Comments on the November 2009 Draft Specification for Weather-Based Irrigation Control Technologies

April 29, 2010

Commenter: Michael Smith
Affiliation: Control Tech USA, Inc.
Comment Date: November 20, 2009

Template for Public Comment Submission on WaterSense Documents

Commenter Name: Michael Smith

Commenter Affiliation: ASIC, Commercial irrigation controller installer

Date of Comment Submission: 11/20/2009

Topic: Draft for weather-based irrigation controllers

Comment: I've read the draft and I think it is good. There is one requirement that I would like to suggest to be considered. Many of the water purveyors and utility departments here in the Denver area are implementing water budgets for water usage and irrigation on properties. I can't help thinking that this is or will be happening in other areas as well. Would it be beneficial for implementing in these controllers the ability to monitor water usage using a flow sensor, compare it to a user programmed water budget allotment, and then give alerts when the usage of water is close to reaching the allotted amount, and possibly shut down irrigation if the allotted amount of water has been used up?

Rationale:

Suggested Change (or Language):

Commenter: Mike Barth
Affiliation: City of Frisco
Comment Date: December 4, 2009

We have an ordinance requiring installation of a S.W.A.T. approved ET controller on all new installations. My job is to assist the homeowners with programming and try to answer any questions they might have. I firmly believe that any controller considered to be ET based should give credit for rainfall. It should erase any time accumulated up to the rain event or shut the system down for several days, like the Weathermatic Smartline. We have 9 approved controllers for Frisco and if we DID make it a requirement for rainfall credit, it would only knock out 2 of the 9.(The Hunter Solar Sync and the Irrotrol Smartdial).Probe type controllers give credit in their own way by not letting the system come on until the ground dries out enough to permit watering. If you include this requirement, I believe the less effective controllers and add-ons will be eliminated. Thanks- M.Barth

Commenter: Andrew Davis
Affiliation: Casa Loma Homeowners Association
Comment Date: December 4, 2009

To: Tara OHare/DC/USEPA/US@EPA
From: Accurate WeatherSet <andrewdavis@weatherset.com>
Date: 12/04/2009 04:29PM

FROM: Andrew Davis
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...in the 1980s, the EPA labeled some products as "water conserving" and the EPA found that some products performed very poorly or sub-standard. If the EPA uses the SWAT protocol labeling irrigation controllers as water savings, the EPA will have the same sad experience.

The published SWAT test results of ET controllers are below. You will note that all the controller "performed" identically in the first four columns and nearly all performed identically in the last two columns. So, under SWAT testing, all these controllers are identical though their technology varies widely. If you believe that, I have a bridge to sell to you.

The reasons that all these controllers performed identically are several. First, each manufacturer has the right to suppress unfavorable results. The manufacturer can then pay the testing agency another $3500, re-program their controllers and submit for re-testing until each manufacturers gets these perfect scores. Second, the SWAT report only cover 30 days of testing though the controller has been in the hands of the testing agency for months. Third, though plants need different amounts of water during different months even under the same weather condition (different crop coefficients), the SWAT protocol does NOT test for yearly adaptive behavior of irrigation controllers because the SWAT test results are only for 30 days. So if the weather is the same in April and September and the plants grow more rigorously water in April to build new leaves, branches, roots and fruit, the SWAT protocol will be unable to measure how the controller respond to this variation in need for water.
On page 143 of the attached report, the report concludes that SWAT testing was NOT designed to measure water conservation.

Seven of the eight controller brands included in this study 28 have published SWAT test results. Only Accurate WeatherSet has chosen not to participate in the SWAT testing process, but still this technology achieved statistically significant water savings.
All of the published SWAT scores were above 95% for adequacy. The results from this study indicate that the SWAT testing protocol may be a predictor of reasonable field performance, but is not a guarantee of water savings. The SWAT testing protocol was not designed as a way to assess water savings,
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So what is the alternative to the meaningless SWAT testing of controllers to measuring ET controller performance? There are several. The most recent and convincing is the 309 page, multi-year study of 1,000s of ET controllers bought and installed by homeowners and contractors in California. That report is attached with Bookmarks that I have created. The most important chart in that report is presented below.

The right-most column shows the water savings by manufacturer. You will note wide variations in the effective of the controllers. We, Accurate WeatherSet, saved more water than any of the other controllers. Please note that we are NOT in the SWAT list. We have NOT submitted our controllers for SWAT testing because we do NOT believe that spending $3500 on a meaningless test is worth the money. We have waited patiently for the multi-year reports.

Several other regional reports of ET controllers will be released next year.

These multi-year reports reveal the effectiveness of the various technologies AND the ease of use. Water conservation MUST be simple to effective at the homeowner level where most water is wasted. I have read the EPA's draft specification for Smart Controllers, and it is NOT simple. It mimics the protocol of Toro/Irritrol/HydroPoint and Weathermatic. It looks like Toro/HydroPoint hijacked the specification process to favor their difficult and complicated approach. I believe that part of the reason these controllers performed so poorly in the California report is that they are too complicated for most people AND the EPA draft protocol is duplicating this very complicated programming.

Let me ask whether YOU could program a controller in your garage that required these functions.

> Draft Version 1.0 2 November 19, 2009 WaterSense Draft Specification for Weather-Based Irrigation Controllers
> 4.3. Zone-by-Zone Control – The controller shall have the capability to implement runtimes specific for each zone (station) at a minimum using the following attributes:
> 4.3.1. Plant type, crop coefficient values, and/or depth of root zone
> 4.3.2. Soil type
> 4.3.3. Slope
> 4.3.4. Sprinkler type and/or precipitation rate

1) Tara, can you enter for each zone the plant type, its crop-efficient (which varies by month) and root depth?
2) You probably could enter the soil type correctly for each zone.
3) Tara, can you enter the slope correctly for each zone? 4?,8? 16?, 33? slope? Who can guess correctly?
4) Tara, can you enter the precipitation rate correctly for each sprinkler in your yard?

If you answer NO or "very difficult" to questions one or four, then the EPA is setting up itself for failure because the homeowners who "don't know, don't care, and don't have time" to fiddle with sprinkler timers will throw their hands up in disgust and waste even more water because they will NOT understand or have patience to program the timers. Most contractors will also throw their hands up.

Another part of the HydroPoint/Toro controller that made it into the
EPA draft specification is

4.2.6. Percent adjust (water budget) feature – The controller shall include a “percent up/down adjust” feature (or “water budget” feature) such as a button or dial that permits the user to increase or decrease the runtimes or application rates for each zone by a prescribed amount or percent, by means of one adjustment without modifying the settings for that individual zone. This percent adjust factor is a crutch, a band-aid to cover the large errors that homeowners and contractors will make when entering the obscure and difficult factors for each zone.

All these difficult factors (plant type, root depth, soil type, slope, precipitation rate and percent adjust) hide the calculation of Runtimes which are the main simple factor that homeowners understand today and can easily use today.

WATER CONSERVATION MUST BE SIMPLE TO BE EFFECTIVE. Our simple approach that resulted in 33% water savings to ask the homeowner or contractor only two simple questions for each zone to get zone-by-zone control.

First "Assign Valves to Flowers program, Lawn program, or Shrub program."

Second, "Set MAX Runtime" for each valve.

Our controllers have another setting which we have labeled "Stop RUNOFF-Set Cycle Limit." We ship all controller with this limit set a 4 minutes per hour. It may be easily changed for any valve or even shut off for drip systems or sandy soils if homeowners both. Our experience has shown that homeowners easily understand and appreciate this feature.

Flowers, Lawns and Shrub programming get at root depths and crop coefficients.

"Stop RUNOFF-Set Cycle Limit" gets DIRECTLY at precipitation rate, soil type and slope.

"Set MAX Runtime" eliminates the need for "percent adjust" feature in the spec.

WATER CONSERVATION MUST BE SIMPLE and DIRECT for homeowners to handle. I have attached a flyer of our controller to show how simple water conservation can be. Please look at page two of the attached Long Beach flyer.

I hope that the EPA or above specs from their draft or at least restates their spec so that "shall" is changed to "may" to allow controllers such as ours that have and easier way to save more water than the complicated controllers.

If the EPA uses SWAT testing, the EPA will be disappointed in the decade of 2010 as it was in 1980s. The California Energy Commission has decided NOT to use SWAT testing for its labeling of controllers. They have not settled on the standard/standard that they will use. But they have eliminated SWAT. I can give you a contact at the California Energy Commission if you wish to verify this statement.

Well, this is long. But, it may be the most important email on this topic that you read. The Emperor has no clothes and SWAT has no use in measuring water conservation.

If you are not the one for submission of comments on this spec, please send their their contact info. But I thought that you should hear these criticisms directly.

If the EPA uses the SWAT protocol labeling irrigation controllers as water savings, the EPA will have the same sad experience as in the1980s.

Andrew Davis

(See attached file: pastedGraphic.pdf)
(See attached file: Long Beach Flyer.pdf)
(See attached file: Evaluation_of_California_Smart_Controller_Programs_-_Final_Report.pdf)
(See attached file: AW logo for email.jpeg)(See attached file: PastedGraphic-1.tiff)

Note: The Evaluation of California Smart Controller Programs report is not included in this comment compilation due to size. To view the report, please visit www.aquacraft.com/.

Product	Irr adequacy minimum 6 zones	Irr adequacy maximum 6 zones	Irr adequacy average of 6 zones	Irr excess minimum 6 zones	Irr excess maximum 6 zones	Irr excess average of 6 zones
Alex-tronic Enercon Plus	100.0%	100.0%	100.0%	0.0%	3.6%	1.0%
Alex-tronic Smart Cloc	100.0%	100.0%	100.0%	0.0%	1.1%	0.2%
AquConserve ET9	100.0%	100.0%	100.0%	0.0%	1.3%	0.2%
Calsense ET200e	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
Hunter ET System	100.0%	100.0%	100.0%	0.0%	2.3%	0.5%
IrriTrol SmartDial	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
Rainmaster RME Eagle	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
Toro Intellience	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
HydroPoint/WeatherTrak	100.0%	110.0%	100.0%	0.0%	0.0%	0.0%
Weathermatic	100.0%	100.0%	100.0%	0.0%	2.3%	0.4%

Greatest Water Savings Lowest Price

Table 56: Summarized data by controller manufacturer (weather-normalized change in use, % change in per site outdoor use)

Savings

Price Retail

Manufacturer/Brand	N	Avg. Weather-Normalized Change In Use (kgal)	Std. Dev. Weather-Normalized Change In Use (kgal)	95% Conf. Interval	Statistically Significant?	Avg. % Change in Outdoor Use	
Accurate WeatherSet	342	-50.5	85.5	+ or - 9.1	Yes	-33.2%	$220
Aqua Conserve	288	-159.4	1492.6	+ or - 172.4	No	-10.0%	$240
Calsense	17	-1114.1	3043.2	+ or - 1446.6	No	-12.0%	$1250
ET Water	94	-185.4	810.0	+ or - 163.7	Yes	-6.2%	$490
Hunter	44	-40.1	150.5	+ or - 44.5	No	-13.3%	$429+controller
HydroPoint/Irritrol/Toro	642	4.5	439.2	+ or - 34.0	No	0.5%	$349+fees
Rain Master	22	-270.5	853.7	+ or - 356.7	No	-6.9%	$640
Weathermatic	838	-5.1	85.6	+ or - 5.8	No	-4.2%	$299
All Sites	2287	-47.5	670.0	+ or - 27.5	Yes	-6.1%	

Source of the chart is "Evaluation of Califonria WeatherBased "Smart" Irrigation Controller Programs" presented to California DWR by MWD and EBMUD. You may download the full report at www.weatherset.com/reports.

