

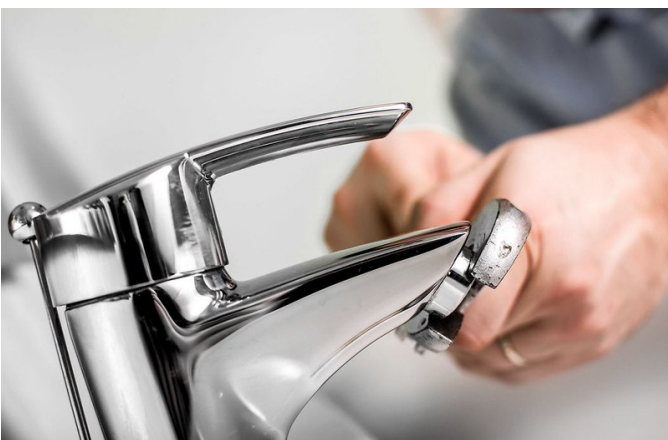


WaterSense at Work

Water Use Monitoring 2.2 Leak Detection and Repair



Best Management Practices for
Commercial and Institutional Facilities



November 2023

WaterSense® is a voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA) that seeks to protect the nation’s water supply by transforming the market for water-efficient products, services, and practices.

WaterSense at Work is a compilation of water efficiency best management practices intended to help commercial and institutional facility owners and managers from multiple sectors understand and better manage their water use. It provides guidance to help establish an effective facility water management program and identify projects and practices that can reduce facility water use.

An overview of the sections in *WaterSense at Work* is below. This document, covering leak detection and repair, is part of **Section 2: Water Use Monitoring**. The complete list of best management practices is available at www.epa.gov/watersense/best-management-practices. WaterSense has also developed worksheets to assist with water management planning and case studies that highlight successful water efficiency efforts of building owners and facility managers throughout the country, available at www.epa.gov/watersense/commercial-buildings.

- **Section 1. Getting Started With Water Management**
 - **Section 2. Water Use Monitoring**
 - **Section 3. Sanitary Fixtures and Equipment**
 - **Section 4. Commercial Kitchen Equipment**
 - **Section 5. Outdoor Water Use**
 - **Section 6. Mechanical Systems**
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 - **Section 8. Onsite Alternative Water Sources**
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This document is one section from *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities* (EPA-832-F-23-003). Other sections can be downloaded from www.epa.gov/watersense/best-management-practices. Sections will be reviewed and periodically updated to reflect new information. The work was supported under contract 68HERC20D0026 with Eastern Research Group, Inc. (ERG).

Overview

Identifying and repairing leaks and other water use anomalies within a facility's water distribution system, processes, or equipment can keep a facility from wasting significant quantities of water. As described in Table 1, water leaks and costs from wasted water can add up over time.^{1,2}

Table 1. Potential Losses From Water Leaks

Malfunction	Leaking Flow Rate (gallons per minute [gpm]) ³	Water Loss ³	Estimated Cost of Water Loss ⁴
Leaking Toilet <ul style="list-style-type: none"> Small (e.g., worn flapper) Medium (e.g., misaligned flapper) Large (e.g., stuck fill valve) 	0.02 gpm 0.2 gpm 3.0 gpm	860 gallons per month 8,600 gallons per month 4,300 gallons per day	Up to \$1,400 per month
Drip Irrigation Malfunction	1.0 gpm	43,200 gallons per month	\$5,700 per year
Unattended Water Hose at Night	10.0 gpm	5,400 gallons per day	\$22,000 per year
Broken Distribution Line for: <ul style="list-style-type: none"> One day One week One month 	15.0 gpm 15.0 gpm 15.0 gpm	21,600 gallons 151,200 gallons 648,000 gallons	Up to \$86,000 per year
Tempering Water Line on a Steam Sterilizer Stuck in the "On" Position	2.0 gpm	86,400 gallons per month	\$11,500 per year
Stuck Float Valve in a Cooling Tower	5.0 gpm	216,000 gallons per month	\$29,000 per year

¹ New York City Department of Environmental Protection. Repair Your Leaking Toilets: Save Water and Stop Flushing Away Your Water Bill. www.nyc.gov/assets/dep/downloads/pdf/water/drinking-water/toilet-detect-leak-brochure.pdf.

