

# Technical Reference Manual for WaterSense® Labeled Homes



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## Section 1: Introduction

WaterSense, a voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA), is both a label for water-efficient products and a resource to help save water. The WaterSense label makes it simple to find water-efficient products, homes, and programs that meet EPA's criteria for efficiency and performance.

The WaterSense Labeled Homes Program is designed to actively promote water efficiency in the home building industry. It provides a nationally consistent home certification that ensures a WaterSense labeled home is at least 30 percent more water-efficient than a typical new home, is free of leaks, and features WaterSense labeled plumbing products. The program enables builders anywhere in the country to specify, design, and build water-efficient homes that can earn the WaterSense label.

### How WaterSense Labeled Homes Save Water

WaterSense labeled homes are independently certified to meet EPA's criteria for water efficiency and performance. Home Certification Organizations (HCOs), which are responsible for overseeing the certification and labeling of homes for WaterSense, must first undergo an application and approval process to ensure they have the organizational infrastructure to oversee home certification. As part of the application process, a technical evaluation of their chosen method of measuring water efficiency is conducted. EPA verifies that the HCO's methodologies can accurately and consistently identify homes that are at least 30 percent more water-efficient than a typical new home. Once approved, these methods are referred to as WaterSense Approved Certification Methods (WACMs), which outline the requirements for a home to meet the WaterSense efficiency requirement.

WaterSense labeled homes must be free of leaks and include WaterSense labeled toilets, faucets, and showerheads, regardless of the WACM used to achieve the efficiency requirement. Additional water efficiency features are included in WaterSense labeled homes, but those features can vary from home to home and are dependent on the requirements of the HCO's WACM.

Features that can contribute to water efficiency may include, but are not limited to:

- High-efficiency kitchen faucets
- ENERGY STAR® certified clothes washers and dishwashers
- Efficient hot water delivery
- Landscape size, design, and plant selection
- Irrigation technology, including use of WaterSense labeled irrigation products

- Irrigation system design, installation, or audit by a professional certified by a WaterSense labeled program

Builders have the flexibility to select an HCO and WACM that work with their existing certifications, if applicable, and best fit their needs and the needs of their customers.

WaterSense labeled homes also provide significant energy savings and utility cost savings by reducing hot water use. Compared to typical new construction, the average WaterSense labeled home could save more than \$700 in water and energy utility costs and 50,000 gallons of water per year.

### Purpose of This Manual

The WaterSense Labeled Homes Program provides a building science approach to improving indoor and outdoor water efficiency. Whether you are a builder looking to earn the WaterSense label for homes, a tradesperson wanting to learn more about strategies to improve water efficiency, or a verifier seeking to understand what to look for during field surveys, you've come to the right place! This *Technical Reference Manual for WaterSense Labeled Homes* is intended to serve as a resource for anyone interested in the WaterSense Labeled Homes Program and water-efficient solutions in homes.

The manual is divided into four sections and designed for readers to focus on sections of particular interest or review the document in its entirety.

- **Section 2: A Brief Overview of the WaterSense Labeled Homes Program:** Start here to learn about the basics of the WaterSense Labeled Homes Program, including its scope, benefits, and core documents.
- **Section 3: How a Home Earns the WaterSense Label:** Follow the process of earning the WaterSense label for a home from start to finish. Understand the roles of various program participants and identify ways you can actively promote WaterSense labeled homes.
- **Section 4: Features of Water-Efficient Homes:** This section provides details on indoor and outdoor water-efficient technologies for single-family and multifamily residences. It is divided into two subsections: Mandatory Requirements for WaterSense Labeled Homes and Optional Water Efficiency Measures. This section consists of one- or two-page technical fact sheets focused on different water-efficient fixtures, systems, or practices, with details specific to construction or verification.
- **Section 5: Additional Resources:** Explore a variety of topics in detail through resources written for audiences with different levels of understanding about water efficiency.

## How Professionals Can Use This Manual

Although everyone can use this manual to learn more about residential water efficiency, icons identifying specific trades and/or professions are included throughout the document, allowing readers to focus on sections of interest.



### **WaterSense Builder Partners**

- Build homes to earn the WaterSense label (Section 3: How a Home Earns the WaterSense Label)
- Identify other organizations that can help with the certification process (Section 3: How a Home Earns the WaterSense Label)
- Incorporate water-efficient features into residential construction (Section 4: Features of Water-Efficient Homes)



### **WaterSense Home Verifiers**

- Become a WaterSense home verifier (Section 3: How a Home Earns the WaterSense Label)
- Verify water-efficient features in a home (Section 4: Features of Water-Efficient Homes)



### **Tradespeople**

- Receive irrigation training through a WaterSense labeled certification program (Section 3: How a Home Earns the WaterSense Label)
- Incorporate water-efficient technologies into residential construction (Section 4: Features of Water-Efficient Homes)



### **Utilities and Local Governments**

- Encourage builders to build WaterSense labeled homes in the community (Section 2: A Brief Overview of the WaterSense Labeled Homes Program)
- Educate residents, local home builders, and tradespeople about WaterSense and water efficiency (Section 3: How a Home Earns the WaterSense Label and Section 5: Additional Resources)

For additional questions or guidance, please contact the WaterSense Helpline at (866) WTR-SENS (987-7367) or [watersense@epa.gov](mailto:watersense@epa.gov).



## Section 2: A Brief Overview of the WaterSense Labeled Homes Program

Since 2009, the WaterSense Labeled Homes Program has provided a whole-house solution to help consumers save water, energy, and money while maintaining a high level of performance.

The WaterSense Labeled Homes Program has a broad scope that covers:

- New construction
- Renovations
- Single-family homes
- Multifamily

### Multifamily Opportunities





Look for this icon throughout the manual for information specific to multifamily buildings.

The specification is largely performance-based, with only a few mandatory requirements. Builders have flexibility to incorporate water-efficient systems and features in homes based on local market conditions and climate.

### Benefits of WaterSense Labeled Homes

Water efficiency is essential in the community planning, land entitlement, and building process. As water becomes an increasingly important asset in the residential building industry, WaterSense labeled homes can help builders and local jurisdictions address the following challenges:

- **Community Planning and Water Availability:** With increasing population and limited water resources, some states and municipalities are looking for strategies to meet growing housing demand in the face of water availability challenges due to drought or supply limitations. Because WaterSense labeled homes are at least 30 percent more water-efficient than typical new construction, these homes help ease this burden and lead communities to more sustainable and resilient growth. 
- **Entitlements and Connection Fees:** New developments frequently face challenges of water and infrastructure availability as new homes increase demand on existing water systems, resulting in high utility connection fees. Some municipalities and water utilities may choose to streamline the permitting process and/or reduce utility connection fees for construction of new water-efficient homes. 

- Corporate Social Responsibility:** Homebuyers and investors are holding builders accountable by demanding they demonstrate good stewardship of resources. Building WaterSense labeled homes can help builders meet these expectations for corporate social responsibility at a marginal cost.
- Utility Costs:** Rising utility costs mean that homebuyers can save more money with a high-performing, water-efficient home while mitigating their impact on limited resources and existing infrastructure.



### Building Blocks

Three main components—the specification, the certification system, and the process for evaluating certification methods—provide the structure for the WaterSense Labeled Homes Program. The sections below describe the purpose and contents of each document.



- 1) Specification:** The *WaterSense Specification for Homes* ([www.epa.gov/watersense/homes-specification](http://www.epa.gov/watersense/homes-specification)) establishes the criteria that a home must meet to earn the WaterSense label. The specification includes a Mandatory Checklist, as well as the 30 percent water efficiency requirement. The Mandatory Checklist (Figure 1 on the next page) contains basic measures of water efficiency and performance that are applicable to all homes, whereas the efficiency requirement establishes total water savings regardless of variables such as size of the home and the local climate. The Mandatory Checklist includes WaterSense labeled plumbing fixtures and verification that no visible or hidden water leaks are present in a home. The efficiency requirement means that a home must use at least 30 percent less water compared to a home built using typical new construction practices. The efficiency requirement is achieved through certification to a WACM.

**Figure 1. Mandatory Checklist for WaterSense Labeled Homes**

✓
**Mandatory Checklist to Ensure Quality Performance**

**Leaks**

- Pressure-loss test on all water supplies detects no leaks
- Free of visible leaks from all fixtures and appliances at point of use or point of connection to water distribution system
  - Toilets
  - Bathroom faucets
  - Showerheads
  - Bathroom tub faucets, i.e., tub spouts
  - Kitchen and other sink faucets
  - Other fixtures or appliances (e.g., water heaters, clothes washers, dishwashers)

**WaterSense Labeled Plumbing Fixtures**

- Toilets
- Bathroom sink faucets
- Showerheads

✓
**Efficiency Requirement**

**Verified Efficiency**

- At least 30 percent more water-efficient than a typical new home (based on national standards and common design and landscape practices).

- 2) **Certification System:** The *WaterSense Home Certification System* ([www.epa.gov/watersense/homes-certification](http://www.epa.gov/watersense/homes-certification)) outlines the administrative structure of the program and assigns roles and responsibilities for conducting home certification for WaterSense. It explains the qualifications that a prospective HCO must meet for EPA to approve them to oversee the verification and labeling of homes for WaterSense.

When a prospective HCO applies to the program, EPA evaluates whether it meets requirements for the following categories: independent oversight; quality assurance; verifier training and authorization; home verification protocols; impartiality; and messaging and reporting. This ensures that an HCO has the organizational structure and necessary qualifications to oversee the certification process.



- 3) **Process for Evaluating Certification Methods:** As part of its application, a prospective HCO submits the proposed certification method it intends to use to confirm whether homes meet WaterSense’s water efficiency requirement. EPA reviews the proposed certification method according to the *WaterSense Technical Evaluation Process for Approving Home Certification Methods* ([www.epa.gov/watersense/homes-specification](http://www.epa.gov/watersense/homes-specification)). The technical evaluation serves as a stress test to ensure that homes will meet WaterSense’s 30 percent efficiency requirement at the HCO’s proposed certification threshold. HCOs have flexibility in identifying water efficiency features their certification method will include, as long as the certification threshold specified passes WaterSense’s technical evaluation. If approved by EPA, the HCO’s proposed certification method is designated as a WACM.

Figure 2 on the next page lists HCOs approved by EPA at the time of publication and provides details on their WACMs. The current list of HCOs and their contact information are maintained on the WaterSense Homes Certification web page ([www.epa.gov/watersense/homes-certification#approvedhcos](http://www.epa.gov/watersense/homes-certification#approvedhcos)). HCOs train and authorize WaterSense Home Verifiers, who conduct onsite verifications to confirm that the home meets the Mandatory Checklist and the technical requirements of the HCO’s WACM (therefore ensuring they achieve the 30 percent efficiency requirement). The HCO then issues the WaterSense label to homes meeting all requirements.

Learn more about the process of earning the WaterSense label in Section 3: How a Home Earns the WaterSense Label.

### Local Rules, Ordinances, and Permits



















The *WaterSense Specification for Homes* is not intended to replace or contravene state or local codes and requirements. All homes, landscapes, and irrigation systems are required to meet all applicable national, state, and local building codes and regulations. In addition, all plumbing and irrigation system installers must meet all applicable state and local licensing requirements.

In some locations, local jurisdictions and other government entities have chosen to incorporate WaterSense labeled products and/or WaterSense labeled homes into their regulations or community planning requirements as a way to achieve their sustainability and water saving goals.<sup>1</sup>

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<sup>1</sup> The Appliance Standards Awareness Project (ASAP) maintains a list of states that have adopted energy and water efficiency standards on its web page (<https://appliance-standards.org/states>). The Urban Land Institute’s report *Water Wise: Strategies for Drought-Resilient Development* (<https://knowledge.uli.org/reports/research-reports/2022/water-wise>) discusses best practices for water-smart development and landscaping.

Figure 2. EPA Approved HCOs

HCO	Scope			Method for Labeling Homes
	Regionality	Building Types	Construction Type	
 CHEERS		Single-Family 	New Construction 	Achieve a score of 70 or less under CHEERS WaterSense
 Green Builder Coalition		Single-Family 	New and Existing Construction 	Achieve a score of 66 or less under the Water Efficiency Rating Score (WERS) with WaterSense Baselines
 Home Innovation Research Labs		Single-Family and Multifamily  	New and Existing Construction 	Complete a set of selected practices from the National Green Building Standard (NGBS)
			New Construction 	Achieve a score of 64 or less under the Water Rating Index
 RESNET		Single-Family 	New and Existing Construction 	Achieve a score of 70 or less under HERSH2O



## Section 3: How a Home Earns the WaterSense Label

Homes earn the WaterSense label through an iterative process involving multiple participants. Figure 3 on the next page illustrates WaterSense’s home certification process, showing the basic steps to earning the WaterSense label from design and construction to occupancy. Keep in mind that the certification process replicates the building process in that it is not linear and requires interdisciplinary collaboration. In addition, some administrative requirements may be required at different points in the process, depending on the HCO.

