



Improving Water Management Using Advanced Metering Infrastructure Data: A Guide for Facility Managers



Beyond labeling products, homes, and professional certification programs that help save water, the U.S. Environmental Protection Agency's (EPA's) WaterSense® program also develops technical tools and resources to assist commercial and institutional facilities in identifying and implementing water efficiency best management practices. Measuring and monitoring water consumption data is a great first step for property owners and facility managers to take to improve facility or campus water management, and advanced metering infrastructure (AMI) can be a useful tool to support that process. This guide provides an overview of the benefits of AMI, common ways to access AMI data, and tips for using AMI data to improve facility water efficiency and water management.

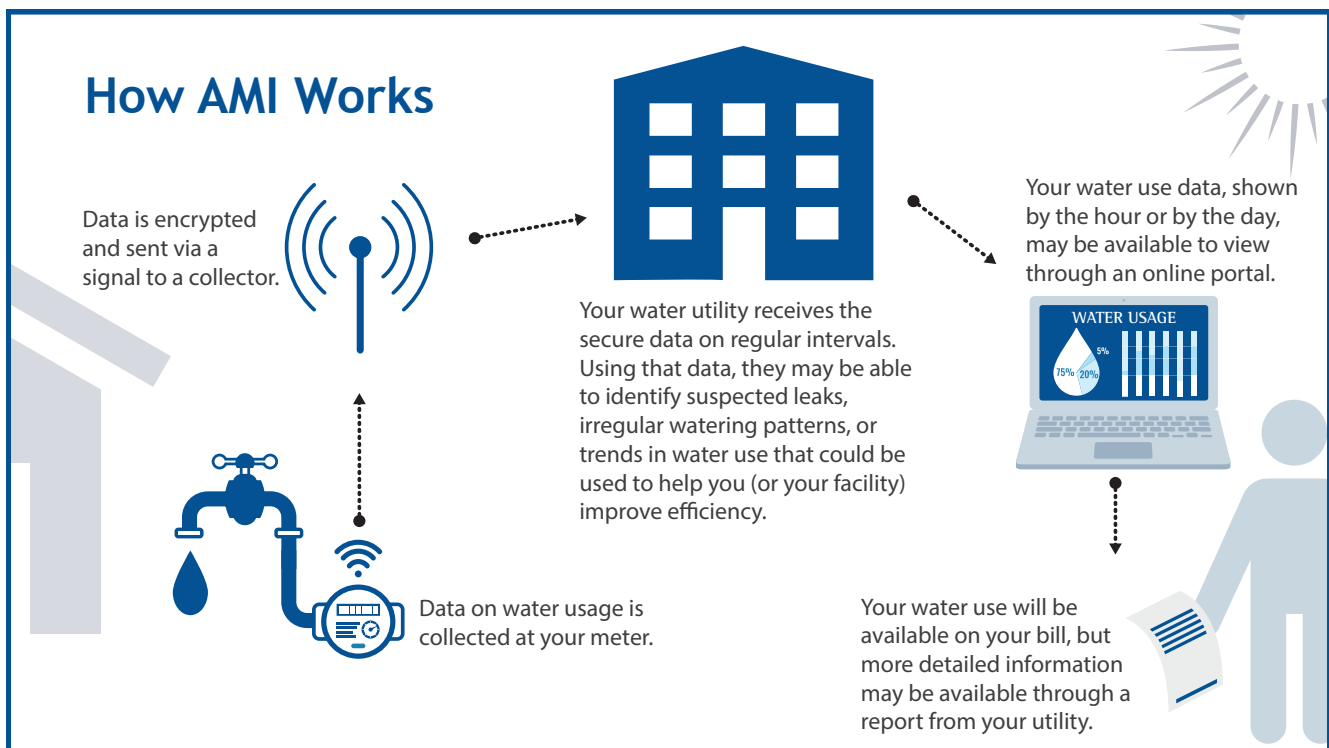


Figure 1: How AMI works

What Is AMI?

AMI is a collection of devices and systems used by utilities to collect, measure, communicate, and analyze water use data from treatment through delivery to customers. Many water utilities are embracing AMI to modernize and streamline their operations. The increase in data improves their ability to serve their customers, target and monitor conservation programs, detect and measure water loss, and increase security and reliability. AMI also improves time efficiency, allowing utilities to redirect time and resources spent reading meters to other projects.

In many cases, AMI technology also provides commercial and institutional facilities easy access to accurate, timely, and on-demand water use information that can be used to operate a facility more efficiently. AMI meters often collect water consumption data hourly (or more frequently), providing property owners and facility managers with a resource to identify use trends, uncover leaks, anticipate equipment failures before they occur, and seek opportunities for improving water efficiency.