² City of Poway, California. How to Detect a Water Leak. <https://poway.org/183/How-to-Detect-a-Water-Leak>.

³ To convert from gallons to liters, multiply by 3.79.

⁴ Based on an average commercial rate of \$11.09 per 1,000 gallons for water and wastewater determined from data in: American Water Works Association (Raftelis Financial Consulting). 2020. *Water and Wastewater Rate Survey*.

An effective leak detection and repair program can help facility managers better understand building water use and save money by avoiding water waste. Leak reporting and education of building occupants can also be effective in reducing water waste from leaks, as long as reported leaks are promptly addressed. Refer to *WaterSense at Work Section 1.3: Education and Outreach* at www.epa.gov/watersense/best-management-practices for more information, and to the WaterSense Fix a Leak Week webpage at www.epa.gov/watersense/fix-leak-week, which includes resources to post in commercial and institutional restrooms to encourage leak reporting in the workplace.⁵ While Fix a Leak Week occurs in March, educating employees on finding and fixing leaks can happen all year long.

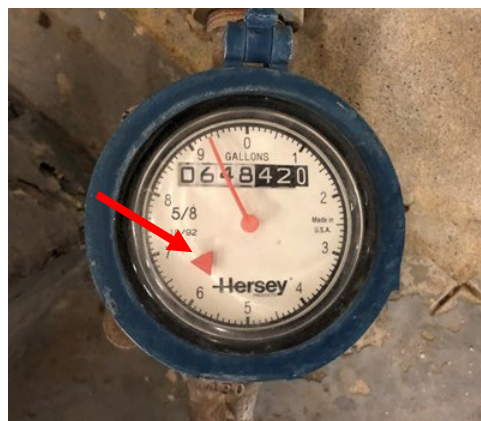
Best Practices

Reading water meters regularly, installing leak detection and flow monitoring devices, and conducting visual and auditory inspections are important best practices to detect leaks. To reduce unnecessary water loss, all detected leaks should be repaired quickly.

Reading Meters and Installing Leak Detection and Flow Monitoring Devices

To reduce water loss, consider the following metering and leak detection methods:

- Read the facility water meter during off-peak hours when all water-using equipment can be turned off and building occupants, employees, and visitors are not using sanitary fixtures. After all water uses have been shut off, read the meter, then read it again an hour later. If the water meter reading significantly changed, this indicates there may be a leak somewhere within the distribution system or within the facility. Alternatively, many meters include a leak indicator (e.g., a flashing dot or animated symbol on electronic meters, a spinning triangle or dial on mechanical meters). When all water uses have been shut off, observe if the leak indicator is spinning or activated, which could mean there is a leak.
- Contact the water utility to understand whether the facility has advanced metering infrastructure (AMI). Advanced meters may be capable of recording and transmitting water consumption data daily, hourly, or in shorter time intervals. Work with the water utility to obtain access to their customer portal that would allow more frequent observation of facility water use data. At the same time, investigate whether the utility offers high water use or leak notifications. For more



Example leak indicator dial

⁵ U.S. Environmental Protection Agency's WaterSense program. Fix a Leak Week: In the Workplace. www.epa.gov/watersense/fix-leak-week.

information about using AMI, see WaterSense's AMI guide, *Improving Water Management Using Advanced Metering Infrastructure Data: A Guide for Facility Managers* at www.epa.gov/watersense/advanced-metering-infrastructure.