The diagram assumes that all participants have already taken specific steps to ensure that they are eligible to participate in the WaterSense Labeled Homes Program, namely:

- Home builders must first partner with WaterSense ([www.epa.gov/watersense/join-watersense](http://www.epa.gov/watersense/join-watersense)) to certify homes with the WaterSense label. Partnership is free but requires builders to commit to building at least one WaterSense labeled home per year.
- EPA must approve HCOs to certify homes and issue the WaterSense label.
- Verifiers work directly with HCOs to become WaterSense home verifiers.

As the home certification process diagram (Figure 3) shows, the WaterSense Labeled Homes Program relies on the involvement and expertise of various stakeholder groups. Each can encourage adoption and raise awareness of water-efficient and high-performing products and design practices in the building industry. Although water utilities are not involved in the specific process to certify a home, they, along with local governments, can also play a significant role in bringing WaterSense labeled homes to their communities.

Table 1 and Table 2 on pages 3-3 and 3-4, respectively, illustrate the role of the participants involved with building, certifying, and promoting WaterSense labeled homes and the benefits they receive from involvement with the program. Both WaterSense partners (Table 1) and those who are not eligible for partnership (Table 2) can participate in varying capacities. WaterSense partners commit to promote the value of water efficiency and WaterSense labeled products, homes, and programs; adhere to the *WaterSense Program Guidelines* ([www.epa.gov/watersense/program-guidelines](http://www.epa.gov/watersense/program-guidelines)); and feature WaterSense on websites and promotional materials. WaterSense partners also have exclusive access to educational and marketing materials. Visit the WaterSense Partners web page ([www.epa.gov/watersense/watersense-partners](http://www.epa.gov/watersense/watersense-partners)) to learn more.

With various participants contributing expertise and insight, the WaterSense Labeled Homes Program is grounded in building science and offers a multidisciplinary approach to residential building. Collaboration among participants is essential to the program’s success.

**Figure 3. WaterSense Labeled Home Certification Process Overview**



**Step 1.** Builder works with their verifier to identify a WACM. If builder does not currently work with a verifier, they can locate one using EPA’s Find a WaterSense Verifier tool at [www.epa.gov/watersense/find-home-verifier](http://www.epa.gov/watersense/find-home-verifier). If applicable, the builder will register the project with the HCO.



**Step 2.** Builder specifies features of the home to meet certification criteria, consulting with a verifier as needed.



**Step 3.** Builder works with trades to build the home and correct any issues that may arise during construction and/or verification.



**Step 4.** Home is ready for certification. Verifier conducts verification of specified features to confirm that the home meets certification criteria. Verifier identifies any issues, works with the builder and trades to correct them, and submits documentation to the HCO.






**Step 5.** Once the home meets the certification criteria, the HCO provides the builder with a label certificate and WaterSense label use guidelines. The HCO reports the certified home to EPA.






**Step 6.** Home is delivered to the resident. Builder should provide education and guidance for maintaining the water-efficient products and systems to the new resident.

**Table 1. WaterSense Partners Involved in the WaterSense Labeled Homes Program**

Participant	Role	Benefits
<p><b>Builders</b></p> 	<ul style="list-style-type: none"> <li>Partner with WaterSense and commit to building at least one home earning the WaterSense label within the first year of joining and at least one home annually thereafter.</li> <li>Install WaterSense labeled plumbing and irrigation products in homes.</li> <li>Work with trades, such as plumbers and irrigation professionals, to raise awareness of the benefits of designing systems and installing products that are water-efficient.</li> <li>Work with HCOs and WaterSense Home Verifiers to certify homes.</li> <li>Help communicate the value of WaterSense labeled homes to the public and prospective homebuyers.</li> </ul>	<ul style="list-style-type: none"> <li>Receive co-branded marketing materials and program support from WaterSense, including a promotional label for builders of WaterSense labeled homes.</li> <li>Serve as a nexus for various stakeholders involved with building homes that meet WaterSense’s requirements by engaging with verifiers, tradespeople, water utilities, and municipalities.</li> <li>Become eligible to receive national recognition by applying for the annual WaterSense Awards program.</li> </ul> 
<p><b>Water Utilities and Local Governments</b></p> 	<ul style="list-style-type: none"> <li>Promote the WaterSense program and WaterSense labeled products and homes to consumers and other organizations.</li> <li>Encourage water efficiency in home building through marketing campaigns and/or educational resources.</li> <li>Provide incentives, such as rebates, water connection fee reductions, and permit prioritization, for builders and developers building WaterSense labeled homes.</li> <li>Consider providing customers with enhanced or smart metering information that can be used to track their water use over time.</li> </ul>	<ul style="list-style-type: none"> <li>Achieve greater reduction in water use at the jurisdictional level than is typically achieved through product standards, rebates, or retrofits alone.</li> <li>Facilitate smart growth in the housing sector by adopting water efficiency measures and contributing to local sustainability and drought mitigation plans.</li> <li>Become a WaterSense promotional partner to enjoy the following benefits:             <ul style="list-style-type: none"> <li>Access to educational and marketing resources that can be used to promote water efficiency.</li> <li>Eligibility to receive national recognition through the WaterSense Awards program.</li> </ul> </li> </ul>

**Table 2. Non-Partners Involved in the WaterSense Labeled Homes Program**

Participant	Role	Benefits
<p><b>Tradespeople</b></p> 	<ul style="list-style-type: none"> <li>• Understand WaterSense labeled indoor and outdoor products and communicate their benefits to builders and consumers.</li> <li>• Participate in water utility rebate programs that incentivize installing water-efficient products.</li> <li>• For plumbing professionals: Learn about and install water-efficient hot water delivery systems in residential buildings.</li> <li>• For irrigation professionals: Become certified to design, install/maintain, and/or audit irrigation systems through a WaterSense labeled program (<a href="http://www.epa.gov/watersense/professional-certification-0">www.epa.gov/watersense/professional-certification-0</a>).</li> </ul>	<ul style="list-style-type: none"> <li>• Differentiate a business by offering expertise in water efficiency.</li> <li>• For irrigation professionals certified through a WaterSense labeled program:                         <ul style="list-style-type: none"> <li>○ Be listed in WaterSense’s online Directory of Certified Professionals at <a href="http://www.epa.gov/watersense/find-pro">www.epa.gov/watersense/find-pro</a>.</li> <li>○ Use the WaterSense promotional label on marketing materials.</li> <li>○ Receive access to tools and program support from WaterSense.</li> </ul> </li> </ul>
<p><b>WaterSense Home Verifiers</b></p> 	<ul style="list-style-type: none"> <li>• Receive training on the WaterSense Labeled Homes Program and the requirements specific to the HCO’s WACM.</li> <li>• Conduct verification to confirm that a home includes:                         <ul style="list-style-type: none"> <li>○ All features on the Mandatory Checklist.</li> <li>○ Verified absence of leaks as confirmed through tests.</li> <li>○ Any features that contribute to the 30 percent water efficiency requirement in accordance with the HCO’s WACM.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Meet customer demand for water efficiency certification, especially in regions experiencing drought.</li> <li>• Offer WaterSense certification services in addition to other home certifications, such as ENERGY STAR and Zero Energy Ready Home (ZERH).</li> <li>• Use the WaterSense verifier mark on marketing materials.</li> <li>• Become part of WaterSense’s online Directory of WaterSense Home Verifiers at <a href="http://www.epa.gov/watersense/find-home-verifier">www.epa.gov/watersense/find-home-verifier</a>. This tool helps builders and other stakeholders locate qualified verifiers.</li> </ul> 



## Section 4: Features of Water-Efficient Homes

Water efficiency in homes can be achieved in many ways and is dependent on the local climate, region, and builder or homeowner preferences. The Mandatory Checklist (Figure 1 on page 2-3) identifies features that are required for all WaterSense labeled homes. However, homes will need to go beyond these mandatory requirements to achieve the 30 percent efficiency requirement to earn the WaterSense label. Working with their verifier and reviewing guidance from the selected HCO, builders can decide on how best to achieve the 30 percent efficiency requirement. This section provides technical details and information on the items in the Mandatory Checklist, as well as fixtures, systems, and practices that may help a home achieve the 30 percent efficiency requirement.

This section includes one- or two-page technical fact sheets on topics related to residential water efficiency. Table 3 on the next page provides a list of the technical fact sheets included in this section. Each technical fact sheet indicates whether the topic is mandatory or optional to earn the WaterSense label. “Optional” refers to features that may contribute to the efficiency requirement, which may differ by HCO and WACM. Be sure to check your HCO’s WACM for further details on these optional fixtures, systems, or practices.

Each technical fact sheet is divided into the following three subsections:



**Understand:** General background on the topic.



**Build:** Instructions for incorporating the feature into home design and construction.



**Verify:** Guidelines for confirming whether the feature is installed in a home.

Each technical fact sheet also provides links to additional resources to find out more about the topic area. WaterSense may include additional fact sheets within this document in the future.

The technical fact sheets have been designed to be standalone documents, allowing users to reference and share a single fact sheet on a particular fixture, system, or practice in either printed or digital format. The fact sheets can be brought to a construction site for reference or shared with prospective homebuyers or renters.

**Table 3. List of Technical Fact Sheet Topics**

Fact Sheet Topic	Mandatory*	Optional**
<b>Indoor</b>		
<a href="#">Free of leaks</a>	✓	
<a href="#">Toilets</a>	✓	
<a href="#">Bathroom sink faucets</a>	✓	
<a href="#">Showerheads</a>	✓	
<a href="#">Kitchen faucets</a>		✓
<a href="#">Dishwashers</a>		✓
<a href="#">Clothes washers</a>		✓
<a href="#">Hot water delivery</a>		✓
<a href="#">Water softeners</a>		✓
<b>General</b>		
<a href="#">Metering</a>		✓
<a href="#">Leak detection and flow monitoring systems</a>		✓
<a href="#">Service water pressure</a>		✓
<b>Outdoor</b>		
<a href="#">Landscape design and plant selection</a>		✓
<a href="#">Soil management and mulching</a>		✓
<a href="#">Spray irrigation</a>		✓
<a href="#">Microirrigation</a>		✓
<a href="#">Rain sensors</a>		✓
<a href="#">Irrigation controllers</a>		✓
<a href="#">Using a certified professional for irrigation system design, installation, and auditing</a>		✓
<a href="#">Pools and outdoor water features</a>		✓


\* Mandatory fixtures and practices must be included in all WaterSense labeled homes regardless of the HCO’s WACM.

\*\* Optional fixtures, systems, and practices can contribute to the 30 percent efficiency requirement if included in the certifying HCO’s WACM.



# Free of Leaks



- 
**Mandatory Checklist Requirement:** There must be no detected leaks from any water-using fixtures, appliances, or equipment. Compliance shall be verified through pressure-loss testing and visual inspection.



## UNDERSTAND

- The average household's leaks can account for nearly 10,000 gallons of water wasted per year. Common types of leaks found in homes are from worn toilet flappers, dripping faucets, poor connections to hot and cold water lines, leaking irrigation system components, and other leaking valves. However, leaks can occur in new construction as well, and proactively identifying and fixing leaks leads to more satisfied customers and a more water-efficient home.
- To be eligible to receive the WaterSense® label, homes must be verified to be free of water leaks at the time of certification.



## BUILD

- CONFIRM** valves and hoses for water-using fixtures and appliances are installed correctly throughout the home. Use plumber's tape when making threaded connections, such as with showerheads or some tub spouts.
- CONDUCT** a pressure-loss test on all water supplies to check for leaks before the verification (see the Pressure-Loss Test Protocol at right). This will offer the opportunity to address leaks proactively and ensure the home is free of leaks before the verifier's visit.
- REPAIR** leaks when they are identified outdoors and work with the irrigation installer to commission the system and replace leaky sections.



## VERIFY

- VERIFY** the following requirements as part of the Mandatory Checklist for WaterSense Labeled Homes:
  - Pressure-loss test on all water supplies detects no leaks (see Pressure-Loss Test Protocol box above).
  - No visible leaks from toilet(s), as determined through visual assessment and by conducting a dye test in each toilet to ensure the flapper or flush valve seal is not leaking (see Toilet Leak Test Protocol at right).
  - No visible leaks from bathroom faucets.

### Pressure-Loss Test Protocol

- Attach a pressure gauge to the cold-water faucet for the washing machine or a hose bibb. Turn on the water to the fully open position and take a pressure reading.
- Turn off the water to the home or unit using the home's shutoff valve.
- The pressure should remain constant after 5 to 10 minutes.
- If the pressure drops, this indicates that the home has a leak.
- Work with the builder to find and fix any leaks before proceeding with the home verification.
- If the home or multifamily building has a separate water supply for irrigation, check both the indoor and outdoor water supply lines for leaks.