Why Use AMI Data?

Save Water and Money

Water and sewer costs are included in overhead and considered part of the cost of doing business. However, when it comes to cutting costs, these utilities are often overlooked. Saving water can also result in energy savings for fixtures and appliances that consume hot water. By using AMI to implement informed efficiency practices, you could be saving money and water.

Protect Equipment and Facilities

Commercial water damage is one of the most common and costly claims for businesses, yet it is a regular exception in insurance policies. Beyond the cost of the water itself, average repairs may exceed \$10,000, as water damage can affect floors, walls, ceilings, equipment, and even foundations. Facility flooding can also damage electrical equipment or lead to environmental or safety hazards related to gray or black water damage and mold, which can result in operational downtime.

Demonstrate Value

Unexpected shutdowns or service interruptions can mean lost revenue and poor perceptions from management or building occupants. AMI

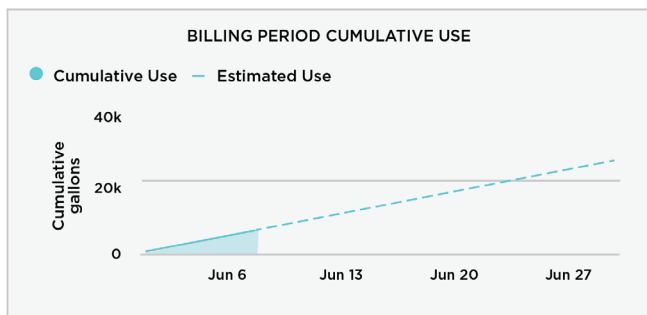
equips facility staff with data to quickly identify water-related problems, so you can make repairs or spot an issue before it becomes a crisis. Facility managers can also use meter data to report savings to executive management and get buy-in for additional efficiency projects. Sharing and promoting data-based decision-making for water conservation demonstrates the value of a facilities management team.

Avoid Surprise Bills

Many facility managers only interact with water on a monthly or quarterly basis when the bill comes, if they even see the bills, but they are the first ones management will call when a leak sends a water or sewer bill skyrocketing. With the ability to check water use in near-real time, you can monitor for irregular water use and make repairs before the bill increases. Many customer portals even offer the ability to set alerts for exceeding a certain amount of water use over a period of time or receive notifications if the system suspects a leak.

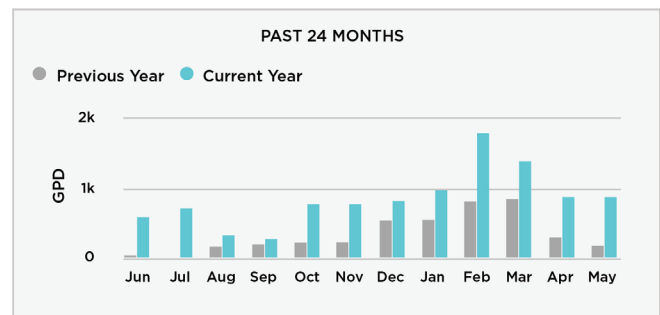
Perform Preventative Maintenance

Does your facility have old, water-cooled air conditioning units, dishwashers, or toilets? Is an old irrigation system starting to fail? By referencing AMI data, you may be able to isolate



You've used 7,104.90 Gallons this billing period

At this rate we estimate you'll use about 27,909 Gallons total, which is 29% more than your typical use. These estimates are informational only.



Increasing use

You used about 130% more water during the most recent twelve-month period compared to the prior twelve-month period.

Figure 2: Some customer portals offer a monthly projection including your total bill amount, as well as total water use. They may also show a comparison of water use month-over-month or year-over-year. Image of VXengage portal (previously known as the WaterSmart portal) provided by VertexOne, care of Scotts Valley Water District.

the water use of your equipment. From there you can detect if it is operating efficiently or starting to fail. You can also conduct a payback analysis to determine the return on investment for replacing or upgrading fixtures, appliances, and equipment.

Exhibit Leadership

Water efficiency goes beyond protecting your facility and equipment from damage. Data from AMI can help you address changing regulations, business priorities, and sustainability objectives. Green building certifications and other recognition for green businesses are growing. Many organizations are establishing environmental, social, and governance (ESG) or sustainability goals to reduce energy and water use to lessen their environmental impacts. AMI data can assist facility managers in accurately tracking consumption and targeting efficiency projects to meet these goals.

Strive for Sustainability

Engaging in sustainable practices can help businesses grow. Studies show that customers and employees care more about sustainability than ever before. According to recent NielsenIQ data, about 73 percent of consumers claim they are willing to change their purchasing habits to reduce their environmental impact.¹ The same practices show a positive impact on employee recruitment and retention.

