum on the lagoon surface. Often concentrating at the edge of the lagoon.

Some species of cyanobacteria produce cyano-toxins, which can cause health impacts to humans or animals exposed to the affected water.

At X WWTP, cyanobacteria typically appear in the final lagoon on an annual basis during the summer months. Since 2017 there has been x years where the toxic species [*Microcystis flos-aquae]* has bloomed between January and June. During this 5-year period the toxin concentrations have ranged between x and y µg/L of microcystin m-LR equivalent which has the potential to be harmful if animals or humans were to ingest the affected water.

#### 2.4.2.2 Environmental risks:

*Assess the environmental risks associated with using recycled water at the intended irrigation sites. This can be achieved by comparing the recycled water quality results with the short-term and long-term irrigation guideline limits listed in Table A5.1 b of the AGWR 2006, or by specifically addressing the 9 key environmental hazards identified in the Table 4.3 of the AGWR, 2006.*

*The management of environmental risks associated with the application of recycled water, such as leaching into the groundwater, soil health, plant health and yield are the responsibility of the end user/land owner of the irrigation site and should be managed in accordance with national guidelines (see links below). The supplier of recycled water can take responsibility for providing connected users with recycled water quality information so that they can sustainably irrigate.*

[Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1), 2006](https://www.waterquality.gov.au/sites/default/files/documents/water-recycling-guidelines-full-21.pdf)

[Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) - Volume 3 - Chapter 9 - Primary Industries](https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol3.pdf).

# Preventative measures for recycled water management

## 3.1 Preventative measures and multiple barriers

*Preventative measured can be performed to reduce recycled water risks to humans and to the environment.*

*List the relevant preventative measures that will be applied to mitigate each of the following risks categories.*

### 3.1.1 Health

*Examples include multiple treatment barriers at the WWTP, trade waste control program to reduce the likelihood of toxic chemicals entering the WWTP, on-site preventative measures at the irrigation site, signage, spray drift control, WH&S measures to protect operators, contractors and irrigators, backflow prevention & adherence to plumbing codes and standards.*

Preventative measures include:

### 3.1.3 Environment

*Examples include monitoring for leaks/ bursts, prevention of irrigation run off, pooling and nutrient/salt overloading etc.*

Preventative measures include:

## 3.2 Critical Control Points

*Define a critical control point (CCP). Refer to Section 2.3.2 of the AGWR for guidance.*

*Include a table showing the critical control points at the WWTP with their critical limits clearly outlined. Note there should be a CCP for each treatment barrier where a LRV (pathogen reduction) is claimed in Table 16.*

*Do not include operational parameters or verification monitoring that are not CCPs in this table. BOD, SS and E. coli results are used for verification, and are not CCPs. Operational and verification monitoring should be discussed in section 4 of the RMP.*

A Critical Control Point (CCP) is an activity, procedure, or process where control can be applied that is essential for preventing or reducing risk to an acceptable level.

A critical limit is a prescribed tolerance of the Critical Control Point that distinguishes acceptable from unacceptable performance. Exceeding a critical limit represents a loss of control of a process and indicates there may be an unacceptable health or environmental risk (AGWR, 2006).

At X WWTP, both the lagoons and the chlorine disinfection system are used to reduced pathogens as described in Table 16. These barriers must be continuously controlled within the critical limits listed in Table 17 to ensure the recycled water supply from X WWTP is safe for its intended use.

Table 17: Critical Control Points for X WWTP

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Critical Control Point** | **Hazard** | **Monitoring Location/s** | **Parameter** | **Target** | **Critical Limit** |
| Lagoons | Pathogens:  Virus, protozoa, bacteria | Inflow rate and lagoon volume | Detention time | >66 days | ≥50 days  < 1.1 m in Lagoon 3 at peak monthly flow |
| Chlorination | Pathogens:  Virus, & Bacteria | End of contact pipe | Total Chlorine Residual | >1<5 mg/L | ≥1 mg/L |

# Operational procedures and process control

## 4.1 Operational procedures

*Include a list of the operational procedures in place (or to be developed for new plants) and a brief statement about how they’re used e.g., daily operations, wastewater sampling (external analysis), wastewater testing (onsite analysis), instrument calibration etc.*