### Toilet Leak Test Protocol

- Drop a dye tablet or a few drops of food coloring into each toilet tank.
- Wait 5 to 10 minutes without flushing.
- Check the toilet to see if the color leaked from the tank into the bowl.
- If color is observed in the bowl, the flapper or flush valve seal is leaking and needs to be replaced.

**Note:** Flush the toilet within 5 to 10 minutes after inserting the dye to avoid staining.

- No visible leaks from showerheads.
- No visible leaks from bathroom tub spouts when showerhead(s) are activated, as determined through visual assessment after showerheads have been activated for one minute (see instructions at right).
- No visible leaks from kitchen and other sink faucet(s).
- No visible leaks from other fixtures or appliances (e.g., water heaters, clothes washers, dishwashers, hose bibbs, irrigation systems) at the point of use or point of connection to the water distribution system.
- **ENSURE** tight connections to hoses and valves that connect to fixtures and appliances.
- **CHECK** in-ground irrigation systems for broken sprinklers or nozzles spraying outside the landscaped area. Consider having the irrigation system designed, installed, and/or audited by a professional certified by a WaterSense labeled program. Find a certified professional in your area with WaterSense's Find a Pro tool at [www.epa.gov/watersense/find-pro](http://www.epa.gov/watersense/find-pro).

### Bathroom Tub Faucets Leak Test

1. For all bathtub/showerhead combinations, turn on the water and divert flow so it is flowing only through the showerhead.
2. Wait one minute.
3. Observe whether a continual stream of water seepage (more than a few drips) comes from the tub spout while the shower is flowing.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### Where to Look for Leaks

Check all of the fixtures and appliances listed in the table below to look for leaks, and visit the WaterSense Fix a Leak Week web page at [www.epa.gov/watersense/fix-leak-week](http://www.epa.gov/watersense/fix-leak-week) to learn more about identifying and fixing leaks.

Fixture or Appliance	What to Check
Water heater	<ul style="list-style-type: none"> <li>● Supply connections</li> </ul>
Toilets	<ul style="list-style-type: none"> <li>● Angle valve</li> <li>● Tank overflow tube</li> </ul>
Showers	<ul style="list-style-type: none"> <li>● Showerhead outlet</li> <li>● Shower arm and threaded connection</li> <li>● Tub faucet/spout</li> </ul>
Bathroom and kitchen faucets	<ul style="list-style-type: none"> <li>● Faucet outlet</li> <li>● Hot and cold water connection hoses and valves</li> </ul>
Dishwashers	<ul style="list-style-type: none"> <li>● Visible supply connections and valves</li> </ul>
Clothes washers	<ul style="list-style-type: none"> <li>● Visible supply connections and valves</li> </ul>
Irrigation systems	<ul style="list-style-type: none"> <li>● Landscape where irrigation is installed</li> <li>● At each sprinkler head/emitter</li> <li>● At the irrigation shut-off valve</li> </ul>
Hose bibbs	<ul style="list-style-type: none"> <li>● Hose bibb outlet</li> </ul>
Other (e.g., water softeners, drinking water treatment systems, evaporative cooling systems)	<ul style="list-style-type: none"> <li>● Visible water supply connections and valves</li> </ul>



# Toilets



 **Mandatory Checklist Requirement:** All toilets must be WaterSense® labeled.



## UNDERSTAND

- WaterSense labeled toilets have a maximum flush volume of 1.28 gallons per flush (gpf), which is 20 percent lower than the current U.S. federal standard.
- The *WaterSense Specification for Tank-Type Toilets* and *WaterSense Specification for Flushometer-Valve Water Closets*, as applicable, also establish criteria for toilet performance and markings.
- WaterSense labeled toilets are independently certified for efficiency and flush performance and must also meet requirements of the applicable national standard for toilets, ASME A112.19.2/CSA B45.1 *Ceramic Plumbing Fixtures*.
- WaterSense specifications cover both single- and dual-flush toilets.



## BUILD

- **USE** the WaterSense Product Search Tool at [www.epa.gov/watersense/product-search](http://www.epa.gov/watersense/product-search) to identify and specify toilet models that have earned the WaterSense label.
- **CONFIRM** toilets are properly installed to prevent leaks.
- **CHECK** that all toilet components, such as flappers, flush valves, and fill valves, are connected and working properly at time of installation.



## VERIFY

- **OBTAIN** the makes and model numbers for all toilets in a home. Use the WaterSense Product Search Tool to confirm that all toilets are WaterSense labeled.
- **CHECK** the gpf marking on the fixture or inside the tank.
- **CONFIRM** that no leaks are present through visual inspection and dye tablet test in toilet tank (see the “Free of Leaks” informational fact sheet).

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### Learn More

Visit WaterSense’s Residential Toilets web page at [www.epa.gov/watersense/residential-toilets](http://www.epa.gov/watersense/residential-toilets) to learn more about WaterSense labeled toilets.



### Look for Leaks

Misaligned or warped toilet flappers, flush valves, or other flushing mechanisms can cause undetected leaks that waste significant amounts of water over time. Conduct a simple water dye test to check for toilet leaks (see the “Free of Leaks” informational fact sheet for details). Replace the flush mechanism if necessary.


### Getting a Handle on Dual Flushing

If selecting dual-flush toilets, make sure the buttons or handles are intuitive so homeowners and residents select the appropriate flush setting and achieve the desired water savings. Provide an owner’s manual that explains which flush is which.



# Bathroom Sink Faucets



 **Mandatory Checklist Requirement:** All bathroom sink faucets must be WaterSense® labeled.



## UNDERSTAND

- WaterSense labeled bathroom sink (lavatory) faucets use a maximum of 1.5 gallons per minute (gpm) at 60 pounds per square inch (psi) of water pressure, which means the faucet's water flow is at least 30 percent lower compared to the U.S. federal standard flow rate of 2.2 gpm.
- WaterSense labeled bathroom sink faucets are also tested to provide no less than 0.8 gpm at 20 psi of water pressure, ensuring they provide adequate flow for typical bathroom activities (e.g., face washing, shaving) without sacrificing performance at lower pressures.
- WaterSense labeled bathroom sink faucets are independently certified for water efficiency and performance and meet expected life cycle and lead-free requirements of the national standard for faucets, ASME A112.18.1/CSA B125.1 *Plumbing Supply Fittings*.
- They are available at a wide variety of price points and styles. For greater efficiency or to meet local requirements, many models are available with maximum flow rates of 1.0 to 1.2 gpm.



### Not Too Low Flow

Faucets that flow at a rate of 0.5 gpm or less are intended for public restrooms within commercial buildings; they generally do not provide enough flow to be suitable for residential bathrooms, where activities such as shaving and face washing require more water and demand hot water to get to the tap quickly. Therefore, WaterSense established a minimum flow rate for WaterSense labeled lavatory faucets (i.e., 0.8 gpm at 20 psi). Faucets below this flow rate do not meet EPA's criteria for lavatory faucets and should not be installed in WaterSense labeled homes.

As an exception, 0.5 gpm faucets may be appropriate for shared bathrooms within multifamily buildings, such as in the lobby, pool house, or other common areas.

### Learn More

Visit WaterSense's Bathroom Faucets web page to learn more ([www.epa.gov/watersense/bathroom-faucets](http://www.epa.gov/watersense/bathroom-faucets)).



## BUILD

- **USE** the WaterSense Product Search Tool at [www.epa.gov/watersense/product-search](http://www.epa.gov/watersense/product-search) to identify and specify bathroom sink faucet models that have earned the WaterSense label.
- **INSTALL** WaterSense labeled faucets and/or faucet accessories (e.g., aerators) in all bathroom sinks at the time of construction.



## VERIFY

- **OBTAIN** the makes and model numbers for all bathroom sink faucets in a home. Use the WaterSense Product Search Tool to confirm that all bathroom sink faucets are WaterSense labeled.
- **CHECK** the gpm marking on the faucet or faucet aerator.
- **VERIFY** that no more than 0.25 gallons (32 ounces) of water are collected over 10 seconds of operation.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*




This technical fact sheet is part of EPA's *Technical Reference Manual for WaterSense Labeled Homes*. For the full document and other tools and resources for homes, visit [www.epa.gov/watersense/tools-and-resources](http://www.epa.gov/watersense/tools-and-resources).

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# Showerheads



 **Mandatory Checklist Requirement:** All showerheads must be WaterSense® labeled.



## UNDERSTAND

- WaterSense labeled showerheads have a maximum flow rate of 2.0 gallons per minute (gpm), which is 20 percent less than the current federal standard.
- The *WaterSense Specification for Showerheads* also establishes criteria for showerhead performance and marking.
- WaterSense labeled showerheads are independently certified for water efficiency and performance criteria including minimum flow rate, spray force, and spray coverage.
- Showerheads, rain showers, and hand-held showers are all eligible to earn the WaterSense label.



## BUILD

- **USE** the WaterSense Product Search Tool at [www.epa.gov/watersense/product-search](http://www.epa.gov/watersense/product-search) to identify showerhead models that have earned the WaterSense label.
- **SPECIFY** WaterSense labeled showerheads to be installed in every shower at the time of construction.
- **LIMIT** the number of showering devices that can be turned on at the same time within a shower compartment. Check with the Home Certification Organization (HCO) for guidance if you plan to install multiple showerheads.



## VERIFY

- **OBTAIN** the makes and model numbers for all showerheads in a home. Use the WaterSense Product Search Tool to confirm that the showerheads are WaterSense labeled.
- **VERIFY** the gpm marking on the showerhead. Confirm that no more than 0.5 gallons (64 ounces) of water are collected over 15 seconds of operation.
- **DETERMINE** the maximum flow rate when all devices are operating for shower compartments with multiple showering devices.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

## Performance Criteria



WaterSense collaborated with stakeholders to conduct consumer testing to determine the performance metrics that are important for meeting users' expectations for showerheads. Based on the results, WaterSense established performance criteria for showerheads to earn the WaterSense label. Labeled products must be tested across a range of permissible service pressures to:

- Maintain minimum spray force (what most users refer to as “shower pressure”)
- Maintain a consistent flow rate

Learn more at WaterSense's Showerheads web page at [www.epa.gov/watersense/showerheads](http://www.epa.gov/watersense/showerheads).



## Thermostatic Shutoff Valves

While waiting for water to heat up, bathers may waste a lot of water before they enter the shower. Thermostatic shutoff valves (TSVs) slow water flow down to a trickle after hot water arrives until the user is ready. TSVs can be installed on a showerhead or tub spout diverter to reduce water waste before showering.



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# Kitchen Faucets



**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Federal efficiency standards require kitchen faucets to have a maximum flow rate of 2.2 gallons per minute (gpm) or less at 60 pounds per square inch (psi) of water pressure.
- WaterSense does not have a specification that applies to kitchen faucets. Instead, builders should look for models certified to the national standard for faucets, ASME A112.18.1/CSA B125.1 *Plumbing Supply Fittings*.
- Kitchen faucets are available in a wide variety of price points and styles. For greater efficiency or to meet local requirements, many models are available with maximum flow rates of 1.5 to 1.8 gpm.
- Some states have adopted kitchen faucet efficiency standards, which can help guide kitchen faucet selection.
- Some models of kitchen faucets can have a variety of features that are useful to homeowners, such as different spray functions and sensor or touch technology. See Faucet Types at right for more information.



## BUILD

- **SPECIFY** and **INSTALL** kitchen faucets that have a flow rate between 1.5 gpm and 1.8 gpm to save water compared to the federal standard.
- **CHECK** state efficiency standards to ensure kitchen faucets meet local requirements. See Learn Local Requirements at right for more information.



## VERIFY

- **OBTAIN** the makes and model numbers for all kitchen faucets in a home and look up the rated flow rate.
- **VERIFY** the maximum flow rate from each kitchen sink faucet. Use a small bucket or attach a flow-measuring bag to the faucet spout, turn on the water completely while starting a stopwatch and, after 10 seconds, turn off the water and check the volume of water collected.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

## Faucet Types

**Spray Modes:** Some faucets allow the user to switch between a traditional faucet flow and a spray stream to assist with rinsing.

**Pull-Down and Pull-Out:** Some faucets allow the flow direction to be manipulated by pulling the faucet spout away from the rest of the fixture using a flexible hose. Both “pull-down” and “pull-out” designs are common in the marketplace.

**Sensor Technology:** Some kitchen faucet products are equipped with touch or no-touch (sensor) technology that allows activation without having to pull the handle.

## Learn Local Requirements

Some states and municipalities have set more stringent efficiency standards, requiring kitchen faucets to have a flow rate below the federal 2.2 gpm standard. However, in some cases, faucets are allowed to be equipped with a temporary “boost” mode to override the typical operating flow and assist with quicker pot filling or other volumetric needs. The faucet is required to revert back to its typical flow rate once it is turned off.