How Do You Access AMI Data?

One of the benefits of AMI is making information on water use readily available to customers through an online portal. Customer portals are ideally integrated into existing online billing and account systems; however, in some cases they can be housed on a separate, secure website. Even if an online portal is not available, it still may be possible for facilities to access their water use

data. Below are a few strategies for accessing data.

Online Customer Portals

Many AMI utility programs include an online customer portal that provides access to the meter data. This portal is commonly integrated with customer billing, so you may need to talk to the person at your facility who is responsible for paying water bills to get access. Portals regularly provide hourly water use data for days, weeks, months, and sometimes even years. Customer portals sometimes include additional information on local incentive or rebate programs, watering regulations, conservation tips, resources on finding and repairing leaks, and more. Some utilities have even gamified their portals, developing ways to reward customers for using water efficiently, educating themselves, or participating in conservation programs.

Many portals allow the customer to set notifications. Most systems have at least one or more customizable options including email, call, text, or U.S. mail. Setting notifications is especially useful when you are not onsite, or if suspicious water use is difficult to detect (e.g., underground leaks, during times of vacancies). Depending on the utility and software, the AMI system usually offers notifications of a potential leak (defined by a minimum volume of continuous use over a certain duration or a sharp increase in use). You may also be able to set alerts based on hitting a dollar or volume of water threshold, which is helpful for meeting budgets, as well as avoiding higher priced water consumption tiers. The options may be programmed or modified specifically for your facility. For example, if you have normal continuous use as part of your operations, you can override or customize the notification setting for a leak.

¹<https://nielseniq.com/global/en/insights/analysis/2019/a-natural-rise-in-sustainability-around-the-world/>

Use History

BILLING **AMI** LEAKS

Jan 1, 2022 — Jun 9, 2022

DAY WEEK 2 WEEKS 2 MONTHS YEAR

● Normal Use ● Possible Leak ● Timed Irrigation ● Data Unavailable

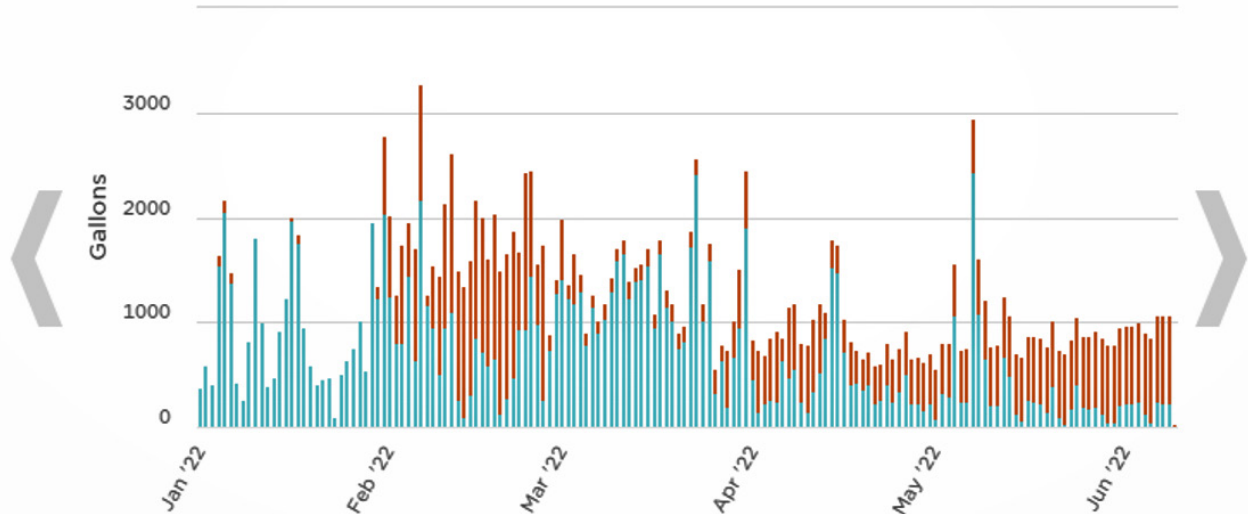


Figure 3: Customer portal showing daily water use and the volume of daily use that may be indicative of a possible leak for the facility to investigate. Image of VXengage portal (previously known as the WaterSmart portal) provided by VertexOne, care of Scotts Valley Water District.

Improving AMI-Based Utility Programs

Utilities continue to explore new ways to use AMI data to help customers. For example, the Metropolitan North Georgia Water Planning District has convened an AMI Users Group, a statewide group to facilitate discussion among water utilities that have implemented AMI or are interested in doing so. Members connect with other utilities within the region and share their successes, challenges, and overall journey. With over 20 water utilities and growing, they work together to solve issues, develop standards, and implement best practices to help customers access and benefit from AMI data. Utilities often welcome input from their customers, especially in the commercial, industrial, or institutional sectors.