Accurate WeatherSet has NOT submitted its timers to SWAT for testing because SWAT does NOT test for water conservation. See page 143 of the above report where this statement is made. Some obvious deficiencies of SWAT testing are listed below.

1. SWAT reports on only 30 days of testing even though the controller may be in SWAT testing for several months until the required ET and rainfall over 30 days are met for reporting purposes.

2. Manufacturers may suppress bad test results; pay another $3,500; reprogram their controllers: and submit for SWAT retesting until manufacturer gets the best results. You can see the meaningless uniform SWAT test results listed below where all manufacturers got 100% on testing for *adequacy* and nearly all got 0% on testing for *excess*. Compare this uniformity to the wide variation in water savings shown in the multiyear testing presented in the top chart.

Product	Irr adequacy minimum 6 zones	Irr adequacy maximum 6 zones	Irr adequacy average of 6 zones	Irr excess minimum 6 zones	Irr excess maximum 6 zones	Irr excess average of 6 zones
Alex-tronic Enercon Plus	100.0%	100.0%	100.0%	0.0%	3.6%	1.0%
Alex-tronic Smart Cloc	100.0%	100.0%	100.0%	0.0%	1.1%	0.2%
AquConserve ET9	100.0%	100.0%	100.0%	0.0%	1.3%	0.2%
Calsense ET200e	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
Hunter ET System	100.0%	100.0%	100.0%	0.0%	2.3%	0.5%
IrriTrol SmartDial	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
Rainmaster RME Eagle	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
Toro Intellience	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%
HydroPoint/WeatherTrak	100.0%	110.0%	100.0%	0.0%	0.0%	0.0%
Weathermatic	100.0%	100.0%	100.0%	0.0%	2.3%	0.4%

Easiest Programming

Accurate WeatherSet
www.weatherset.com
andrewdavis@weathset.com
818-993-1449

Only 2 simple programming steps are required for most installations.

Step 1: Rotate main switch to **Assign Valves to Flower,® Lawn®, Shrub®, LWU (low water usage) or Fixed programs** as shown in Figure 4.

Put California Friendly and California Native plants in the LWU program. *(See* **www.weatherset.com/Explain/CalNative/** *for more information).* For other plants, put shallow-rooted plants in the Flowers® program, deeper-rooted plants in the Lawn® program and deepest rooted plants in the Shrub® program. *(See Tutorial T3 and programming P2 in booklet for details.)* NOTE: Every gardener knows that shallow-rooted plants dry more quickly than deeper rooted plants and need watering more often and so does our Smart Timer™. The Flowers® program will water most frequently and the Shrubs® and LWU program will water less frequently.

Figure 4: **Assign Valves to Flower®, Lawn®, Shrub™, LWU or Fixed programs** selected by rotary switch. Display shows that Valve 3 is assigned to ***Shrub***® program. Also shown are the Water Days for the program under current weather. The Smart Timer will automatically change these days for each program as the weather changes.

To move to a different valve, push and hold the NEXT or PREVIOUS switches to the left of the display

To change program assignment, push and hold the NO switch to the right of the display to see choices.

Figure 4

NOTE: Another new way of thinking and watering for some gardeners is to water less often and more deeply. This watering method encourages the roots to grow more deeply, thus creating a stronger and healthier plant. The Flower®, Lawn®, Shrub® and LWU programs give you easy access to this more effective watering method.

Step 2: Rotate main switch to **Set MAX Runtime as** shown in Figure 5. Push and hold the **MORE** and **LESS** switches to the right of the display to change the minutes of watering for each valve. For a good starting point, use the minutes for each valve that was in your old controller. This setting determines the maximum number of minutes that the controller will run a valve for each Start Time on each watering day.

The Smart Timer will make small adjustments in the **Runtime** as the weather changes a little. For large changes in weather, the Smart Timer will adjust the number of watering days per week for each program.

Many of the routine settings of the Smart Timer are already set for you. These routine settings are

- Correct Year, Month and day of month
- **StartTime** in each program set at 3 AM and may easily be changed.
- Most significantly,

Stop RUNOFF-Set Cycle Limit set at 4 minutes per hour for each valve and each valve may be easily set for another limit. As you increase the MAX Runtime for any valve above 4 minutes, the controller will spread the extra minutes over additional hours. The Cycle Limit automatically breaks long runtimes into shorter cycles so that the water has time to penetrate the ground rather than runoff into street, streams and our drinking water.

Figure 5: **Set MAX Runtime** is selected by rotary switch. Display shows that MAX Runtime for Valve#3 is set to 40 Minutes. Any Runtime from 0 to 255 may be set for each valve.

To move to a different valve, push and hold the NEXT or PREVIOUS switches to the left of the display

To change MAX Runtime, push and hold the MORE or LESS switches to the right of the display to see choices. *(Step 9 in Detailed Manual)*

Figure 5

Sensors mounted on roof.

Commenter: Michael Bailey
Affiliation: Casa Loma Homeowners Association
Comment Date: December 6, 2009

These specifications are good news for communities in drought areas and for irrigators and condo and apartment associations across the country. It is especially critical the controllers work with rain sencing devises and have the ability to determine when soil moisture is adequate so they won't come on until needed. These capabilities should make the equipment pay for itself quickly and would alos probably allow it to qualify for rebates from the local water agencies. It will also be important that these new controllers be able to work with recycled water systems in order to get the maximum benefit and efficiency from the equipment and the system. Another consideration will be how easy it will be to train landscapers and installers in how to use the new controllers. I am on the Board of Directohrs of a Condo Association in far Southern Orange County. We just changed landscapers. One reason for the change was the old one didn't understand the irrigation controllers and had them operating in ways that violated the water agency's water use restrictions. The new landscaper is used to working with the water agencies and with recycled water systems. Thank you and best wishes, Michael E. Bailey, 25801 Marguerite Parkway, No. 103, Mission Viejo, CA 92692.

Commenter: Kenneth Cook
Affiliation: Acequia, LP
Comment Date: December 10, 2009

Dear Ms. Tanner:

On behalf of Acequia, LP, I thank you for allowing an opportunity to provide commentary on the EPA's WaterSense Program proposed Draft Specification for Weather-Based Irrigation Controllers.

Acequia promotes water conservation partnerships with commercial and industrial property owners in many subsectors, which hopefully offers you a unique perspective of the real-world issues in the commercial landscape arena. While I recognize the specification is drafted for residential and Light Commercial use, the proposed specifications will undoubtedly have significant use throughout the commercial sector as I identify in the specific comment section below.

We recognize that our views and comments are based on a rather unique and strategic perspective of the commercial property arena, yet consider our approach to conserving water one that could provide needed support to the EPA's admitted limited resource availability. Acequia believes that performance based water conservation solutions are readily available, yet highly underutilized as a means to stretch existing supplies and to mitigate our nation's growing water demands on a severely stressed natural resource.

We offer the following recommendations and comments:

While our focus will be directed towards water efficiency in landscapes, the following are generalized suggestions.

* It would be much more efficient and accommodating to all stakeholders for public comments to be posted for public viewing and subsequent comment, such as a LinkedIn or Google Group format. In alternative, postings could be pushed out to all stakeholders for public posting and comment through their own web-based forums.
* Our initial and continued comment and recommendation is that prior the EPA should consider creating and adopting WaterSense Service Provider Specifications and Standards, as a means to fulfill WaterSense Partnering adoption by all stakeholders. The recent public forums at San Antonio (IA Conference 2009) and Las Vegas (WaterSmart 2009), as well as the press release by Irrigation Association this month regarding the Residential home certification program readily identify the overwhelming stakeholder consent towards performance based initiatives over prescriptive programs. Acequia is interested and willing to assist the EPA in the development of these specifications.
* Adoption of a program that is performance based as opposed to prescriptive based. Such a program, through appropriate measuring and monitoring, will ensure sustainable water savings and continued reductions in water waste. The current program, as proposed, is not accurately measureable based on the "allocation of an average savings potential for each product sold methodology" as defined in the public forum at The IA Conference - San Antonio, TX Dec 4, 2009.

* The program should reward maximization of sustainable initiatives and direct EPA resources towards obtaining the most measurable success in water savings and time.
* The program should promote conservation/efficiency practices capable of generating immediate results with first dollars invested.
* The program should not penalize early adopters of conservation strategies.

Specific Comments

1. Certification Scope - Residential & Light Commercial

a. The specifications are currently stated to be for "Residential & Light Commercial" based upon hydrozone count per control unit. From significant field experience and observation, the vast majority (95%+) commercial irrigation controls are 14 HZ and less. The US EPA WaterSense specification in review will ultimately be consumed by virtually all commercial irrigation control sites as long as the HZ count is set at this level, meeting manufacture desire for product sales, but not meeting US EPA goal for sustained water savings.

i. State "Residential" in Specification title of draft specifications;
ii. Develop effective specifications for Light Commercial

b. It would be my recommendation NOT to include a HZ count, but to include a prescribed label for a product to be WaterSense "Certified for Residential Use Only". As an example, most multi-family apartment communities have multiple (3-50) irrigation controls that could be well within the HZ count specified, not providing for the additional level of water management and sustainability originally intended by US EPA for commercial properties.

c. Additionally, a US EPA WaterSense Certified product solution would be perceived by the general (commercial property owner/ irrigation service technician) to be the equivalent of a managed irrigation solution, thus reducing the water saving potential of a site based solely on the most economical solution to pressure imposed by water utility providers for conservation practices.

1. Lack of Sufficient Data to Operate Effectively

a. Specifications include ET data (multi-source) but do not provide for Effective Rainfall integration into the scheduling algorithm or engine;

b. Water conservation based on soil moisture management is totally ineffective without this important inclusion.

2. Prevention of Tampering (Commercial application)

a. The specifications as provided do not prescribe a solution that can not be altered or adjusted by field personnel in a commercial use environment.

b. Most of the failure of these systems occurs due to adjustment by untrained field personnel.

3. Notification of Failure to Receive Environmental Data

a. The specifications do not provide a means for user to identify if current environmental data has been received prior to every irrigation schedule.

b. Under the proposed specifications, the control would "Default" to a High-Performing irrigation control, operating a reference schedule and remain there until reconfigured by owner/ operator to receive environmental data again.

4. Rain Fall Calculation Importance in water savings

a. The use of ET/ and effective rainfall in water requirement calculations should be performed on an hourly basis, as opposed to a 24Hr total basis.

5. Min/ Max Run Time Clarification

a. The specification denotes a minimum 3 minute run-time; while this was noted to be for testing only, the specification note resides outside of the test protocol. The specification should

read "the irrigation control unit will not activate a hydrozone in a given irrigation cycle if the total calculated run time is less than 3 min.".

b. More importantly, the specification should also provide that the irrigation control prevent a single irrigation cycle from activating a hydrozone for more than a specified time (i.e. over 3 minutes per cycle) to prevent run off.

6. Cycle-Soak Calculation for Most Effective Application

a. The current specifications, as written, does not contain cycle-soak provisions to accommodate item #7above, other than in the default provisions to a high-performance irrigation controller.

b. A specification for automatic calculation of cycle-soak based on soil type/ infiltration rates at each hydrozone.

Thanks once again for the opportunity to comment.

Best regards,

Kenneth W. Cook
Partner
O 800-276-1507 Ext 4
F 888-264-3957
C 512-750-2788

Commenter: Karen Galt
Affiliation: Seattle Parks and Recreation
Comment Date: December 14, 2009

Attached. Thank you for the opportunity to comment. Good luck!

