City of Tustin and Irvine Ranch Water District Study: Wick irrigation to beautify, save water and meet the run-off regulations

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Introduction

Since 1996, the concept of wick irrigation has never fully developed as common method of irrigation. The initial tests of wick irrigation demonstrate a new means to apply water to turfgrass. The application of wick irrigation eliminated key problems associated with traditional irrigation methods. Primarily, traditional irrigation sprinklers have low efficiency and wastes water through runoff. Wick irrigation is has a higher efficiency because of its design. Wick is a series of low volume emitters. The spacing and the flow rate are calculated using the soil type, and the slope.

The major reason for the development of wick irrigation study was the unique nature of the Jamboree Median in the City of Tustin. The city was dedicated to maintaining the appearance of the median and preferred a turfgrass site. Yet, many factors work again sprinklers in this location. Street median require the full amount of Evapotranspiration (ET) for turfgrass. The median is in a corridor between the ocean area of Newport Beach and the desert area of Riverside. The corridors of this nature tend to experience high winds on a regular basis. Because of these conditions, transplanting other plants material may not solve the three main problems associated with the median.

The city recognized the need for a different approach to maintain. The first element is the landscape appearance of the City of Tustin. The traditional sprayheads have never produced a healthy turf area. Second, Tustin cooperates with IRWD in water conservation but this area had continuous problems with over usage to maintain even a sub par appearance. Finally, the new storm water permit changes both Tustin's and IRWD's emphasis on irrigation runoff. Excess watering as demonstrated in the Residential Runoff Reduction Study is directly related to runoff.

The study is a work in progress but the 5 months of operation suggests general conclusion are possible at this time. A further analysis is planned after the full year of operation of the wick irrigation system.

General Study design

The wick irrigation study consists of 5-metered areas. The first site is the wick irrigation. This site's irrigation consists entirely of wick emitters. The second site is a combination of rotors with wick emitters along the outside by street. The rotors are set in from the curb by 2 feet. The outside 2 feet are watered by the excess irrigation of the rotors and the wick emitters. The last three meters are control meters. There is a single valve, which is similar in size to the wick irrigation site.

In addition, the single valve control site and the 2 wick sites are sub-metered from 2 metered landscapes. These two meters have over a decade of the irrigation history. The meters are part of the IRWD landscape irrigation allocation system, which is based on IRWD's tiered rate structure. This will allow for a historical comparison for water conservation.

Appearance

While it can be argued that conservation and runoff reduction should be regarded as the advocate for changing irrigation systems, cities, businesses and residents demand a solution that focuses on their main irrigation concern. That concern is a healthy landscape. The authors and a representative from the city of Irvine evaluated the general appearance.

The ranking of the turf was performed on a bi-monthly basis. The ranking was done in three categories: Color, density and presence of weeds. The general appearance was discussed among the group and the consensus is listed in the chart below.

	16-Apr	14-May	16-Jul	17-Sep
Wick				
Color	5	4	5	4
Density	3	3	5	3.5
Weeds	3	2	4.5	3.5
Sprayhead- Wick				
Color	5	4	3	3
Density	3	3	2.5	2.5
Weeds	3	3	4	3.5
Control				
Color	5	3	2	2
Density	3	3	2	2.5
Weeds	3	3	4	3.5

The rankings show that the wick irrigation has out performed the traditional sprayheads in the same type of landscape in the side-by-side plots. The general evaluation is that the wick irrigation and the side strips that are augmented by wick irrigation have a very good overall appearance. The general appearance of

the traditional sprayhead area is a fair overall appearance with noticeable dry spots. These dry spots are several feet in width, in many parts of the landscape and brown spots are visible even at a distance. While the wick has dry spots, there are few of them; none is greater that a foot in width, and the brown spot are not visible at a distance.

Runoff

The runoff is qualitative at this time. The study sites do not lend themselves to volume measurements. The observation is two parts. The first observation is a black resurfacing strip. The length of the three sites has been resurfaced with a stripe of 9 inches in width. The second observation is the actual operation of the wick, the wick combination and the traditional sprayheads.

The visual change in the black stripes or the surface of the road is only long term change. Members of the study team agree that there is a noticeable difference on the road surface. The water residue marks the road along the traditional system but not at the wick or the wick combination. However, the erosion of the black stripes is not noticeable. It should be cautioned that the winter rains may remove any noticeable different between sites.

The direct operation of the irrigation at each site leads to a better understanding of the difference in runoff. The operation of the three different systems demonstrates the runoff reduction of potential. The traditional sprayheads were activated for 6 minutes. This was the setting on the controller prior to the study. After the sprayheads were active for 2 minutes, water began to runoff the site. At the end of the 6 minutes, water had sheeted across 1 full lane and a few streams ran from the median to the other side of the street.