- If AMI data is not available to the facility, read water meters and water bills monthly. Pay close attention to water meter readings to ensure they make sense and are consistent with expected water use trends. Compare monthly water bills to the previous month and to the same month of the previous year, keeping in mind expected seasonal water use increases (e.g., more water in the summer months for building cooling and landscape irrigation). If water use is unexpectedly high, a significant leak might be present in the distribution lines or within the facility.
- Install submeters on major water-using equipment (e.g., cooling tower make-up water lines, reverse osmosis system supply lines, irrigation systems). Refer to *WaterSense at Work Section 2.1: Metering and Submetering* at www.epa.gov/watersense/best-management-practices for more information. Monitor and record the submeter readings to identify unexpectedly high water uses, which may indicate that equipment is malfunctioning or that a leak is present.
- Install leak detection and/or flow monitoring devices that will send an alert upon detection of a leak. Flow monitoring devices installed inline or attached to pipe can sense if equipment is malfunctioning or identify leaks by detecting abnormal increases in water flow over extended periods of time. Leak detection sensors can be placed on the ground in

Devices to Assist With Leak Detection

There are a variety of devices that can help detect leaks and assist facility managers in preventing costly water damage and waste. There are two main types intended for commercial and institutional facilities.

Leak sensors (also called flood sensors) are small sensors, typically in the form of a small disk or probe, that are placed in areas prone to leaks or flooding (e.g., under sinks, near hot water heaters, near other end uses such as toilets, dishwashers, and ice machines). When the sensor comes in contact with water, it activates an alarm response or a shut-off valve to prevent major damage.

Flow monitoring devices act similar to water meters to measure water flowing through a pipe. These devices can be installed externally or in-line to a water pipe and communicate water usage. When abnormal water use behavior is detected, the device transmits an alert or activates a shut-off valve on the water line.



Reading facility submeters

areas where water might collect in the event of a leak or flood (e.g., near a hot water heater or clothes washer). An alert is sent when water comes in contact with the sensor. Flow monitoring and leak detection devices can alert a user if an issue is detected via alarm, flashing light, text message, building automation system, or other method. Some can even automatically turn off the water supply to the equipment when connected to, or integrated with, a shut-off valve.

- Incorporate multiple flow monitoring devices, surface leak sensors, and sensor-activated shut-off valves to create a dynamic leak detection system. Linking these devices to a building automation system or other system connected to the internet can allow for early detection of leaks and immediate shut-off to prevent significant water loss and damage. Some companies package these features together as a service to provide leak detection, water monitoring, and other recommendations on efficient water use. These companies can monitor real-time data and send alerts if they notice a potential leak.

Visual and Auditory Inspection

In addition to meters, conduct visual and auditory inspections as described in the following best practices:

- Perform daily tours of the building wherever water use occurs, including: restrooms; kitchens; irrigation systems; interior mechanical spaces with water-using systems (e.g., boilers, water purification systems, vacuum systems); cooling towers; and laboratory spaces. Building maintenance staff can usually complete these walkthroughs without much extra effort. Pay close attention to all water-using equipment indoors and outdoors by listening and looking for unexpected water use, such as:
 - Sanitary fixtures or water-using kitchen equipment continuously flushing, leaking, dripping, or left running.
 - Unanticipated discharge to floor drains in mechanical spaces.
 - Wet spots on sidewalks, in parking lots, and in grassy areas surrounding the facility. If soggy ground is unexpected, contact the water utility to determine if there is a leak in the distribution line.
 - Water flowing to an overflow drain(s) within a cooling tower basin.
 - For tips on finding more water waste, see the *WaterSense Operations and Maintenance Water Waste Checklist for Commercial and Institutional Facilities* at www.epa.gov/watersense/tools-ci-facilities.