States that have adopted kitchen faucet efficiency standards can be found on the Appliance Standards Awareness Project web page at <https://appliance-standards.org/product/faucets>.



# Dishwashers



**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- WaterSense recommends that dishwashers, including those in common areas of multifamily buildings, be ENERGY STAR® certified. These models use 3.2 gallons of water per cycle (gpc) or less, which is at least 30 percent less than dishwashers meeting the federal standard of 5.0 gpc.
- ENERGY STAR certified models include several innovations that reduce energy and water consumption and improve performance. For example, dishwashers with an auto-sensing cycle have a soil sensor that tests how dirty dishes are throughout the wash and adjusts the cycle to achieve optimum cleaning with minimum water and energy use.
- The ENERGY STAR criteria are based on specific energy and water consumption levels. The maximum energy consumption is measured in kilowatt hours per year (kWh/year) and the maximum water consumption is measured in gpc.
- ENERGY STAR criteria vary based on standard or compact-sized dishwashers.



## BUILD

- **SPECIFY** ENERGY STAR certified dishwashers and confirm that they have been labeled by using the ENERGY STAR Product Finder at [www.energystar.gov/productfinder/](http://www.energystar.gov/productfinder/).



## VERIFY

- **VERIFY** the appliance's make, model, and water consumption in gpc through either of the following:
  - Refer to the product specification sheet.
  - Search the ENERGY STAR Product Finder.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*



## Advantages of ENERGY STAR

Dishwasher technology has improved dramatically over the last decade, and new ENERGY STAR certified models include several innovations such as soil sensors, improved water filtration, more efficient jets, and dish rack designs that reduce energy and water consumption and improve performance.

A standard-sized ENERGY STAR certified dishwasher can save homeowners about 3,800 gallons of water over its lifetime.

Using an ENERGY STAR certified dishwasher can also result in notable water savings compared to washing dishes by hand.

## Learn More




Check out the ENERGY STAR Dishwashers web page at [www.energystar.gov/products/dishwashers](http://www.energystar.gov/products/dishwashers) for more information.



# Clothes Washers



 **Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- WaterSense recommends that clothes washers, including those in common-use laundry rooms of multifamily buildings, be ENERGY STAR® certified. These models have an integrated water factor (IWF) of less than or equal to 4.3 gallons of water per cycle per cubic foot capacity.
- Different criteria can apply to residential clothes washers depending on their capacity and whether they are front-loading or top-loading washers.
- ENERGY STAR uses thresholds for integrated modified energy factor (IMEF) and IWF as criteria.
  - IMEF is the energy performance metric. A *higher* IMEF is indicative of a more energy-efficient clothes washer.
  - IWF is the water performance metric. It allows the comparison of clothes washer water consumption independent of clothes washer capacity. A *lower* IWF is indicative of a more water-efficient model.
- Front-load washers generally offer greater opportunity to reduce water consumption.
- Common-use areas in multifamily buildings might have commercial clothes washers, which have different criteria for earning the ENERGY STAR certification, but still improve water efficiency.



## BUILD

- **SPECIFY** ENERGY STAR certified clothes washers and dryers and confirm that they have been labeled by using ENERGY STAR Product Finder at [www.energystar.gov/productfinder/](http://www.energystar.gov/productfinder/).



## VERIFY

- **VERIFY** the appliance's make, model, capacity, and IWF through either of the following:
  - Refer to the product specification sheet.
  - Search the ENERGY STAR Product Finder.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocol.*

### Front-Load or Top-Load: What's the Difference?

Both types of clothes washers can be effective and save water.

- Front-loaders tumble clothes through a small amount of water instead of rubbing clothes against an agitator in a full tub.
- Modern top-loader impeller washers have a low-profile cone or disc, rather than an agitator. Impeller washers are more energy- and water-efficient compared to agitator washers.

ENERGY STAR certified front-load washers are about 25 percent more energy- and water-efficient than top-load impeller washers. However, both designs dramatically reduce the amount of hot water used in the wash cycle and the energy needed to heat that water. ENERGY STAR certified clothes washers also leave less moisture in the clothes, which means less time and energy required for drying.

### Learn More



Check out the ENERGY STAR Clothes Washers web page at [www.energystar.gov/products/clothes\\_washers](http://www.energystar.gov/products/clothes_washers) for more information.



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# Hot Water Delivery

**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Efficient hot water delivery (HWD) systems provide hot water to fixtures faster, wasting less time, water, energy, and money.
- To design efficient HWD systems, minimize pipe run lengths and right-size pipe diameters.
- Residential HWD systems come in a variety of design installation methods and materials. Some of the most common are summarized in the table below.

HWD System Description	HWD System Schematic
<p><b>Trunk-and-branch systems</b> have one or more long, large diameter common flow main lines (trunks) that run from the water heater to the farthest fixture. “Branches” from the main trunk supply hot water to different parts of the house, and “twigs” provide hot water to individual fixtures.</p>	
<p><b>Core systems</b> rely on a centrally located water heater that can supply fixtures with individual small-diameter pipes.</p>	
<p><b>Whole-house manifold systems</b> supply a central manifold with a single, short, large-diameter pipe and have small-diameter piping running from the manifold to reach individual fixtures.</p>	
<p><b>Recirculation systems</b> have a continuous loop of hot water recirculating through the home by means of a circulating pump. Ensuring the recirculation is demand-activated (for example by a push button or motion sensor) ensures that recirculation does not unnecessarily increase the energy used to heat water.</p>	



## BUILD

- **DESIGN** a hot water distribution system that meets the needs of the homeowner and achieves performance by considering the layout of the home and the most appropriate type of piping for the system.
- **AIM** to design and install a system that has the lowest volume of water between the water heater and each end use possible. A good target is 0.5 gallons or less between each end use (e.g., shower, faucet).
- **COORDINATE** verification of the HWD system by a WaterSense home verifier, if possible, prior to installation of drywall.



## VERIFY

- **VERIFY** the volume and time needed to detect a 10°F temperature change by identifying the fixture farthest from the hot water source. Place a bucket under the hot water fixture, turn the hot water completely on, and use a thermometer to record the starting temperature. Once the water temperature has increased by 10°F, turn off the water. Measure and record the volume of water collected.
- **CONFIRM** that a demand-initiated recirculation pump has been installed, if applicable.

*\*NOTE: Consult with the Home Certification Organization (HCO) for specific verification protocols.*

### Energy-Saving Heat Pumps

Water heaters use about 20 percent of a home's energy. Builders can install an ENERGY STAR® certified heat pump water heater to help reduce energy use associated with heating water. Visit the ENERGY STAR Super-Efficient Water Heater web page at [www.energystar.gov/products/energy\\_star\\_home\\_upgrade/super\\_efficient\\_water\\_heater](http://www.energystar.gov/products/energy_star_home_upgrade/super_efficient_water_heater) to learn more and find eligible models.



### Piping Materials

There are several choices for pipe materials, although their selection may be influenced by the type of system being installed:

- Trunk-and-branch and core systems traditionally use copper pipes but can use any type of piping.
- Whole-house manifold systems use flexible piping, such as types of cross-linked polyethylene (PEX).
- Demand-initiated recirculation systems can use any type of piping.

Consider the effect of pipe diameter on efficiency and performance of the system. For example, smaller diameter piping may be acceptable to deliver water from the main supply line to individual fixtures, whereas the main line requires larger diameter piping to ensure adequate flow.

Pipe insulation can further improve HWD efficiency, as it reduces the overall rate of heat loss from water stored in the piping. Pipe insulation with a minimum R value of R-3 should be used.

### Learn More

Check out WaterSense's *Guide for Efficient Hot Water Delivery Systems* at [www.epa.gov/watersense/watersense-labeled-homes-hot-water](http://www.epa.gov/watersense/watersense-labeled-homes-hot-water) to learn about designing hot water delivery systems to reduce wait times and maximize water efficiency.



# Water Softeners



**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Water softeners are common household appliances found in regions where hard water (or water that contains higher amounts of dissolved calcium or magnesium) is prevalent. Hard water can cause scale to form on the inside of pipes, water heaters, and other appliances and equipment. Scale does not conduct heat well and can reduce the flow of water through pipes and fixtures. Hard water also reacts with soap to form a sticky coating on skin and reduces soap's ability to lather, which can make a bath, shower, or clothes washer cycle less productive.
- Cation exchange water softeners remove the calcium and magnesium ions found in hard water by exchanging them with sodium (or potassium) ions in salts that include chloride. Once all the ions are fully exchanged, the water softener undergoes a regeneration process to flush the system of excess ions so that the system is again ready to soften incoming hard water.
- Water softeners are not necessary in all homes. They should only be considered in areas of substantial hardness or where recommended by appliance manufacturers, local health and safety codes, and/or water utilities. Some jurisdictions may limit the use of water softeners or have requirements that must be met to minimize water waste or preserve water quality.
- The NSF/ANSI 44 *Residential Cation Exchange Water Softeners* standard includes a voluntary efficiency rating that requires softeners to use 5.0 gallons of water or less per 1,000 grains of hardness removed.
- Water softeners that use demand-initiated regeneration are more efficient than water softeners that function based on a fixed schedule.

### Not Just Water Efficiency

When selecting a water softener to install in a home, it's best to consider not just water efficiency, but salt efficiency too. Salt efficiency defines the hardness removal capacity of a water softener and is measured in grains of hardness removed per pound of salt.

Salt efficiency is important for two reasons. First, greater salt efficiency reduces the amount of salt that needs to be purchased and supplied to the unit by the homeowner. Second, it decreases the amount of sodium and chloride ions that are discharged into the home's wastewater. Too great a concentration of these ions can negatively impact septic systems or affect the ability for the community to meet water quality discharge limits for sodium and chloride or reuse municipally treated wastewater.





## BUILD

- **AVOID** installing water softeners when water hardness levels do not indicate a need for softening.
- **SPECIFY** demand-initiated regeneration systems that meet the voluntary efficiency rating requirements of NSF/ANSI 44. Select models with a lower water consumption (i.e., gallons per 1,000 grains of hardness removed) and higher salt efficiency (i.e., grains of hardness exchanged per pound of salt).
- **CONSIDER** supplying softened water only to a subset of fixtures or household uses. For example, consider plumbing the system to only soften hot water. Likewise, outdoor water use, for example, may not require softened water. Reducing the demand on a water softener will result in lower water consumption and operating costs.



## VERIFY

- **OBTAIN** the make and model number for all water softeners.
- **REVIEW** the manufacturer's product specification sheet or product literature to determine water efficiency and salt efficiency.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### Alternatives to Water Softeners

Technologies have been developed that provide alternatives to traditional cation exchange treatment. Evidence suggests that some of these devices can provide anti-scaling treatment without the use of salt and reduce water consumption from flushing the system. The links below provide information on some of the alternatives.

- University of Nebraska Extension Fact Sheet: <https://water.unl.edu/article/drinking-water-wells/salt-free-water-softener-alternatives>
- City of Waterloo, Ontario, Information on Softener Alternatives: <https://watersoftenerfacts.ca/how-softeners-work/#alternate>

IAPMO/ANSI Z601 *Standards for Scale Reduction Devices* was developed to evaluate whether softening devices or other treatment devices effectively reduce scale. More information about the standard can be found at [www.wqpmag.com/services/product-testing-certification/article/10958980/testing-for-scale](http://www.wqpmag.com/services/product-testing-certification/article/10958980/testing-for-scale).


### Learn More

Visit WaterSense's Cation Exchange Water Softeners web page at [www.epa.gov/watersense/cation-exchange-water-softeners](http://www.epa.gov/watersense/cation-exchange-water-softeners) for more information.



# Metering



-  **Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Single-family residences typically have a single meter that is required by the water utility or authority having jurisdiction (AHJ) for billing purposes. However, this is not always the case. It is common for homes supplied with onsite well water to not have a meter installed.
- WaterSense encourages installation of water meters, even when not required by the local water utility or AHJ, to help homeowners and multifamily building managers understand and manage their water use.
- Multifamily properties typically have a master meter for a whole building or property, unless submetering of individual units is required by the water utility or AHJ, or unless the property plans to submeter each unit for billing purposes.
- Individual metering or submetering for each unit in multifamily buildings helps residents track their usage and allows property managers to identify and manage issues such as leaks in a specific unit.
- Utility water meters are typically owned by the water utility and are used to track water use from whole properties or significant pieces of a property. To be separately metered, each unit must represent a wholly separate plumbing system attached to the main line. Submetering typically involves using downstream meters to monitor distinct uses of water or systems.
- Work with the water utility or AHJ to identify the meter type and size appropriate for the home or unit. Pursue reducing the meter size to the extent possible, which often reduces initial and ongoing charges from the utility. If a multifamily building is pursuing submetering independent of a water utility, it is important to select the correct type and size of meter.
- For multifamily buildings, meters and submeters can be integrated into a centralized building management or billing system, making it easy to track water usage and accurately bill residents.
- A dedicated irrigation meter might be appropriate for some types of residential properties, such as single-family residences with large landscapes, multifamily buildings, homeowners associations with outdoor common space, or



### Understand Local Submetering Rules

Owners and operators of multifamily properties should be sure to understand the rules and regulations related to submetering and resident utility billing, as these can vary by location. For example, some states or local utilities may require the use of submeters for individual units, whereas other states require prior approval from the responsible state agency or public utilities commission before installing submeters.