Karen Galt
Natural Resources Unit - Irrigation Conservation
Seattle Parks and Recreation
4209 W. Marginal Way SW, Seattle 98106
office 206.684.0370
cell 206.661.4332
fax 206.615.1407

Creating community through people, parks and programs.

Template for Public Comment Submission on WaterSense Documents

Commenter Name: Karen Galt, Irrigation Conservation Program
Commenter Affiliation: Seattle Parks and Recreation, Natural Resources Unit
Date of Comment Submission: Dec. 14, 2009

Topic: WaterSense Draft Specification for Weather-Based Irrigation Controllers
Comment: Make it clear from the beginning that the testing is only to test the ability of the controller to correctly translate weather-inputs into appropriate run times for the parameters entered for any given irrigation zone.
Rationale: The current statement in the objective implies efficient watering will result if the controller tested OK, however this testing is really about (and can only be about) the programming and electrical function of the controllers.
Suggested Change (or Language): Add clarifying statement to 1.0, after "This specification is designed to… runoff. *The evaluation is based solely on its capacity to generate appropriate irrigation schedules from weather inputs*.

Topic: WaterSense Draft Specification for Weather-Based Irrigation Controllers
Comment: 3.0 Performance Criteria, 3.1. May want to consider if longer minimum run times are needed for rotors and/or call out separately for sprays.
Rationale: Some systems can take a long time to fill a line and then make a full rotation with the rotors.
Suggested Change (or Language): WaterSense may want to check with manufacturers for longest typical rotation time.

Topic: WaterSense Draft Specification for Weather-Based Irrigation Controllers
Comment: Section 4.4…. It seems that most ET-based controllers will try to apply as much of ET as they are programmed to do, such that if they have OFF days for drought restrictions or mow-days, they have longer run times the following day to make up for the day off. This seems, conceptually, to be at odds with potential Drought Restrictions in that I would think the restrictions are in place to reduce the overall amount of water being used; whereas the

controller will try to apply all that is needed by the plants, regardless of timing or drought restrictions.
Rationale: See comment.
Suggested Change (or Language): Possibly items 4.4.1 – 4.4.4 should be moved to a different section not having to do with drought restrictions, or should be titled differently: "…drought and other restrictions…" Items 4.4.5 – 4.4.7 seems more tightly aligned with the reduction concept behind drought restrictions and can remain as titled.

Topic: WaterSense Draft Specification for Weather-Based Irrigation Controllers
Comment: Overall the specification itself seems fine and would be a good indicator of a versatile, tunable and useful weather-based controller. The weak point seems to be the reference to the SWAT Climatologically Based Controllers, due mainly to the controversy around that.
Rationale: To come to some resolution on testing protocol, it can be useful to have additional knowledgeable parties involved in the testing procedure.
Suggested Change (or Language): Possibly create a team of scientists from NOAA, USDA-NRCS that could try the protocol or create a similar one to evaluate the controllers.

Topic: WaterSense Draft Specification for Weather-Based Irrigation Controllers
SUPPORTING STATEMENT 11/19/09
Comment: Potential Water Savings Section: It is my understanding from some recent presentations and our own experience, that the assumption that a weather-based controller may save an average of 20% on irrigation water use, is not necessarily what people are actually seeing over time. Where people have been watering excessively, yes, they see savings; however some studies have noted that participants were 'deficit' watering to begin with, and in those cases they see an increase in water use as these controllers correct to 'plant water need.'
Rationale:
Suggested Change (or Language): I think it would be good to add a note about this possibility so readers see the range of outcomes possible by using these controllers.

Commenter: George Alexanian
Affiliation: Alex-Tronix Controls
Comment Date: December 14, 2009

Attached is a comprehensive review, analysis, and recommendations for the EPA WaterSense draft specifications for weather based irrigation controllers. Please provide these comments to whoever is responsible for this information. I may be contacted at 888-224-7630 (Fresno, California) for clarifications.
Thanks
George Alexanian
President, Alex-Tronix Controls

COMMENTS FOR THE WATERSENSE® DRAFT SPECIFICATIONS FOR WEATHER BASED IRRIGATION CONTROLLERS (Nov 19)
By George Alexanian, President Alex-Tronix controls
Fresno, California 888-224-7630
Dec 14, 2009

SPECIFICATION ANALYSIS AND RECOMMENDATIONS

Alex-Tronix has been a proponent of simple and effective water conservation since 1977 with the design and manufacture of irrigation controllers and supports SWAT testing and WaterSense labeling. The U.S. Dept of Energy recognized Alex-Tronix for energy conservation and awarded a grant to continue designing and manufacturing energy and water conserving controllers. The following constructive comments and recommendations regarding this draft specification are based upon our experience and in the interest of the water conservation effort in the irrigation industry:

1. Change title of draft specification to: "WaterSense® Weather Based Smart Irrigation Controllers and Add-on Devices"
2. Smart Add-on devices should not be called add on controllers. An add-on does not program irrigation schedules or power valves. In most cases, it normally breaks the common line to determine if and when irrigation is to occur.
3. Weather based irrigation controllers should not be limited to ET based estimates and calculations. The 8th SWAT testing protocol definitions for "Climatologically based controllers" should be adopted and section 1.0 should be rewritten as follows:

This specification establishes the criteria for weather-based smart controllers and add-on devices to be labeled under the U.S. Environmental Protection Agency's (EPA's) WaterSense program. These controllers and add-ons can use either evapotranspiration (ET) or other sensor(s) or climatological methods to estimate or calculate landscape watering needs on a daily basis. These methods and devices are substantially outlined in the SWAT 8th draft test protocol and include:

a. Controllers that store historical Eto or ETc data characteristic of the site modified by current weather conditions
b. Controllers that utilize on-site sensors as a basis for calculating real time Etc or ETo.
c. Controllers that utilize a central weather station as a basis for ETo or ETc calculations and to transmit the data to individual home owners from remote sites.

d. Controllers not limited to ET that utilize on-site rainfall and temperature sensors to estimate residential landscape water needs.
e. Add-on devices not limited to ET that are added to existing conventional (non-smart) controllers that in combination can meet the standards of section 3.2 and 3.3, as modified per these comments.
f. All the above methods of estimating or calculating water needs shall meet the standards of sections 3.2 and 3.3, as modified below.

This specification is designed to ensure the controller or add-on has the ability to provide adequate and efficient irrigation while minimizing runoff.

This specification applies to residential or light commercial products with 16 or fewer stations that are designed and sold for use at homes and similar scale light commercial and institutional properties.

The justification for rewriting section 1.0 is as follows:

a. There are 13.5 million residential and light commercial irrigation controllers in current use in the U.S. The vast majority of them are in working order and the homeowners are not likely to instantly purchase a smart controller given their cost, complexity, and long 15 year payback. Smart non ET based add-ons are likely to be a much more affordable simple option, and their use is likely to produce more immediate water conservation and a significantly reduced payback time.
b. Add-ons are not programmed with watering schedules (assignment of stations to multiple programs, start times, watering durations, etc…) and cannot power valves by themselves. Hence they are not controllers and should not be classified as such. Because they are not controllers, they are by themselves not subject to the controller feature requirements of section 4.2. While the SWAT test protocols for ground moisture sensors is still in development, separate ground moisture sensors are in effect add-ons to existing controllers. The Rain Bird ET Manager, the Hunter Solar Sync, Hunter ET system, and the Weather Matic weather station are other examples of add ons in the sense that they are sold separately. None of these can power the activation of valves or be programmed with watering schedules.
c. Limiting smart controllers to ET inhibits innovation of alternate and potentially simpler means of calculating or estimating landscape vegetation watering needs. The ET method itself is a calculated estimate of vegetation watering needs. Therefore, alternate methods of estimating landscape water needs without the use of ET should be allowed. The currently recognized modified Penman-Monteith ET calculation is one of at least 15 different ET based equations developed over the last 50 years. A study by Cattaneo and Upham a few years ago compared four of these equations, including the Pennman-Monteith, and found that using the same CIMIS data but different weather parameters and equations, resulted in calculated watering estimates between the four methods with variations by as much as 60% from each other at certain times of the year. Who is to say that another estimating method is not as good or better than ET?
d. Virtually every method involving ET is patented or patent pending. It would be difficult to provide variations of ET methods without the risk of patent infringement.
e. Limiting smart technology to ET could be considered restriction of trade. The purpose of the SWAT test is to verify that the selected method approximates the industry and CIMIS chosen Pennman-Monteith method well.

f. Representatives of the EPA at various prior meetings (stakeholder meeting in Phoenix, the 2008 WaterSense portion of the SWAT meeting in Anaheim, by teleconference with the California Energy Commission meeting in Sacramento in April of 2009), have stated that smart controllers are not limited to ET.
g. The Bureau of Water Reclamation also recognizes the difference between smart controllers and add-ons to existing controllers in the "Weather and Soil Moisture Based Landscape Irrigation Scheduling Devices" publications
h. Water districts in California that provide rebates for smart controllers recognize SWAT tested controllers without limitation to ET based controllers.

4. Sections 2.0 and 3.2 and 3.3 specify the irrigation surplus as a maximum of 5%. This is a rather strict limitation and should be modified that this is an average surplus of 5% for the six SWAT zones and not for every zone. The minimum irrigation adequacy percentage of 80% may be per zone or an average.
5. Section 3.1 specifies a 3 minute minimum run time during the SWAT test. However, the minimum 3 minute run time suggested in section 4.2.3 should not apply to the controller in normal use. Manual operation and valve and sprinkler testing frequently may be for as little as one minute. There is no sense in wasting water during system maintenance if only one minute will suffice. The variable run time of section 4.2.3 should be from 1 minute to a minimum of 60 minutes.
6. Section 4.1 requires a non volatile memory in the smart controller or add-on. This is appropriate for both ET and non ET versions, and add-ons.
7. Section 4.2 applies to controllers and does not apply to add-ons.
8. Section 4.2.5 that requires that the smart controller or add-on to have a means of informing the user that the sensor signal is lost is appropriate.
9. The zone by zone control specification of section 4.3 only applies to smart ET based controllers and ET based add-ons. Plant type, soil type, slope, and sprinkler precipitation rate are only required to calculate run times using ET methods. Hence smart non ET controllers or add-ons should not be subject to this specification. These additional programming entries into ET based controllers normally require home owners to use professional assistance for installation and programming, adding to the cost and payback period. They also frequently require call backs for further assistance at add additional cost and payback time for the smart ET controller. This additional cost and call backs are normally not necessary for non ET controllers or non ET add-ons.
10. A new section should be added to the specification that addresses the fact that in practice no small to medium residential irrigation system requires six programs. Typically, no more than two, or at most three programs are used in residences. However, six programs are needed to satisfy the SWAT testing because of the six diverse zones. It is recommended that since section 4.2.1 requires three programs in the subject controller. Requiring six programs for SWAT testing and only three for installed use are not consistent. Requiring six programs for every controller would add unnecessary programming complications and is an overkill for residential use. It is recommended that for consistency, if two or three programs are required for labeling, that two or three identical controllers be permitted to be used (each with two or three programs) to comply with the six water zones of the SWAT test.
11. In general, the add on requirements should generally satisfy the SWAT recommendations provided in September 2009:

    The standard (conventional) residential or light commercial irrigation controller SWAT tested with the add on type device:

    a. Is a typical irrigation controller up to 16 stations with 24 VAC outputs

b. Has at least two programs
c. Has the capability, at a minimum, to be installed as an interrupt type device on the common and/or control wires of the controller
d. The combination of the add-on and standard controller shall satisfy the 80% minimum adequacy and 5% maximum average excess specifications herein specified, with no single zone with more than 8% excess.
e. The add-on shall be tested with a standard controller model specified by the add-on manufacturer, or from a list of standard controllers provided by the add-on manufacturer.