Water Utility Staff

Some utilities install AMI meters prior to—or without—developing a customer portal. In that case, the utility usually still has access to the data. This data could be updated multiple times each day, overnight, or on an otherwise regular schedule. One of the many benefits of AMI is its ability to help utilities reduce costs by reducing water waste and increasing water use efficiency. To that end, utility staff are generally eager to share this data with customers and could be willing to provide recent meter reads by request or on a regular basis. They may even be able to program the software to run a report on specific days or intervals.

Water Bills

By using AMI, customer bills can become more transparent and accurate. Water bills for your facility may compare billing periods or include

information on accessing AMI data. Information on AMI, accessing portals, or requesting reports could be included as an insert into your water bill.

What and How Can AMI Data Be Used?

With multiple AMI technologies on the market, your water data could be displayed in one of several formats with varying degrees of detail and functionality. Ideally, and most often, data are shown on an hourly basis with bar charts that can be customized to reflect a day, week, month, or any period in between. There are a variety of programs and software available to help analyze and visualize time-interval water use data, including ENERGY STAR® [Portfolio Manager](#)®.

By analyzing more granular data, facility managers can begin to identify trends and patterns. Unexplained usage or anomalies to these trends could indicate leaks or other issues. For example, if the business has a general baseline use and the data show a steady or sudden increase, it could indicate an open valve running to a drainpipe, a cracked pipe that has started to spread, or even a burst pipe or stuck irrigation valve. AMI data may also help to look for other patterns, such as when your irrigation system is running. This can help inform you if your irrigation schedule may need to be adjusted or reduced in time, especially if the local water utility has watering restrictions at certain times or on certain days during periods of drought.

The following summarizes types of available data and common applications that can help with water management.

Total Water Use

While AMI provides meter readings on a more frequent basis, the total water use for a billing period is generated using the same data. These advanced and automated meter readings are less

susceptible to human error, as well as problems that can result in estimated readings (e.g., a meter being blocked by snow or a vehicle).

Trends and Outliers

Since data are available more frequently, water utility staff and customers with portal access can quickly identify water use trends. By looking at week-to-week water usage, for example, you may be able to spot peak production periods, or the exact hours when your irrigation system is running. You could also compare water use across a day, week, or month to evaluate changes. For example, by comparing water use during certain periods of time, facility managers may be able to:

- Estimate water use from certain end uses, such as irrigation or cooling towers.
- Evaluate the impacts of weather on water use.
- Understand how building occupancy or operating conditions impact water use.
- Quantify water savings from fixing leaks, efficiency projects, or conservation campaigns.
- Identify errors in equipment programming, such as irrigation running at the wrong time or on the wrong days.

Leak Detection and Isolation

Most AMI systems have integrated technology that generates continuous use reports, also known as leak reports. The parameters may be a default value or they could be set by the water utility. Default values can range in terms of the volume of water per hour, as well as the length of time before continuous use shows up on a report. These reports can be used to generate notifications in an online portal, or your utility may contact you directly. Even if alerts indicate only a small leak, it is important to investigate and repair them before they become worse and waste more.



OVERVIEW	BILLING	BILL EXPLAINER	USE HISTORY	USE ANALYSIS	PROFILE	PREFERENCES	FORMS	ACTIONS	PROGRAMS
 Leak Alert Continuous	Started	Rate	Volume	Alert	Status	Cause			
	Jun 1	50 GPH	7,462 gal	Email Alert Sent June 2 at 49 GPH	No Response				

Figure 4: Customer Portal Leak Alert. Image of VXengage portal (previously known as the WaterSmart portal) provided by VertexOne, care of Scotts Valley Water District.