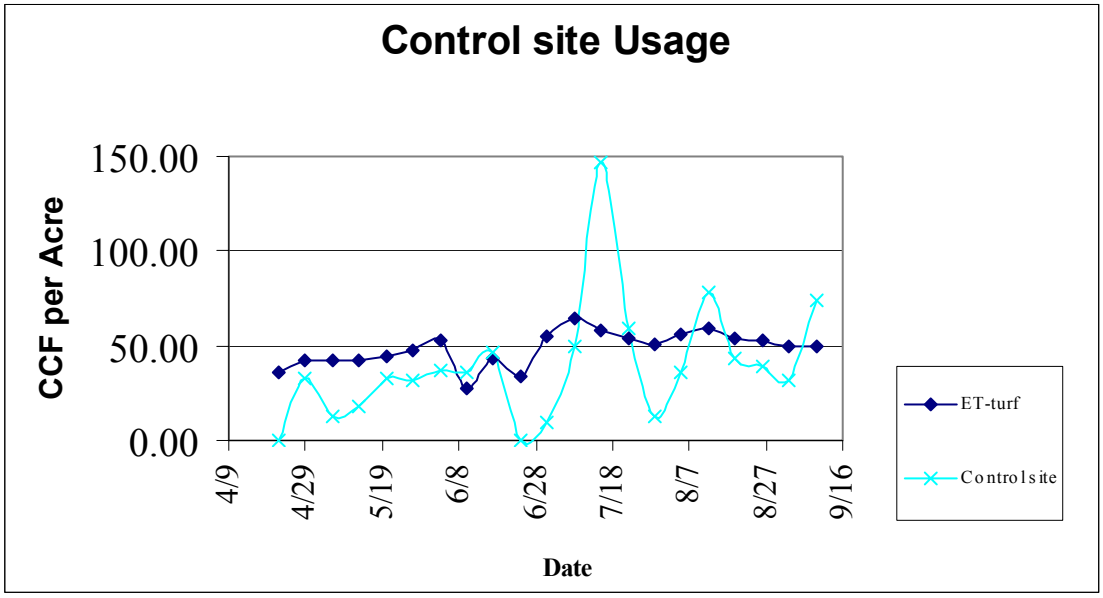
The wick combination had limited runoff. The operation of the rotors was angled to so that the spray extended past the line of rotors. The heads' angle allowed the irrigation stream to touch the curb. This resulted in a small amount of water wetting the pavement. The largest wetted pavement covered an area of approximately 4 feet in length and 1 foot width from the curb. None of this water crossed the lanes from the median to the other side of the street.

The study team operated the wick system for a full 40 minutes as a trial test of the system. The first two trials resulted in no runoff but after a rain, a third trial resulted in some water seeping out a few cracks in the curb. The largest observed wet spot was less than 1 foot wide and approximately 2 feet in length.

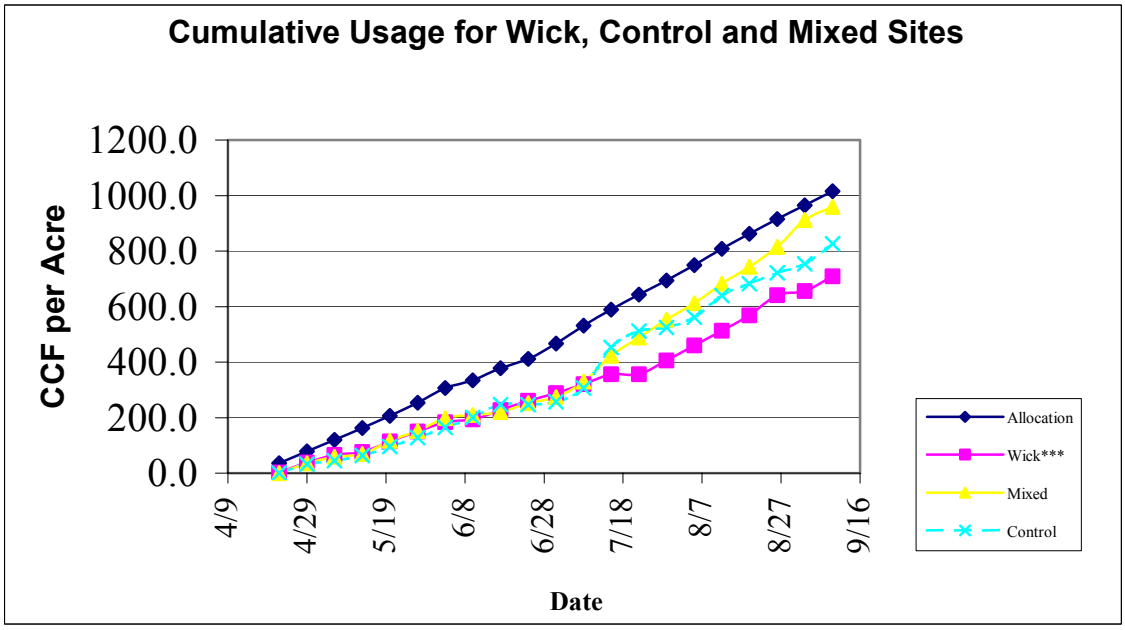
Conservation

The actual value of the volume of water conserved is difficult to determine at the present time. Several factors have worked against the study. Malfunctioning controllers and a car accident which knocked down a controller

