ONSITE WATER REUSE PROGRAM GUIDEBOOK

IMPLEMENTING ONSITE WATER REUSE IN AUSTIN

Austin WATER

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Austin Water

INTRODUCTION TO ONSITE WATER REUSE SYSTEMS

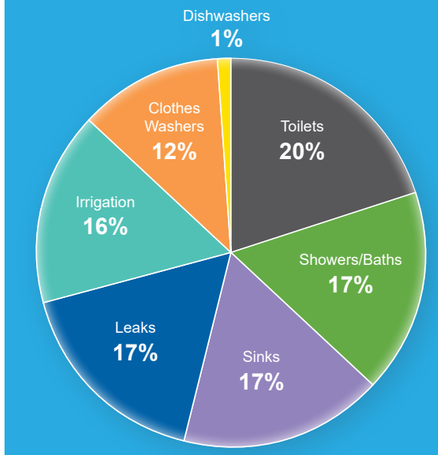
Purpose

Onsite water reuse systems (OWRS), sometimes referred to as water recycling systems, when properly designed and operated, make efficient and safe use of water that would otherwise be diverted to a treatment plant or water body. Recognizing this fact, the City of Austin adopted the Onsite Water Reuse System Ordinance in December of 2020. It added Chapter 15-13 to the City of Austin Code, to regulate the collection, treatment, and use of alternative water sources for non-potable uses in multi-family and commercial buildings. This guide helps developers, architects, and design engineers navigate the City of Austin's newly developed regulations. It also describes incentives for installation and provides general design guidance.

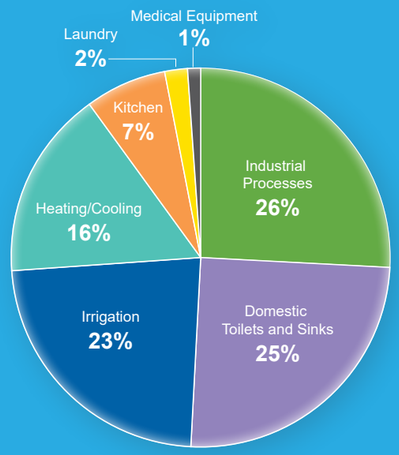
Background

For more than 100 years, Austin Water has been committed to providing, safe, reliable, high quality and sustainable water to our customers. Austin Water currently treats drinking water from the Colorado River at three treatment plants located along Lakes Austin and Travis. In an effort to maintain a sustainable water supply for future generations, Austin Water is committed to reducing its water demands through conservation programs, and to promote efficient and resilient water systems that will help mitigate the effects of future droughts.

Recognizing that a significant portion of water use at multi-family residential and commercial developments (irrigation/outdoor, heating/cooling, clothes washing, toilet flushing and certain industrial processes) could be met by a non-potable supply, Austin Water provides rebate incentives for property owners who install certain types of onsite collection and water reuse systems at their property.



Average Multi-Family Residential Usage in Austin



Average Commercial Usage in Austin

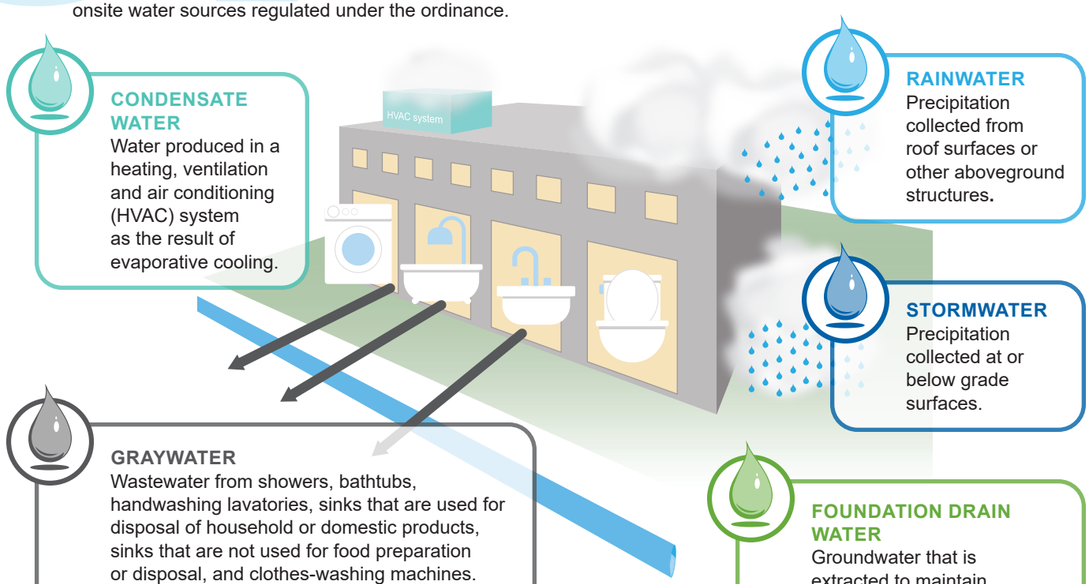
Why Implement Onsite Water Reuse

Implementing an onsite water reuse system into a development project requires additional permitting steps and increases a project's capital cost. So, one might ask, why would a developer choose to include an OWRS in their project? It turns out there are a number of potential benefits that make it the right choice for a project:

- **Get reimbursed for project costs.** Austin Water has several incentive programs for implementing onsite water reuse. Most notably, Austin Water is currently administering a pilot incentive program which makes up to $500,000 available to each project that includes an OWRS if the system can offset sufficient potable water demand. See page 31 for more information on Austin Water's incentive programs.
- **Increase the project's value.** Data shows that sustainable homes are not only in high demand among potential renters and homebuyers, but people are also willing to pay more per month for a sustainable home, including homes with water saving technology.
- **Reduce a site's utility rates.** By reusing water that would otherwise go into the City's sewer or stormwater infrastructure, the project can reduce its ongoing wastewater and drainage charges. By reducing the potable water demand, the project will have lower water bills.
- **Contribute to Austin's long-term sustainability.** Austin is a rapidly developing city with new people and businesses moving here every day. In order to sustain that growth, Austin needs to carefully manage its limited water resources. By reducing a project's potable water demand, you help ensure that water will be available for continued growth.
- **Add resiliency elements.** Supplemental water sources can provide an extra layer of security for buildings and their tenants during climate-related catastrophic events, such as droughts or severe storms, which may cause disruptions in water service delivery.
- **Stay ahead of the curve.** To date, only projects with a total air conditioning system cooling capacity of 200 tons or greater are required to install an OWRS. However, the City's adopted Water Forward Plan has recommended that OWRS become a requirement for new commercial and multi-family developments over 250,000 square feet by the end of 2023. By including an OWRS into a project now, the developer will become familiar with the future requirements, and even have a hand in shaping them. When the new requirements roll out, architects and design engineers will be prepared.

Alternative Onsite Waters and End Uses

The Onsite Water Reuse System Ordinance allows for the usage of several alternative onsite water sources that can be collected from commercial and multi-family buildings. See the schematic below for a description of alternative onsite water sources regulated under the ordinance.



CONDENSATE WATER
Water produced in a heating, ventilation and air conditioning (HVAC) system as the result of evaporative cooling.

RAINWATER
Precipitation collected from roof surfaces or other aboveground structures.

STORMWATER
Precipitation collected at or below grade surfaces.

GRAYWATER
Wastewater from showers, bathtubs, handwashing lavatories, sinks that are used for disposal of household or domestic products, sinks that are not used for food preparation or disposal, and clothes-washing machines. Graywater does not include wastewater from the washing of material, including diapers, soiled with human excreta or wastewater that has come into contact with toilet waste.

FOUNDATION DRAIN WATER
Groundwater that is extracted to maintain a building's or facility's structural integrity and would otherwise be discharged to the storm sewer.