Example water leak identified through site walks

- Perform a water assessment of the facility once every four years as outlined in *WaterSense at Work Section 1.2: Water Management Planning* at www.epa.gov/watersense/best-management-practices. During a water assessment, all major water uses will be identified and estimated to establish a facility water balance. If more than 10 percent of water use cannot be accounted for, the facility may have leaks in the distribution lines or from equipment and further investigation is warranted.
- Use WaterSense's Find a Pro tool at www.epa.gov/watersense/find-pro to select an irrigation professional certified through a program that has earned the WaterSense label⁶ to audit the landscape irrigation system for outdoor water leaks. All audits should be conducted according to the Irrigation Association's recommended audit guidelines.⁷
- Educate building occupants, employees, and visitors to immediately report to facility maintenance staff any leaks that they detect in restrooms, kitchen areas, or any other part of the facility. Immediate leak detection is vital to avoid water and monetary losses from unnecessary water waste. To encourage this feedback and build a culture of reporting leaks, be sure to repair leaks in a timely manner. Contact the facility's water utility to see if any special resources, free water audits, or programs directed at leak detection are being offered. See the WaterSense website at www.epa.gov/watersense/fix-leak-week for tools that can be used by staff to identify leaks⁸ and *WaterSense at Work Section 1.3: Education and Outreach* at www.epa.gov/watersense/best-management-practices for more information on ways to encourage leak reporting.

Finding and Fixing Leaks

EPA's WaterSense program sponsors Fix a Leak Week annually the third week of March to remind Americans to find and fix leaks. This week is the perfect time to educate employees about finding and fixing leaks at home, as well as in the workplace.

WaterSense has several leak detection and repair videos and employee education materials available on its website at www.epa.gov/watersense/fix-leak-week. Consider using these videos and other resources to further educate facility staff about identifying leaks and posting signs in restrooms or other locations to encourage employees and visitors to report leaks.

Leak Repair

If a plumbing fixture or other piece of water-using equipment is leaking, repair it according to manufacturer specifications. If necessary, replace it with new, properly functioning

⁶ EPA's WaterSense program. Irrigation with a Pro. www.epa.gov/watersense/irrigation-pro.

⁷ Irrigation Association. Technical Resources: Irrigation Audit Guidelines. www.irrigation.org/ia/Resources/Audit-Guidelines.aspx.

⁸ EPA's WaterSense program. Fix a Leak Week. www.epa.gov/watersense/fix-leak-week.

equipment; look for WaterSense labeled or ENERGY STAR® certified models where available.

For specific information on operation and maintenance, retrofit options, or replacement options, see the relevant sections for technologies and systems covered by *WaterSense at Work* at www.epa.gov/watersense/best-management-practices.

Additional Resources

City Energy. May 2019. Water Audit Guidance for Commercial Buildings.

www.cityenergyproject.org/wp-content/uploads/2019/05/City_Energy_Project_Resource_Library_Water_Audit_Guidance_For_Commercial_Buildings.pdf.

EPA's WaterSense program. "Fight Leaks and Water Waste in your Facility with WaterSense." www.epa.gov/sites/default/files/2019-02/documents/ws-falw-commercial-checklist.pdf.

EPA's WaterSense program. Fix a Leak Week. www.epa.gov/watersense/fix-leak-week.

EPA's WaterSense program. *Improving Water Management Using Advanced Metering Infrastructure: A Guide for Facility Managers*.

www.epa.gov/system/files/documents/2022-09/ws-commercial-ami-guide-facility-managers.pdf.

EPA's WaterSense program. Tools for CI Facilities. www.epa.gov/watersense/tools-ci-facilities.

Irrigation Association. Technical Resources: Irrigation Audit Guidelines.

www.irrigation.org/ia/Resources/Audit-Guidelines.aspx.

North Carolina Department of Environment and Natural Resources, et al. May 2009. *Water Efficiency Manual for Commercial, Industrial and Institutional Facilities*.

www.deq.nc.gov/watereducation/water-efficiency-business-2/download.

U.S. Department of Energy (DOE), Federal Energy Management Program (FEMP). Best Management Practice #3: Distribution System Audits, Leak Detection, and Repair.

www.energy.gov/femp/best-management-practice-3-distribution-system-audits-leak-detection-and-repair.

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www.epa.gov/watersense
(866) WTR-SENS (987-7367)