12. Concerning section 4.4, most smart or conventional controllers have the features listed in sections 4.4.1 to 4.4.7. However, smart controllers or add-ons are generally not compatible with local specific water utility districts watering schedule limitations on an automatic basis. An ET or other smart controller or add-on normally accumulates ET or other data to determine when the next irrigation is to occur. In many cases, this may fall onto a non watering day or time of day if both smart technology and watering restrictions are employed simultaneously.

This simultaneous accommodation of watering schedules and smart technology would require periodic manual reprogramming of the controller for compliance. The major advantage of smart controllers is to automate water use. Periodic manual reprogramming will cause homeowner frustration to comply with watering schedule requirements. Programming new start times and allowed watering days may accidentally and negatively affect the smart programming and cause the homeowner to relinquish smart watering in order to not be fined, or water more frequently on allowed watering days to "make up" for the watering restrictions. This practice could lead to runoff and higher water use than with a conventional controller.

Water districts have various degrees of water related problems, depending upon the region. Some may have water pumping and delivery issues. Some may have the required infrastructure, but limited water supply, while others may have both problems. If section 4.4 is to be a meaningful and viable specification, it is recommended that controllers or add ons have the capability of providing smart technology and automated custom watering schedules for specific water districts for the highest flexibility for that particular municipality or water district. The water district can decide, depending upon their local situation, which method is best for their purposes.

13. Another issue is relevant to water conservation either through smart controllers or water rationing. California water districts are generally set to be revenue neutral. Lower water usage will most likely lead to higher water rates to balance the cost of delivery and revenues. It is therefore likely that homeowners who save water may see a smaller reduction in their water bills than expected. Therefore, the calculated payback in the supporting statement may be much longer than 15 years for smart controllers, and longer yet for those ET based controllers that require professional installation and follow ups, and even longer for those that have monthly ET service fees.
14. Section 4.5 should state that "The controller or add-on device shall be compatible with a rain device."

    Section 4.5.5 should not require that a rain switch terminal connection be provided in the controller. The conventional way of connecting a rain switch is by breaking the electrical common line to the solenoid valves. The important issue here is that a rain switch can be

used with a controller or add on in order that irrigation be shut down for a period of time during and after precipitation. Requiring that the controller recognize a rain device and display irrigation shut down would require that a number of newly manufactured controllers be redesigned. It is much more likely for the homeowner to wonder when his smart controller will irrigate and whether it is working properly than why irrigation is not occurring during or for a period of time after precipitation has occurred.

A more useful feature would be to not irrigate when the ambient temperature approaches freezing. This will not only save water, but be a viable safety feature so that water does not freeze on driveways, sidewalks, or roadways.

15. Section 6.0 regarding future specification revisions is appropriate
16. Definitions should be renumbered as 7.0 and reworded to be consistent with those of the previous comments and the SWAT protocol.
17. Appendix A, sections 1-3 are appropriate. In the product set up section 4.0, no guidance or requirement is specified for selecting the controller with which the add-on is to be tested. Who is to select and provide the controller to be mated with the add-on? A randomly selected controller may have the three programs specified, but not the six programs required for SWAT testing unless two controllers are allowed for simultaneous testing. Also, the approved testing laboratory may not have the technical skills to program all controllers properly. If the SWAT test fails because the controller or add on was not programmed correctly, or the rain switch was improperly connected, who is to blame?

    Recommendation: Provide the option for the manufacturer to provide and program the subject controller or add-on in person under the supervision of the test facility, or provide sufficient guidance for the laboratory to set up and program the subject smart controller or add on with a conventional controller. If the test lab makes an inadvertent error in programming, they are not held responsible because the manufacturer had the opportunity to program the test set up in person. The manufacturer should provide a waiver of responsibility if they choose to have the test lab perform the set up and programming.

Commenter: Jenna Smith
Affiliation: Seattle Public Utilities
Comment Date: December 16, 2009

Template for Public Comment Submission on WaterSense Documents

Commenter Name: Jenna Smith
Commenter Affiliation: Seattle Public Utilities
Date of Comment Submission: Dec. 16, 2009

Topic: 2.0 Summary of Criteria
Comment: I support the parameters of 80% adequacy and 5 percent irrigation excess.
Rationale: Defining an industry accepted standard will push manufactures to develop more efficient technologies.
Suggested Change (or Language):

Topic: 2.0 Summary of Criteria
Comment: An additional bullet here should require that the controller packaging, or it should be listed somewhere else, should include information about all the parts that were used to test the product.
Rationale: It should be clear which components were included during SWAT testing and that produced the WaterSense performance levels so that consumers, contractors and agencies are clear about which components to install to receive comparable results.
Suggested Change (or Language): Add a bullet: The controller must include at time of purchase all the components included during performance testing in order to

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Topic: 4.0 Supplementary Feature Requirements
Comment: 4.2.1. – 4.2.6 – All these features are important for a standard controller and should be included on a WaterSense certified controller if smart capabilities no longer function.
4.2.6.: The percent adjust should work for each zone or for each program.
Rationale: Since this is only a backup feature, it's not necessary for the controller to have both zone by zone or program percent adjust capabilities. It's more important that the smart controller can make the percent adjust by zone.
Suggested Change (or Language): 4.2.6.: Percent adjust (water budget) features – The controller shall include a "percent up/down adjust" feature (or "water budget" feature) such as a button or dial that permits the user to increase or decrease the runtimes or application rates for each zone (or by program) by a prescribed amount or percent, by means of one adjustment without modifying the settings for that individual zone or program.

Topic: 4.3: Zone-by Zone Control
Comment: 4.3.1 – 4.3.5: All important controller capabilities for regular or smart control use. 4.3.3: I'm not sure there's a need to have both slope and cycle and soak. Usually slope is what triggers the need for cycle and soak.

It might make more sense to include 4.4.7 in the 4.4 Zone by Zone control since this will be the tool used to dial in water use during the calibration period.
Rationale:
Suggested Change (or Language): Change 4.4.7 to 4.3.6

Commenter: Thomas Noonan
Affiliation: Ewing Irrigation Products, Inc.
Comment Date: December 22, 2009

Please find attached my comments provided on your template for public comments.

(See attached file: WaterSense Draft Comments.doc)

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Template for Public Comment Submission on WaterSense Documents

Commenter Name: Thomas Noonan
Commenter Affiliation: Ewing Irrigation Products
Date of Comment Submission: December 22, 2009

Topic: Item 4.2.1
Comment: Incorrect word selection
Rationale: Semantics
Suggested Change (or Language): "… programming" should read "… program"

Topic: Item 4.2.1
Comment: Incorrect word selection
Rationale: Zones don't have landscape needs, they have irrigation needs.
Suggested Change (or Language): "… differing landscape needs." should read "… differing irrigation needs."

Topic: Items 4.2.6 and 4.4.7
Comment: Incorrect word selection
Rationale: Application rate cannot be altered by changing the runtime.
Suggested Change (or Language): "… application rates …" should read "… total application amount …"

Topic: Item 1.0
Comment: Inclusion of controllers with various station counts.
Rationale: Many manufacturers sell controllers that have various station count capability through the use of add-on modules. These modules can add 2, 3, 4, 6 or 12 stations depending

on the manufacturers' design. A common multiplier of all these modules is 24 stations. Since new designs may incorporate the need for additional hydrozones based on plant material and microclimate factors, 24 stations would seem a better fit for the description of "residential or light commercial" controller usage.

Suggested Change (or Language): This specification applies to residential or light commercial products with 24 or fewer stations that are designed and sold for use at homes and similar scale light commercial and institutional properties.

Commenter: Deville Hubbard
Affiliation: Irrigation Contractor
Comment Date: January 11, 2010

Template for Public Comment Submission on WaterSense Documents

Commenter Name: DeVille Hubbard
Commenter Affiliation: Irrigation contractor , Texas LI1836
Date of Comment Submission:1/7/2010

Topic: "The U.S. Environmental Protection Agency's (EPA's)WaterSense program was designed to make it easy for Americans to save water and protect the environment." Veronica Blette Acting Chief WaterSense Branch November 19, 2010
Comment: This is the opening statement Veronica Blette used in her November 19, 2009 letter requesting comment on the Draft specifications for weather based irrigation controllers. Although ET based irrigation controllers are great tools to help conserve water for experienced operators, there is nothing in the draft specifications that require them to be easy to use.
Rationale: Many current ET enabled controllers require lengthy step by step programming. Any incorrect data inputs results in failed ET results. It is easy for home owners to use ET enabled controllers improperly resulting in wasted landscape irrigation water. The second concern with many ET enabled controllers is that they require a proper base irrigation program that the ET functions use when reducing watering amounts. If the base program is not properly calculated for the site microclimate it is easy to waste landscape irrigation water. I understand that the "Guidelines for Irrigation Audits on WaterSense Labeled New Homes" requires a seasonal and grow in program to be reviewed but that seasonal program is not static and may need to be adjusted several times per year. If the program is not monitored and corrected, the ET enabled controller is no longer conserving water it is capable of. The monitoring and adjustment of landscape irrigation programs require specific training and can not be ignored. I agree with the intent of Weather –Based irrigation Controllers but feel that home owners will be lured into thinking the ET controllers will achieve water conservation independent of professional irrigation service or maintenance agreements.
Suggested Change (or Language): Add this statement into the body of the WaterSense program where consumers will see it. **"Weather based irrigation controllers are a great tool that will help achieve water conservation if properly programmed and monitored. Consult a local irrigation professional regarding the proper use of these controllers."**

Commenter: Bob Drews
Affiliation: Not Disclosed
Comment Date: January 13, 2010

As an irrigation professional for over 25 years, it is very important to have clock with the ease of programing and programing manuals that are written in layman's terms. Short and concise. The basic functions should be in the beginning of the manual. I have worked with several ET based clocks, where the user just as soon remove the units because the programing was not only difficult but the user manual was written by an engineer and not an end user. Quick reference guides need to be in plastic not paper inside the clock.

Commenter: Diana Schulz
Affiliation: Cyber-Rain, Inc.
Comment Date: January 14, 2010

Attached are my comments on the weather-based irrigation controller specification. Thank you for giving us the opportunity to provide input. Feel free to contact me if you have any questions.

Best regards,
Diana Schulz

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Cyber-Rain Comments on WaterSense Draft Specifications
Commenter Name: Diana Schulz
Commenter Affiliation: CEO, Cyber-Rain Inc.
Date: January 15, 2010

Topic: Section 1.0: Scope and Objective – Calculation of Evapotranspiration
Comment: The language should be generalized to accommodate real world differences in how controllers use ET principles to calculate irrigation schedules and adjust schedules based on real time environmental conditions.
Rationale: Evapotranspiration (ET) principles are generally used by manufacturers as an element in determining irrigation schedules, but the exact methodology varies by manufacturer. This variation has been recognized by the Irrigation Association. In addition, many climatic variations are encountered when developing a product for national release, which makes it necessary for manufacturers to incorporate a fair degree of flexibility in the design and application of how weather data is used. As a result, manufacturers also vary in how they adjust irrigation schedules based on real time environmental conditions.
Suggested Language: We recommend the following alternative wording to the first two paragraphs of this section (starting with the second sentence).