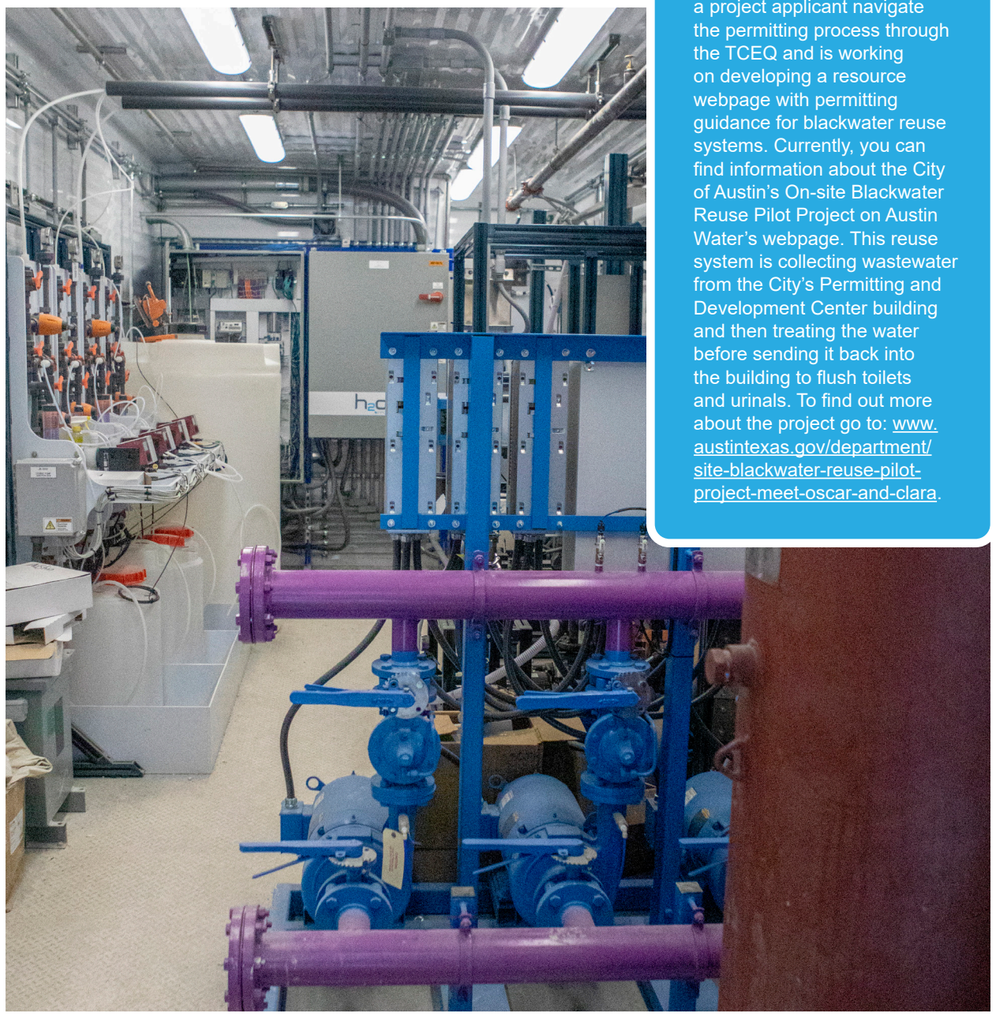
These onsite alternative water sources can be treated and reused to meet the following non-potable end uses:

Indoor Uses:	Outdoor Uses:
Toilet and urinal flushing	Subsurface irrigation
Clothes washing	Drip or other surface non-spray irrigation
Trap priming	Spray irrigation
Indoor water features/ fountains	Outdoor water features/ fountains
Fire protection	Cooling applications
	Dust control/street cleaning

While the Onsite Water Reuse Program provides a permitting framework for larger commercial, mixed-use, and multi-family developments, Austin Water also encourages the use of alternative water sources in single-family and two-unit homes through its residential rainwater and graywater programs. For more information, visit: www.austintexas.gov/department/rebates-tools-programs.

Other Alternative Onsite Water Systems

Other types of alternative onsite water systems are currently allowed to be used in multi-family and commercial buildings in Austin, but they are regulated by the Texas Commission on Environmental Quality (TCEQ) and therefore not included in the City of Austin's Onsite Water Reuse System Ordinance. These include systems constructed for industrial and closed loop process water reuse, and systems constructed for blackwater or domestic wastewater reuse. Regulations for these types of reuse systems can be found in Chapter 210 of Title 30 of the Texas Administrative Code.



Help Available

Austin Water offers project assistance to customers who are interested in blackwater reuse. The Austin Water Onsite Water Reuse team can help a project applicant navigate the permitting process through the TCEQ and is working on developing a resource webpage with permitting guidance for blackwater reuse systems. Currently, you can find information about the City of Austin's On-site Blackwater Reuse Pilot Project on Austin Water's webpage. This reuse system is collecting wastewater from the City's Permitting and Development Center building and then treating the water before sending it back into the building to flush toilets and urinals. To find out more about the project go to: www.austintexas.gov/department/site-blackwater-reuse-pilot-project-meet-oscar-and-clara.

PERMITTING ONSITE WATER REUSE SYSTEMS

Permitting Overview

All new multi-family or commercial development projects applying for a building permit on or after December 20, 2020 are required to obtain approval from Austin Water before installing an onsite water reuse system. The requirements for obtaining an OWRS approval and operating permit are outlined in Chapter 15-13 of the City of Austin Code. All application materials can be found on the Austin Water OWRS webpage at www.austintexas.gov/department/onsite-water-reuse-systems.

The permitting and approval process for OWRS projects is integrated into the City's overall building permit process. These projects involve coordinated reviews between Austin Water Onsite Water Reuse (AW-OWR), Austin Water Special Services Division (AW-SSD), Development Services Department Commercial Plan Review (DSD-CPR), and Development Services Department Building Inspections Division (DSD-BID). For district-scale projects with private plumbing located in the City's right-of-way, Office of Real Estate Services (ORES) review will also be required.

The table on the following page shows the various departments' roles in each step of the permitting of an OWRS project, which are explained in greater detail following this section.

	Applicant	City of Austin Review and Approval
Design Approval	**STEP 1** Submit an OWRS Application and Water Balance Calculator	**AW-OWR:** Approves OWRS application and informs project of next steps depending on system type
	STEP 2 Submit an Onsite Water Reuse Implementation Plan[1]	**AW-OWR:** Approves Implementation Plan for district-scale systems
	STEP 3 Submit an OWRS Engineering Report[2]	**AW-OWR:** Approves engineering report for treatment system design
	STEP 4 Obtain Encroachment Agreement[3]	**ORES:** Approves encroachment agreements for OWRS with infrastructure located within the public right-of-way
	STEP 5 Obtain Building Permits	**AW-SSD:** Approves auxiliary water source plans to protect the City's drinking water supply from the non-potable water system **DSD-CPR:** Approves building plans and ensures the OWRS meets the City's Plumbing Code
Construction Inspections	**STEP 6** System Construction and Inspection	**DSD-BID:** Inspects the building construction, including mechanical, electrical and plumbing systems and signs off on the project
	STEP 7 Cross-Connection Control Test and Inspection	**AW-OWR:** Conducts OWRS certification inspection and signs off on the project **AW-SSD:** Verifies third-party cross-connection inspection and test have been performed and signs off on the project
Ongoing Monitoring and Reporting	**STEP 8** Submit Documentation for a Permit to Operate[2]	**AW-OWR:** Issues the Permit to Operate in Conditional Start Up Mode
	STEP 9 Operate in Conditional Start Up Mode[2]	**AW-OWR:** Reviews monthly monitoring reports and approves OWRS to Operate in Final Use Mode
	STEP 10 Operate in Final Use Mode[2]	**AW-OWR:** Reviews annual monitoring reports and renews OWRS annual permit **AW-SSD:** Verifies backflow assemblies are tested annually and cross-connection test is performed at least once every four years

[1] *This step is only applicable to district-scale projects that share plumbing across property lines*
[2] *This step is only applicable only to projects with indoor uses and/or outdoor spray type uses*
[3] *This step is only applicable to projects with piping or other components in the public right-of-way*

Projects with Non-Spray Type Irrigation Uses

OWRS projects that reuse alternative onsite water only for subsurface or non-spray irrigation pose very minimal risk to human health and safety since the water is used just at or just below the ground surface. Accordingly, these projects have a simplified approval process and do not require an engineered treatment system for approval, nor do they require an operating permit with the associated ongoing monitoring and reporting requirements. Step 3 and steps 7 through 10 in the permitting and approval process are omitted.

Projects with Indoor Use and/or Outdoor Spray Type Use

OWRS projects that reuse alternative onsite water either for indoor fixtures or outdoor spray type uses where there is a potential for human contact, pose a greater risk to human health and safety since the water could be incidentally ingested. These projects are required to undergo all 10 of the review and approval steps. This process has three stages: design approval, construction inspections, and ongoing monitoring and reporting.