While WaterSense recommends water metering and submetering wherever feasible, another common strategy to recoup water costs is through a Ratio Utility Billing System (RUBS). Through a RUBS program, a property owner is able to allocate costs from a master meter serving a multifamily property to individual units, typically based on square footage, occupancy, and/or other factors.

To find out more regulations pertaining to submetering or RUBS, contact your state government, public utility commission, or water utility.

properties with access to reclaimed water for irrigation purposes. These meters exclusively measure outdoor water use and can be particularly helpful for evaluating outdoor water efficiency.



## BUILD

- **INVESTIGATE** submetering during the early stages of designing the plumbing system for multifamily properties. Consider supplying each unit with a single pipe source for the water to facilitate individual unit submetering, which is less expensive than metering each source of water entering the unit.
- **SELECT** equipment that is best suited for the property. For example, positive displacement meters may be well-suited for residential applications, because they have high accuracy at low flows and can precisely measure peak flows.
- **COMMUNICATE** with the water utility or meter manufacturer to select an appropriately sized meter, which depends on the home's or unit's size, function, fixture types, anticipated occupancy, and peak population. These statistics affect minimum and maximum flow rates, which guide meter sizing.
- **FOLLOW** the meter manufacturer's instructions for installation.
- **INSTALL** meters in an accessible location that is protected from weather and potential damage (work with water utility as appropriate).
- **AVOID** installing the meter near pipe bends. Place the meter where there is a length of straight pipe equivalent to at least 10 times the pipe diameter downstream of the meter and five times the pipe diameter upstream of the meter.
- **INCLUDE** a strainer on all meters and submeters to prevent debris and sediment from damaging the device. An inline strainer on the meter's inlet will prevent debris and sediment from entering the meter body.



## VERIFY

- **REVIEW** building plans to identify water meter location(s).
- **CONFIRM** that a meter or alternative for tracking water use is installed for each unit in a multifamily building.
- **ENSURE** that residents can easily access information from the submeters.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*



## Savings Potential

One national study on submetering of multifamily buildings showed that residents in submetered units used approximately 15 percent less water than residents in unmetered units.

## Learn More

- EPA's *WaterSense at Work: Best Management Practices* at [www.epa.gov/watersense/best-management-practices](http://www.epa.gov/watersense/best-management-practices) guide has information on implementing metering in commercial and institutional properties, but much of the information is also relevant to multifamily buildings. Builders and property managers may find the document useful, especially for tips on meter installation and maintenance.
- Pacific Northwest National Laboratory's *Water Metering Best Practices* guide at [www.pnnl.gov/publications/water-metering-best-practices](http://www.pnnl.gov/publications/water-metering-best-practices) has useful recommendations for selecting a meter.
- IAPMO's Water Demand Calculator at [www.iapmo.org/water-demand-calculator/](http://www.iapmo.org/water-demand-calculator/) can help right-size plumbing systems based on anticipated maximum flow rates.




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# Leak Detection and Flow Monitoring Systems



 **Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Leaks can be associated with toilet flappers, dripping faucets, irrigation lines, or many other sources.
- Leak detection and flow monitoring systems are devices used to identify potential leaks in water systems. If a leak is detected, these devices sound an alarm or send a notification to the homeowner, helping to limit water waste and potential water damage.
- Some insurance companies may provide premium discounts or credits for leak detection or flow monitoring systems, particularly those connected to automatic shutoff devices.
- These devices use a variety of technologies, have unique installation requirements, and offer different features and benefits. It's important to consider priorities for a particular house/project in selecting the appropriate leak detection device(s). See Potential Features of Leak Detection and Flow Monitoring Devices on the next page.



## BUILD

- **UNDERSTAND** product limitations from the manufacturer. Some products do not work under certain conditions (e.g., under higher water pressure) or with certain models of meters.
- **SELECT** a device capable of monitoring for all water use in the home. For example, if a home has an irrigation system, select a device that can monitor for indoor and outdoor water use or leaks.
- **FOLLOW** the manufacturer's installation instructions. If installing an in-line device, ensure the plumbing design has enough pipe length to accommodate the device and that the leak detection system is installed in an area that is easily accessible.
- **ENSURE** the device is installed such that it will not interfere with fire sprinkler systems.
- **COMMUNICATE** sign-up or subscription requirements, if applicable, to the homeowner upon turnover of the home.

### Make the Home System Ready

Not sure if the future homeowner will want a leak detection device installed? Some manufacturers of in-line systems offer pipe spacers to ensure the plumbing system is ready for easy installation of the device at a later time.



## VERIFY

- **CONFIRM** the location and installation of leak detection devices.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

## Potential Features of Leak Detection and Flow Monitoring Devices


<b>Monitoring Technology</b>	<ul style="list-style-type: none"> <li>Moisture-sensing devices use electrodes to detect water as it appears in a designated area and sound an alarm or activate a shut-off valve to notify homeowners when water is in a location that is not intended, such as on the floor near a water-using appliance or fixture.</li> <li>Flow monitoring devices record water flow or water pressure in pipes to detect irregularities. If irregular water use or pressure changes are detected, the device notifies the homeowner and/or activates an associated shut-off valve to prevent water waste or damage.</li> </ul>
<b>Installation Requirements</b>	<ul style="list-style-type: none"> <li>In-line devices, which typically come with shutoff capabilities, are more invasive and likely require a plumber to install within water piping.</li> <li>Moisture-detection or external flow monitoring devices are less complicated to install.</li> <li>Some systems integrate multiple technologies (e.g., separate devices for moisture detection and flow monitoring) in a mesh network to offer enhanced protection.</li> </ul>
<b>Area and Uses Being Monitored</b>	<ul style="list-style-type: none"> <li>Some moisture detection and flow monitoring devices are focused on a specific point of use, such as a toilet or water heater, while others are installed at the point of entry to a home or unit to monitor whole-house water consumption.</li> <li>Some devices are specifically intended for indoor or outdoor water use, while others can monitor water use in both areas.</li> </ul>
<b>Intervention Abilities</b>	<ul style="list-style-type: none"> <li>Some devices offer integrated shutoff capabilities or otherwise activate a water shutoff valve.</li> <li>Devices without shutoff abilities typically sound an alarm or send a notification.</li> </ul>





# Service Water Pressure



 **Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Water pressure in supply main lines can reach 100 pounds per square inch (psi) or more. High water pressure can damage plumbing piping, fixtures, and appliances, and can lead to increased water consumption, premature equipment failure, and risk of leaks.
- Most U.S. plumbing codes require pressure-regulating valves (PRVs, also called pressure regulators) on domestic systems where the pressure of the supplied water exceeds 80 psi.
- Single-family residences supplied by groundwater wells should use a pressure tank set at 60 psi. This not only ensures optimal performance of the home and protects it from leaks, but conserves energy.
- WaterSense recommends incoming service pressure to be between 45 and 60 psi to ensure efficient use of water and proper system function. This water pressure is within the optimal pressure range for water-using fixtures and appliances, while still reducing the amount of water used and risk to the system compared to higher pressures.



## BUILD

- **CONFIRM** that service pressure does not exceed 80 psi by consulting with the public water supplier.
- **INSTALL** a PRV downstream of the point of connection to the water source and set the PRV to limit pressure to between 45 and 60 psi.
- **CONSULT** local plumbing codes to see if thermal expansion, which can occur from installing a PRV since it creates a closed system, needs to be addressed.
- **MAINTAIN** fire sprinkler systems in accordance with state and local codes and regulations.



## VERIFY

- **VERIFY** the water pressure to the home or unit to determine if the PRV, if installed, is set and working correctly.
  - Attach a pressure gauge to a hose bibb, the cold-water faucet for the washing machine hookup, or a cold-water faucet on the first floor. Turn on the water to the fully open position.
  - If the home has multiple water supplies (e.g., an independent source for irrigation), verify the water pressure from each supply.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### Direct-Acting Valves

The most common type of water pressure-reducing valve is a direct-acting valve, which consists of a globe-type body with a spring-loaded, heat-resistant diaphragm connected to the outlet of the valve that acts upon a spring. Water entering the valve is constricted within the valve body and directed through the inner chamber, which is controlled by an adjustable spring-loaded diaphragm and disc. The minimum flow through a PRV should be between 10 and 15 percent of the maximum desired flow rate. Select a regulator for which operating pressures fall within the middle of its rated range, not based on the size of the pipe to which it will be attached.

### Learn More

Visit the Building America Solution Center at <https://basc.pnnl.gov/resource-guides/service-water-pressure> to learn more.




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## OUTDOOR FEATURES

# Landscape Design and Plant Selection



 **Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- When designing a landscape, consider factors such as local climate, sun and shade, soil conditions, required maintenance, and intended use to select appropriate plants. Each area of a landscape may have a different ability to support various plant species without the need for supplemental water and fertilizers.
- Once established, many drought-tolerant plants require little water beyond normal rainfall. Because native plants are adapted to local soils and climate, they are more resistant to pests and diseases than other species. See WaterSense's Landscaping Tips web page at [www.epa.gov/watersense/landscaping-tips](http://www.epa.gov/watersense/landscaping-tips) for more information.



## BUILD

- **SELECT** plants that are defined as low water use or drought-tolerant for your region. Use regionally appropriate, low-water-using, and/or native plants. These plant species are more likely to be able to survive in the regional climate with minimal, if any, need for supplemental watering. See WaterSense's What to Plant web page at [www.epa.gov/watersense/what-plant](http://www.epa.gov/watersense/what-plant) for more information.
- **PLANT** based on site conditions, such as soil type and exposure to sun and wind. Grouping vegetation with similar watering needs (i.e., hydrozoning) reduces water use by providing plants with their ideal water requirement.



## Benefits of Water-Smart Landscaping

The benefits of designing a water-smart landscape include:

- Lower water bills from reduced water use.
- Conservation of natural resources and preservation of habitats for plants, pollinators, and other wildlife, such as fish, birds, and waterfowl.
- Reduced home heating and cooling costs through the careful placement of shade trees and shrubs.
- Reduced runoff of stormwater and irrigation water that carries topsoils, fertilizers, and pesticides into lakes, rivers, and streams.
- Fewer yard trimmings to be managed or landfilled.
- Reduced landscaping labor and maintenance costs.
- Extended life for water resource infrastructure (e.g., reservoirs, treatment plants, groundwater aquifers), which reduces taxpayer costs.



## VERIFY

- **DETERMINE** whether there is a landscape design for the property. Use the design to confirm that the correct species were planted in the intended locations.
- **CONFIRM** that plants are suitable options given the landscape and region, if the plants selected for the design were not available at the time of installation.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*



### Water-Smart Landscaping Tips for Turf

How and where turf is placed in the landscape can significantly reduce the amount of irrigation water needed to support the landscape. Lawns require a large amount of supplemental water and generally greater maintenance than other vegetation. Use turf where it has a practical function, such as in play or recreation areas.

Grouping turf areas can increase watering efficiency and significantly reduce evaporative and runoff losses. Select a type of grass that can withstand drought periods and become dormant during hot, dry seasons. Reducing or eliminating turf areas altogether further reduces water use. See WaterSense’s Landscaping Tips web page at [www.epa.gov/watersense/landscaping-tips](http://www.epa.gov/watersense/landscaping-tips) for more strategies.

### Xeriscaping for Arid Regions

A xeric environment is one that is very dry and has little moisture. Xeriscaping is a form of water-smart landscaping intended for arid and semi-arid regions. It involves selecting xeric plants that thrive in dry conditions and require very little supplemental watering. Incorporating xeriscaping does not mean that the home must be devoid of turf or other water-intensive plants. Different areas can be zoned for different plant types (and irrigation requirements). For example, xeriscaping can be incorporated at the outer edge of the property, while a smaller “oasis” zone intended for play and recreation can be maintain closer to the house. Locating the oasis on the north and east sides of the house will ensure it receives more shade, which reduces irrigation requirements. To learn more, check out *New Mexico’s Enchanted Xeriscape Guide* at [www.ose.state.nm.us/WUC/LearningXeriscape/XeriscapeGuide\\_ScreenResolution.pdf](http://www.ose.state.nm.us/WUC/LearningXeriscape/XeriscapeGuide_ScreenResolution.pdf).