## 4.2 Operational monitoring

*Outline how the WWTP is operated and maintained including:*

* *the minimum frequency that operator’s attend the WWTP each week,*
* *an overview of the WWTP automation e.g., is there SCADA or online monitoring and control?*
* *the online instruments used to monitor/control the process,*
* *an overview of the onsite operator testing conducted routinely to monitor and control the WWTP e.g., pH, MLSS, SVI, conductivity, Cl residuals, UVT or turbidity.*
* *the routine operator records e.g., flow rate or total, detention time, pump hours, lagoon levels etc.*

## 4.3 Operational corrections

*Include a description of what the operator should do when test results are out of specification or alarms are received? Who do operator report to?*

*Include a table listing the operational monitoring points and corrective actions that should be applied if results deviate out of spec.*

Table 18: Operational limits and possible corrective actions at X WWTP

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WWT Barrier** | **Sample Location** | **Parameter** | **Frequency** | **Target** | **Possible Corrective Actions** |
| Secondary Treatment – Lagoons | Final lagoon | Level | Weekly | >0.6 < 1.3 m | Review water balance.  Restrict recycled water extraction to ensure adequate detention time. |
| Detention time | >50 days |
| BOD soluble | <20 mg/L | Review loading BOD levels.  Consider introducing aeration into the lagoons.  Consider loading and design |
| Disinfection | After chlorine contact tank | Total Cl | >1mg/L | Check/clean/flush chlorine residual and pH instruments.  Calibrate instruments if required.  Increase chlorine dose if required to meet residual target.  Consider seasonal influences on Cl demand from algae, pH, turbidity, and temperature changes. |
| pH | 6.5 – 9 |
| E. coli | <1000 MPN/100mL |
| TDS | <1500 mg/L | Review influent TDS. Consider possibility of groundwater infiltration or excessive evaporation. |

## 4.4 Equipment capability and maintenance

*Describe how the maintenance of WWTP equipment and instruments are managed. Include a weekly or monthly scheduled for online instrument calibration and maintenance.*

## 4.5 Materials and chemicals

List the bulk chemicals and their maximum quantities stored at the WWTP.

Table 19: Chemicals storage at X WWTP

|  |  |
| --- | --- |
| **Chemical** | **Maximum quantity stored onsite** |
|  |  |
|  |  |
|  |  |

# Verification of recycled water quality and environmental performance

## 5.1 Recycled water quality monitoring

*Include a brief statement about the purpose of the verification monitoring program.*

*Include a table identifying the sample frequency of testing performed at a NATA accredited laboratory.*

*Identify the type of samples collected e.g., grab samples or 24hr composite samples.*

*Include a map or diagram showing the sample point locations and their names/ID.*

Table 20: Verification monitoring at X WWTP.

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample Location** | **Sample ID** | **Parameter** | **Frequency:**  **Tests / year** |
| X WWTP Lagoon 3 effluent | 12345 | BOD soluble\*, Conductivity & TDS, pH | Monthly |
| Ammonia as N, Nitrite + Nitrate as N, Nitrogen - Total, TKN as N, Phosphorus – Total.  Algal count\*\* | Monthly |
| Metals (full metal suite) | Quarterly |
| X WWTP Effluent after chlorine | 23456 | Chlorine – Free, Chlorine Total\*,  E. coli\* | Fortnightly |

\*Mandatory monitoring parameters required to be tested by DHW at a NATA accredited laboratory at a minimum frequency prescribed in the DHW approval.

\*\*In the event of a cyanobacteria bloom, an algal count test would inform on the dominant cyanobacterial species present. Once this is known, a specific cyanotoxin test can be performed to determine the concentration of the cyano-toxin.

## 5.2 Application site and receiving environment monitoring

*Outline who will be responsible for the environmental management of the irrigation areas. Either explain how the receiving environments that will be monitored e.g., soils, groundwater, and plants, or refer to where this information can be found e.g., Irrigation Management Plan.*

## 5.3 Satisfaction of users of recycled water

*Explain who communicates with the end user (irrigator/s) and how complaints or issues will be dealt with.*

## 5.4 Short term evaluation of results

*Explain who is responsible for reviewing recycled water quality results internally and how they will engage with the operators to report on the performance.*

*List the requirements for regulatory reporting e.g., DHW requires recycled water quality results to be submitted annually.*