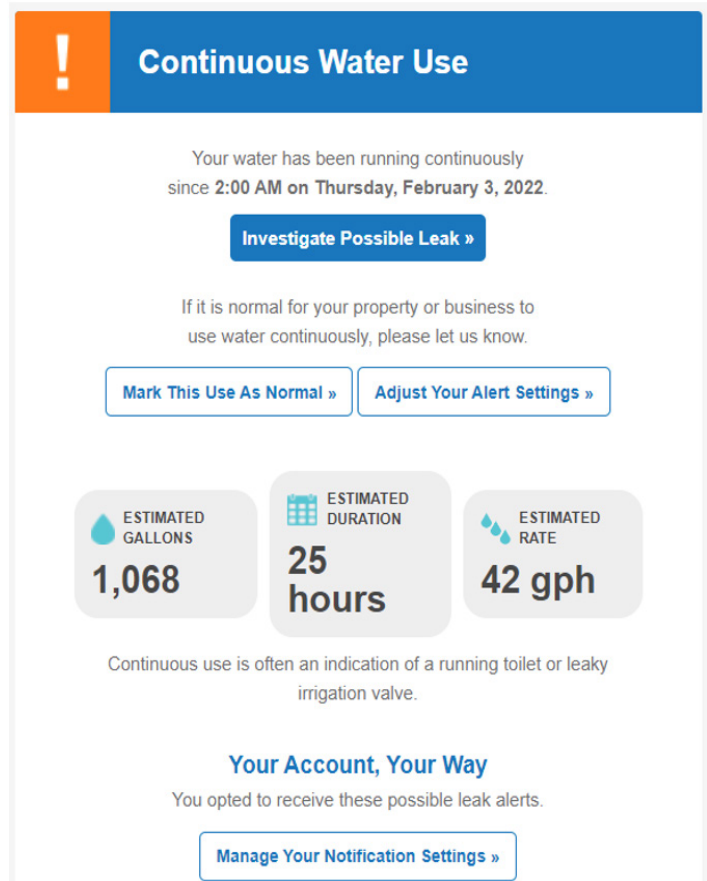
It is worth noting that continuous use does not always indicate a leak. For example, some equipment uses water continuously (e.g., medical equipment for kidney dialysis treatment). AMI can often interpret these types of equipment as a possible leak.

Benchmarking Facilities

If you manage multiple buildings, businesses, or irrigation systems, it can be perplexing when one of them is using more water and/or energy than the others. By benchmarking your facilities, you can compare and analyze water use patterns and volumes and target high-water-consuming buildings to incorporate best management practices. ENERGY STAR Portfolio Manager or other utility management software can help manage AMI data and offer insights on water performance.

Specialized Information

Depending on the system installed by the water utility, AMI may provide more than just the volume of water used. Some AMI systems provide information on water pressure, temperature, or water quality. Depending on the type of facility you manage, water quality could be vital to product development (e.g., a beverage manufacturer) or for maintaining equipment prone to scaling (e.g., cooling towers). Appropriate water pressure can be important for the proper functionality of equipment that is designed to operate within a specific range. High pressure can be a contributing factor for equipment failure,






Continuous Water Use

Your water has been running continuously since 2:00 AM on Thursday, February 3, 2022.

[Investigate Possible Leak »](#)

If it is normal for your property or business to use water continuously, please let us know.

[Mark This Use As Normal »](#) [Adjust Your Alert Settings »](#)

 ESTIMATED GALLONS 1,068	 ESTIMATED DURATION 25 hours	 ESTIMATED RATE 42 gph
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Continuous use is often an indication of a running toilet or leaky irrigation valve.

Your Account, Your Way

You opted to receive these possible leak alerts.

[Manage Your Notification Settings »](#)

Figure 5: Additional information on continuous water use and options to resolve offered through a customer portal. Image of VXengage portal (previously known as the WaterSmart portal) provided by VertexOne, care of Scotts Valley Water District.

as well as excessive water consumption, and may indicate the need for a pressure regulator. Some AMI systems allow utilities to turn a water meter off or on remotely. In the event

your business has a catastrophic leak, calling your utility to have the water shut off quickly could save thousands of dollars in damage. AMI systems that include this function can also be beneficial when you need the water shut off for repairs and reduce the wait time before water service can be restored.

Real-Time Feedback

Large facilities can have multiple sources of water use—and water loss, such as leaks. If you undertake a repair, it is good to know if that repair has solved the problem. With access to data in real-time through AMI, you could fix a stuck valve or toilet leak in the morning and know by afternoon if that leak was the only problem. You can also use the data to isolate issues. For example, if you turn off the water supply line to equipment with a suspected issue, such as an air conditioning unit or irrigation line, you could check your portal shortly thereafter to see if it is still reflecting continuous water use. If it is still showing use, you can rule out that equipment or systems fed by that water supply line. If the water use stops, then you know that is where you have to investigate further.

Take Action on AMI

1. Contact Your Utility

Contacting your utility is a good first step to determining if your facility currently has AMI and whether they provide access to a customer portal or can otherwise share interval water use data. As illustrated in the case studies on the following pages, it also pays to check with your local water supplier to ask about rebates or other incentives that could help you make the case for water efficiency projects and offset the costs of improvements. Utilities may offer bill adjustments for timely leak repairs, as well as rebates for turf removal, toilet replacement, high-

efficiency sprinklers, cooling tower controllers, and more. Some even offer assistance in locating leaks or surveying the facility or irrigation systems. WaterSense maintains a list of rebate opportunities at www.epa.gov/watersense/rebate-finder.

