Improving Landscape Irrigation Efficiency with ET Calculations, Aerial Photography, and On-site Evaluations

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Abstract

Utilities are constantly looking for innovative ways to save water in the summer months when outdoor water use is at an all time high. With outdoor water use accounting for up to fifty percent of the total summer potable water use in the City of Austin, much attention has been focused on reducing the demand for irrigation water among residential customers. For the past fifteen years, the City of Austin has offered free irrigation evaluations to its customers to help educate and assist homeowners in understanding their landscape's water needs; however, getting the highest residential water customers interested in this service has proven to be difficult in the past.

In the spring of 2005, the Austin Water Utility's Water Conservation Division initiated a program that provided the top 1,000 residential customers with an approximation of how much outdoor "over-watering" had been occurring at their property for the past three years based on evapotranspiration (ET) data. These customers use approximately 35,000 gallons or more during the summer months, with the top ten residential customers using a combined amount of over 2 million gallons during August of 2004 alone. By specifically targeting this group of customers, the program aimed to increase water use awareness among the residential customers who needed it most.

Irrigation in the City of Austin

Austin is located in central Texas and receives approximately 32 inches of rainfall on average each year. The summer months are often very dry, increasing overall water use in the summer by almost 100 percent over winter use, especially during extended dry periods throughout the months of July and August. The increased water use places stress on the City's water treatment infrastructure and necessitates the expansion of current infrastructure to accommodate the irrigation needs of customers during peak times. Water conservation efforts in Austin have evolved into programs designed to reduce peak day demand and average per capita use aimed at delaying the construction of additional water treatment plant capacity.

In response to noticeably excessive outdoor watering by both residential and commercial customers, an irrigation evaluation program was introduced in order to help customers water more efficiently. Residential customers often have a poor understanding of how their controllers work, have multiple programs or start times that they are unaware of, lack a backup battery in their controller, or have heads that mist due to too-high pressure. The City water auditor checks the system for leaks, water application rates and adequate coverage, and helps determine an efficient watering schedule. This watering schedule also takes into account specific factors such as plant type and shade coverage to develop an optimum

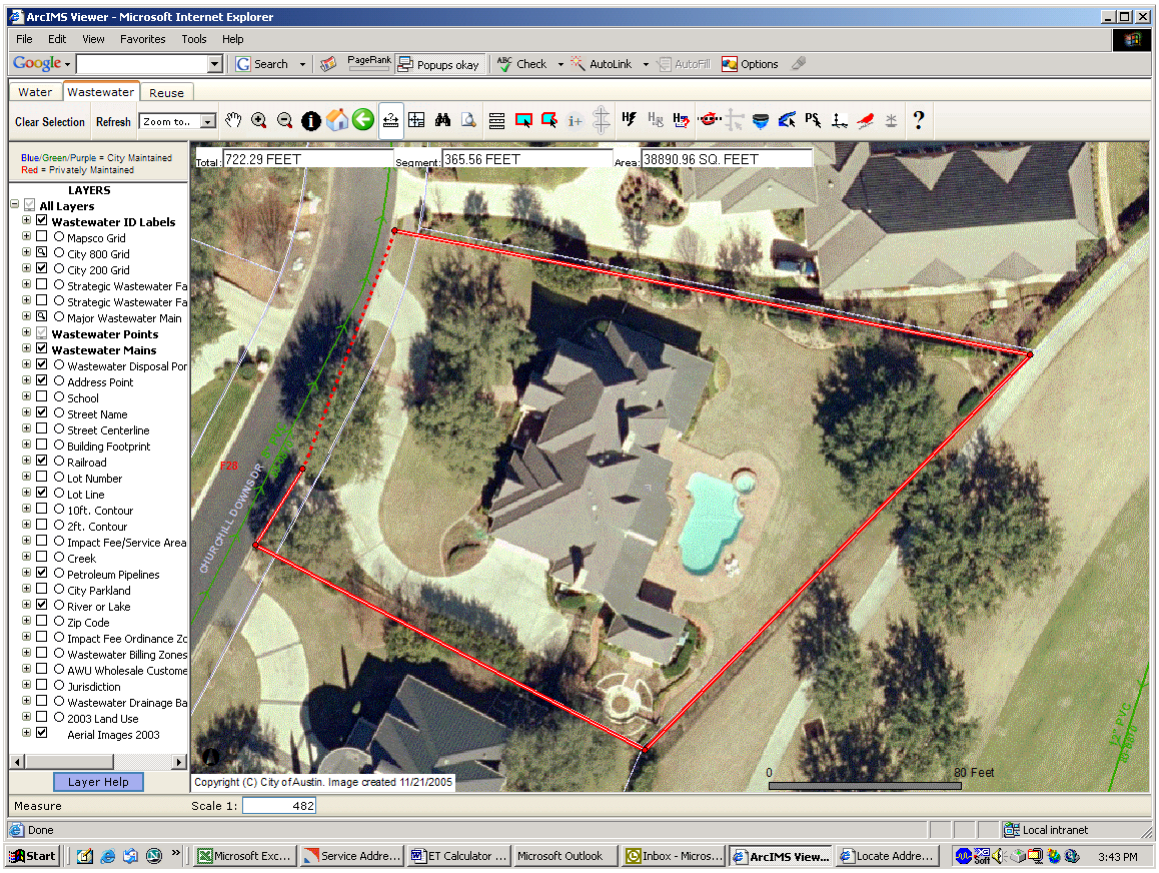
irrigation schedule for the landscape area. In addition, the auditor assesses the adequacy of the equipment and recommends replacement of components if appropriate. These audits often result in reductions of 30 percent or more in irrigation water usage.