## 5.5 Corrective responses

*Discuss the process taken when operational monitoring criteria or wastewater/recycled water quality results are found to be out of specification. e.g., resampling, further testing, investigation of SCADA trends, discussion with WWTP supervisor, WWTP adjustments, recording and reporting.*

*How do you ensure timely rectification of plant performance?*

# Management of incidents and emergencies

*Provide information on the planned management of incidents and emergencies for the WW system being described in this RMP.*

*Add a table that lists the incident criteria where DHW notification would be required. Priority type 1 and type 1 incident criteria pose the highest risk to the public and requires immediate notification to DHW. Type 2 incidents pose a lesser health risk and would require notification to DHW within 24hrs. The requirement for specific incident criteria should be discussed with DHW.*

The planned response to a range of potential emergency situations is documented in the X WWTP Emergency Response Plan. The plan includes power outages, fires, chemical spills, network bursts and leaks, blockages, flooding, lagoon overflow, chemical shortages, and major process failure.

Table 21 lists the incident criteria where notification to DHW is required to be notified due the potential for health risks to the public.

Priority Type 1 and Type 1 incidents require immediate notification to DHW via phone (1300 043 215), and within 24 hrs via the [CWMS Incident Notification Form](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fforms.sa.gov.au%2F%23%2Fform%2F62d64194ad9c5c60149c182a&data=05%7C01%7CGretchen.Marshall%40sa.gov.au%7Cd8074f68569e450dc0d308dbc53f1edb%7Cbda528f7fca9432fbc98bd7e90d40906%7C1%7C0%7C638320647107564972%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=3A%2B5H4BJ0rY4ma0Z64UiZcJ8Q%2BuaK26inXxJlSy4zmQ%3D&reserved=0). Type 2 incidents require notification via email or an I-apply form within 24 hrs. No phone call required. DHW contact details (24hr reporting): [healthwastewatermanagement@sa.gov.au](mailto:healthwastewatermanagement@sa.gov.au), Phone: 1300 043 215.

Table 21: Incident criteria for wastewater and recycled water systems

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Approval Limit or Target** | **Type 2 Incident** | **Type 1 Incident** | **Priority Type 1 Incident** |
| E. coli (MPN/100mL) | a.) <1  b.) <100  c.) <1000  d.) <10,000 | a.) >4  b.) >400  c.) >4000  d.) > 40,000 | a.) >10  b.) >1000  c.) >10,000  d.) > 100,000 |  |
| Wastewater discharges | No discharge | Discharge of >5kL <100 kL of wastewater (treated or untreated) due to a failure within the wastewater system | Discharge of ≥100 kL of wastewater (treated or untreated) due to a failure within the wastewater system | >1 kL of discharge of wastewater (treated or untreated) or sludge to an area with public access and potential for high-risk exposure e.g., drinking water source, childcare facility, school, aged care, markets, commercial food preparation areas, recreational areas. |
| Cross connection | No cross connections of recycled water with drinking water without adequate backflow prevention. |  | Detection of a cross-connection or misconnection where there is a potential for recycled water to contaminate a drinking water network. | Detection of a cross-connection or misconnection where it is confirmed that recycled water has contaminated the drinking water network. |

# Operator, contractor and end user awareness and training

*Provide an overview of operator, contractor, and end user training.*

*How will operators be trained in this RMP and any relevant recycled water approvals?*

# Community involvement and awareness

*Discuss if there has been community consultation about the wastewater treatment plant and the recycled water use.*

# Validation, research and development

## 9.1 Validation of processes

*Validation refers to the specific testing of a discreet treatment barrier under maximum/peak/ultimate design conditions (e.g., maximum flow, peak loading etc) to determine how well it can reduce specific pathogens (typically viruses and or protozoa).*

*Validations of a treatment barrier or process is required when:*

* There is a desire to claim a LRV for a treatment barrier where defaults LRV’s cannot be applied or when the barrier is likely to achieve a higher LRV than the default value.
* When there is notable change to a validated barrier (aka ‘revalidation’).