### Additional Resources

The following resources may help with addressing water efficiency during landscape design and plant selection:

- The WaterSense Water Budget Tool can help users plan their landscapes and determine whether it will use an appropriate amount of water for the climate ([www.epa.gov/watersense/landscape-water-budget-tool](http://www.epa.gov/watersense/landscape-water-budget-tool)).
- The Lady Bird Johnson Wildflower Center allows users to search for native plants based on their state and other parameters, such as light requirement ([www.wildflower.org/plants/](http://www.wildflower.org/plants/)).
- The North American Native Plant Society has compiled links for native plant societies in each state (<https://nanps.org/native-plant-societies/>).
- WaterSense’s *Water-Smart Landscapes* guide includes daily maintenance tips and step-by-step instructions for achieving a water-efficient landscape ([www.epa.gov/system/files/documents/2021-12/ws-outdoor-water-smart-landscapes.pdf](http://www.epa.gov/system/files/documents/2021-12/ws-outdoor-water-smart-landscapes.pdf)).
- WaterSense’s Additional Outdoor Resources web page offers more resources to reduce outdoor water use ([www.epa.gov/watersense/additional-outdoor-resources](http://www.epa.gov/watersense/additional-outdoor-resources)).



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# Soil Management and Mulching



**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Healthy soil helps cycle nutrients, minimize runoff, retain water, and absorb excess nutrients, sediments, and pollutants.
- Local jurisdictions may have post-construction soil management requirements as part of their stormwater management programs.
- Soil characteristics such as pH and composition can help determine appropriate plant choice for a water-efficient yard.
- Slopes can be challenging because of the potential for erosion and runoff. If slopes cannot be avoided, consider installing plants with deeper root zones, such as native groundcovers and shrubs, to provide stabilization and prevent erosion. Ensure that appropriate plantings are used, and that only irrigation methods suitable for slopes are applied.
- Soil amendments can be organic or inorganic. They are mixed into the soil and help the soil retain moisture so that less irrigation is needed. As a result, soil amendments can result in short- and long-term water savings and improve plant health.
- Mulch can also be organic or inorganic. Organic mulches include wood-based materials such as wood chips, while inorganic mulches include rock-based materials such as pea gravel or lava rock.
- Mulching prevents water from evaporating from the soil and, in the case of organic mulch, decays and improves soil health over time.



## BUILD

- **RETAIN** and protect native topsoil and vegetation where practical. If soil needs to be removed, stockpile and reuse it to restore disturbed soils.
- **MINIMIZE** soil compaction during the construction phase. Soil can become compacted during construction from equipment and foot traffic. Aerate soil with a lawn aerator to increase the infiltration

### Benefits of Mulching

The benefits of mulching for maintaining healthy soil include:

- **Preventing loss of water from the soil by evaporation.** Moisture moves to the surface and evaporates if the soil is not covered by mulch.
- **Maintaining a more uniform soil temperature.** The mulch acts as an insulator that keeps the soil cool under intense sunlight and warm during cold weather.
- **Preventing crusting of the soil surface.** Mulch improves absorption and percolation of water into the soil and reduces erosion.
- **Improving soil structure.** If using organic material for mulch, as it decays, the material becomes topsoil and can also add nutrients to the soil.



of water into the ground, thus improving water flow to the plants' root zones and reducing water runoff. See the Sustainable Development Code web page at

<https://sustainablecitycode.org/brief/reduce-soil-compaction-during-construction-2/> for more information on reducing soil compaction during construction.

- **COLLABORATE** with the landscape professional to ensure that any steep slopes are planted correctly. Choose plant types that will hold onto the soil, and be mindful of irrigation system design, if applicable. Work with the landscape professional to ensure that any material placed on the slope will not move over time. This guidance primarily applies to slopes greater than four feet of horizontal run per one foot of vertical rise (4:1, 25 percent or 14 degrees).
- **APPLY** two to three inches of mulch to non-turf landscaped areas, such as those with shrubs, trees, annuals, perennials, and/or groundcover. Avoid piling mulch against the stems of plants or the trunks of trees to prevent rot.
- **AVOID** using rock mulches in sunny areas or around non-arid climate plants, as they radiate large amounts of heat and promote water loss that can lead to scorching.



## VERIFY

- **CONFIRM** that the soil has not been compacted from construction activities by ensuring that the soil is soft enough to push a shovel in and that there are no signs of pooling or puddling of water in low areas.
- **VERIFY** that steep slopes are covered or planted appropriately to ensure stability. This primarily applies to slopes greater than four feet of horizontal run per one foot vertical rise (4:1, 25 percent or 14 degrees). Verifiers can measure the grade of slopes with tools such as a laser level or clinometer.
- **MEASURE** the depth of mulch in landscape beds using a ruler or tape measure.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

## Soil Test Kit

To determine soil health, the builder or homeowners can have their soil tested for nutrient content, pH, soil composition, and organic matter content. Contact a local Cooperative Extension Office at [www.nifa.usda.gov/land-grant-colleges-and-universities-partner-website-directory?state=All&type=Extension](http://www.nifa.usda.gov/land-grant-colleges-and-universities-partner-website-directory?state=All&type=Extension) or state university for a soil test kit or soil testing services.

## Learn More

Go to WaterSense's Landscaping Tips web page at [www.epa.gov/watersense/landscaping-tips](http://www.epa.gov/watersense/landscaping-tips) to learn more about strategies to improve and maintain soil health.

The Sustainable Technologies Evaluation Program also maintains a guide for preserving and restoring healthy soils during construction at <https://sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/healthy-soils/preserving-and-restoring-healthy-soil-best-practices-for-urban-construction/>.



# Spray Irrigation



**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Different landscape types can be watered most efficiently with various types of irrigation equipment. Spray irrigation is best suited for turfgrass, as it can be designed to distribute water evenly over uniform turfgrass areas. It is not optimal for planted beds, since the varied heights of shrubs and trees can obstruct the spray from sprinklers. Spray sprinklers consist of a body and a nozzle.
- Spray sprinklers with excessive incoming pressure can waste water due to misting, overspray, and uneven coverage. This could also result in product failure.
- Pressure can be regulated by WaterSense labeled spray sprinkler bodies, which have integral pressure regulation, or with a pressure-regulating valve on the irrigation system. These solutions provide for consistent flow of water and ensure a more uniform distribution of water on the landscape.
- WaterSense labeled spray sprinkler bodies are certified to provide pressure regulation, resulting in a consistent flow rate, in accordance with the *WaterSense Specification for Spray Sprinkler Bodies*.
- To maximize water efficiency, ensure the irrigation system has matched precipitation nozzles. A spray sprinkler nozzle's precipitation rate is the speed at which water is applied to a specific area of the surrounding landscape.

### What Is Matched Precipitation?

When all spray sprinkler nozzles within the zone/system have the same precipitation rates, they are said to have “matched precipitation.” Designing a system with matched precipitation rate heads/nozzles can save water by ensuring that all areas of the landscape are watered at the same rate. This limits brown spots and prevents the homeowner from applying extra water to alleviate those brown spots.

### Other Water-Saving Features

In addition to integral pressure regulation, sprinkler bodies may have optional features such as flow reduction capabilities, integral check valves, and attributes to indicate reclaimed water use. Flow reduction prevents water from flowing when a sprinkler is broken or damaged. An integral check valve prevents water from flowing out of the system at lower elevations. Both are beneficial for operating an efficient irrigation system.



## BUILD

- **SPECIFY** models of spray sprinkler bodies that have earned the WaterSense label, using the WaterSense Product Search Tool at [www.epa.gov/watersense/product-search](http://www.epa.gov/watersense/product-search) for reference.
- **WORK** with an irrigation professional certified by a WaterSense labeled program (found at [www.epa.gov/watersense/findapro](http://www.epa.gov/watersense/findapro)) to design and install the irrigation system.
- **INSTALL** either WaterSense labeled spray sprinkler bodies or a pressure-regulating valve to maintain recommended operating pressure.

- **SPECIFY** and **INSTALL** spray sprinkler nozzles with matched precipitation to deliver enough water to cover the entire area of the landscape. This is especially important when a landscape has sprinklers with varying coverage (e.g., half- and quarter-arc sprinklers).

- Ensure matched precipitation throughout each spray irrigation zone by installing nozzles from the same model family produced by the same manufacturer. For matched precipitation, sprinkler spacing must be consistent, flow rates must be based on coverage, and the pipes need to deliver water at a uniform pressure to each sprinkler.



- See “What Is Matched Precipitation?” on the previous page for more details.

- **ENSURE** that spray sprinkler bodies have a four-inch or greater pop-up height, as they need a certain amount of clearance over the turfgrass surface to operate correctly.
- **AVOID** using turfgrass and spray irrigation on strips less than four feet wide, because it is difficult to irrigate narrow strips efficiently without creating overspray.
- **RESTRICT** installation of spray irrigation on slopes in excess of four feet of horizontal run per one foot vertical rise (4:1 or 25 percent), because the flow rates associated with sprinklers are often a source of runoff on steep slopes.



## VERIFY

- **CONFIRM** that spray sprinkler bodies are WaterSense labeled. Use the WaterSense Product Search Tool at [www.epa.gov/watersense/product-search](http://www.epa.gov/watersense/product-search) to search for the makes and model numbers for all spray sprinkler bodies installed in the landscape.
- **VERIFY** that pressure-regulating valves are regulating to the appropriate operating pressure recommended for the spray sprinkler nozzles, if applicable.
- **IDENTIFY** whether spray sprinkler nozzles have matched precipitation using manufacturer specification sheets or other literature. Verifiers can suggest changes that can help achieve matched precipitation.
- **CHECK** that the station or zone pressure is within plus or minus 10 percent of manufacturer-recommended operating pressure for the installed product (e.g., spray sprinkler body and nozzle). Verifiers can test a representative zone of the irrigation system.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### Learn More

Visit WaterSense’s Spray Sprinkler Bodies web page at [www.epa.gov/watersense/spray-sprinkler-bodies](http://www.epa.gov/watersense/spray-sprinkler-bodies) to learn more.




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# Microirrigation



 **Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense Approved Certification Method (WACM).



## UNDERSTAND

- The term "microirrigation" describes a type of irrigation that applies water to the root zone of plants at a lower flow rate. Some examples of microirrigation devices include drip line emitters, point-source emitters, multiple outlet emitters, and microsprays.
- Microirrigation systems use 20 to 50 percent less water than conventional sprinkler systems.
- Microirrigation requires additional components to ensure the system operates efficiently. At a minimum, microirrigation systems should be equipped with the following components:
  - Pressure regulators to maintain the lower pressure required for microirrigation;
  - Filters to keep emission devices free from debris; and
  - Flush end assemblies to flush the laterals after the end of an irrigation cycle.



## BUILD

- **WORK** with a certified irrigation professional to ensure that a microirrigation system is designed and installed properly. Certified irrigation professionals are experienced in the design and installation of microirrigation, as it takes expertise to ensure an efficient system. Find out more about professionals certified by a WaterSense labeled program at [www.epa.gov/watersense/irrigation-pro](http://www.epa.gov/watersense/irrigation-pro).
- **INSTALL** microirrigation on separate zones from the rest of the irrigation system if standard spray sprinklers are used in other parts of the landscape.
- **INCLUDE** pressure-compensating drip if using drip irrigation. These products help deliver a constant flow rate over a range of pressures and are intended for landscapes with wide fluctuations in elevation, topography, and pressures.
- **ENSURE** that the microirrigation system is properly equipped with the additional system components (i.e., pressure regulators, filters, and flush end assemblies).



## VERIFY

- **CONFIRM** that the station or zone pressure is within  $\pm 10$  percent of manufacturer-recommended operating pressure for the emission device or product being used. Verifiers can test this on a representative zone of the microirrigation system.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### WaterSense Resources

WaterSense has developed two guides to help irrigation professionals and homeowners understand the benefits of microirrigation.

- *Adding Microirrigation to Your Services: A Mini-Guide for Irrigation Professionals* explains how designing, installing, or retrofitting an existing system with microirrigation can help customers save water and enhance plant health.
- *Saving Water With Microirrigation: A Homeowner Guide* describes the types of landscapes where microirrigation works best and suggests how to work with an irrigation professional to design and install a system.

To find these guides and learn more visit WaterSense's Microirrigation web page at [www.epa.gov/watersense/microirrigation](http://www.epa.gov/watersense/microirrigation).



# Rain Sensors



**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Rain sensors, or rainfall shutoff devices, are products designed to interrupt a scheduled irrigation event when a certain amount of rain has fallen. They prevent an automatic sprinkler system from turning on until the water has evaporated from the sensor, or for a predetermined amount of time, depending on the technology.
- Rain sensors operate by measuring rainwater by weight or electrical conductivity or measuring the proportional expansion of water-sensitive materials like cork disks.
- Some states, such as Florida, Georgia, and New Jersey, require these devices by law.