Design Approval

STEP 1

Submit an OWRS Application and Water Balance Calculator to AW-OWR

Each project (including projects with non-spray type irrigation only) must first prepare a Water Balance Calculator and Onsite Water Reuse System Application. The application provides an overview of the project's OWRS and the available alternate water supplies and proposed non-potable end uses.

Tips on preparing an OWRS Application and Water Balance Calculator:

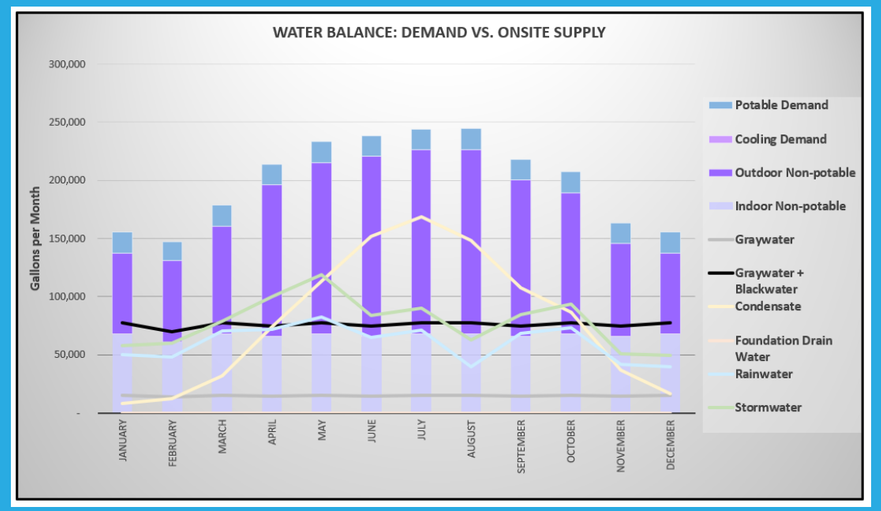
- Utilize the Water Balance Calculator to fill out the OWRS Application form.
- The application fee must be paid for the application to be complete (no fee is required for projects with only non-spray type irrigation uses).
- Austin Water will accept Water Balance Calculators with modifications made to the calculator's default assumptions for occupancy, fixture flow rates, or others if backup documentation is provided at the time of submittal.
- Re-submit a OWRS Application form and Water Balance Calculator if a project's design changes.
- Projects with only non-spray type irrigation will be required to submit a landscape irrigation plan that shows the type of irrigation system that will be installed

Upon approval of the OWRS Application, Austin Water will inform the project of the next steps.

PERMITTING ONSITE WATER REUSE SYSTEMS

Example Water Balance Calculator Output

Austin Water's Water Balance Calculator tool provides monthly estimates of onsite water supplies available to a project and compares them to non-potable demands. Users can design an OWRS that matches selected supplies to selected demands for their project.



STEP 2

Submit an Onsite Water Reuse Implementation Plan to AW-OWR (applicable only to district-scale systems)

OWRS can be designed for a variety of scales, including for a single building or for a district. Sharing alternative water sources within a district-scale development project can provide greater efficiencies for onsite water reuse. District-scale projects are subject to additional requirements given the complexity of design, phasing, and implementation.

District-scale projects must submit an Onsite Water Reuse System Implementation Plan to AW-OWR. The plan must be prepared in accordance with the Onsite Water Reuse System Implementation Plan Checklist, which includes, but is not limited to:

- Schematic layout of OWRS components
- Details on the OWRS
- Estimated potable and non-potable water supplies and demands
- Estimated discharges to the sewer system
- Proposed ownership model and compliance plan
- Phasing for implementation of district-scale project

District-scale projects must also execute an enforceable legal agreement that defines the roles and responsibilities of the supplier and user(s). In addition to having a treatment system manager responsible for the district-scale system, each property shall designate a site supervisor to oversee operation and maintenance of their portion of the district-scale project, including distribution and/or collection systems. The site supervisor is also responsible for acting as a liaison between the users of the treated water, Treatment System Manager and AW-OWR.

STEP 3

Submit an Engineering Report to AW-OWR

All OWRS projects must submit an Engineering Report to AW-OWR, except projects that reuse an alternative water source solely for subsurface irrigation or for surface non-spray irrigation.

Engineering Reports must be prepared by a qualified engineer licensed in TX, following the AW-OWR template and include information on the following project elements:

- Alternative water sources collected and treated for non-potable end uses
- Entity or entities involved in the design, treatment, operation, and maintenance of the OWRS
- Treatment processes used to meet required water quality criteria
- Demonstration of compliance with the pathogen log reduction targets
- Information on operating conditions and continuous online monitoring
- Cross-connection and backflow prevention measures
- Contingency plan and system bypass that will allow the system to divert to the sewer

AW-OWR approval of the Engineering Report is required to obtain building permit approval from DSD-CPR, so it's recommended to submit the Engineering Report for review and approval in advance of the project's building permit application.

STEP 4

Obtain Encroachment Agreement from ORES (applicable only to systems with piping or other components in the public right-of-way)

OWRS with infrastructure located within the public right-of-way (such as a sidewalk or street) are required to obtain an Encroachment Agreement from the City of Austin - Office of Real Estate Services (ORES). This review ensures there are no potential public utility conflicts with the OWRS.

STEP 5

Obtain Building Permits from DSD-CPR and Plan Approval from AW-SSD

After approval of the Engineering Report by AW-OWR, the project must obtain a building permit from the Development Services Department. This step requires review and approval of the Auxiliary Water Source Plan Review by AW-SSD and a Commercial Plan Review by DSD-CPR. These reviews verify that the OWRS meets the City of Austin's Plumbing Code requirements, and that the OWRS is designed to protect the City's drinking water supply. Once the building permit is obtained, the OWRS can be constructed.

Planning Ahead with Alternate Methods of Compliance

Buildings with OWRS will be required to undergo initial and periodic cross-connection testing to ensure separation between the potable and non-potable water systems. A typical two-sided cross-connection test involves draining both the potable water system and the non-potable water system in a building and then re-pressurizing these systems one at a time to ensure there is no interconnection between the two systems. This requires a building to be without water services for a substantial amount of time. Having an Alternate Method of Compliance (AMOC) approved during the Auxiliary Water Source Plan Review process can eliminate the need to shut down a building during a cross-connection test. Two examples of acceptable AMOCs are dye injection tests (useful for testing indoor fixtures) and one-sided shut-down tests (useful for testing outdoor irrigation systems).

A dye injection system is a relatively inexpensive apparatus that allows the cross-connection test to be performed by injecting a dye into the non-potable distribution system while keeping both the potable water system and the non-potable water system online. A one-sided shutdown test can be performed on an irrigation system when the building's potable water line is encased in flowable fill from the meter to the building. The AW Auxiliary Water Source Plan Review team can recommend other acceptable AMOCs on a case-by-case basis.

Construction Inspections

STEP 6

System Construction and Inspection from DSD-BID

During construction, the project must obtain all necessary building inspections from DSD-BID, including a plumbing inspection, to verify that the OWRS meets the City of Austin Plumbing Code requirements.

For more information on scheduling building inspections, visit: www.austintexas.gov/page/schedule-inspection.

STEP 7

Cross-Connection Control Test and Inspection from AW-SSD and AW-OWR (CCT)

Prior to starting up any OWRS, a cross-connection test is required to ensure separation between the building's non-potable and potable water systems. The test must be completed by a state licensed Customer Service Inspector (CSI) or Water Supply Protection Specialist (WSPS) who is registered with AW-SSD. When the test is complete, the inspector will certify the results using the CCT Form. This completed form can be submitted electronically to AW-SSD. A list of companies and individuals registered with AW-SSD to perform a CCT is available at www.austintexas.gov/department/onsite-water-reuse-systems.

With an approved AMOC (as described in Step 5) the cross-connection test can be performed without having to shut down a building. This makes the recurring cross-connection tests specified in the table below less of a burden on a building operator:

Cross-Connection Inspection and Testing Requirements

Before conditional startup[1]	Every 4 years	After major plumbing alteration

[1] *For new construction, cross-connection test must be performed for building to receive Temporary Certificate of Occupancy (TCO)*

OWRS Certification Inspection

Once the OWRS is constructed, the project engineer must conduct a final inspection in support of preparing a Construction Certification Letter. AW-OWR staff must be present for the project engineer's final inspection to get a walk-through of the OWRS components for project sign-off.