*Consultation with DHW is required before the validation to seek endorsement on the validation methodology and after validation, to approve the Log Reduction Value demonstrated during the validation.*

*If no validation work has occurred, state that there are no validations planned at this site.*

*Where validation has occurred, include an overview of the validation work conducted for each validated barrier. Include the resultant LRV and the references to the methodology and final validation report.*

## 9.2 Investigative studies and research monitoring

*Include information on any relevant research conducted on the wastewater treatment plant or recycled water system (supply or use).*

# Documentation and reporting

*Explain where operator records, water quality data, plant drawings/schematics and procedures are stored.*

*Who is responsible for collating annual reports and submitting them to regulators?*

# Evaluation and audit

*Explain who reviews the long-term wastewater treatment performance and how compliance with the recycled water regulatory approvals is checked internally.*

# Review and continuous improvement

*Detail how often this RMP be reviewed and updated. As a minimum, RMP should be reviewed every 2 years and submitted to DHW on a 5 yearly basis.*

# Appendix A: Guide to applying default Log Reduction Values for wastewater treatment barriers

Table 22 below provides a guideline to assign Log Reduction Values (LRVs) to wastewater treatment barriers. For barriers that don’t fit with the default criteria identified below, DHW consultation is required.

The LRVs included in Table 22 are conservative default values that DHW are likely to approve in the absence of a validation. DHW may credit higher LRV’s if a barrier specific validation is conducted which confirms a higher level of pathogen reduction is achieved during maximum stress. Without a validation, the default values can be applied for well operated wastewater treatment barriers which meet the water quality objectives and onsite operational controls specified below.

Table 22: Default Log Reduction Values (LRV) for Wastewater Treatment processes

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WWTP** | **Log Reduction Values (LRV)** | | | **External NATA accredited.**  **lab analysis** | | **Onsite operator testing, attendance, and control** | | |
| **Treatment Barrier** | **Virus** | **Protozoa** | **Bacteria** | **Water Quality Objectives** | **Monitoring Frequency Minimum\*** | **Operator onsite tests / checks** | **Minimum Operator attendance** | **Required Controls** |
| Secondary Treatment via Activated Sludge Processes | 0.5 | 0.5 | 1.0 | BOD total <20 mg/L  SS <30 mg/L | Monthly | MLSS, pH, SVI  Ammonia, SS | Weekly | Online aeration monitoring and alarming.  Online flow monitoring.  Online dissolved oxygen monitoring & alarming\*. |
| >50 days lagoon detention  (Following primary treatment) | 1.0 | 1.0 | 1.0 | Soluble BOD <20 mg/L | Monthly | Lagoon level  Flow | Weekly | Controls to ensure lagoon detention criteria is **always** met e.g., minimum water levels in final lagoon, pumping interlocks etc.  Short circuiting prevention |
| >25 days lagoon detention  (Following secondary treatment) | 0.5 | 0.5 | 0.5 | Soluble BOD <20 mg/L | Monthly | Lagoon level  Flow | Weekly |

\*Required controls for new or upgraded Activated Sludge Plants (ASPs). For existing ASPs, the control specified in the DHW approval is valid, however improved controls may be required in the event of poor performance.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **WWTP** | **Log Reduction Values (LRV)** | | | **Instrumentation** | **Onsite operator testing, attendance, and control** | | |
| **Treatment Barrier** | **Virus** | **Protozoa** | **Bacteria** | **Online Monitoring** | **Operator onsite tests / checks** | **Minimum Operator attendance** | **Required Controls** |
| Chlorine disinfection with a Free Cl Ct. | 1 – 4\* | 0.0 | 1 - 4 | Free Cl residual, Ct pH, temperature &  turbidity in line with Table 25. | Cl, pH, turbidity instrument crosschecks/calibrations. | 2 / week. | Chlorine dosing control with Free Cl Ct monitoring. |
| Chlorine disinfection with total Cl residual. | 0.0 | 0.0 | 1.0 | Total Cl residual after a specified contact time. | Total Cl residual  Flow rate. | Weekly. | Chlorine dosing control and Total Cl residual monitoring. |
| UV Disinfection of a pre-validated system. | 0.5 - 4 | 0.5 - 4 | 0.5 - 4 | UV Transmissivity  UV Intensity  Flow  UV Dose. | UVT instrument cleans/crosschecks.  Lamp hours. | 2 / week. | Online monitoring and control of UV dose rate.  Refer to Appendix D: Pathogen reduction via UV Disinfection. |
| Filtration. | No default values - validation required to claim LRV. | | | To be determined. | | | |
| Membrane Bioreactor (MBr) | 1.5\*\* | 2.0\*\* | 4.0\*\* | Bioreactor DO, pH, temperature, flow.  Membrane flux, TMP and Turbidity | Instrument crosschecks and calibration.  Sludge age, HRT, MLSS. | 2 / week. | Online monitoring and control of MBr including aeration, filtration, scouring. |
| Reverse Osmosis. | No default values - validation required to claim LRV. | | | To be determined. | | | |

\*\*In line with the Tier 1 approach in the MBr validation protocol (WaterVal, 2017).