> **It applies to both stand-alone and add-on controllers (collectively referred to in this specification as controllers) that utilize current climatological data and elements of evapotranspiration (ET) data as a basis for scheduling irrigation. This specification applies to controllers that adjust irrigation schedules using ET principles by:**
>
> - **Using onsite sensor(s) to calculate irrigation schedules based on current ET data elements**
> - **Using onsite sensor(s) to calculate irrigation schedules by modifying historical ET data elements**

- **Receive weather data from a real-time source to calculate irrigation schedules based on current ET data elements**
- **Receive direct ET-based data elements from a remote source**

Topic: Section 1.0: Scope and Objective – Controller Station Capacity
Comment: Limiting the scope to 16 stations is arbitrary and will cause market inefficiencies.
Rationale: First, manufacturers already have multiple residential and light commercial installations with controllers over 16 stations. Second, as it is anticipated that rebates will be tied to the WaterSense label, this could result in inefficient market behavior with customers purchasing multiple small controllers instead of one larger controller. Finally, most of the controllers on the market with the features specified in this specification are part of product families of 6 -48 zones. It is not logical that only part of such a product family would be certified.
Suggested Language: We recommend focusing solely on end uses of the products, similar to the FDA's approach with pharmaceuticals. Recommended alternative wording:

This specification applies to residential or light commercial products that are designed and sold for use at homes and similar scale light commercial and institutional properties. It does not apply to products sold for use in agriculture.

Topic: Section 3.0: Performance Criteria – Testing Facilities
Comment : Testing facilities should accommodate all sources of weather information
Rationale: Weather access is needed to test controller performance.
Suggested Language: The following language should be added

Testing facilities will accommodate all sources of weather information during the entire test period, including a broadband internet connection. For web-based services, a computer should be available at testing facilities or manufacturers should have the option of providing one.

Topic: Section 3.1: Minimum Runtimes for Testing
Comment : A three minute minimum runtime for testing is too long.
Rationale: A three minute minimum run time will cause the majority of controllers to have too much run-off for SWAT Hydrozone 2 (slope, clay soil, spray heads). We recommend changing the minimum run-time to two minutes as this should be sufficient to fill pipes while meeting performance criteria across all hydrozones.
Suggested Language:

Minimum Runtimes – All runtimes (irrigation cycles) that occur during the test period must be greater than two minutes in duration.

Topic: Section 4.2.1: Supplemental Features – Multiple Programming Capabilities
Comment : More general language is recommended for this requirement as not all manufacturers use programs as their basis for irrigation schedules.
Rationale: Program-based scheduling technology was developed due to historical software limitations. Many manufacturers now offer more flexible techniques with equal or better results. The wording of this item should be generalized to focus on the stated goal of independent station control.
Suggested Language:

Multiple programming capabilities – The controller shall be capable of storing a minimum of three separate irrigation schedules to allow for separate schedules for zones with differing irrigation needs.

Topic: Sections 4.2.6 and 4.4.7: Supplemental Features – Water Budget
Comment : Controllers should be able to achieve deficit irrigation by either shortening runtimes or reducing irrigation events.
Rationale: Based on the discussion during one of the review meetings, it was stated that the goal of this requirement is to facilitate deficit irrigation schedules. This can be achieved by shortening runtimes and/or reducing irrigation events (irrigating less frequently than typical), with the latter often being preferable from a horticultural perspective. This preference is referenced in a comparison of deficit irrigation strategies done for the Denver, CO area by the Northern Colorado Water Conservancy District: *"Trees and shrubs will not receive sufficient moisture and they will compete with grass for the moisture. Once-A-Week watering would be a better use of the water to encourage deeper soaking of the water into the root zone rather than Twice-A-Week watering of only .25" per watering."* (excerpt from *Conservation Strategies for Lawn Watering During Drought or Water Shortages; Brent Mecham; March 2003).* The current wording in the specification is too prescriptive and does not allow the manufacturer sufficient flexibility in delivering horticulturally superior deficit irrigation capabilities.
Suggested Language:

> **Deficit irrigation -- The controller shall have some mechanism for reducing all zones water consumption by a prescribed amount or percent by means of a single adjustment and without modifying the settings for the individual zones.**

Topic: Sections 4.4.1-4.4.3: Supplemental Features – Restricted Watering Days
Comment : Controllers should only be required to provide day of the week scheduling. Regardless, even/odd scheduling should not be a requirement as it is not horticulturally based and the same results can be achieved through interval schedule.
Rationale: Requiring all controllers to accommodate such a broad range of restricted day scheduling will likely increase the cost of devices for consumer. This consumer impact needs to be weighed against the water agencies desire for unlimited flexibility in imposing water restrictions. As WaterSense is setting the minimum requirement, we believe that requiring only day of the week scheduling is the best compromise between providing enforcement flexibility for local agencies and containing costs for consumers.
Furthermore, the requirement to accommodate odd/even restrictions should particularly be dropped from the specification as this method is not horticulturally based and the same conservation goal can be achieved with better landscape quality through interval scheduling. Real world implementation of the odd/even conservation strategy has met with unintended results in many cases, such as is documented in the article *A Ban on Odd-Even Watering?* , which was published in the BOSTON GLOBE on September 30, 2007 [excerpt only]:

> *One of those advances, Cantoreggi and others say, would be the elimination of the most popular type of restriction, the odd-even water ban…. In his experience, Cantoreggi said, the odd-even restrictions actually serve as a memory trigger for many homeowners, who end up watering more than they might have otherwise, not less. When he was the DPW director in Millis, he said, residential water use increased when the town put the ban in place….Some specialists have told the DEP that watering deeply, but less often, actually encourages healthier, more drought-resistant grass, while limiting weeds, which have shallower roots…."Every irrigation specialist we've talked to says that you can water effectively in one or two days per week," LaVangie said. "Up to now, people have just had their landscapers come early in the year, set their sprinkler systems to water every other day, and then just forgotten about it. That's just not acceptable anymore."*

Suggested Change: Delete 4.4.2 and 4.4.3

Topic: Section 4.4.4: Supplemental Features – Minimum Start Times
Comment : More general language is recommended for this requirement as not all manufacturers use programs as their basis for irrigation schedules.
Rationale: Program-based scheduling technology was developed due to historical software limitations. Many manufacturers now offer more flexible techniques with equal or better results.
Suggested Language:

Minimum of three start times per valve within a 24-hour period.

Topic: Section 4.4.7: Supplemental Features – Water Budget
Comment : This requirement is a duplicate of 4.2.6 and should be deleted.
Rationale: Water budget scheduling and skip day scheduling do not work in concert. They can be offered individually but both cannot be implemented at the same time without conflicts. All of the other items in 4.4 can be delivered in concert. If 4.4.7 is deleted, the resulting specification will be clearer that both water budgets and restricted days are independently required as features.
Suggested Change: Delete 4.4.7

Topic: Section 4.6: Supplemental Features – Read Flow
Comment : We strongly encourage the EPA to consider requiring all controllers to have the ability to read flow data by interfacing with flow meters/sensors.
Rationale: "You can't manage what you can't measure." Most residential units are not dual metered. Irrigation run times are a poor proxy for actual flow as application rates and volume vary significantly. Outdoor water usage is clearly more discretionary than most indoor water usage, but consumers and water agencies do not have the tools available to differentiate. If information is available on water being used on landscapes, water agencies can implement tiered rates and/or penalties. Consumers will naturally conserve more as the cost of water rises if they have an understanding of where they use water – they will understand the benefits of irrigating efficiently and switching to water-efficient landscaping. Water agencies will be able to accurately access the true water savings of these conservation devices or programs. Finally, flow meters can give controllers the ability to detect leaks, which has been identified as one of the biggest opportunities to conserve water by many including Mike Lee of the UNION-TRIBUNE in *Conservation Efforts Slow to Slack Consumers' Thirst* on February 29, 2009: "*…The majority of residential water use occurs outdoors. Ways to reduce landscape irrigation include: 1) Test and tune sprinkler systems to eliminate overspray, leaks, broken heads and other waste. 2) Install a 'smart' irrigation controller that waters based on weather and other factors.…"*
Currently water conservation programs are being designed around a series of assumptions. Actual landscape water usage must be measured to evaluate and refine these programs. Advances in technology have now made flow meters affordable at the residential level. Requiring controllers to read flow will put in place the key capability for water agencies and consumers to evaluate and optimize the water being used on yards. This critical infrastructure should be the foundation for all conservation efforts.
Suggested Language:

4.6.1. The controller shall have the capability to stop and/or prevent an irrigation cycle from occurring when abnormally high flow is detected or when flow is detected when no irrigation is occurring

4.6.2. The controller shall provide some form of visual display to indicate when it has suspended irrigation due to abnormal flow.
4.6.3. The controller shall provide some form of visual display to indicate the volume of water used while irrigating.

Commenter: Brian Vinchesi
Affiliation: Irrigation Association
Comment Date: January 15, 2010

All-

Attached are the official comments of the Irrigation Association SWAT Committee. Please let us know if you have any questions or need any additional information/clarification.

Thanks for all of your hard work.

John

John R. Farner, Jr.
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PUBLIC COMMENT SUBMISSION ON EPA WATERSENSE DRAFT WEATHER-BASED IRRIGATION CONTROLLER SPECIFICATION AND SUPPORTING DOCUMENTS

Commenter Name:
Brian E. Vinchesi, Chair
Irrigation Association Smart Water Application Technologies (SWAT) Committee
Commenter Affiliation:
Irrigation Association SWAT Committee
Date of Comment Submission:
January 15, 2010

Topic:
Reference to the "*Smart Water Application Technologies™ test protocol* for climatologically-based controllers (Draft 8, September 2008)" throughout the specification.
Comment:
The specification should refer to the IA SWAT committee's most recent draft of the weather-based irrigation controller testing protocol, not specifically the 8th draft.
Rationale:
The IA SWAT process is an evolving process which reviews protocols on a minimum three-year basis. The specification should always reflect testing to the most recent protocol. This will keep the specification current and reduce the need for continual updates.
Suggested Change (or Language):

All references to the "Draft 8, September 2008 protocol" should be changed to read "the most recent version of the IA SWAT committee's weather-based irrigation controller protocol."

Topic: Section 1.0 Scope and Overview
Comment:
The definitions and bullet points are not consistent with the most recent version of the IA SWAT committee's weather-based irrigation controller protocol.
Rationale:
The specification is intended for weather-based irrigation controllers. Not all weather-based irrigation controllers are ET-based. The specification should include products that do not use real-time ET data. This inclusion will allow for innovation in the marketplace and the development of new technologies, leading to further water-use efficiency in the landscape.
Suggested Change (or Language):
Change the scope of the specification (the first paragraph and the corresponding bullet points) to be consistent with the most recent draft of the IA SWAT committee's weather-based irrigation controller protocol.

Topic: Section 2.0 Summary of Criteria
Comment:
The specification should require that at the time of purchase the controller packaging should clearly list all components tested with the product.
Rationale:
It should be clear which components were included during the testing that produced the WaterSense performance levels so consumers, contractors and agencies can easily determine any components that need to be installed with the controller to receive comparable results.
Suggested Change (or Language):
Add a bullet that states the controller must include at time of purchase a list of all the components used during performance testing in order to realize the same results.

Topic: Section 2.0 Summary of Criteria
Comment:
The specification should require that the operating instructions included for testing be the same as the operating instructions that are sold with the controller for installation by a homeowner or landscape/irrigation professional.
Rationale:
The licensed certifying body (LCB) should not be provided any additional or different information for correctly setting up and/or using the controller that would not be also provided to the end user.
Suggested Change (or Language):
See above Comment.