The Construction Certification Letter must be submitted to AW-OWR certifying that the OWRS was installed in accordance with the approved Engineering Report. If system modifications were made during construction, the letter must detail the changes. The Construction Certification Letter must be provided on company letterhead, signed, and stamped by a Texas licensed engineer.

Contact AW-OWR at AW_OnsiteReuse@austintexas.gov to schedule the final inspection.

STEP 8

Submit Documentation for a Permit to Operate from AW-OWR

Once steps 1 through 6 are completed, the project must submit to AW-OWR:

- The engineer's Construction Certification Letter
- A final operation and maintenance manual
- Proof of a contract with a certified laboratory
- Proof of a contract with the designated treatment system manager
- Treatment system manager affidavit acknowledging sufficient skills, abilities and training
- Documentation of an enforceable legal agreement (applicable only to district-scale projects)
- A change of ownership form (if the property has been transferred to a new owner)
- Pay the annual permit fee to receive the permit to operate (fee must be paid annually)

Once the above materials have been submitted, AW–OWR will issue a permit to operate the OWRS. Projects that reuse an alternative water source solely for subsurface irrigation or for surface non-spray irrigation do not need to obtain a Permit to Operate.

Operation and Ongoing Monitoring

STEP 9

Operate in Conditional Start Up Mode

Operation in Conditional Startup Mode for a minimum of 90 days is required for all systems. The requirements are summarized below. If a project does not complete the requirements for conditional startup within 365 days of the permit issuance, the permit will expire, and a new application must be submitted to and approved by AW-OWR.

Requirements for Conditional Startup Operation:

- Verify that log reduction targets are met
- Verify compliance with water quality standards – BOD, TSS, total coliform, etc.
- Divert treated water to sewer (air-conditioning condensate systems and rainwater systems may be allowed to forego or end bypass conditions prior to the end of the conditional startup mode)
- Supply end uses with potable water
- Operate in final plumbing configuration with an approved cross-connection test completed
- Confirm all alarms and diversions work as described in the Engineering Report
- Treatment System Managers must submit monthly monitoring reports of water quality sampling and system performance to AW-OWR:

Summary of Conditional Startup Water Quality Sampling Requirements			
Parameter	**Rain/Condensate**	**Stormwater/ Foundation Drain**	**Graywater**
Total Coliform	Weekly for rainwater	Weekly	Weekly
BOD5 & TSS	N/A	N/A	Weekly
Chlorine Residual	Continuously at entry to end-use plumbing		
LRTs	Continuously as specified in the engineering report		
Flow	Continuously measuring alternative water treated by the OWRS		

STEP 10

Operate in Final Use Mode with AW-OWR Approval

After satisfying the requirements of Conditional Startup Mode, an OWRS will be operated in Final Use Mode. To maintain a valid permit to operate, ongoing monitoring and reporting are required for OWRS to ensure systems are properly working and continuously protecting public health. If a treatment process is being used to achieve log reduction targets, continuous online monitoring of treatment process performance via surrogate parameters is required. Examples of continuous monitoring methods for common treatment processes can be found on page 16.

In Final Use Mode, Treatment System Managers must submit annual monitoring reports of water quality sampling and system performance to AW-OWR:

Summary of Final Operating Permit Water Quality Sampling Requirements			
Parameter	**Rain/Condensate**	**Stormwater/ Foundation Drain**	**Graywater**
Total Coliform[1]	Monthly	Monthly	Monthly
BOD5 & TSS	N/A	N/A	Monthly
Chlorine Residual	Continuously at entry to end-use plumbing		
LRTs	Continuously as specified in the engineering report		
Flow	Continuously measuring alternative water treated by the OWRS		

[1] *Total coliform monitoring may be eliminated after 12 consecutive months of consistent compliance.*

Lastly, in accordance with the approved operations and maintenance manual, the OWRS must be regularly inspected and tested to verify that the system is operating correctly, meets permit requirements, and remains physically separated from the potable water system. Backflow prevention assemblies must be tested annually, and cross-connection tests must be conducted at least every four years.

DESIGNING ONSITE WATER REUSE SYSTEMS

Treatment System Requirements

The Engineering Report is used to document how a project's treatment system complies with the requirements for OWRS. This includes detailed information on the treatment processes and how they are used to meet the water quality criteria for allowed alternative water sources and end uses. In addition to physical and chemical water quality requirements, projects must demonstrate compliance with the pathogen log reduction targets, or LRTs, listed below, which represent the minimum requirements for the removal or inactivation of pathogens including viruses, protozoa, and bacteria.

Log Reduction Targets for Onsite Water Reuse Systems

Alternate Water Source	Enteric Virus	Parasitic Protozoa	Bacteria
Condensate Water	--	--	--
Rainwater	--	--	3.5
Stormwater	3.5	3.5	3.0
Stormwater Outdoor Use Only	3.0	2.5	2.0
Foundation Drain Water	3.5	3.5	3.0
Foundation Drain Water Outdoor Use Only	3.0	2.5	2.0
Graywater	6.0	4.5	3.5
Graywater Outdoor Use Only	5.5	4.5	3.5

To meet the LRTs and other water quality requirements, projects should design an effective treatment train which may include the use of common treatment processes such as microfiltration (MF), ultrafiltration (UF), membrane bioreactor (MBR), ultraviolet light (UV) disinfection, and chlorination. The Engineering Report should detail how the treatment train will achieve pathogen reduction credits in order to meet the LRTs, including addressing any validation and ongoing monitoring requirements related to the treatment processes. Austin Water will review each project's Engineering Report and accept pathogen reduction credits based on established crediting frameworks such as those developed for drinking water, potable reuse, and non-potable reuse.

The following table provides example pathogen reduction credits for common treatment processes and example information that must be submitted with the project's Engineering Report. Other treatment processes may be used within the treatment train and Austin Water will assess pathogen reduction credits on a case-by-case basis.

Example Pathogen Reduction Credits for Treatment Processes

Example Treatment Process	Maximum Log Reduction Credits Virus/ Protozoa/Bacteria	Example Information to be Included in an Engineering Report	Example Continuous Monitoring Requirements
Microfiltration or Ultrafiltration	0/4/0	Description and calculation of how the system defines an acceptable pressure decay test value per the EPA's Membrane Filtration Guidance Manual to detect 3.0 µm breach	▪ Daily pressure decay test ▪ Effluent Turbidity
Membrane Biological Reactor (MBR)	1.5/2/4	Operation within the Tier 1 operating envelope as defined in the AWRCE Membrane bio-reactor, WaterVal validation protocol	▪ Effluent Turbidity
Reverse Osmosis	Up to 2/2/2	Demonstration of ability to meet salt rejection criteria and a description of surrogate parameter used to calculate pathogen reduction credits	▪ Influent and Effluent Total Organic Carbon (TOC) ▪ Influent and Effluent Electrical Conductivity
Ultraviolet (UV) Light Disinfection	Up to 6/6/6	UV reactor's validation report following US EPA UV Disinfection Guidance Manual or NSF/ANSI 55 Class A validation and demonstration of ability of system to meet criteria to achieve specified UV dose	▪ UV intensity ▪ Flow rate
Chlorine Disinfection	Up to 5/0/5	Demonstration of ability to achieve a target CT[1] including description of chlorine contactor, contact time provided, and monitoring of chlorine residual	▪ Free chlorine residual ▪ Flow rate
Ozone Disinfection	Up to 4/3/4	Demonstration of ability to achieve a target CT[1] including description of ozone contactor, contact time provided, and monitoring of ozone residual	▪ Ozone residual ▪ Flow rate

[1] *CT = disinfectant residual concentration (C) x contact time (T)*

Additional Water Quality Requirements for Graywater Systems

High concentrations of organics will be present in many sources of graywater. As a result, biological treatment is required for graywater systems to reliably meet the treated water biological oxygen demand (BOD) limit of 25 mg/L and the total suspended solids (TSS) limit of 30 mg/L. Using biological treatment to reduce BOD and suspended solids will help:

- Improve reliability of pathogen reduction performance in downstream processes such as UV, chlorine, or ozone disinfection
- Increase operational reliability of downstream processes such as membrane filtration, reverse osmosis, or UV disinfection
- Minimize issues with aesthetics (color and odor)
- Minimize regrowth of microorganisms (including Legionella) in the distribution system

The list below provides biological treatment technologies that can reduce BOD and TSS in an onsite graywater system:

- Membrane Biological Reactor (MBR)
- Engineered Wetland
- Sequencing Batch Reactor
- Moving Bed Biofilm Reactor
- Conventional Activated Sludge
- Biofilter

A MBR can provide the dual-benefit of reducing organics concentrations and providing pathogen reduction credit under an existing crediting framework (see example graywater treatment trains).

