



Davenport

Making Good Technology Better to Enhance Water Conservation

Approximately 26 bil gal of water is consumed daily in the United States according to the US Environmental Protection Agency (USEPA). Of this amount, about 7.8 bil gal is devoted to outdoor uses, and the majority of this is for irrigation (USEPA, 2010). The figures vary, but most experts agree that between 50 and 70% of residential water consumption is used to water landscaping—and most people overwater. Not counting rainwater, the typical suburban lawn consumes 10,000 gal of water per year (USEPA, 2010).

Naturally, in the face of increasing demand resulting from population growth and drought conditions in many parts of the United States, water utilities and their customers are looking for tools they can use to minimize the overapplication of water to their lawns and landscaping.

Irrigation controllers have been around many years and have become increasingly important in water conservation efforts. However, to the residential user the task of managing the many settings depending on the time of year, type of plants being watered, and size of the specific irrigation zone have, for some, made the efficient use of these devices a daunting task (Brown and Caldwell, 2012; Mayer et al, 2009). The fairly recent introduction of “smart controllers”—also referred to as evapotranspiration (ET) controllers and weather-based irrigation controllers—has made the use of irrigation controllers not only more approachable but also more efficient and therefore more effective as a conservation measure. Smart controllers incorporate weather conditions, current and historic ET rates, soil moisture levels and other factors to adapt water applications to meet the real-time needs of plants (Mayer et al, 2009). In addition to the consumer resistance to the complexity of using these devices, research has also shown that at an average cost of \$200, irrigation controllers are cost-prohibitive for the average residential user (Brown and Caldwell, 2012; Mayer et al, 2009).

Taking advantage of current technology that is widely available on the Internet, a California company has developed another innovative solution to the challenge of effectively using irrigation controllers to reduce outdoor water waste.

THE SCIENCE BEHIND THE DEVICE

Developed with residential users in mind, the WaterDex® overrides existing residential irrigation controllers and provides consumers with a simple remote-control dial that can be set on a daily, weekly, or monthly basis to zip code-specific watering indexes, which are compiled using

historic and realtime ET data. The ET data measure the loss of water evaporated from the soil and transpired by plants. It is calculated from specialized weather stations that measure information such as solar radiation, air temperature, relative humidity, and wind velocity. The ET values are primarily dependent on the amount of solar radiation. A watering schedule should be designed to periodically replace the amount of water lost via ET.

The watering index used by WaterDex compares the average ET data for the most recent week with the highest average weekly ET value recorded during the past 10 years. The historical high occurs in July and equals 100% on the watering index.

Figure 1 shows a typical ET curve and the step-curve created from watering index values calculated over a 12-month period. The third curve shows the water used when the irrigation schedule is adjusted just twice a year—a common approach for many residential users.

WaterDex can be thought of as a remote-control water budget dial similar to the water budget dial found on many timers that can be adjusted from 0 to 100%. After WaterDex is installed, the sprinkler timer is adjusted to the typical July/August settings, which represent a water budget of 100%. The science behind WaterDex is in how to properly determine at which value the remote dial should be set.

Two methods are offered. One method for determining how to set the device is by implementing the watering index principal, which is based on ET and was developed by John Wynn of the California Department of Water Resources. Simply stated, the watering index is an average of 10 years of historical ET values divided

by the current ET value. The resulting value is the watering index percentage, for example, 85%. The remote dial is adjusted to the watering index value, providing a simple way of adjusting a sprinkler system to local weather conditions.

As a result of data gathered by the National Oceanic and Atmospheric Administration and other weather resources within the United States, daily ET values are now available at a 2 km² resolution for the entire country. To set their device to the proper ET value for their area, users are instructed to go to www.waterdex.com and enter their zip code. Their watering index is instantly and automatically calculated. Additionally, users have the option to register to have their weekly watering index automatically sent via e-mail or text message.

SUSTAINABILITY ON SEVERAL LEVELS

The WaterDex receiver that is used in conjunction with the remote is retrofitted to any existing irrigation timer by connecting four wires regardless of the number of watering zones. With this installed, the wireless remote control may be used to adjust the entire irrigation system without having to reprogram the timer. Retrofitting to existing timers is less expensive than replacing timers and keeps them out of landfills.

Although some have criticized that a completely automated device may be more effective, the developers of WaterDex have argued that circumventing the homeowner does not generate the type of behavioral change that is desirable for true sustainability.

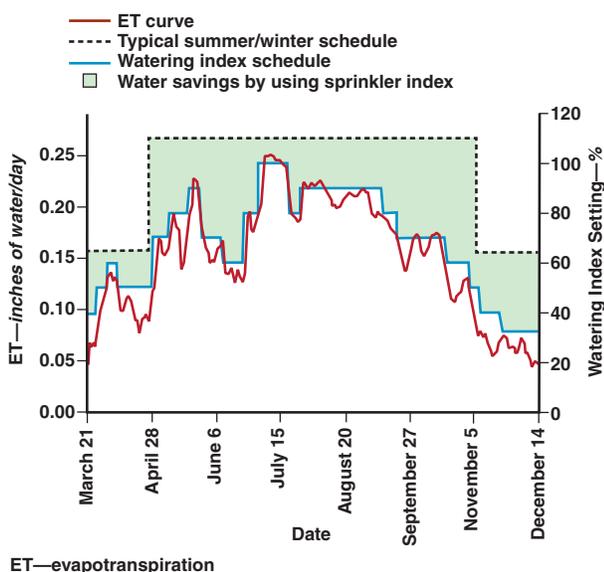
“When we developed WaterDex, we were striving for a product that would have broad appeal,” said Hank Ortiz, co-founder of Irvine, Calif.-based Rockrose Technology, the developer of WaterDex. “For the vast majority of us, this means that the product has to be simple, convenient, and affordable. We applaud the development and ongoing innovation in weather-based controllers; we just don’t see them as affordable or practical tools for most of our neighbors, friends, and families,” Ortiz continued. “On the other hand, everyone understands a dial, and we believe that in order for water districts and entire communities to achieve meaningful aggregate water savings, the entire community has to be on board. For this to occur, innovations must be simple, convenient, and affordable.”