Topic: Section 3.1
Comment:

The IA SWAT committee supports, for testing purposes only, that minimum runtimes must be greater than three minutes in duration.
Rationale:
A longer minimum run time during testing allows for more accurate tests and alleviates the ability to score higher by having short frequent irrigation cycles.
Suggested Change (or Language):
See above Comment.

Topic: Section 3.2
Comment:
The term "irrigation adequacy," as referenced in this section, should be "average irrigation adequacy."
Rationale:
The most recent IA SWAT protocol for weather-based controllers reports average irrigation adequacy. As written, a water purveyor, or other authority, could interpret the label as all six individual zones meeting the 80 percent adequacy requirement; actually the requirement is for an average of 80 percent.
Suggested Change (or Language):
See above Comment.

Topic: Section 3.3
Comment:
The term "irrigation excess" as referenced in this section should be "average irrigation excess."
Rationale:
The most recent IA SWAT protocol for weather-based controllers reports average irrigation excess. As written, a water purveyor or other authority could interpret the label as all six individual zones meeting the 5 percent irrigation excess requirement; actually the requirement is for an average of 5 percent.
Suggested Change (or Language):
See above Comment.

Topic: Section 4.4.6
Comment:
The specification needs to be more specific regarding what is meant by "complete shutoff capability."
Rationale:
As stated, it is difficult to determine what is meant by the statement of "complete shutoff capability." Is this simply an on/off switch or the ability to globally shutdown all controllers from a single source?
Suggested Change (or Language):
The controller shall have a manual on/off switch.

Topic:
Section 4.0 Supplementary Feature Requirements
Comment:

Replace the above referenced section with the one below in the following *"Suggested Change (or Language)".*

Rationale:

Section 4.0 as written is very prescriptive. The features as written often force a method rather than outline performance expectations that can be met by current methods or future innovation. Also as written, language in 4.2 and 4.4 are nearly identical. Our suggested edits are the result of a collaborative work group of controller manufacturers and water purveyors. To the greatest extent possible our goal was to meet the intent of the original language, and to define performance parameters of a high-performance controller that can be programmed to meet drought restrictions. We believe this language will invite innovation to meet these performance criteria rather than restrict innovation due to prescribed criteria.

Suggested Change (or Language):

4.0 Minimum Feature Requirements

The controller shall have the following minimum features:

- 4.1 The controller shall include a storage device or means to preserve the contents of the irrigation program settings when the power source is lost and no backup battery is available.
- 4.2 Multiple programming capabilities – The controller shall have independent zone specific programming or be capable of storing a minimum of three different programs to allow for separate schedules for zones with differing water needs.
- 4.3 For areas prone to runoff, the controller shall have the ability to initiate irrigation at least three times for each zone in a 24-hour period.
- 4.4 The controller shall have a means of indicating to the user when it is not receiving a signal or local sensor input, and the controller is not adjusting irrigation based on current weather conditions.
- 4.5 Rain shut-off device – The controller shall either include a rain shut-off device or be equipped to interface with a rain shut-off device. The controller shall meet the following requirements:
  - 4.5.1 If the rain shut-off device is not integral to the product, the controller shall provide a dedicated terminal connection to allow a rain shut-off device to be connected during or after the installation of the controller.
  - 4.5.2 The controller will prevent irrigation from occurring when the rain shut-off device is activated by the presence of rain and will continue to prevent irrigation while the rain shut-off device is still wet from rain.
  - 4.5.3 The controller shall have a means for indicating to the user when the rain shut-off device has suspended irrigation.
- 4.6 Zone level control – The controller shall have the capability to irrigate appropriately for the specific water requirements of each zone. The resulting zone setup can be accomplished by either entering information directly into the controller or by providing appropriate means that allow the user to determine operating parameters such as runtimes which can then be entered into the controller. The following attributes shall be included in the controller setup methodology:
  - 4.6.1 Plant characteristics
  - 4.6.2 Soil characteristics
  - 4.6.3 Slope
  - 4.6.4 Irrigation device characteristics or precipitation rate
  - 4.6.5 Sun exposure

4.7 The controller shall have the ability to accommodate a variety of watering restrictions. It shall have the following capabilities:
- 4.7.1 Operating on any prescribed day(s)-of-week schedule (for example, Monday-Wednesday-Friday, Tuesday-Thursday-Saturday, any two days, or any single day, etc.).
- 4.7.2 Even day or odd day scheduling.

The ability to set irrigation runtimes to avoid a prohibited time of day. (For example, irrigation will not occur between 9 a.m. and 9 p.m.)
- 4.7.3 Complete shutoff for total elimination of outdoor irrigation.
- 4.7.4 Allow for every other week watering on a defined day.

4.8 If the primary source of weather information is not present, the controller will revert to either a proxy of historical weather or a percent adjust (water budget) feature.
- 4.8.1 The percent adjust (water budget) feature is defined as having the means to increase or decrease the runtimes or application rates for all zones by a prescribed amount by means of one adjustment without modifying the settings for each individual zone.

4.9 Manual operation – The controller shall allow for a manual operation troubleshooting test cycle at the physical location of the controller installation.

Topic: Section 6.0 Definitions
Comment:
Reference to the "*Smart Water Application Technologies™ test protocol* for climatologically-based controllers (Draft 8, September 2008)" in the Specification (currently pages 1 and 4) Rather than referencing Draft 8, September 2008, the EPA specification should reference the most recent draft of the IA SWAT protocol as mentioned in section 3.0 above.
Rationale:
This will be consistent with the published literature and be more accurate so people who are researching the protocol will find it more easily.
Suggested Change (or Language):
See above Comments.

Topic: Appendix A
Section 3.0 Testing Add-On Controllers
Comment:
Add-on controllers should be tested with more than one standard irrigation controller.
Rationale:
Even though the add-on device may only interrupt the common wire there are a number of different types of standard irrigation controllers on the market and at least three controllers chosen by the LCB should be tested with the add-on device.
Suggested Change (or Language):
See above Comments.

Topic: Supporting Statement
Comment:

In addition to saving water, an important aspect of smart controllers is to reduce runoff which protects the environment, one of the stated goals of the WaterSense program. The supporting statement should discuss the benefits of reducing runoff using a weather-based controller.
Rationale:
In many parts of the country, especially in the arid West, dry weather runoff is caused by over watering from irrigation systems, causing runoff into the stormwater systems. The ability of the weather-based controller to reduce runoff is an important reason for its use in addition to saving water.
Suggested Change (or Language):
See above Comments.

Topic: Supporting Statement
Comment:
The links to the IA SWAT websites can be simplified. We would suggest using the www.swatirrigation.org site instead of the Irrigation Association SWAT site.
Rationale:
It will be easier for people to locate the information through simplified links.
Suggested Change (or Language):
N/A

Commenter: Kathy Nguyen
Affiliation: Cobb County Water System
Comment Date: January 15, 2010

My comments are attached.

Kathy Nguyen
Senior Project Manager
Cobb County Water System
770-419-6244

Template for Public Comment Submission on WaterSense Documents

Commenter Name: Kathy Nguyen
Commenter Affiliation: Water Resource Manager, Cobb County Water System
Date of Comment Submission: 01/15/2010

Topic: Scope and Objectives
Comment: These specs will only cover the controller's ability to set schedules that could potentially provide adequate irrigation and minimize runoff. Not that they actually have the ability to provide adequate irrigation and minimize runoff.
Rationale: Though the SWAT criteria is the best we have right now it is a virtual simulation with no correlative field test to check the real world performance or effect on landscapes in actual environmental conditions and with 3rd party management.
Suggested Change (or Language): The specification is designed to ensure the controller has the ability to create schedules that should potentially provide adequate and efficient irrigation while minimizing potential runoff if programmed and operated in compliance with manufacturer's instructions.

Topic: General concern – Not specific to any of the parameters
Comment: I have an overriding concern. WaterSense is widely known as "labeled products that save 20% over other available technology." This is not the case with weather based irrigation controllers. Particularly controllers tested in a virtual setting which is admittedly limited. You have no ability to judge the ease of use, the homeowner can refuse to subscribe to the ET info, and they can set it up and enter incorrect information or have no way of knowing what information is needed. This particular technology's potential to save water is so dependent upon installers and property owners. I worry about any implication that the technology alone saves water. In a small control group study we found those using manual control timers actually used less water. I think the need for companion guidance document and clarifying language about the limitations of the testing and the dependence upon the proper installation, setting, and management are essential.
Rationale: As the program has been described the labeled technology alone saves water. I realize this is not the case with certified irrigation professionals, but certification of education programs is different than certification of technology. For a customer on the ground a WaterSense toilet = a WaterSense labeled controller. They don't have to manage their toilet to maximize water savings they won't understand the difference.

Suggested Change (or Language): I think a guidance document is needed as well as some kind of disclaimer or savings optimization info sheet.

Topic: Educational Information
Comment: This refers back to the phone conference. I believe EPA said they were going to come up with some kind of educational program or info. I think input from stakeholders will be vital in the creation of these documents.
Rationale: You need a consensus from those who install and deal with customers as well as those water providers who have concerns about the potential savings if not managed correctly. Also many irrigation professionals and water providers already have educational material that might provide the basis for this education program.
Suggested Change (or Language): I would recommend at the least ensuring input into the process before the educational materials are released. The best may be to ask for input in creating these and working with small groups.

Commenter: Charles Swanson
Affiliation: Texas A&M University
Comment Date: January 15, 2010

EPA-Watersense,

Please accept my public comments in reference to the WaterSense Draft Specification for Weather-Based Controllers.

A reply confirming their receipt would be appreciated.

Thank You

Charles Swanson, M.Agr.
Extension Associate - Urban Irrigation
TCEQ Licensed Irrigator#16931
Texas Agrilife Extension Service
-Texas ET Network
-Texas A&M School of Irrigation

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979-845-5614

Template for Public Comment Submission on WaterSense Documents

Commenter Name: Charles Swanson
Commenter Affiliation: Irrigation Technology Center, Texas Agrilife Extension Service
Date of Comment Submission: January 15, 2010

Topic: Virtual Landscape Defined By SWAT
Comment: Virtual Landscape Conditions are unrealistic, especially for typical Texas Conditions
Rationale: The Root Zone Depth of the 6 zones defined by SWAT range from 8.1 to 28 inches, with the turf root zone depths ranging from 8.1 to 10 inches. These root zone depths are unrealistic for typical turf zones across the State of Texas. Having a deeper root zone allows for much more water to be stored for plant uptake and greater time frame between irrigations (when plant available water reaches a managed allowable depletion).
Suggested Change (or Language): Typical turf landscapes in the State have an effective root zone depth of 2 to 4 inches for residences and 4 to 6 inches for sports athletic fields. Suggest adding or changing the virtual landscapes accordingly. This would result in more frequent irrigations and a better indicator of the controllers scheduling ability.

Topic: Ability to Comply With Potential Utility Drought Restriction
Comment: Although it is recognized the need for a controller to be programmed to comply with Drought Restrictions, there is no indication on the Testing Protocol that the controller will be tested to follow any restriction.

Rationale: Many municipalities in Texas implement some form of drought restrictions throughout the year, either by limiting times of the day or days of the week irrigation can occur.
Suggested Change (or Language): Testing protocol should reflect some type of restriction to be in place while controller is being tested to reflect the controllers' ability to schedule irrigation while complying with municipal ordnances.