## BUILD

- **MOUNT** the rain sensor in an open area where it is exposed to rainfall, such as on top of a fence or on the eaves of an existing structure, not impeded by overhangs, foliage, gutters, or other obstructions.
- **INSTALL** the rain sensor outside all irrigation zones, as water from the sprinklers could trigger the sensor.
- **WORK** with an irrigation professional who can help ensure that a rain sensor is included within the irrigation system design and installed properly.
- **REFERENCE** the WaterSense Labeled Controllers web page at [www.epa.gov/watersense/watersense-labeled-controllers](http://www.epa.gov/watersense/watersense-labeled-controllers) for information on WaterSense labeled irrigation controllers to pair with the rain sensor. All labeled controllers are required to be able to wirelessly connect to the rain sensor.



## VERIFY

- **CONFIRM** that a rain sensor is installed in an open area with access to open sky and rain, and that the device is properly connected to the irrigation controller.
- **TEST** the device by using a hose to spray at the rain sensor while one of the nearby irrigation zones is running to confirm that the sensor will interrupt irrigation. Some controllers require a particular mode to properly test the sensor. Check the controller model user manual for details. If the sensor doesn't shut the irrigation system off after a few minutes, let the builder or system installer know to fix the problem.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*



### Handoff Tips for the Homeowner

Maintenance is essential for a rain sensor to function properly. This may include replacing batteries at specified intervals, removing debris from the rain sensor, and ensuring that the connection (wired or wireless) is working correctly. Builders should communicate the manufacturer's recommended maintenance procedures.

### Learn More

Learn more about reducing outdoor water use at WaterSense's Watering Tips web page at [www.epa.gov/watersense/watering-tips](http://www.epa.gov/watersense/watering-tips).



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# Irrigation Controllers

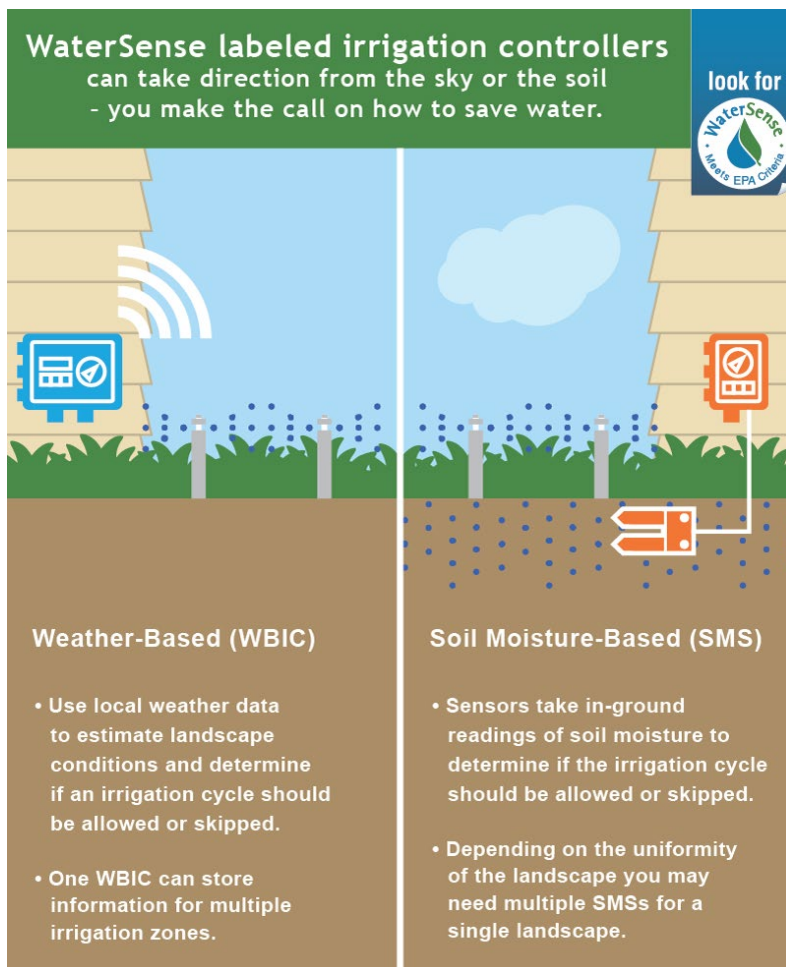


**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- WaterSense labels two types of irrigation controllers:
  - **Weather-based irrigation controllers (WBICs)** use local weather and landscape conditions to tailor watering schedules. WBICs can obtain weather data from onsite weather sensors and/or signals from local weather stations.
  - **Soil moisture-based irrigation controllers (also known as soil moisture sensors or SMSs)** monitor moisture levels in the soil to prevent irrigation when water is not needed. An SMS is comprised of a sensor mechanism (which stays in contact with the soil and measures the amount of moisture) and an interface device (which communicates the reading from the sensor mechanism to the controller).
- Both types of WaterSense labeled controllers can be purchased as stand-alone controllers. They can also be purchased as an “add-on” or “plug-in” device that can upgrade a clock-based controller.
- The diagram at right illustrates the difference between the two irrigation controllers.



## Real-World Results

Read WaterSense’s reports on weather-based irrigation controllers ([www.epa.gov/sites/default/files/2020-05/documents/ws-products-irrigation-outdoor-wbic-mini-report.pdf](http://www.epa.gov/sites/default/files/2020-05/documents/ws-products-irrigation-outdoor-wbic-mini-report.pdf)) and soil moisture-based irrigation controllers ([www.epa.gov/sites/default/files/2021-04/documents/ws-outdoor-products-sms\\_mini-report.pdf](http://www.epa.gov/sites/default/files/2021-04/documents/ws-outdoor-products-sms_mini-report.pdf)) to learn more about how the products function, guidelines for programming, and how to help homeowners maintain long-term water savings. They can also help a builder, irrigation professional, or homeowner decide which type of WaterSense labeled irrigation controller is best for the landscape.



## BUILD

- **SPECIFY** and **INSTALL** a WaterSense labeled WBIC or SMS. Use the WaterSense Product Search Tool at [www.epa.gov/watersense/product-search](http://www.epa.gov/watersense/product-search) for reference.

- **WORK** with an irrigation professional certified by a WaterSense labeled program to install the irrigation controller. These individuals are trained to install these devices and program them to work properly. Use WaterSense’s Find a Pro tool at [www.epa.gov/watersense/find-pro](http://www.epa.gov/watersense/find-pro) to find a certified professional in your area.
- If installing an irrigation controller yourself, use the following guidelines:
  - **FOLLOW** the manufacturer’s installation instructions found in product packaging or online. Manufacturers may also provide training on installation and operation through irrigation distributors or retailers.
  - **PROGRAM** the controller as described in the instructions. Note that that the initial period of landscape establishment may require more water, but the device should be reprogrammed for water efficiency once plants are established.
  - **MONITOR** the landscape after initial installation for several weeks to look for dry or overly wet areas. Adjust the controller accordingly.
  - **ENSURE** that the sprinklers are working properly and there is no overspray onto adjacent areas. The irrigation controller will not provide expected savings if sprinklers are malfunctioning.
  - **PROVIDE** information to the resident on properly programming the irrigation controller from the manufacturer or from WaterSense’s Watering Tips web page at [www.epa.gov/watersense/watering-tips](http://www.epa.gov/watersense/watering-tips).
- There are additional installation considerations for soil moisture sensors:
  - **INSTALL** the sensor in the area of the landscape that requires the most frequent irrigation (e.g., turf with minimal shade). Place the sensor mechanism in the root zone of the plants.
  - **USE** more than one sensor mechanism for large landscapes. Place each sensor in a separate irrigation zone.
  - **CALIBRATE** the sensor mechanism according to the manufacturer’s recommendations.
  - **ENSURE** that the SMS and rain sensor are wired in series (as opposed to in parallel), if a rain-sensing device is also installed. See the WaterSense report on SMSs at [www.epa.gov/sites/default/files/2021-04/documents/ws-outdoor-products-sms\\_mini-report.pdf](http://www.epa.gov/sites/default/files/2021-04/documents/ws-outdoor-products-sms_mini-report.pdf) for more details on installation.



Image courtesy of Rachio



## VERIFY

- **CONFIRM** that the irrigation controller is WaterSense labeled. Use the WaterSense Product Search Tool at [www.epa.gov/watersense/product-search](http://www.epa.gov/watersense/product-search) to confirm that the irrigation controller installed has earned the WaterSense label.
- **CHECK** for signs the landscape is being over- or under-watered by looking for soggy areas, brown spots, or wilted plants. Work with the builder or irrigation professional to adjust the irrigation controller.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### Learn More

Go to the WaterSense Labeled Controllers web page at [www.epa.gov/watersense/watersense-labeled-controllers](http://www.epa.gov/watersense/watersense-labeled-controllers) to learn more.




This technical fact sheet is part of EPA’s *Technical Reference Manual for WaterSense Labeled Homes*. For the full document and other tools and resources for homes, visit [www.epa.gov/watersense/tools-and-resources](http://www.epa.gov/watersense/tools-and-resources).

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## OUTDOOR FEATURES

# Using a Certified Professional for Irrigation Systems Design, Installation, and Auditing

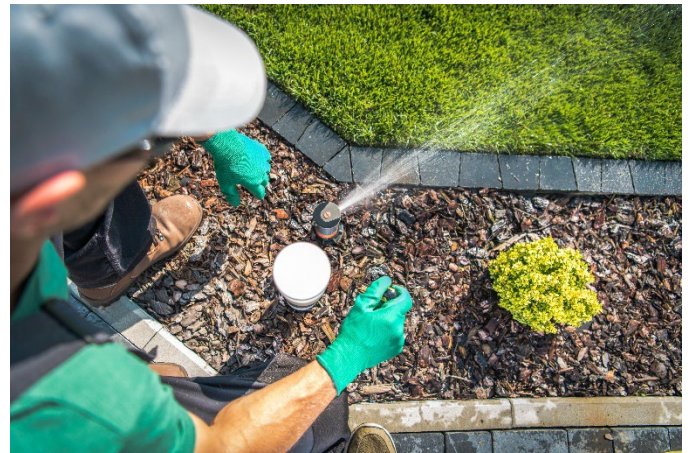


 **Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- It is essential to properly design and install a landscape irrigation system for optimal water efficiency.
- WaterSense has labeled certification programs for irrigation professionals in three categories: system designers; installation and maintenance professionals; and auditors. These individuals have passed a comprehensive exam covering general irrigation subjects, as well as specialized areas related to water efficiency.
- Certified irrigation professionals can address the following topics:
  - **Design:** Customize the irrigation system to suit the landscape and local climate conditions.
  - **Installation, maintenance, and repair:** Select and service the appropriate equipment and site layout. Schedule the irrigation system to optimize performance.
  - **Audit:** Examine the irrigation system to ensure that it performs efficiently.



## Benefits and Real-World Results

Irrigation professionals certified by WaterSense labeled programs help save water and maintain healthy and beautiful landscapes across the country by maximizing the efficiency of an irrigation system. WaterSense's Certified Professionals in Action web page at [www.epa.gov/watersense/certified-professionals-action](http://www.epa.gov/watersense/certified-professionals-action) showcases these professionals and describes the benefits of their expertise. Check out the stories to learn how a certified professional can help your property save water.



## BUILD

- **CONTRACT** with an irrigation professional certified by a WaterSense labeled program to design and install the irrigation system. Identify certified professionals using WaterSense's Find a Pro tool at [www.epa.gov/watersense/find-pro](http://www.epa.gov/watersense/find-pro) or, if one is not available in your area, look for a professional who has other training or professional certifications that address water efficiency or sustainable landscaping.
- **ASK** potential irrigation professionals questions to evaluate their knowledge of water-efficient irrigation, referencing WaterSense's list of suggested questions to ask an irrigation contractor at [www.epa.gov/sites/default/files/2017-01/documents/ws-outdoor-questions-for-landscape-contractors.pdf](http://www.epa.gov/sites/default/files/2017-01/documents/ws-outdoor-questions-for-landscape-contractors.pdf) when engaging in these conversations. For example, ask contractors about minimizing water waste in the landscape and listen for some of the following suggestions:

- **CHECK** sprinklers for breaks or leaks. Ensure that water is being delivered to its intended destination.
- **TEST** the irrigation system to ensure the zones are programmed correctly.
- **CREATE** an irrigation schedule that can be easily adjusted by season.
- **SCHEDULE** an irrigation audit by a certified irrigation professional after an irrigation system has been installed.



## VERIFY

- **CONFIRM** whether an irrigation professional certified by a WaterSense labeled program was used for irrigation system:
  - Design
  - Installation and controller scheduling/programming
  - Auditing
- **USE** the Find a Pro tool at [www.epa.gov/watersense/find-pro](http://www.epa.gov/watersense/find-pro) to verify credentials.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*

### Learn More

Visit WaterSense's Irrigation with Pro web page at [www.epa.gov/watersense/irrigation-pro](http://www.epa.gov/watersense/irrigation-pro) to learn more about irrigation professionals certified through WaterSense labeled programs.