2. Pursue Leak Detection

You can review AMI data to determine whether water use is occurring continuously or during unexpected periods, such as overnight, on weekends, or during holidays. Once you know a leak exists, the next step is to isolate the location in preparation for repair. Walk through the property and visually inspect water-using equipment both inside and outside, including checking in storm drains, under sinks, or other places where water may be unexpectedly flowing or puddling. Many leaks are silent and challenging to uncover, so work with your utility or a specialized leak detection company, as necessary.

3. Set Up Facility-Specific Notifications

AMI portals are typically designed to meet the needs of most—but perhaps not all—customers. If your facility has continuous use as part of its regular operations, you could receive false or nuisance notifications. You may be able to revise these notifications within the portal or ask your utility how they can be customized. Some software allows the customer to respond to notifications directly online, for example, when you are investigating a leak or if continuous usage was intentional for a time period, such as when filling a storage tank, fountain, or pool.

4. Monitor Consumption and Get Recognized

As discussed previously, regularly monitoring water consumption is a critical step in a facility's water efficiency and water management efforts. Whether tracking for leak detection, internal

reporting, pursuing green building certification, or participating in a buildings challenge, AMI data can help property owners and facility managers more easily monitor water consumption and progress towards meeting water efficiency goals.

Explore Additional Resources and Case Studies

EPA has developed additional resources that can help you track utility consumption, understand water-using systems, and identify strategies for improving water efficiency and reducing operating costs.

- ENERGY STAR Portfolio Manager. www.energystar.gov/buildings/benchmark
- *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities*. www.epa.gov/watersense/best-management-practices
- WaterSense Fix a Leak Week. www.epa.gov/watersense/fix-leak-week

The case studies on the following pages show AMI in action and demonstrate water savings results.

Case Study: Freeman Toyota and Santa Rosa Water

Santa Rosa Water in California offers customized assistance to help commercial customers eliminate water waste and improve water efficiency through comprehensive water audits by dedicated professional technical staff. The utility has worked with many local businesses to achieve water savings and reduce water loss due to breaks and leaks.

After Santa Rosa Water’s WaterSmart Portal identified continuous use of approximately 140 gallons of water per hour for 48 consecutive hours at Freeman Toyota, Ryan Freeman immediately created a customer account to access water use data for all of the dealership’s water meters. Ryan also contacted the utility’s water efficiency team for assistance finding the leak.

An onsite water audit revealed several toilet leaks, but these were not wasting enough water to account for the volume of continuous use. After additional investigation, Santa Rosa Water and Freeman Toyota were able to isolate an issue with the facility’s car wash. The car wash vendor



Image Courtesy Freeman Toyota

was called in and discovered the recirculating water system was malfunctioning and running continuously. The leaking toilets and car wash recirculating system were repaired (see Figure 6), and these repairs reduced Freeman Toyota’s water usage by 50 percent. “I appreciated getting a courtesy call from Santa Rosa Water after their system flagged a spike in water use on one of our meters. The onsite audit was informative and helped us quickly identify and resolve the issue,” Ryan Freeman said.

The onsite survey also pre-qualified Freeman Toyota for Santa Rosa Water rebates. Based on the audit recommendations combined with water use statistics, Freeman Toyota decided to replace all of its urinals. Santa Rosa Water provided a rebate that covered the cost of the new fixtures.

“One of our managers now keeps a close eye on all of our water usage. This alerted us to the fact that our irrigation system was leaking water during the wintertime even though the system was turned off. We can now gauge our water use and identify issues as they arise, and we’re working proactively to reduce our water use,” Freeman said.