Topic: Initial Conditions for Testing Setup
Comment: Little information is provided on initial landscape conditions on which the controller it to begin operating at. SWAT Protocol states that the moisture balance calculations start at one-half full root zone capacity.
Rationale: SWAT Protocol states that a moisture balance by zone for each controller be developed and the total deficit and surplus for each zone be calculated. Initial soil conditions are important when calculating a soil water balance. If a controller irrigates on Day 1 and initial soil conditions are soil capacity, then irrigation surplus has already occurred. I do not know of any way to define initial moisture conditions in most controllers, at least at a 50% initial capacity.
Suggested Change (or Language): Initial Water Balance Conditions should be able to be reflected on or by the controller in testing protocol, either full or empty soil profile.

Topic: Irrigation Adequacy
Comment: The calculation for irrigation adequacy in the SWAT Testing does not properly define the performance of the controller.
Rationale: Based on current SWAT Protocol, a controller would receive a 100% Adequacy as long as what SWAT Defines as Root Zone Working Water Storage (RZWWS) remained positive. This means a controller could irrigate every day, replenishing ETc and easily maintain a 100%. This would eliminate the need for any irrigation scheduling calculation to be done. Essentially any conventional "time based" controller could be set to irrigate based on peak demand and maintain an Irrigation Adequacy of 100% as well. This does not promote "efficient" irrigation.
Suggested Change (or Language): Irrigation Adequacy should be reevaluated to represent a controller's ability to meet a managed allowable depletion.

Topic: Turf Coefficients
Comment: SWAT Protocol identifies monthly coefficients for turf but the test may only run for 30 days. Are all controllers expected to follow these coefficients and what testing is in place to ensure this? And are these coefficients too high?
Rationale: Some controllers may only utilize 1 coefficient throughout the year and some controllers that offer only a plant type do not display a coefficient. Personally I believe these coefficients to be too high for use in Texas.
Suggested Change (or Language): Clarification on what coefficients can be used.

Topic: Rain Management
Comment: Draft Protocol by EPA says that a controller must be equipped to interface with a rain device, but does not mandate a controller be tested with one.
Rationale: A controller should be tested while utilizing a rain device to determine the full potential of the controller to save water. If there are going to steps in place to define the rain device then it should be included with the testing as well.

Suggested Change (or Language): Add all controllers should be tested while connected to a rain device.

Topic: Irrigation Excess
Comment: The term "irrigation excess" as defined by the SWAT Protocol and EPA Draft Specifications is misleading in describing controller performance.
Rationale: Irrigation Excess as defined by the Protocol evaluates only the scheduling efficiency of the controller.
Suggested Change (or Language): Irrigation excess should reflect the amount of irrigation applied overall in excess of what the total plant water requirement was, not how it was applied.

Topic: Quality of Input Data
Comment: The protocol states "The quality of the input data must be verified by a certified professional". What input data is this in reference to and what certification is required to do this?
Rationale: If I had to speculate what this was in reference to I would refer to the ETo value used by the controller. It appears that the data used by the controller for those controllers that have ETo communicated to them from offsite is the same data the manufacturer is providing. There has been no independent verification of the quality of the ETo value being sent to the controllers. This ETo value as well as the ETo value calculated by the controller that utilized onsite sensors should be compared to ETo from an independent source representative of the same location.
Suggested Change (or Language): Little information is available to explain the meaning of the above comment. I would suggest producing 2 moisture balances per controller utilizing manufacturer ETo and an independent ETo to compare quality of data.

Commenter: David Bracciano
Affiliation: Tampa Bay Water
Comment Date: January 15, 2010

Although the proposed specification has many points that I am in favor of, there appears to be a dearth of actual field studies, particularly in the east and southeast portion of the country that provide information on consumer acceptance of the products, how well consumers understand how to operate those products, and savings rates associated with these products under actual field conditions in comparison to other actual irrigation. There has been an expectation that when products are certified as WaterSense this means they generally experienced a 20% savings in the field (not controlled conditions). What field research has been done in the southeast to determine how well these products work under actual conditions?

Additionally, research conducted through ERG titled "Examination of SWAT Protocol Utilizing a Performance Analysis of Weather-based Irrigation Controllers", dated July 2009 by Dukes and Davis has a number of issues, many which appear to be addressed in the draft specification. It appears this comment has not been addressed-"Unfortunately, the Florida testing conditions were unusually dry. Thus, the test results do not fully show the effect of controller performance in a rainy climate despite satisfying the minimum testing requirements of ETO and rainfall. Increasing the length of the test and increasing the ETO and rainfall thresholds would better define controller performance under changing conditions. For example, partial growing season ETO might range from 15-20 inches for a minimum 90 day period and rainfall of 5 inches in a minimum of 10 events would be reasonable limits for the eastern U.S."

This seems to be a major issue associated with the test protocol not resolved that needs resolution. If the item has not been resolved, how will warm humid rainy states like Florida have confidence that test protocols are representative of our conditions?

My recommendation is that EPA should either 1. delay the acceptance of the protocol until the issues identified are resolved or 2. recognize that the protocol will be approved but modified if necessary based on resolution of issues identified in EPA-based research and other independent testing being proposed or implemented in early 2010.

David Bracciano
Demand Management Coordinator
Tampa Bay Water
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Clearwater, FL 33763
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www.tampabaywater.org

Commenter: Melissa Musicaro
Affiliation: Southwest Florida Water Management District
Comment Date: January 15, 2010

Please see the attachment with comments on the draft specification for weather-based irrigation controllers from the Southwest Florida Water Management District.

Thank you.

Melissa Musicaro
Staff Water Conservation Analyst
Southwest Florida Water Management District
352-796-7211, ext. 4197
melissa.musicaro@watermatters.org

Public Comment Submission on WaterSense Documents

Commenter Name: Melissa Musicaro
Commenter Affiliation: Southwest Florida Water Management District
Date of Comment Submission: January 15, 2010

Section: Draft Specification, 1.0 Scope and Objective. "It applies to both stand- alone and add-on controllers that utilize current climatological data and some form of ET data as a basis for scheduling irrigation ".
Comment/Question: I assume that some weather-based irrigation controllers have the ability to measure and react to local rainfall, without adding on a rain sensor device? If this is correct, it should be clarified upfront that some weather-based irrigation controllers do not include rainfall as a weather parameter and that if rainfall is a desired weather parameter, a rain sensor device would need to be installed.
Reason Change Needed: For weather-based irrigation controllers installed in wet/humid climates, rainfall may be a desired weather parameter for irrigation control, so it should be stated upfront that some weather-based irrigation controllers are not capable of measuring rainfall and a rain sensor device may need to be added on. Even though section 4.5 addresses add-on rain sensors, it should be addressed in section 1.0 as well.

Section: Appendix A, Calculations and Assumptions – Potential Water Savings, "Large-scale, long-term studies have shown that on average, weather-based irrigation controllers have the potential to save at least 20 percent of applied irrigation water". And in the Supporting Statement, V. Additional Issues for Consideration, "While weather-based irrigation controllers have been shown to save significant amounts of water-upwards of 50 percent in certain applications, there are numerous outside factors that must be considered and addressed in order to achieve intended savings".
Comment/Question: From the footnote provided in Appendix A, the source of the 20 percent water savings appears to be from studies in the western US. This savings percentage is on the low end for wet/humid states. It would be ideal to have a range of savings, 20 to 40 percent water savings, and anticipated savings would depend on the location and application.
Reason Change Needed: It could be beneficial to acknowledge a water savings range, since the savings potential can be much greater than 20 percent, as is states in the above referenced Supporting Statement, "upwards of 50 percent in certain applications."

Section: Supporting Statement, V. Additional Issues for Consideration. "There are numerous outside factors that must be considered and addressed in order to achieve intended savings. Second, the weather-based irrigation controller must be installed and programmed properly".
Comment/Question: The Supporting Statement addresses proper installation and operation, but should also address other factors such as water rates and education, which may be important in the successful use of the devices.
Reason Change Needed: Factors including proper installation and operation, water rates and education may be important in the successful use of the devices, since some projects that have installed these controllers have seen an increase in post-water use. The additional factors (water rates and education) could be added to the section Supporting Statement under V. Additional Issues to Consider.

Section: This is a comment not addressed in the specification.
Comment/Question: The operator should have the ability to manually override the weather-based irrigation controller, especially if a rain sensor has been installed. If the controller does have a manual override capability, the controller should also have a mechanism to default to the irrigation program and settings, after the manual override is used.
Reason Change Needed: There could be instances when a manual override is needed. For example, if someone is watering with a hose and accidentally sprays the rain sensor, then the irrigation system may bypass the scheduled irrigation cycle even though the landscape needs to be watered.

Commenter: Steven Moore
Affiliation: Irrisoft, Inc.
Comment Date: January 15, 2010

Please accept the attached document containing my response to: WaterSense® Draft Specification for Weather-Based Irrigation Controllers – Version 1.0 dated November 19, 2009

Sincerely,

Steven Moore
Irrisoft, Inc.
Office: 435-755-0400
Mobile: 435-770-3896

Attached file name: Steven Moore - Response to EPA on Water Sense Label Specification for Controllers.pdf

Public Comment Submission on WaterSense Documents

Response to: WaterSense® Draft Specification for Weather-Based Irrigation Controllers – Version 1.0 dated November 19, 2009
Commenter Name: Steven Moore
smoore@irrisoft.net
435-755-0400
Commenter Affiliation: Irrisoft, Inc. – Logan, Utah
Date of Comment Submission: January 15, 2010

Topics:

1. Testing the method to calculate ET
2. Test facility implementation of ET Formula
3. Sensors
4. Cheat to Pass the Test
5. 3-Minute Run Time
6. Root Zone Water Working Storage
7. Effective Rain
8. Saturation vs. Field Capacity
9. “Dumb Controller gets Water Sense Mark”
10. Improved Scoring
11. Protocol Documentation
12. Hourly Time Step
13. 16 stations
14. Crop Coefficients
15. Non-Volatile Memory
16. High-Performing Irrigation Controller
17. Testing Add-on Controllers
18. Publish Results
19. Deficit Irrigation

Topic 1: Testing the method to calculate ET

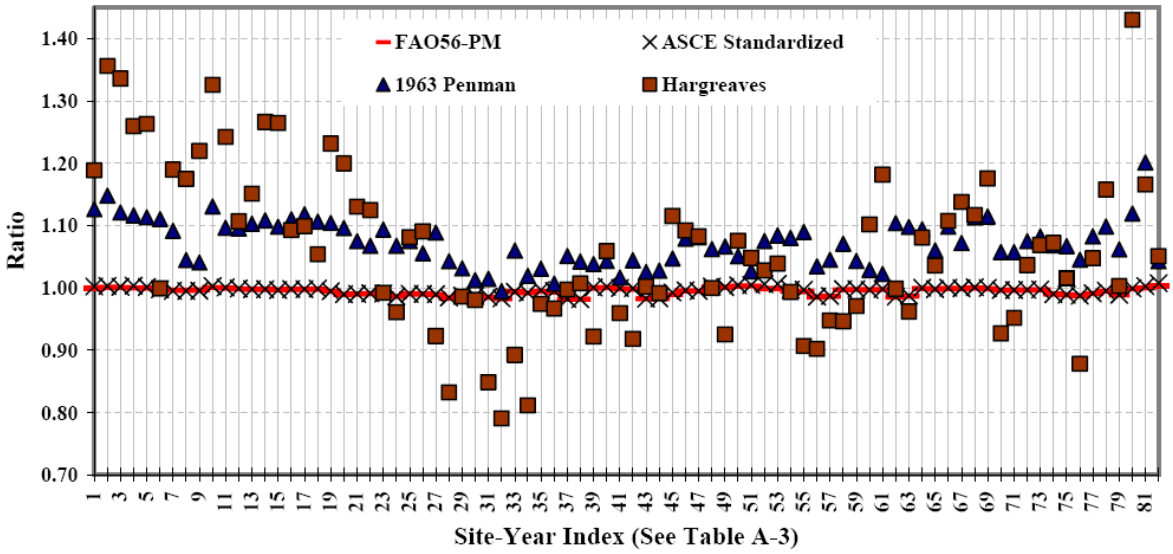
Comment: The SWAT Protocol recognizes the ASCE Standardized ET equation as the industry Standard. There are many methods to calculate ET. Because the test period only requires 2.5" of ET and there is so much "wiggle" room in the current "Root Zone Water Working Storage" values; the controller's method to calculate ET can be off by as much as 45% and the Controller would earn a perfect score.