The following sections provide guidance on how to credit common treatment processes, create effective treatment trains to meet the LRTs, and document the validation and ongoing monitoring requirements.

DESIGNING ONSITE WATER REUSE SYSTEMS
03

Example Treatment Trains

The following pages provide example treatment trains to illustrate how unit processes can be used to meet the LRTs and other water quality requirements. Also shown are the parameters that must be continuously monitored at critical control points to ensure treatment system performance and demonstrate the ability of each treatment process to achieve the pathogen reduction credits. Treatment trains shown here are for planning purposes only. An engineer licensed in Texas and experienced in water and wastewater treatment must prepare the Engineering Report documenting the treatment train and its ability to meet the water quality and monitoring requirements.

Treatment train selection will depend on project-specific factors such as source water, space constraints, and end uses. Common treatment train elements are shown here.

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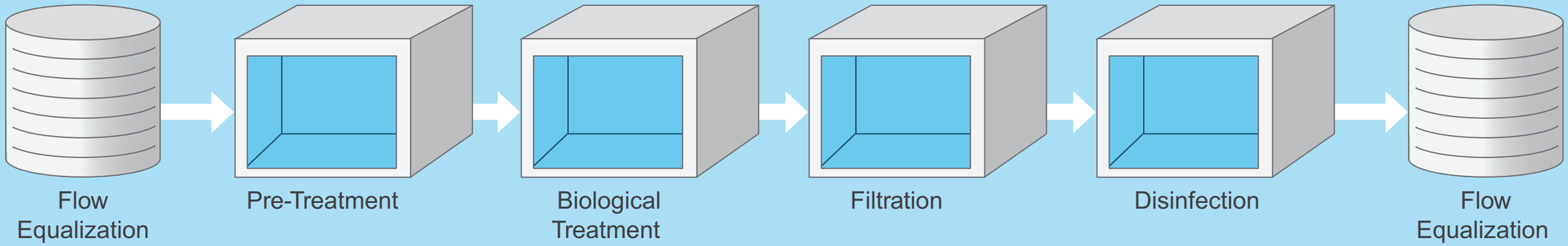


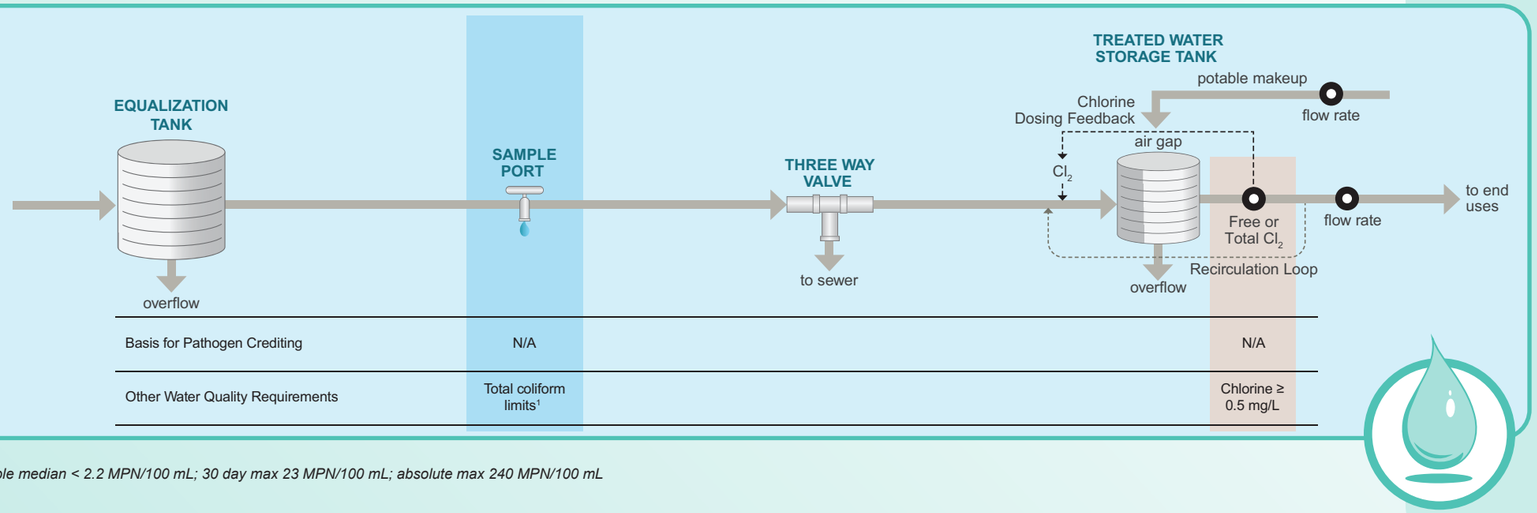
Considerations for selecting appropriate treatment processes include:

- Source water quality entering the treatment system
- Water quality standards
- Solids management
- Site constraints including footprint and access
- Energy usage
- Economics (both capital and operating costs)
- Aesthetics (i.e. color and odor)
- Ease (or complexity) of operation and maintenance
- Reliability to ensure uptime and production

DESIGNING ONSITE WATER REUSE SYSTEMS
03

Example Treatment Trains

1. CONDENSATE SYSTEM (INDOOR USE)

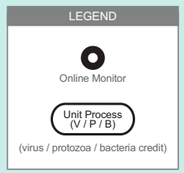


[1] *7-sample median < 2.2 MPN/100 mL; 30 day max 23 MPN/100 mL; absolute max 240 MPN/100 mL*

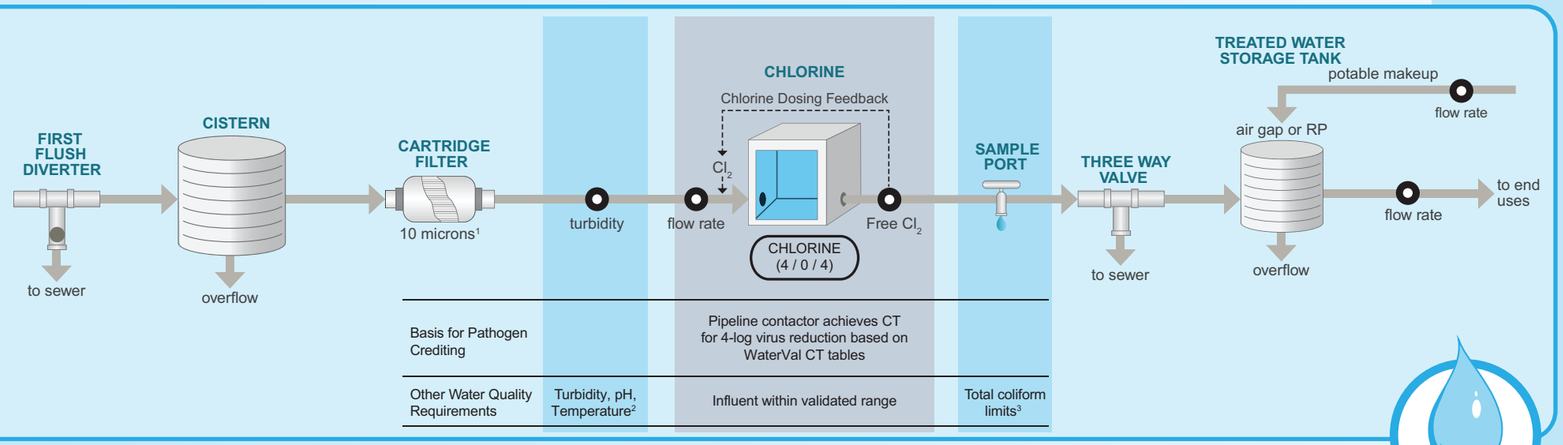
There are no pathogen LRTs for air conditioning condensate water, so a condensate-only OWRS has a simplified treatment train. The only treatment required is secondary disinfection with chlorine, ozone, ultraviolet radiation, or other approved agent where the reuse water has a potential for human contact. For indoor uses, specifically, chlorine dosing to maintain a 0.5 mg/L residual for storage and distribution is required.

