

# Loudoun Water “SMART” Controller Testing Program

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## Purpose

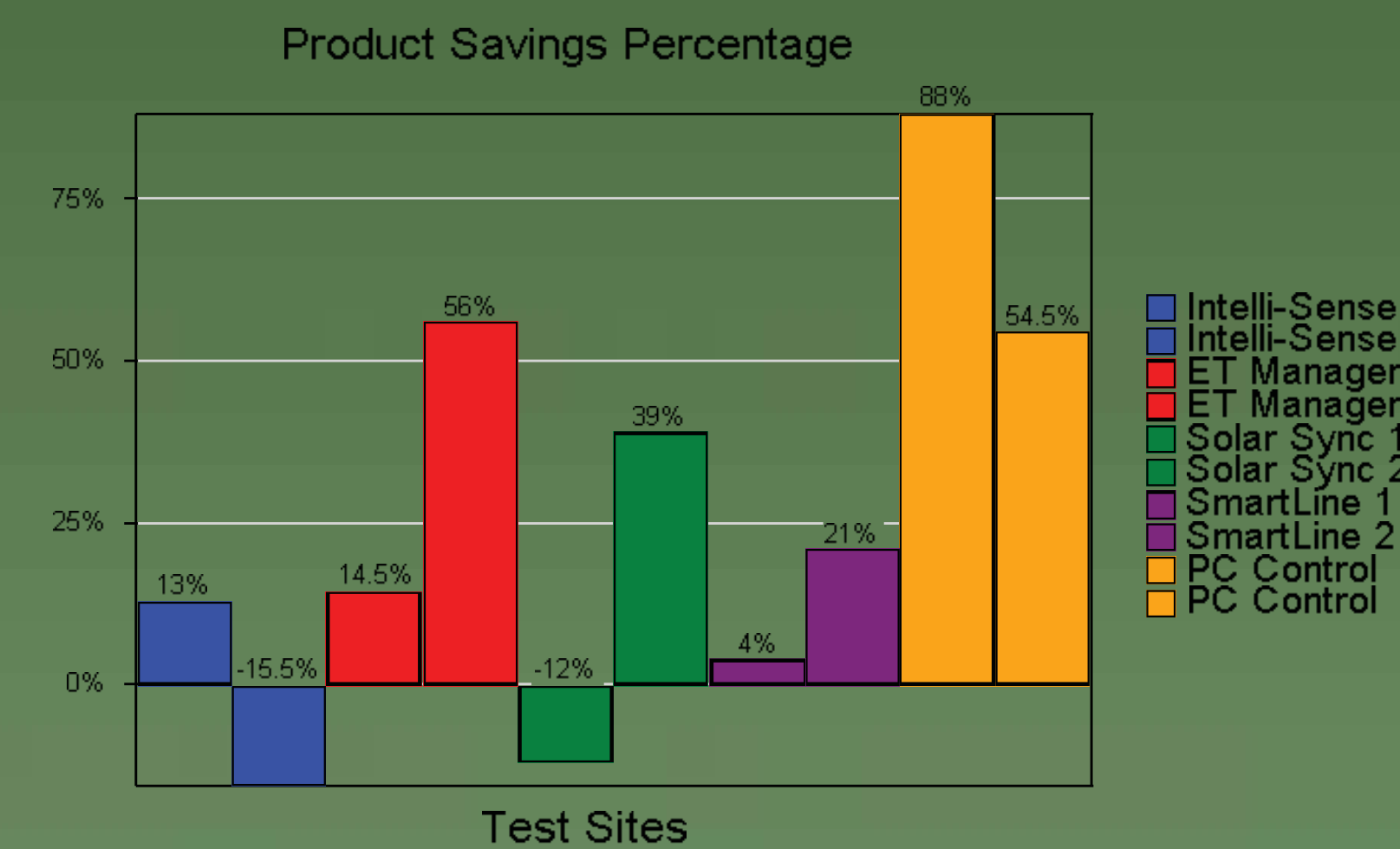
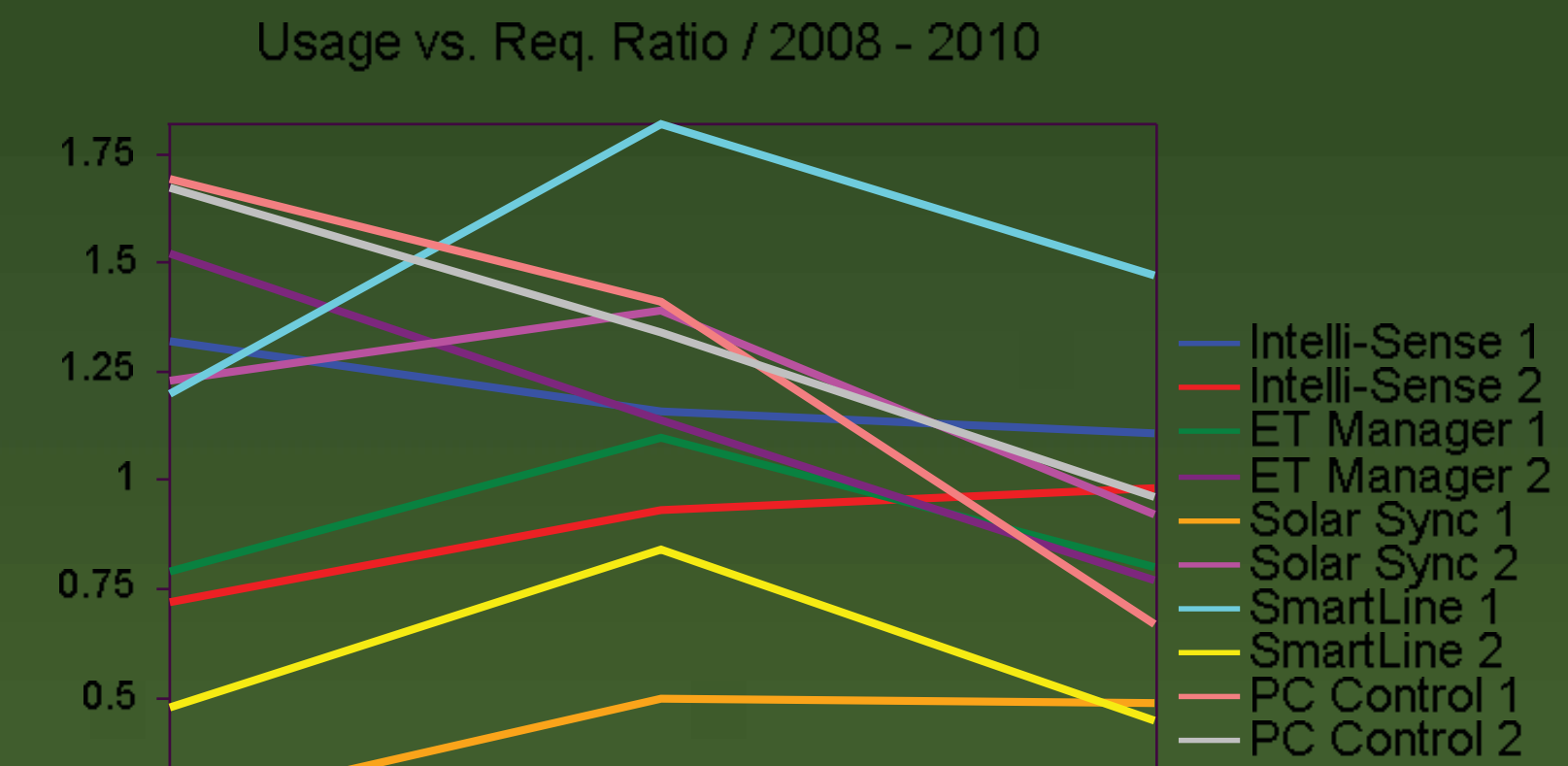
The objective of this testing program is to provide Loudoun Water with market specific knowledge regarding the performance of various “SMART” controller products, and to identify all other influencing factors in order to develop an incentive based customer program which will consistently produce significant water savings in the operation of landscape irrigation systems being serviced by Loudoun Water.