For the past few years, the City of Austin has sent a letter to the 1,000 highest residential water users to get them to participate in the City's free irrigation evaluation program. The response rate from previous mail-outs to these customers has been less than desired, with an average response rate of approximately 5 percent. Previous initiatives from the past mail-outs have included a letter signed by the City's mayor urging customers to reduce their outdoor watering during the summer months, as well as an incentive offering customers money back on their utility bill if they agreed to have an irrigation evaluation by one of the City's licensed irrigators.

ET Calculation Methodology

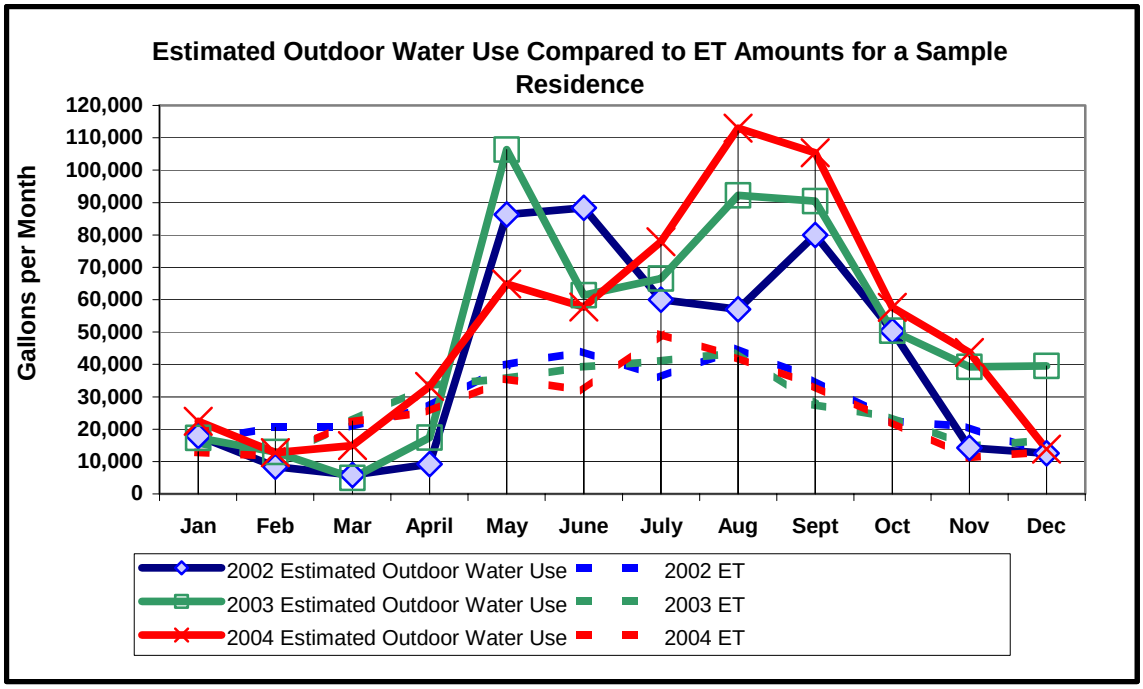
In response to the lackluster participation by the top 1,000 customers in the irrigation evaluation program and the increased interest in evapo-transpiration during the past couple of years, the City's Water Conservation Division began an ET calculation program. The focus on ET has been steadily increasing as weather based controller technology has begun to surface within the marketplace. Evapotranspiration (ET) is a measurement of the total amount of water needed to grow a healthy landscape. This term comes from the words evaporation and transpiration, and specifically refers to the amount of moisture evaporated from the soil and transpired by the plant. The ET amount varies depending upon both plant type and the amount of shade coverage in a given area.