PARTNERING WITH WATER UTILITIES

The developers of the WaterDex device envision working alongside water utilities to make the tool available to their customers and to help water agencies across the country as they look for ways to reduce residential water waste.

“WaterDex not only has the ability to help consumers reduce their water bills, but if enough people use the product it could significantly reduce

FIGURE 1 Example of a watering index



A Comparison of Study Results From Irvine Ranch Water District for Residential Irrigation Devices

Greig Altieri

The Irvine Ranch Water District (IWRD), a leading investigator of water conservation technologies, has recently published a study analyzing the WaterDex® Remote Control for existing automated irrigation systems. This is the third in a series of studies designed to quantify the water savings of residential irrigation devices. The first two studies covered weather-based irrigation controllers. This information is designed to compare the methods and reported results of these three studies so the results may be compared on a “head-to-head” basis.

STUDY 1, 2001

The first study (40 households), Residential Weather-Based Irrigation Scheduling: Evidence from the Irvine “ET Controller” Study, concludes that “on an absolute basis, ET [evapotranspiration] controllers were able to reduce total household water consumption by roughly 37 gallons per household per day.” In addition to the weather-based controller group, there was a second group of customers who received a system of “educational” reminders on reducing water use. These postcards were delivered periodically with the seasonal weather changes. This group (56 participants) saved 29 gpd per household.

The conclusion continues “We believe our retrofit households were already well disposed toward conservation, hardly surprising since participation in the study was voluntary.” This statement can be said of most current customers within Irvine Ranch Water District in 2012.

STUDY 2, 2004

The second study, The Residential Runoff Reduction Study, also evaluated the water conservation effects of weather-based irrigation controllers. This study was

composed of a larger number of installed controllers (97 making the final analysis) combined with “education” materials. This study group saved 41 gpd per household. As in the first weather-based irrigation controller study, there was a second “education-only” group. This group saved 26 gpd per household.

STUDY 3, 2012

The most recent study, WaterDex Remote Control Effectiveness Pilot Study, demonstrated mean water savings of 70 gpd per household (91 residences in the final tally). Although there was not an “education” group associated with this study, IRWD has been aggressive in educating all customers in methods of reducing residential water use in conjunction with the implementation of tiered rates and decreasing water allotments. If the control group in this third study is viewed as equivalent to the “education” group of the previous studies, similar results are seen. This group saved 58 gpd per household.

CONCLUSION

Although all of these studies demonstrate similar net results in nearly identical residential settings within the IWRD, WaterDex provides a more user-friendly means of achieving significant savings within a residence (Table S1). The implementation of a device to add weather-based irrigation control, whether automatic or manually controlled, can provide substantial reductions in residential water use. These devices provide a simple way of complying with ever-restrictive water allocations and help control costs by controlling water use. WaterDex achieves these savings without replacing the existing controller, saving money, time, and complexity.

—Greig Altieri is a cofounder of Rockrose Technology and specializes in new product development. He has commercialized several medical device products currently used in the marketplace.

TABLE S1 Summary of data from studies on water savings

Study Year	Savings With Device gpd	Education-Only Savings gpd	Net Savings gpd
2001	37.4	29.0	8.4
2004	41.2	25.6	15.7
2012	70.4	57.6	12.8

water waste at a time when water agencies across the country are facing increasing shortages,” Ortiz said. Water agencies in California and across the United States have been encouraging consumers to purchase weather-sensitive irrigation controllers to address mostly wasteful outdoor watering. In sunny and dry southern California, water rationing is becoming common. “We developed WaterDex in the hope that its implementation and that of similar innovations can help water agencies across the country work together with their service areas and avoid having to ration water,” Ortiz said.

Because Rockrose has developed the watering index by zip code, it can be used nationwide. “Independent studies have shown that WaterDex has taken a complicated issue and made it simple. So simple that 65% of WaterDex users adjust their controller every week or month. More adjustments to the custom index using WaterDex means less consumption” [Figure 1], Ortiz said. “We are asking water agencies nationwide to offer an incentive to homeowners for purchasing WaterDex. At the end of the day we are all in this together and we have a simple solution to reduce waste and beautify landscapes,” Ortiz concluded.

—Matt Davenport is co-founder of Rockrose Technology, is a US Environmental Protection Agency WaterSense partner, a certified arborist, a horticulturist, and is founder and president of Monarch Environmental Inc., a multidiscipline landscape management consulting firm. He can be reached at matt@monarchenvironmental.com.

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