# Appendix B: on-site preventative measures

The onsite preventative measures required for the use of recycled water is dependent on the quality of the recycled water being supplied. Lower quality water has a higher pathogen concentration, requiring more onsite preventative measures by the end user to reduce the exposure of the recycled water to the public. In contrast, when the recycled water is a higher quality (achieving >5-6 log reduction of viruses, protozoa, and bacteria at the WWTP), less onsite restrictions are required to safely use the water.

Table 23 below provides a list of possible onsite preventative measures that can be employed by the end user with their corresponding log reduction values. At a minimum all WWTPs must achieve secondary treatment and adequate E. coli reduction for the proposed end use, and the recycled water system (WW Barriers and onsite preventative measures) must achieve the total required LRVs prescribed for the intended end use in line with Table 3.7 of AGWR 2006. For municipal spray irrigation, a maximum of 4 log reduction can be applied for onsite preventative measures.

Table 23: LRV assigned to onsite preventative measures.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **End Use** | **Onsite Preventative Measures (OPM)** | **Demonstrated by** | **Protecting** | **Log Reduction Value (LRV)** |
| Dual Reticulation | Cross connection controls | Plumbing audits, lilac pipe, signage and information for residents, network quality monitoring. | Drinking water | TBD by DHW |
| Municipal Irrigation | No access during irrigation | Night time spray irrigation with signage informing that recycled water is on use. | Public in the vicinity | 2.0 |
| No access after irrigation, until dry | 1.0 |
| > 25 m buffer distance | >25 m between the outer irrigation area and publicly accessed areas e.g., roads, walkways, buildings, play equipment and public BBQs | 1.0 |
| Spray drift control | Low through sprinklers with large droplets, inward throwing sprinklers on the boundary, vegetation screen, anemometer switching. | 1.0 |
| Drip irrigation | Irrigation of plants via dripping from an irrigation pipeline. No spray, run off or pooling. | 4.0 |
| Subsurface irrigation | Irrigation installed below the surface. No spray, run off or pooling | 5.0 |
| Commercial Food Crops | Drip or subsurface irrigation of raised crops. | Irrigation of fruit/nut trees and vines via dripping from an irrigation pipeline.  No spray, run off or pooling.  Harvested crops are above the irrigation line.  No harvest of fallen or wet produce. | Consumers | 5.0 |
| Crops with no ground contact and skins removed | e.g., Irrigation of citrus, nuts, and avocados | 4.0 |
| Crops with no ground contact and heavily processed | e.g., Irrigation of grapes for wine production, cereal crops | 5.0 |
| Crops cooked/processed before consumption | e.g., Irrigation of potatoes | 5.0 |
| 1 day withholding period between irrigation and sale |  | 0.5 |
| No access during irrigation | Irrigation area is fully fenced and signed to keep the public out, or  Irrigation occurs at night time with signage informing that recycled water is in use. | Public in the vicinity | 2.0 |
| No access after irrigation, until dry | 1.0 |
| >25m buffer distance | >25 m between the outer irrigation area and publicly accessed areas e.g., roads, walkways, buildings. | 1.0 |
| Spray drift control e.g., low throw, inward through, vegetation screen, no spray in windy conditions | Low through sprinklers with large droplets, inward throwing sprinklers on the boundary, vegetation screen, anemometer switching. | 1.0 |
| Drip irrigation | Irrigation of plants via dripping from an irrigation pipeline. No spray, run off or pooling. | 4.0 |
| Subsurface irrigation | Irrigation installed below the surface. No spray, run off or pooling | 5.0 |
| Non-food crops, trees, turf, woodlots, flowers | No access during irrigation | Irrigation area is fully fenced and signed to keep the public out, or  Irrigation occurs at night time with signage informing that recycled water is in use. | Public in the vicinity | 2.0 |
| No access after irrigation, until dry | 1.0 |
| >25m buffer distance | >25 m between the outer irrigation area and publicly accessed areas e.g., roads, walkways & buildings. | 1.0 |
| Spray drift control e.g., low throw, inward through, vegetation screen, no spray in windy conditions | Low through sprinklers with large droplets, inward throwing sprinklers on the boundary, vegetation screen, anemometer switching. | 1.0 |
| Extended buffer distances > 50 m | >50 m between the outer irrigation area and publicly accessed areas e.g., roads, walkways, buildings, play equipment and public BBQs | 5.0 |
| Drip irrigation | Irrigation of plants via dripping from an irrigation pipeline. No spray, run off or pooling. | 4.0 |
| Subsurface irrigation | Irrigation installed below the surface. No spray, run off or pooling | 5.0 |
| Landscape irrigation – trees, shrubs, public gardens etc | No access during irrigation | Irrigation area is fully fenced and signed to keep the public out, or irrigation occurs at night time with signage informing that recycled water is in use. | Public in the vicinity | 2.0 |
| No access after irrigation, until dry | 1.0 |
| >25m buffer distance | >25 m between the outer irrigation area and publicly accessed areas e.g., roads, walkways, and buildings | 1.0 |
| Spray drift control | Low through sprinklers with large droplets, inward throwing sprinklers on the boundary, vegetation screen, anemometer switching. | 1.0 |
| Extended buffer distances > 50 m | >50 m between the outer irrigation area and publicly accessed areas e.g., roads, walkways, buildings, play equipment and public BBQs | 5.0 |
| Drip irrigation | Irrigation of plants via dripping from an irrigation pipeline. No spray, run off or pooling. | 4.0 |
| Subsurface irrigation | Irrigation installed below the surface. No spray, run off or pooling | 5.0 |