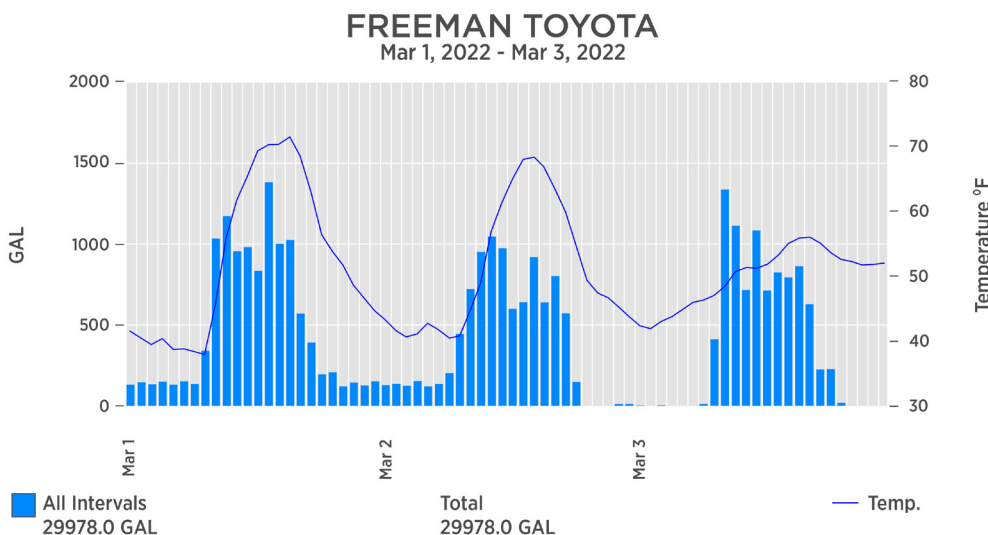


Figure 6: AMI data indicating that the car wash and toilet leaks were resolved on March 3.

Case Study: WorldMark by Wyndham and Big Bear Lake Department of Water

Over the course of three years, WorldMark by Wyndham, located in Big Bear Lake, California, removed more than 34,000 square feet of grass. Facility Manager Francisco “Mike” Duran got started by contacting the City of Big Bear Lake Department of Water and Power (BBLDWP), where he learned that the business would qualify for a turf buyback. While the BBLDWP did not have a customer portal at the time of publication, they offer reports to customers upon request, answer inquiries, and send AMI use charts to customers whenever they detect an irregularity.

WorldMark compared data from 2011 to 2014, prior to the turf removal and just prior to having their AMI meter installed. During the following four years, the business was able reduce their water consumption by more than 40 percent, saving over 5 million gallons of water from 2015 to 2018 during one of California’s severe droughts. Having the ability to track daily and weekly water use using AMI meant that they could quickly begin to measure their savings and start making the case for future projects.

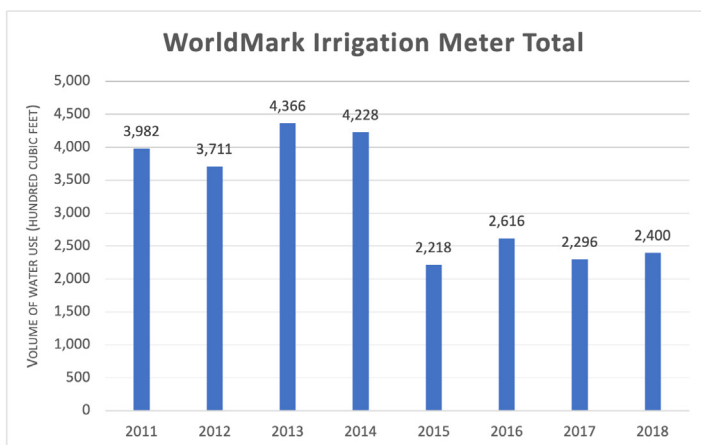


Figure 7: A BBLDWP chart using partial AMI data to indicate a drop in water use after turf removal



Figure 8: WorldMark Facility Manager Mike Duran and Housekeeping Manager Chelsea Coulthard stand on the patch of mulch that once was turf.

Their good work went beyond turf removal; when an employee started installing high-efficiency sprinkler heads on the remaining turf, Duran submitted their efforts to the corporate headquarters as part of “Green-Handed,” a Wyndham sustainability initiative, and they are featured in the company newsletter. The facility continues to remove non-functional turf and uses the buyback funds to install mulch, plant drought-tolerant species, and create recreational facilities.

Reviewing utility notices also helped WorldMark stay in compliance with local watering restrictions, resolve leaks, and identify other efficiency opportunities. After changing landscaping contractors, WorldMark received a notice that they were irrigating out-of-cycle and not in compliance with the local utility’s regulations. With illustrated usage charts, they were quickly able to resolve the issue with the new contractor. They also received a continuous use notice from the utility’s AMI reports; upon investigation, the team discovered a failed toilet flapper. Duran also worked with their housekeeping manager to start replacing old toilets and received rebates from the City of Big Bear Lake.

Case Study: Albuquerque Public School System and Albuquerque Bernalillo County Water Utility Authority

With help from the local water utility, the Albuquerque Public School (APS) system received an education in water conservation. The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) in New Mexico rolled out an AMI leak inspection program between June 2020 and May 2021, with partner Smart Use. ABCWUA conducted more than 100 indoor and outdoor leak inspections in the schools and found over 400 leaks. One cooling system, for example, was leaking 1,000 gallons per hour. When APS facilities staff saw water at the base of the system, they assumed it was from normal condensation. Working together, ABCWUA began training APS staff on how to identify irregular water use stemming from different equipment found at school sites.