The ET calculations were completed using address-specific aerial photographs available online through the Austin Water Utility GIS Access Site. The aerial photographs, taken in 2003, provide the lot lines of the individual properties as well as some clarity on the properties' landscape components. Using a polygonal measurement tool created by the Utility's GIS staff, the total outdoor area of the properties was measured and divided up into categories based on the type of plant (cool season turf, warm season turf, or drought tolerant shrubs/groundcover) and the amount of shade (full sun, partly shady, full shade). An example of the aerial photographs available through the Utility's website is shown on the following page with the polygonal measurement tool outlined in red.



The landscape amounts were entered into an ET calculator spreadsheet, created by the Water Conservation staff, which determined the specific ET requirements for the residence's irrigated area for the past three years based on historical weather station data. The weather station data was recorded and made available through the Texas Evapotranspiration Network of the Texas A&M University Program.

In order to calculate the amount of water that had been "wasted" each month on unnecessary irrigation, the properties' ET amounts were compared with the homeowners' actual water use (made available through the Utility's billing system), with a standard amount deducted for an estimated indoor water use amount. The homeowners were sent a personalized letter as well as information about how much water they could potentially save if they watered at the ET rate, a graph depicting their water use versus the ET rate (an example of which is on the following page), as well as estimates of potential dollar savings for both water and wastewater. For the top users, the savings calculations reached into the thousands of dollars and served as a stunning reminder of just how much money they were wasting each year.



Results

The ET mail-out received a 16 percent response rate, with customers contacting the conservation staff for an irrigation evaluation by a licensed irrigator. Once the irrigation audit was complete, the customers were provided with an efficient schedule that would align their outdoor watering with the calculated ET amounts. An initial comparison of water use amounts from before and after the irrigation audit was performed yielded mixed results, with an average reduction the month following the audit of 37.5 percent. Two months after the audit was conducted, however, the water use reduction was approximately 19.42 percent. Much of this could be due to the temperatures during the month of September increasing to record amounts of over 100 degrees for five days in a row, causing people to increase their irrigation use.

Many of the on-site irrigation evaluations revealed that the ET calculations had underestimated the customers' recommended outdoor water use. A distribution uniformity (DU) factor was not incorporated into the initial calculations, which would have increased the usage estimates by 40 to 50 percent on average, which would align them more with the auditor's recommendations. Irrigation system efficiency can vary greatly depending on factors such as head spacing and design, as well as pressure, but selecting a base number for the DU such as a 60% efficiency rate would have increased the accuracy of the ET amounts.

A handful of the customers who received the ET mailout showed interest in evapo-transpiration, and wanted more information on ET controllers. The majority of the customers who contacted the Water Conservation Division staff for an irrigation audit as a result of the mailer cited both the amount of water they had used and the amount of money that they had spent each year on irrigation were the reasons they had sought the irrigation evaluation. Having a personalized mailer, that had the customer's address, landscape information, water use amounts, and billing history worked to get the attention of the City of Austin's hardest to reach residential customers.