## Design

Five manufacturers were chosen with two sites selected for each manufacturer. The companies and products represented are Toro – IntelliSense, Rain Bird – ET Manager, Irritrol – PC Control, Hunter – Solar Sync, and Weathermatic – SmartLine. One controller for each manufacturer was designated as a site to receive periodic monitoring and adjustment. Each site received an inspection by a C.L.I.A. (certified landscape irrigation auditor) to insure system performance met minimum operating efficiency standards. Peak demand base schedules were written for each site based on average peak ET demand for the previous five year period. After installation, each controller was operated for a full calendar year with water usage tracked and quantified on a monthly and/or quarterly basis. Water usage was then compared to actual water requirements determined from real time daily evapotranspiration (ET) and rainfall data for the test year as well as the two previous years.

## Methodology

- 1) Installation & Programming – A considerable amount of effort and oversight was required to make all controllers operational. Multiple issues with installation including contractor product knowledge, interfaces with existing products, and product failures were encountered.
- 2) System Inspection / Audit - All systems were inspected prior to installation of “SMART” controllers. Most systems had significant issues effecting overall system efficiency which had to be corrected. Some of the common problems are listed as follows; lack of matched precipitation rate nozzles, high operating pressure, sprinkler spacing issues, blocked coverage, poor hydro-zoning, poor arc adjustment, and missing rain sensors. Correcting these items was necessary to insure the greatest possible benefit from “SMART” controller operation.
- 3) Base Schedules – A peak demand base schedule was completed and programmed into each test site controller including plant water requirement, irrigation water requirement, and all scheduling parameters. Each product then made run time adjustments based on current weather conditions. Some controllers such as the Hunter Solar Sync and the Weathermatic SmartLine used on-site devices to produce a modified daily ET value which was used to adjust daily run times. The Toro Intelli-Sense and the Rain Bird ET Manager relied on off-site generation of ET which was transmitted to each individual controller via a paging signal. The Irritrol PC Control was set up with monthly base schedules based on an historical average ET from the last five years.
- 4) Monitoring Visits – One test site for each manufacturer was designated as a monitoring site and received a site inspection approximately every 4 to 6 weeks during the growing season. A soil probe was used to determine soil moisture levels and make necessary fine tuning adjustments to the irrigation schedule.
- 5) Water Use Tracking – Actual water usage was tracked on a monthly and/or quarterly basis. Loudoun Water is currently in the process of upgrading existing domestic meters to a new meter capable of providing daily usage information. Existing manual water meters are read on a quarterly basis. Irrigation usage was determined by subtracting average domestic usage from total usage readings. Average domestic usage was estimated by averaging usage in those winter months when no irrigation usage occurred.
- 6) Analysis – Actual irrigation usage was then compared to irrigation water requirements as depicted on the following spreadsheet. Daily ET & rainfall data for the Sterling, VA area was provided by the Virginia Climatology Office. Effective rainfall was estimated using the following formula (Daily rainfall minus 0.25 x 0.67 but not to exceed .68 which is the plant available water calculation for turf with 4” roots in a silty clay soil).



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Dates	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10
Actual ET - Sterling, VA	5.46	5.79	3.60	1.74	1.00	0.04	0.00	0.00	1.01	2.31	3.83	6.00	30.78
Actual Effective Rainfall	0.26	2.14	0.54	2.47	1.30	2.58	0.52	1.18	1.29	0.56	2.43	0.06	15.33
Actual ET - ERF	5.20	3.65	3.06	(0.73)	(0.30)	(2.54)	(0.52)	(1.18)	(0.28)	1.75	1.40	5.94	15.45

Site	Zone	Sprk	LC	DU	PR	GPM	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	
Site 1	1	Rotor	0.70	0.70	0.67	7.80	466	327	274	0	0	0	0	0	0	157	125	532		
Site 1	2	Spray	0.50	0.60	1.58	4.72	165	116	97	0	0	0	0	0	0	55	44	188		
Site 1	3	Spray	0.70	0.65	2.01	5.85	167	117	98	0	0	0	0	0	0	56	45	191		
Site 1	4	Rotor	0.70	0.65	0.55	12.68	611	429	359	0	0	0	0	0	0	206	164	698		
Total Req. Monthly Gal							13,133	9,218	7,728	0	0	0	0	0	0	4,420	3,536	15,002	53,038	
Actual Usage																			92,924	
Avg. Potable Demand																			34,176	
Projected Irr Usage																			58,748	
Actual - Req.																			5,710	
Actual / Req. Ratio																			1.11	

## Findings

As depicted on the bar & line graphs in the center column, the majority of the controllers in the study demonstrated an improvement in the usage to requirement ratio in the 09 to 10 period when the “SMART” controller products were operating. This improvement ranges from a low of 4% to a high value of 88%. The two controllers which showed a increase in the amount of water used during the 12 month testing period come from sites where significant deficit irrigation occurred in the previous two years.

## Conclusions

- 1) Site Inspection &/or Audit – Given the number of issues requiring correction on most sites, some form of inspection or audit should be required before a customer qualifies for any rebate program in order to maximize the potential for water savings.
- 2) Installation & Programming – The importance of accurate information input and installation by qualified, knowledgeable personnel can’t be emphasized enough. In addition to specific product knowledge, any rebate program should require some type of certification such as C.L.I.A. (certified landscape irrigation auditor) designation or equivalent training by all parties installing and programming these “SMART” controllers.
- 3) Effective Rainfall – In temperate regions such as the Mid-Atlantic area, accounting for effective rainfall can have more impact on conservation results than any other factor. At a minimum, each controller should have the ability to successfully interface with a rain override device.
- 4) Monitoring, Adjustment, & Tracking – Each rebate site should be required to have at least one follow up visit where a sincere effort is made to discover the stress threshold of each irrigation zone. In addition to promoting more irrigation savings, this visit along with some type of water usage tracking can help to change customer behavior.
- 5) Customer Behavior – All products in the study have demonstrated the ability to adjust irrigation schedules based on changing weather conditions. The largest factor influencing the degree to which savings were or were not realized was previous customer behavior. Custom behavior falls into three broad categories. Category I customers consistently operate their systems in a deficit fashion. This customer can actually utilize more water when a “SMART” controller is installed. Category II customers are those that typically operate a “Set It & Forget It Program”. They will typically save in annual water usage because of adjustments made in the spring and fall by their selected “SMART” controller product. Category III customers will usually setup an initial program but also make on-going adjustments based on weather conditions. In order for an incentive based rebate program to consistently produce significant water savings, the majority of the customer pool must fall into the 2<sup>nd</sup> and 3<sup>rd</sup> categories. This can be determined by completing an accurate customer survey prior to rebate program implementation.