At the beginning of the program, APS had an average continuous use of 300 gallons of

water per hour across all school sites. At the end of the year, and with the help of ABCWUA, they had identified and fixed so many leaks that the continuous use dropped to less than 25 gallons per hour. “The most important thing out of this effort is that we developed a really good relationship with these folks and now we are able to not only identify the leaks, but we became partners in the story,” said Carlos Bustos Landivar, water conservation manager for ABCWUA. “We can work together to identify the best way to correct the situation.”

Figure 9 shows the history of APS and ABCWUA working together to find and repair leaks. The dotted trendline shows how the number of leaks per day has declined from around 180 to below 100.

Since the inception of this program, APS made significant changes to the way leaks in the schools are handled. Work orders for leak-related issues are tracked daily to avoid long-term, unresolved leaks, regular meetings are held to discuss persistent problems, and a training program is being planned for the custodial staff to increase their role in leak mitigation.

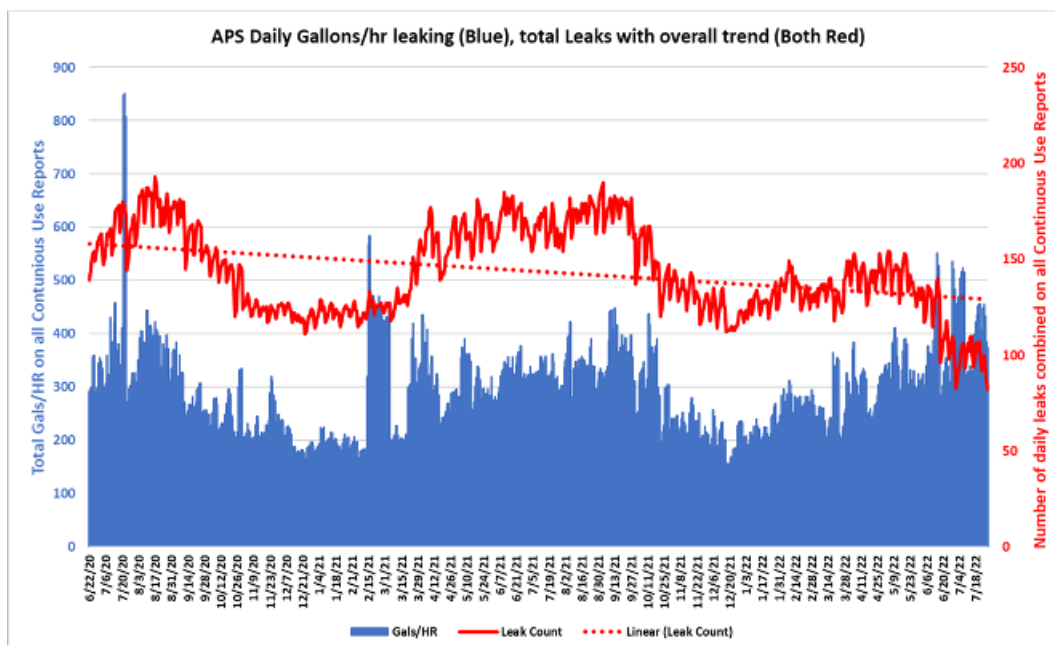


Figure 9: APS undertaking leaks at schools

Case Study: The Coddington Center and Santa Rosa Water

When making repairs to eliminate leaks, it is vital to check the data to verify that continuous water flow is no longer occurring and your water use has otherwise returned to normal. Coddington Center is a Santa Rosa, California, shopping center that includes a mix of over 40 specialty shops, large department stores and restaurants. Coddington General Manager Jimmy Scales contacted Santa Rosa Water after noticing that their water bill had more than doubled. Data confirmed that usage on one of the large commercial meters had recently spiked and was flowing continuously at over 1,000 gallons per hour.

Santa Rosa Water's water efficiency team met with Coddington staff and performed an inspection of all areas served by the meter. No obvious leaks were found; however, a submeter to one of the restaurants in the mall showed that water usage had been increasing. This pointed to a potential mainline leak somewhere inside a restaurant.

A leak detection company was hired, which found and repaired a large mainline break under the restaurant's concrete slab. Data confirmed that the continuous usage had been significantly reduced but was not resolved. After additional investigation, another mainline break was found and repaired, then a third leak was found and repaired. Each time, utility staff provided data and informed the mall's general manager that the usage was still continuous. Ultimately, all mainline leaks were repaired, saving thousands of gallons of water per day.



Image Courtesy Coddington Center

“We would have never found these leaks without Santa Rosa Water's help and the AMI report data,” said Jimmy Scales, Coddington Center general manager. “The hourly usage helped us narrow down our investigation and pinpoint the exact time the usage was occurring. Without it, we may have thought the problem was solved after the first repair was done. Who knows how long it would have taken us to find all of the other mainline breaks?”