Chlorine dosing for residual satisfies secondary disinfection requirement (as shown in this example)

Pathogen Crediting Summary		
	Required	**Total**
Virus	N/A	0
Protozoa	N/A	0
Bacteria	N/A	0



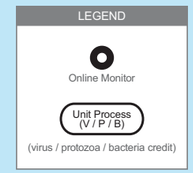
2. RAINWATER SYSTEM (OUTDOOR USE)



[1] *Level of filtration may need to be adjusted to meet turbidity requirements*
[2] *Turbidity, pH, and Temperature requirements WaterVal table*
[3] *7-sample median < 2.2 MPN/100 mL; 30 day max 23 MPN/100 mL; absolute max 240 MPN/100 mL*

For rainwater, the only specified LRT is for bacteria. In this example, the use of chlorination with free chlorine with a validated CT value can achieve pathogen reduction credits and can meet the LRT for bacteria if certain influent water quality conditions are met. The inclusion of a cartridge filter upstream of the chlorination unit provides pre-treatment to improve the quality of the water prior to disinfection and helps meet the turbidity limits.

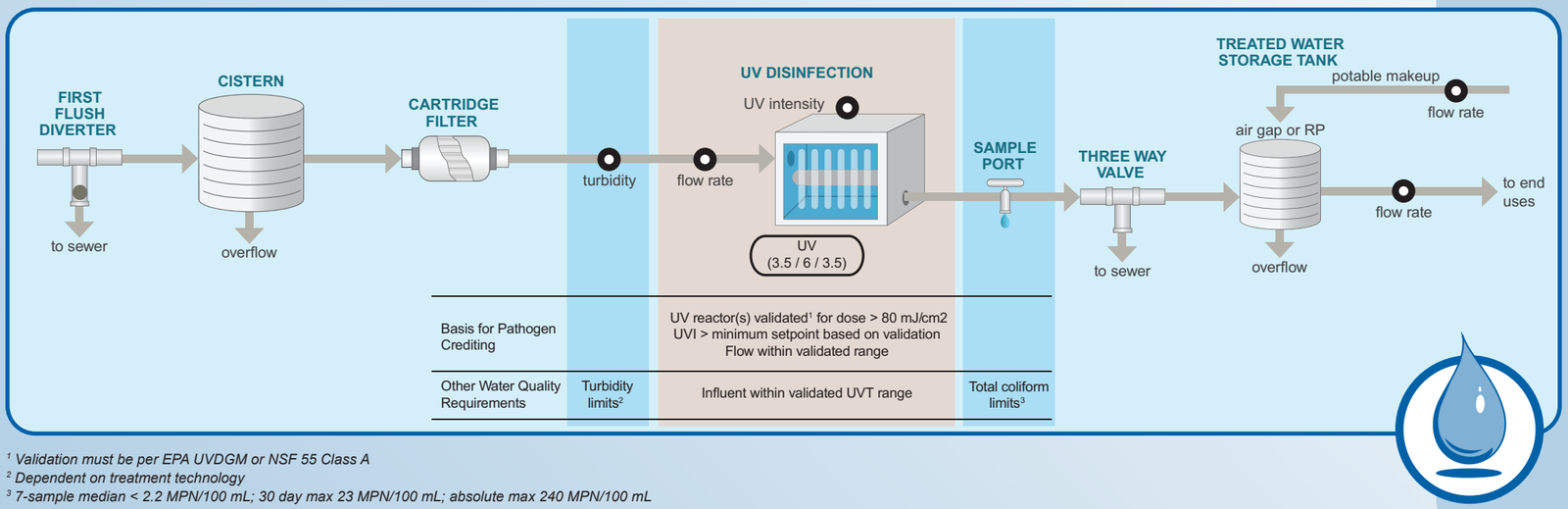
Pathogen Crediting Summary		
	Required	**Total**
Virus	N/A	4
Protozoa	N/A	0
Bacteria	3.5	4



DESIGNING ONSITE WATER REUSE SYSTEMS
03

Example Treatment Trains

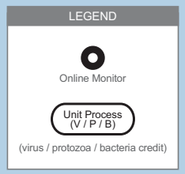
3. STORMWATER OR FOUNDATION DRAIN WATER SYSTEM (OUTDOOR USE)



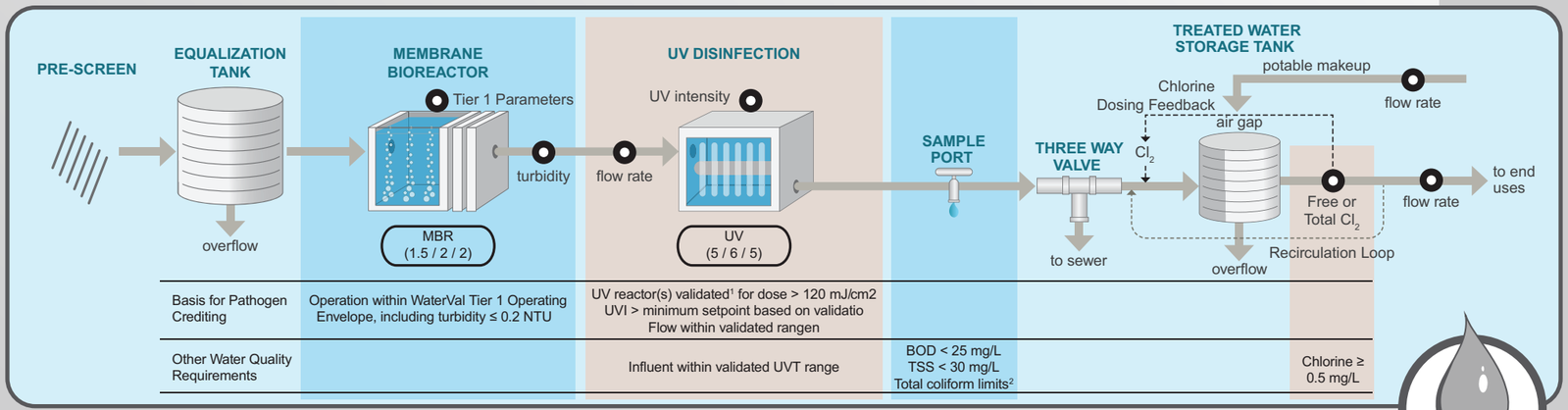
[1] Validation must be per EPA UVDGM or NSF 55 Class A
[2] Dependent on treatment technology
[3] 7-sample median < 2.2 MPN/100 mL; 30 day max 23 MPN/100 mL; absolute max 240 MPN/100 mL

LRTs for stormwater or foundation drain water are dependent on whether the water will be reused indoors or outdoors. For this example, the use is assumed to be outdoors, resulting in lower LRTs, which are met with a validated UV reactor that operates within certain operating conditions. The inclusion of a cartridge filter upstream of the UV reactor provides pre-treatment to improve the quality of the water prior to disinfection and helps meet the turbidity limits. Because the use is outdoors, no chlorine residual is required.

Pathogen Crediting Summary		
	Required	**Total**
Virus	3	3.5
Protozoa	2.5	6
Bacteria	2	3.5



4. GRAYWATER SYSTEM (INDOOR USE)



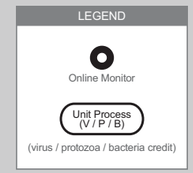
[1] Validation must be per EPA UVDGM or NSF 55 Class A
[2] Seven-sample median < 2.2 MPN/100 mL; 30 day max 23 MPN/100 mL; absolute max 240 MPN/100 mL

In this example, the graywater system meets the LRTs for indoor use using MBR and UV:

- **MBR:** credit for operation within the WaterVal 2017 MBR Validation Protocol Tier 1 operating envelope
- **UV:** A validated UV system providing a dose of 120 mJ/cm2 can achieve the remaining pathogen credits required (for more information on UV crediting, see Page 24). In this example, the UV Intensity Setpoint method is used to verify UV performance.

The system must also be able to successfully operate during conditional startup (see requirements on Page 13), and provide secondary disinfection with chlorine to maintain protection of the distribution system.