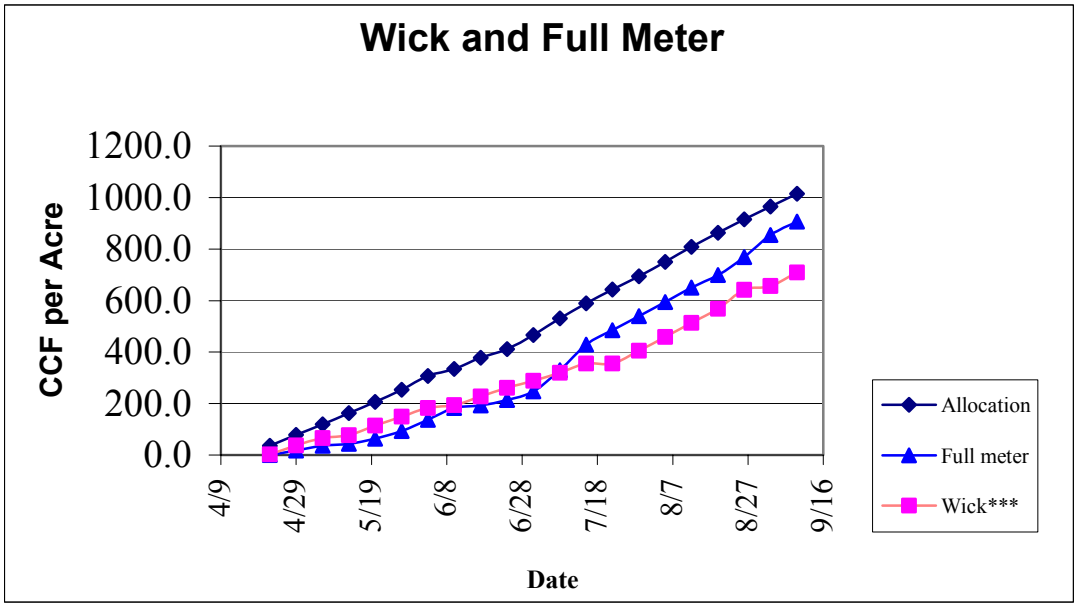
added unforeseen problems. The result of the malfunctions was that the control site did not receive regular irrigation for several weeks. The graph (Control site usage) shows the erratic usage during that period.



After a full year, the statistical noise caused by the accident will be less significant. The following graph (Cumulative Usage for Wick, Control and Mixed sites) shows that cumulative usage of the three sites: the wick site, the mixed site (wick irrigation strips and rotors) and the control site. These three sites are side-by-side landscapes of similar size, weather and plant material to compare water saving. The water usage should be the same but the wick irrigation used less water.



An alternative comparison of water usage is the utilization of the Full meter. The wick site is a sub-meter to the Full meter. The remainder of the Full meter's landscape surrounds the wick site. When the Full meter usage and wick site usage are adjusted to the usage to a per acre basis, the usage should be the same. The graph (Wick and Full Meter) below shows that the wick irrigation used less water. Evaluation of the volume of water saved should be calculated after the completion of one full year of operation.



Conclusion

Wick irrigation can beautify the landscape and maintain the landscape as well as if not better than traditional sprayheads. Wick irrigation works well in turfgrass in summer and in an area where high winds limit the effectiveness of other systems. While wick may not replace all applications for sprinklers, wick irrigation can play a significant role in future developments of landscape irrigation.

Second, wick can reduce or eliminate run-off. This appears to be true for both the full wick irrigation system and the mixed system of wick irrigation and rotors. Runoff reduction is becoming an increasingly important environmental issue.

Finally, the study will continue for the full year before calculating the conservation savings. However considering the problems encountered, it can be further suggested that a second year of data may enhance the understanding of wick and the conservation potential. Especially since the data suggests water saving despite the controller problems, a second year of data might prove larger savings.

1 Hung, Joe Y.T., Joe Byles, Eudell Vis, Ramesh Kumar (1996) Wick Irrigation for Lawn, Irrigation Association International Exposition and Technical Conference, San Antonio Texas.
2 Joe Y.T. Hung, Eudell Vis (1997) Wick Irrigation For Turfgrass Field, ASAE Annual International Meeting, Minneapolis, Minnesota.
3 Joe Y.T. Hung, Arturo Mandoza (1996)