## Multifamily Makeovers

Certified irrigation professionals can provide tailored advice to property managers at multifamily complexes, which have different considerations than single-family residences:

- **Homeowners association:** The residential community of Harvest Gold Village in Loveland, Colorado implemented the recommendations of a certified professional to save more than \$22,500 in water bills in the first year of the project. To learn more, read the case study at [www.epa.gov/sites/default/files/2021-06/documents/ws-commercial-outdoor-casestudy-harvest-gold-case-study.pdf](http://www.epa.gov/sites/default/files/2021-06/documents/ws-commercial-outdoor-casestudy-harvest-gold-case-study.pdf).
- **Apartment complex:** The La Paloma Apartments in Albuquerque, New Mexico, used the results of a landscape audit conducted by certified professionals to update its irrigation system and, along with other water efficiency upgrades, saved over five million gallons of water in the first year. To learn more, read the case study at [www.epa.gov/sites/default/files/2021-03/documents/ws-outdoor-la-paloma-case-study.pdf](http://www.epa.gov/sites/default/files/2021-03/documents/ws-outdoor-la-paloma-case-study.pdf).



# Pools and Outdoor Water Features



**Optional Water Efficiency Measure:** May contribute to the 30 percent water efficiency requirement, depending on the chosen WaterSense® Approved Certification Method (WACM).



## UNDERSTAND

- Thoughtful residential swimming pool design can help save pool owners water, energy, and money. To increase water efficiency, consider addressing issues related to evaporation, water quality, leaks, or pool usage.
- Providing a pool cover and installing a more water-efficient pool filter are the two most effective ways to reduce swimming pool water usage.



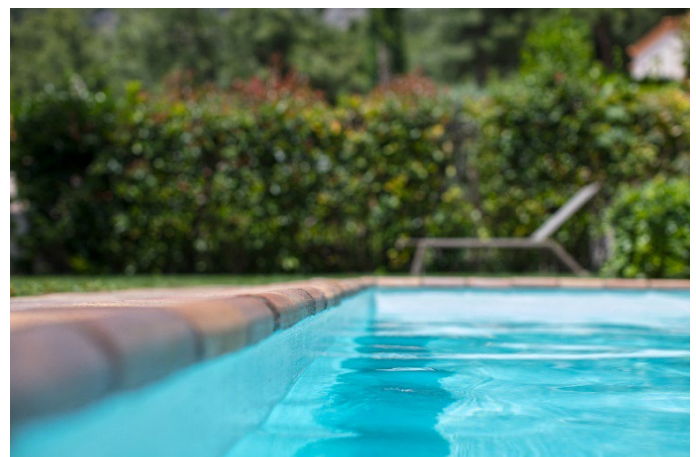
## BUILD

- **SELECT** a high-performance filter that minimizes or eliminates water consumption from backwashing. Filter backwash, in which water is sent backwards through a filter to remove debris, can account for up to a quarter of pool water consumption. Filters with less frequent backwash will help reduce water waste. Cartridge filters are the most water-efficient because they do not require backwashing. Diatomaceous earth (DE) or glass filters also reduce water usage compared to commonly used sand filters. Install a pressure gauge with the filter to help indicate when backwashing is necessary.
- **INSTALL** a separate water meter to help homeowners and multifamily property owners actively monitor pool water consumption and identify potential leaks.
- **DESIGN** the pool to easily accommodate a pool cover and associated equipment for employing the pool cover (e.g., reels, motors). Covering a pool during periods of inactivity will reduce water loss due to normal evaporation.
- **PLAN** landscaping surrounding the pool to reduce evaporation. Landscaping or other physical barriers, such as stone walls or fencing, can increase wind protection. Increasing shade through landscaping can also keep the pool cooler. Be sure to select plants that do not contribute more debris to the pool.
- **INSTALL** a gutter or grate system to catch water from splashing or drag-outs and return it to the pool.

### Design and Maintenance Guide for Pools

WaterSense’s *Jump Into Pool Water Efficiency* guide at [www.epa.gov/system/files/documents/2022-09/ws-outdoor-pool-guide.pdf](http://www.epa.gov/system/files/documents/2022-09/ws-outdoor-pool-guide.pdf) for residential pool owners and maintenance professionals explains how to achieve water efficiency in residential swimming pools. It includes details on using a pool cover, selecting the most appropriate filter type, and improving energy efficiency. The guide is a great resource for anyone responsible for installing, designing, or maintaining a pool.

Learn more about water efficiency for pools at WaterSense’s Pool Water Efficiency web page at [www.epa.gov/watersense/pool-water-efficiency](http://www.epa.gov/watersense/pool-water-efficiency).

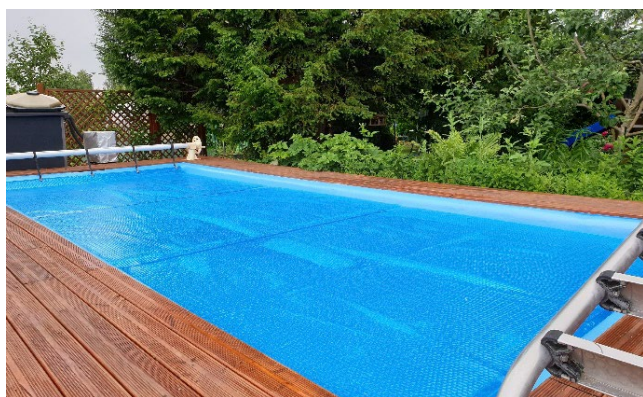




## VERIFY

- **CONFIRM** that there are no wet spots around the pool or air bubbles in the water return pipeline or in the pump strainer. Wet spots or bubbles are a sign of leakage from the pool liner, the pump seal, pool piping, the pool-to-pipe connection, pool edges, or pipe joints.
- **VERIFY** that a pool cover is installed.
- **IDENTIFY** the type of pool filter that is used.

*\*NOTE: Consult with the Home Certification Organization for specific verification protocols.*



## Ornamental Water Features

Ornamental water features can be more water-efficient by following some basic guidelines. Water features should recirculate water from the feature itself and serve a beneficial use such as wildlife habitat, stormwater management, and/or noise reduction. The water consumption of an ornamental water feature can be reduced if smaller pumps, lower pumping rates, and/or pressure-reducing valves are used to reduce water flow. The higher the water flow, the more water wasted due to evaporation. If the water feature includes cascading water, select one that falls down, rather than shoots up, to minimize evaporation. Placing the water feature in a shady area further reduces evaporation.

Recirculating the water reduces the amount of potable water used in an ornamental feature and helps to prevent algae growth in the feature. Two types of pumps are available for recirculating water—submersible pumps and surface (or line) pumps, which are more expensive and require extra plumbing.

## Pool Covers

WaterSense estimates that, depending on climate, an uncovered 500-square-foot swimming pool could lose between 12,000 and 31,000 gallons of water per year due to evaporation, with this number being even higher for heated pools. Pool covers are the most effective method of reducing water loss from evaporation. When in use, solid pool covers can reduce evaporation by more than 90 percent and, in the case of heated pools, save between 50 and 70 percent of pool heating costs.

Type	Effectiveness at Reducing Evaporation	Can It Serve as a Safety Cover?	Additional Information and Considerations
Solid/mesh/hybrid	Up to 95 percent	Yes	Mesh covers are lighter weight than solid covers but allow more evaporation to occur.
Solar (bubble cover, solar rings, thermal)	50 to 95 percent (varies based on shape and coverage)	No	Solar covers are designed to use the sun's energy to heat the pool.
Liquid evaporation suppressant	15 percent	No	Non-toxic, chemical evaporation suppressant is applied to the pool surface on a regular basis.



This technical fact sheet is part of EPA's *Technical Reference Manual for WaterSense Labeled Homes*. For the full document and other tools and resources for homes, visit [www.epa.gov/watersense/tools-and-resources](http://www.epa.gov/watersense/tools-and-resources).

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## Section 5: Additional Resources

WaterSense provides additional resources to help interested parties understand and pursue home water efficiency indoors and outdoors. Check out the following materials for more information on different topics. Please refer to the technical fact sheets in Section 4: Features of Water-Efficient Homes for more information about water-efficient products and designs for WaterSense labeled homes.

### WaterSense Labeled Homes Program

- Tools and Resources ([www.epa.gov/watersense/tools-and-resources](http://www.epa.gov/watersense/tools-and-resources))
  - *WaterSense Labeled Homes Introductory Guide*
  - WaterSense labeled homes across the United States regional fact sheets
- Home Specification Fact Sheets ([www.epa.gov/watersense/homes-specification](http://www.epa.gov/watersense/homes-specification))
  - *WaterSense Labeled Homes Program: Program Overview* fact sheet
  - *WaterSense Labeled Homes Program: Ensuring Homes Deliver on Efficiency* fact sheet
- Buying and Selling ([www.epa.gov/watersense/buying-and-selling](http://www.epa.gov/watersense/buying-and-selling))
  - *A Smart Investment With WaterSense* brochure
  - *WaterSense Labeled Homes Program: Provide Water Savings That Perform* fact sheet
- Homes Certification ([www.epa.gov/watersense/homes-certification](http://www.epa.gov/watersense/homes-certification))

### Indoor Water Efficiency

- WaterSense Labeled Toilets ([www.epa.gov/watersense/residential-toilets](http://www.epa.gov/watersense/residential-toilets))
- WaterSense Labeled Showerheads ([www.epa.gov/watersense/showerheads](http://www.epa.gov/watersense/showerheads))
- WaterSense Labeled Bathroom Faucets ([www.epa.gov/watersense/bathroom-faucets](http://www.epa.gov/watersense/bathroom-faucets))
- Hot Water Distribution Products and System Design Solutions ([www.epa.gov/watersense/watersense-labeled-homes-hot-water](http://www.epa.gov/watersense/watersense-labeled-homes-hot-water))
- Cation Exchange Water Softeners ([www.epa.gov/watersense/cation-exchange-water-softeners](http://www.epa.gov/watersense/cation-exchange-water-softeners))
- Fix a Leak Week Resources ([www.epa.gov/watersense/fix-leak-week](http://www.epa.gov/watersense/fix-leak-week))
  - *Detect and Chase Down Leaks* checklist
- ENERGY STAR Product Finder ([www.energystar.gov/productfinder/](http://www.energystar.gov/productfinder/))

### Outdoor Water Efficiency

- Landscaping Tips ([www.epa.gov/watersense/landscaping-tips](http://www.epa.gov/watersense/landscaping-tips))
  - *Water-Smart Landscapes Start With WaterSense* guide

- Irrigation with a Pro ([www.epa.gov/watersense/irrigation-pro](http://www.epa.gov/watersense/irrigation-pro))
- WaterSense Labeled Controllers ([www.epa.gov/watersense/watersense-labeled-controllers](http://www.epa.gov/watersense/watersense-labeled-controllers))
  - *Is Your Watering Under Control?* brochure
- WaterSense Labeled Spray Sprinkler Bodies ([www.epa.gov/watersense/spray-sprinkler-bodies](http://www.epa.gov/watersense/spray-sprinkler-bodies))
- Microirrigation ([www.epa.gov/watersense/microirrigation](http://www.epa.gov/watersense/microirrigation))
  - *Adding Microirrigation to Your Services: A Mini-Guide for Irrigation Professionals*
  - *Saving Water With Microirrigation: A Homeowner Guide*
- Sprinkler Spruce Up ([www.epa.gov/watersense/sprinkler-spruce-up](http://www.epa.gov/watersense/sprinkler-spruce-up))
  - *Find It, Flag It, Fix It: A Checklist for Your Landscape*
- Pool Water Efficiency ([www.epa.gov/watersense/pool-water-efficiency](http://www.epa.gov/watersense/pool-water-efficiency))
  - *Jump Into Pool Water Efficiency*

### General Water Efficiency Topics

- Multifamily Resource Guides ([www.epa.gov/watersense/water-score-multifamily-housing](http://www.epa.gov/watersense/water-score-multifamily-housing))
- Best Management Practices for Commercial and Institutional Facilities ([www.epa.gov/watersense/best-management-practices](http://www.epa.gov/watersense/best-management-practices))
  - *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities*
- Case Studies ([www.epa.gov/watersense/case-studies](http://www.epa.gov/watersense/case-studies))

There are additional federal programs and resources that can help guide builders in designing and constructing energy- and water-efficient homes.

- U.S. Department of Energy's Building America Solutions Center (<https://basc.pnnl.gov/>)
- ENERGY STAR ([www.energystar.gov/](http://www.energystar.gov/))
- U.S. Department of Energy Zero Energy Ready Home Program ([www.energy.gov/eere/buildings/zero-energy-ready-home-program](http://www.energy.gov/eere/buildings/zero-energy-ready-home-program))

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