Pathogen Crediting Summary		
	Required	**Total**
Virus	6	6.5
Protozoa	4.5	8
Bacteria	3.5	9



Additional Disinfection Guidance

Pathogen Crediting for UV Disinfection

UV Reactor Validation

To receive pathogen reduction credits, UV reactors must be validated per either:

- NSF/ANSI 55 Class A
- EPA UV Disinfection Guidance Manual

For a list of validated reactors, see sfwater.org/np

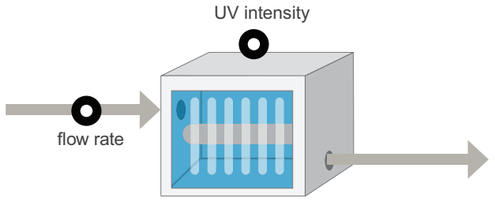
Pathogen Log Reduction Credits for Validated UV Reactors

Validated Dose (mJ/cm²)	Virus	Protozoa	Bacteria
40	2	3	2
80	3.5	6	3.5
120	5	6	5
150	6	6	6

Credits apply for reactors validated using MS2 as the challenge organism

Monitoring Validated UV Reactors

To receive the pathogen credits, continuous online monitoring is required. The UV intensity setpoint method can be used, which involves monitoring the flow rate and UV intensity and verifying that both parameters are within their specified ranges. Setpoints are based on the operating envelope determined as part of the validation testing and should be provided in the manufacturer's documentation.



With the UV Intensity Setpoint approach, UVT monitoring is not required on the influent to the UV reactor. However, it is critical to consider the likely water quality of the influent in terms of UVT when selecting the appropriate reactor. An MBR-treated blackwater may have a UVT in the 60-75% range; if a reactor was validated only down to a UVT of 80%, the system will fail to meet the UV intensity setpoint and thus the reactor would not be an appropriate choice.

Additional Disinfection Guidance

Pathogen Crediting for Chlorine

Crediting Framework

Credit based on CT, where:

CT = C_{l2} residual concentration (C) * Contact time (T)
Contact time = average hydraulic residence time * baffling factor

Chlorine Contactor Design Requirements

- All water entering the contactor must be chlorinated prior to entering the contactor
- Chlorine cannot be added in an internal recirculation loop
- Chlorine residual must be measured in the contactor effluent

Free Chlorine Monitoring

If seeking CT credit for free chlorine disinfection, project must provide evidence in the Engineering Report that the free chlorine analyzer selected can distinguish between free and combined chlorine.

Important Consideration: Ammonia

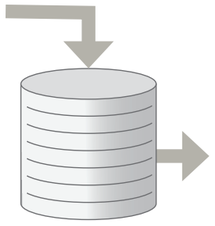
Why is it important?

In blackwater and graywater systems, it presents a challenge for free chlorine disinfection. Ammonia will consume free chlorine and convert it to chloramine, a weaker disinfectant.

How can it be managed?

- Ammonia can be removed through biological treatment via nitrification, i.e. conversion of ammonia to nitrate
- A chlorine dosing control system can be used to breakpoint ammonia and ensure a free chlorine residual
- If ammonia won't be fully removed, consider alternate disinfection for LRT credit, such as UV

Chlorine Contactor Types



Tank Contactor

Default Baffling Factor: 0.1

Pros: Simple design

Cons: Requires larger footprint for same CT, more challenging to control chlorine dosing if tank residence time is long

Pipeline Contactor

Default Baffling Factor: 0.6[1]

Pros: Smaller footprint for same CT because of higher baffling factor, easier control due to faster feedback

Cons: More complex design

[1] *Design requirements: Length/diameter (L/D) ratio > 40; Reynold's number > 4,000 (i.e. turbulent flow regime); no expansions/contractions.*

Additional Disinfection Guidance

Primary and Secondary Disinfection

Primary Disinfection: used to achieve the pathogen log reduction targets for onsite water reuse systems. Associated with the control of enteric viruses, parasitic protozoa, and enteric bacteria.

Secondary Disinfection: used to maintain a disinfectant residual to prevent contamination as water travels through the distribution system. Provides protection against opportunistic pathogens such as Legionella.

Comparison of pros (+) and cons (-) of common disinfectant options for primary and secondary disinfection.

Disinfection Process	Log Reduction Credit (Primary)	Maintaining Residual in Distribution System (Secondary)	Additional Considerations
Free Chlorine	(+) Smaller footprint required for virus credit because of low CTs needed (-) Not effective against protozoa[1] (-) Requires dosing control system to maintain residual	(+) Effective for controlling biofilm growth (-) Will need to breakpoint chloramine in potable makeup water to maintain free chlorine residual (-) Less stable than chloramine	(+) Color control
Chloramine	(-) Requires very large footprint to reach necessary CT values for virus credit (-) Not effective against protozoa	(+) Stable residual (+) Easy to blend with existing potable makeup (+) Less reactive with organics, may reduce overall chemical usage (-) Requires chemical storage and handling of chlorine, ammonia	
UV	(+) Effective against virus, protozoa, and bacteria (+) Relatively simple implementation with pre-validated reactors	(-) Not suitable as a secondary disinfectant due to lack of residual	
Ozone	(+) Effective against virus (-) Not effective against protozoa[1]	(-) Not suitable as a secondary disinfectant due to lack of stable residual	(+) Color Control

[1]*The two major groups of parasitic protozoa are Giardia and Cryptosporidium. Both free chlorine and ozone can be effective against Giardia; however, because they are not effective against Cryptosporidium, they have been described here as not effective against protozoa.*

Additional Considerations For Secondary Disinfection

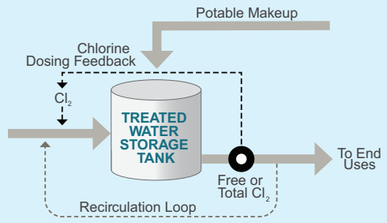
Compatibility of Chlorine and Chloramine

SFPUC potable water has a chloramine residual. This needs to be accounted for in the secondary disinfection design; chloramine reacts with free chlorine in what is called a breakpoint reaction. The net result is an overall lowering of the total chlorine residual. Consider using chloramine as a secondary disinfectant to simplify blending with makeup water and avoid the breakpoint reaction. The two panels on this page illustrate examples of secondary disinfection with free chlorine and chloramine.

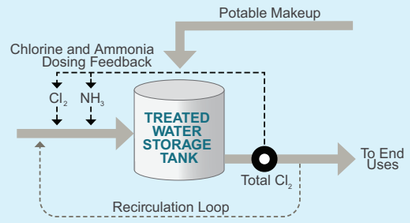
Water Storage and Recirculation

- Because demands may not be constant for these systems, there may be times when water sits in a treated water storage tank (e.g. overnight and weekends in commercial buildings).
- Recirculation is an effective strategy for maintaining the concentration of secondary disinfectant, especially when linked to a disinfectant dosing control system. Such a system would use the chlorine residual measurement to determine whether recirculation and/or changes to chemical dosing are needed to meet the chlorine target (see example treatment trains on pages 18-19).

Secondary Disinfection with Free Chlorine



Secondary Disinfection with Chloramine



Overflow and Bypass

Each OWRS must be designed to allow for both system overflow and system bypass to either the sanitary sewer system or storm sewer system, depending on the source water. Overflow allows an operator to take the system off-line for maintenance, and bypass allows an operator to divert improperly treated water.

Rainwater, Stormwater and Foundation Drain Water Systems

- Overflow is piped to the storm sewer through an approved backwater valve or air gap
- Bypass is diverted to the storm sewer

Condensate and Graywater Systems

- Overflow is piped to the sanitary sewer through an approved backwater valve or air gap
- Bypass is diverted to the sanitary sewer

Make-up Water

All buildings must have the ability to receive water from Austin Water in order to serve potable uses and provide make-up water for non-potable end uses. Make-up water must be supplied in a manner that protects the City of Austin's public water systems from potential backflow. Properties that have OWRS must follow the backflow prevention requirements listed below, which are consistent with the City of Austin's Plumbing Code.

- Containment Reduced Principle Backflow Assembly (RPBA) immediately downstream of the water meter to protect the municipal water connection that serves the property with the OWRS

Condensate, Rainwater, Stormwater and Foundation Drain Water Systems

- Isolation RPBA or isolation air gap at the point of municipally supplied make-up to the OWRS

Graywater Systems

- Isolation air gap at the point of municipally supplied make-up to the OWRS

Flow Meters

In addition to monitoring flow for certain treatment processes to verify LRTs are being met, an OWRS must install a flow meter on:

- The non-potable distribution line from the OWRS
- The make-up water line to the OWRS

These meters will record the amount of water being provided by the alternative water sources, which is required to be reported on all monitoring reports submitted to AW-OWR. District-scale OWRS require each property to be able to meter the alternative water sources being generated and used.