Table 24 provides an example of the assignment of log reduction values for onsite preventative measures achieved for the Golf Course. Each subsequent user of recycled water supplied from X WWTP must be able to consistently achieve 4 log reduction by the onsite preventative measures listed in Table 23.

Table 24: Onsite preventative measure required by a Golf Course

|  |  |  |
| --- | --- | --- |
| **Onsite preventative measure achieved by the Golf Course** | **Category** | **Log Reduction Value (LRV)** |
| Spray irrigation between 10pm and 4am | No access during irrigation and  No access after irrigation until dry | 2 |
| Sprinkler circles are > 30 m away from the boundary of the golf course, with inward throwing sprinklers along the boundary. | > 25m Buffer distance | 1 |
| No spray in windy conditions with anemometer switching to turn off the irrigator when wind speeds are >15km/hr. | Spray drift control | 1 |
| Total LRV for Onsite Preventative Measures = | | 4 |

# Appendix C: Chlorination for virus reduction

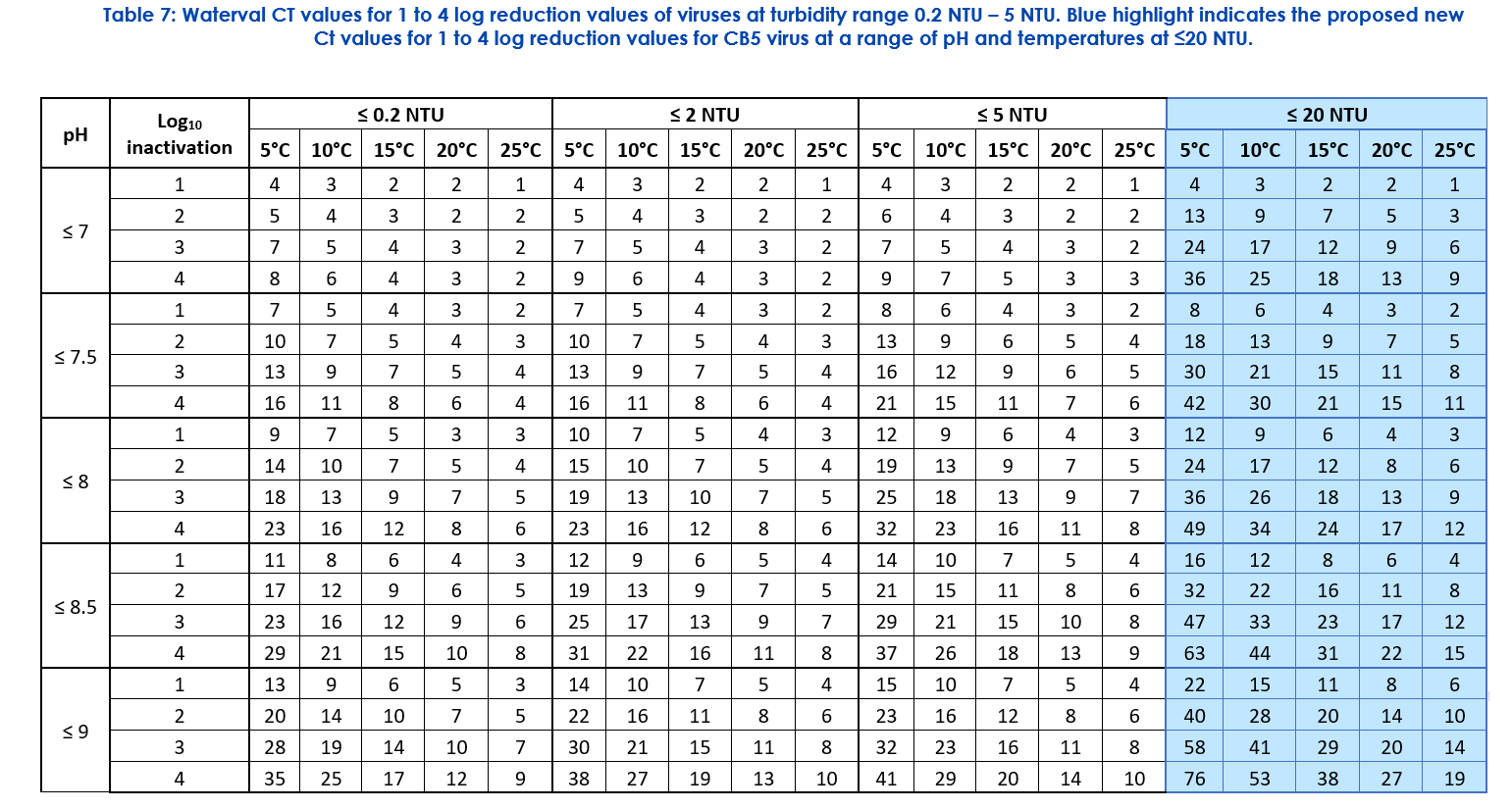
1 to 4 log reduction of viruses can be claimed via chlorination if there is adequate control and monitoring of the chlorination system, and the free chlorine contact time (Ct) is continuously monitored and maintained in the treated effluent in line with the Ct prescribed in the table below for a specific pH, turbidity, and temperature. pH and free Cl residual should be monitored online after a dedicated contact time (typically between 10 -30 minutes). Turbidity and temperature can be measured online before or after chlorine is dosed.

For further details refer to:

[Validation protocol for Chlorine Disinfection, WaterVal 2017](https://members.waterra.au/Members/Members/Publications/WaterVal.aspx)

[Guide to the measurement and use of Ct, WIOA 2019](https://wioa.org.au/wp-content/uploads/2019/10/Guide-to-the-measurement-and-use-of-Ct.pdf)

Table 25: Free Chlorine Ct required for 1-4 log reduction of viruses at varying pH, temperatures, and turbidity ranges (P. Reeve CT expansion report for 1 to 4 log reduction of viruses, 2022)



# Appendix D: Pathogen reduction via UV Disinfection

Up to 4 log reduction can be claimed for virus, protozoa, and bacteria reduction via UV disinfection of a ‘pre-validated’ UV Disinfection system.

Pre-validated UV systems must be validated using the approved methodology outlined in either the:

1. United States Environmental Protection Agency (USEPA) 2006, *Ultraviolet disinfection guidance manual for final long term 2 enhanced surface water treatment rule*, or
2. German Association for Gas and Water 2006, *UV disinfection devices for drinking water supply – requirement and testing*

Refer to the WaterVal [Guideline UV Disinfection, Feb 2017](https://members.waterra.au/Members/Publications/WaterVal-/Guideline-UV-Disinfection.aspx) for an overview of the validation process and an explanation of the differences between the two methods.

For the USEPA method, the table below provides the UV dose rates required to inactivate 0.5 - 4 log reduction of Cryptosporidium, Giardia, and viruses.

Table 26: UV doses required to achieve various log reduction values for target pathogens (WaterVal UV Disinfection Guideline, 2017)