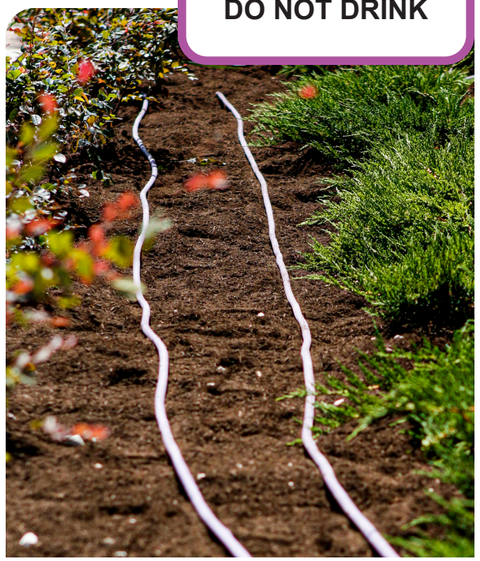
Piping and Other Identification

Piping

All exposed piping and piping carrying alternative onsite reuse water within a building must be either purple pipe or painted purple; all buried piping must be either manufactured in purple, painted purple, taped with purple metallic tape, or bagged in purple; and all exposed piping must be stenciled in yellow with a warning reading "NON-POTABLE WATER."

Signage

Signage for tanks, hose bibbs, restrooms and equipment rooms must be clearly labeled and visible to indicate that a facility uses "NON-POTABLE WATER."



ADDITIONAL CONSIDERATIONS FOR **CONDENSATE REUSE**

Mandatory Condensate Recovery Systems for New Development

In June of 2017 the Austin City Council approved the adoption of the City's Mechanical Code which includes the following provisions related to condensate reuse systems:

- Section 310.10 requires new commercial and multi-family facilities with a cooling capacity of 200 tons or greater to install condensate recovery systems for beneficial reuse. Beneficial reuse includes the allowed usages outlined in this guide.
- Section 1126.0(6) requires new commercial and multi-family facilities with a cooling capacity of 100 tons or greater to either utilize blowdown water for beneficial reuse, or to offset a minimum of 10 percent of the cooling system's make-up water with reclaimed water or water from an onsite water reuse system.

Special Requirements for Industrial Condensate Reuse Systems

The Texas Commission on Environmental Quality (TCEQ) has adopted special requirements for industrial condensate reuse systems that are not covered in this guide. These industrial condensate reuse guidelines can be found in 30 TAC Chapter 210 Subchapter E. Authorization to reuse industrial wastewater under this subchapter may be obtained from the TCEQ, but is not needed for: internal recycling systems, closed loop systems, or makeup water within a facility.

The San Antonio Water System (SAWS) has published a condensate collection and use manual for commercial buildings. The manual was created as a guide for building managers, architects, engineers, and facility personnel to facilitate the comprehensive evaluation, design, and implementation of condensate collection and use systems for commercial buildings. The manual is available for download at the following address on the SAWS website: https://apps.saws.org/Conservation/Commercial/Condensate/docs/SACCUManual_20131021.pdf.

05 ADDITIONAL CONSIDERATIONS FOR **STORMWATER CREDITING**

Stormwater Management and Reuse

The City of Austin requires new developments to manage the water quality of stormwater runoff in compliance with the Environmental Criteria Manual (ECM). Some of the Best Management Practices (BMPs) that can be used to meet the ECM requirements are similar in concept to Onsite Water Reuse Systems (e.g. Rainwater Harvesting). However, systems designed for stormwater management and those designed for non-potable reuse have competing operational needs and therefore designing one system to meet both purposes requires administrative approval. Onsite Water Reuse Systems are eligible for Water Quality credit under the 'Innovative Management Practices' section of the Land Development Code (25-8-151), and an OWRS may reduce required BMP sizing if designed appropriately. If a project applicant is interested in achieving stormwater management credit for their project, they should contact AW_onsitereuse@austintexas.gov to request a joint planning meeting with Austin Water's Onsite Water Reuse team and the Watershed Protection Department's Stormwater Treatment team.

06 **INCENTIVES** FOR ONSITE WATER REUSE SYSTEMS

Austin Water Onsite Water Reuse System Pilot Incentive Program

The Austin Water (AW) Onsite Water Reuse System (OWRS) Pilot Incentive Program provides funding to incentivize the installation of OWRS in the City of Austin to offset potable demands, and to help develop local water supplies using technologies that are new and innovative to the water industry.

AW anticipates funding multiple projects during the pilot program period. Applications are accepted and reviewed in the order received. Program funding is available on a first come, first served basis subject to funding availability.

AW will accept applications through December 31st, 2023. The Onsite Water Reuse Pilot Incentive Program is expected to be eliminated after this period or upon adoption of a mandatory onsite water use system requirement for facilities over 250,000 square feet. Data gathered through participating projects will assist AW in future alternative water planning and implementation efforts.

1. Eligibility

Program funds are available for building-scale or district-scale projects in the Multi-family and Commercial Sectors undertaken by AW Water Customers. Program funding is available for two types of projects:

- Projects that are installing an OWRS on a voluntary basis (Voluntary Projects) to help the City of Austin achieve its water reuse goals;
- Projects that are installing an OWRS on a mandatory basis in compliance with the condensate capture and use requirement under §310.10 of the city's adopted Uniform Mechanical Code, but that are blending or supplementing the system with an additional onsite derived alternative water source, also known as an "Above and Beyond Project."

Eligible projects that meet the program guidelines will be considered for program funding if they can demonstrate augmentation of AW potable supply by collecting, treating, and using alternative water supplies onsite through the utilization of an OWRS.

2. Funding Levels

Projects must demonstrate the ability to achieve at least one of the following thresholds for AW Potable Offset to be eligible for program funding:

The program guidelines and application are posted on www.austintexas.gov/department/onsite-water-reuse-systems.

Estimated AW Potable Water Offset	Rain/Condensate
(gallons per year for 10 years)	Program Funding Available
≥ 1,000,000	$250,000
≥ 3,000,000	$500,000

Austin Water Conservation Rebates

Through its Water Conservation Program, Austin Water currently offers a number of rebates to incentivize customers to install onsite water reuse systems on their property. Projects that do not meet the one million gallon offset threshold amount for the Onsite Water Reuse System Pilot Incentive Program may still qualify for the AW's Bucks for Business rebate.

1. Eligibility

To qualify for an Austin Water rebate you must be a customer of Austin Water or a qualifying water provider, and you must either be the property owner or the utility account holder (with written permission from the property owner). Additional criteria apply for each rebate program, and specific information can be found on Austin Water's Water Conservation webpage at the following address: www.austintexas.gov/department/water-conservation-rebates.

INCENTIVES FOR ONSITE WATER REUSE SYSTEMS

Austin Water Conservation Rebates

2. Qualifying Rebate Programs

At the time of publication the following rebate programs are available to multi-family residential and commercial customers for onsite water reuse system installations through Austin Water.

- Rainwater Harvesting
- Bucks for Business

These rebates are subject to change, and pre-approval is typically required before purchasing or installing any of the materials that are covered by the rebates. For the most up-to-date program information, customers are encouraged to check Austin Water's Water Conservation webpage prior to submitting a rebate application: www.austintexas.gov/department/water-conservation-rebates.

07 RESOURCES

Important Contact Information

Austin Water – Onsite Water Reuse Program

Oversees review, approval, and ongoing operation of Onsite Water Reuse Systems.
www.austintexas.gov/department/onsite-water-reuse-systems
AW_OnsiteReuse@austintexas.gov

Austin Water – Water Conservation Division

Provides guidance and resources related to onsite water reuse systems as well as rebates to incentivize the installation of certain systems.
www.austintexas.gov/department/water-conservation
512-974-2199

Austin Water – Special Services Division

Administers the Cross Connection/Water Protection Program to protect the health and safety of the public water supply from auxiliary water sources including onsite water reuse systems.
austintexas.gov/department/special-services-water-protection
512-972-1060

Development Services Department – Building Permits Service Center

Issues permits to construct and performs installation inspections related to onsite water reuse systems.
austintexas.gov/department/development-services

Austin Watershed Protection Department – Stormwater Management

Oversees implementation of the Watershed Protection Ordinance.
www.austintexas.gov/department/stormwater-management
512-974-3358

Office of Real Estate Services

Issues encroachment agreements.
www.austintexas.gov/department/real-estate-services
512-974-3358

ONSITE WATER REUSE PROGRAM GUIDEBOOK

IMPLEMENTING ONSITE WATER REUSE IN AUSTIN

AustinWater.org | AW_onsitereuse@austintexas.gov