Rationale:

1) For example: See Table 1 "Description of Zones" in the Protocol. The Root Zone Water Working Storage" value for Zone 5 is 2.25". The Protocol sates: "calculation starts with a one-half full root zone." The moisture balance range in Zone 5 is +/- 1.25" before a controller is "penalized" for over or under watering. Given an ET of 2.5" and the 1.25" range, the ET calculation can be off by as much as 45% = 1.25" ÷ 2.5"

2) The following graph is taken from the ASCE Standardized ET Equation report. It shows how different methods to calculate ET produce different results. Comparisons were made at 49 locations across the country for one to two years.

ASCE Standardized Reference Evapotranspiration Equation Page A-26



Notice that some formulas match ASCE exactly in some locations, but when that same formula uses data from another climate it may produce significantly different results. Also note that the Hargreaves equation has the greatest variations. The Hargreaves equation uses temperature only to calculate ET. The ratio range is 80% to over 140% of the benchmark. Clearly various methods to calculate ET can produce significantly different results.

Suggested Change (or Language):

1) If a controller uses anything but the ASCE Standardized ET equation with all required sensors the test shall be expanded to 4 months and ET of 10.0"

2) ET for the test period for all controllers shall be 5.0"

Topic 2: Test facility implementation of ET Formula

Comment: Section 4.7 of the Protocol regarding "Weather Data Source" states: "SWAT Committee to study and define the term accredited." The ASCE Standardized ET equation

includes a preferred method to calculate ET by utilizing hourly measurements from solar, temperature, wind and humidity sensors. There are alternative methods referenced by ASCE, such as daily calculations and means to estimate missing climatic conditions. These methods should NOT be implemented by a testing lab; the lab should follow the preferred method. ASCE also documents, in Appendix D, a data quality assurance process. This should be incorporated in the test protocol.
Rationale: The SWAT committee does not need to redefine "accredited", it has already been done; the document simply needs to reference the ASCE Standard.
Suggested Change (or Language):
1) The test facility shall use an ET source that has implemented the ASCE Standardized equation.
2) Calculate ET on an hourly basis using solar, temperature, wind and humidity sensors.
3) Verify sensors are sited and maintained per ASCE.

Topic 3: Sensors
Comment: The Specification states: "…ensure the controller has the ability…" A Weather-Based Irrigation Controller should provide sustainable results. There is nothing in the Protocol that verifies the reliability of the sensors to "ensure" long term effectiveness.
Rationale: Smart control is dependent on sensors. Sensors provide input to the processor which makes decisions based on algorithms and programmed settings to control sprinkler valves. SWAT is working on test protocols for Soil Moisture based control systems. These products will undergo two tests, one for the sensor and a second to verify water management. Some Smart products deviate from industry standards by eliminating sensors and rely on estimation methods. These are calculated compromises to simplify and decrease the cost of a product.
• What is the long term affect of those compromises?
• What sensors are being used?
• How accurate is the ET calculation?
• What if the consumer does not install the sensor properly, what is the result?
• How long will the sensors last?
• What maintenance must a consumer perform to assure sustained results?
How can the EPA "ensure" a controller, with an on-site senor, will work for several years and accurately calculate ET when the ET for the test period is only 2.5" and there is as much as 45% "wiggle room" in the RZWWS?
Suggested Change (or Language):
1) Products that require on-site sensors to calculate ET shall undergo additional testing to verify sensor reliability and accuracy.
2) Rain Sensors shall be tested per SWAT test protocol. The test shall be expanded to include tipping rain gauges.

Topic 4: Cheat to Pass the Test
Comment: The following quote is taken from the University of Florida report: "Controller programming is important for receiving good SWAT results. Controllers for the Florida test were programmed with settings that do not necessarily describe the landscape specified in the protocol to create a smaller RZWWS than specified for the zone."
"Inputting slightly different program settings can significantly impact SWAT scores." In other words, to "pass the test" - "cheat".

Rationale: Crossing the limits of the Root Zone Water Working Storage creates a penalty, so controller manufacturers set up the program to avoid these limits. The scoring process should be based on how close a controller allows the Moisture Balance to get to limits. Landscapes are healthier and water waste is reduced with deep less frequent watering. The current protocol fails to evaluate the effectiveness of water management; it only quantifies how much a controller crosses the RZWWS boundaries.
Suggested Change (or Language): See recommendation on "Improved Scoring"

Topic 5: 3-Minute Run Time
Comment: It appears the Section 3.1 requirement for a minimum 3- minute run-time was added to try to solve the "cheating" problem described earlier. Adding this requirement does not get at the root cause.
Rationale: There are times a controller is used for other purposes such as; filling a pond, flushing a filter, cooling the turf etc. These functions may require valves to operate for a minute or less. It would be a mistake to require a Controller Manufacturer to have to redesign a product to implement this feature and have it cause other problems. Without addressing the core issue a low application rate sprinkler, like rotors on Zone 6, could run 20 – 3-minute cycles and the test protocol would never detect this situation. Running a zone like this would waste a significant amount of water.
Suggested Change (or Language):
1) Eliminate the 3-minute minimum run time requirement.
2) See recommendation on "Improved Scoring"

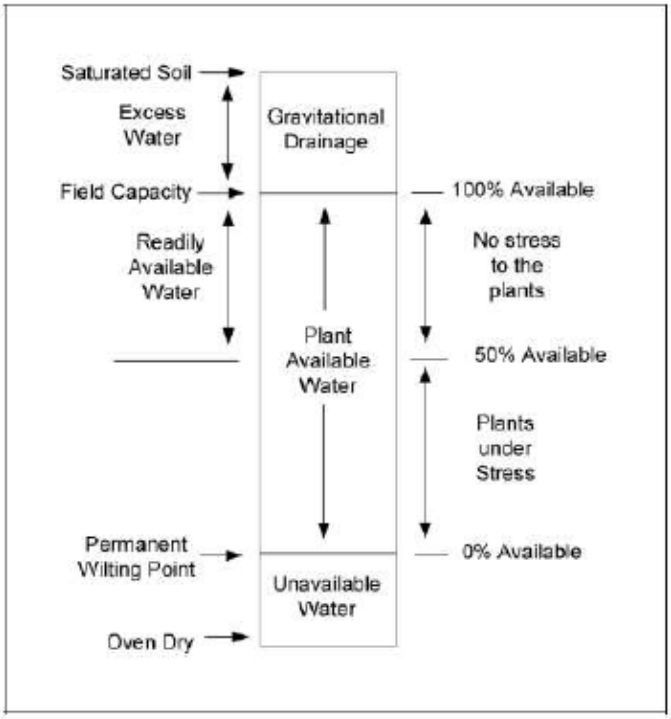
Topic 6: Root Zone Water Working Storage (RZWWS)
Comment: The SWAT Protocol completely revolves around the RZWWS. The current RZWWS ranges from .55" to 2.25". These are unrealistically high for most landscapes. A more realistic RZWWS range is .25" to .8".
Rationale: RZWWS is based in part on root depth. Many landscapes have turf roots at only 3" to 4" and shrubs and trees at 12" to 18". Yes, it would be better if landscapes had deeper roots and many do, but that is not always the reality. A tighter range will more accurately demonstrate the controller's ability to adequately water without excess. If a controller can demonstrate it waters efficiently with shallow rooted plants it will do just as well with deep rooted plants.
Suggested Change (or Language): Modify the RZWWS calculations table in the Protocol to shallower root systems resulting in RZWWS values ranging from .25 to a maximum of .8".

Topic 7: Effective Rain
Comment: The SWAT Protocol defines rain as: "RN = 0.8 (R), in. - Allows for an arbitrary loss of 20% of the rainfall to non-uniformity and runoff." Why use an "arbitrary" value in a test when good science is available?
Rationale: Rain that falls faster than the soil can absorb may run-off. Soil intake rate compared to hourly rainfall rates is accepted science used by many manufacturers as the method to limit effective rain.
Suggested Change (or Language):
1) Rainfall should be accounted for on an hourly basis.
2) The soil intake rate, already defined in the SWAT Protocol to calculate run-off from sprinklers, shall be the basis of limiting rain.

Topic 8: Saturation vs. Field Capacity

Comment: There is a difference in soil moisture content between Saturation and Field Capacity. The SWAT test fails to recognize this difference. It becomes significant when it rains. A heavy rain can saturate the soil. After it rains the water will drain and evaporate. Once soil moisture reaches Allowed Depletion watering should resume. The soil moisture modeling in the SWAT protocol characterizes any rainfall that brings the soil beyond Field Capacity as run-off; this is wrong. The protocol should correctly account for Saturation to be able to correctly model when watering should resume after it rains.
Rationale: Unfortunately testing done at the University of Florida occurred at a time when rainfall amounts where far less than normal and it rarely rains at the CIT test facility in Fresno. So there has not been an opportunity for the EPA or SWAT to see how well some of these controllers perform in very rainy environments. It is a well known fact that rain shut-off devices typically allow watering to resume sooner than needed; this wastes water. Several manufactures have taken the high road by measuring rain instead of using a rainfall shut-off device. The strength of this feature has not become apparent to the EPA. The following diagram is taken from the Irrigation Association's Best Management Practices:

Figure 1-1
Soil Water Relationships within the Root Zone



The BMP states, "Field capacity is the amount of water retained in the soil after ample irrigation or heavy rain when the rate of downward movement due to gravity has substantially decreased, usually one to three days after soil saturation." There are several control systems that recognize this and have programming features to support it. In SWAT tests these features had to be disabled to "pass the test." Yet in real life applications these control systems are smart enough to know when to allow watering to resume after it rains. This saves water!

Suggested Change (or Language): Modify the soil moisture modeling in the SWAT protocol to recognize rainfall may bring soil moisture content beyond Field Capacity to a Saturation limit without run-off.

Topic 9: "Dumb Controller gets WaterSense Mark"
Comment: Under the current protocol achieving an 80% score is too easy.
Rationale: I ran two simulations of the Protocol based on a non-self adjusting controller with a rain shut-off device. This was the setup:
1. Each station was programmed to water every day.
2. Station run-time was based on Historical ET from CIMIS, and was never changed.
3. A rain shut-off device was simulated at .25".
The two 30-day simulations used data from Fresno State CIMIS data from March 2007 and October 2004. I chose the months because they met the 2.5" ET and 0.40" rain criteria for at least 30 days. Here are the results: (I can provide the spreadsheet simulation if you want to see it)

SWAT Simulation
Mar-07

Historical ETo 3.23	ETo 3.98	Rain 0.86

Parameter	Zone #1	Zone #2	Zone #3	Zone #4	Zone #5	Zone #6	Average
Irr. Adequacy	100.0%	100.0%	100.0%	100.0%	100.0%	95.1%	99.2%
Sch. Eff.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Irrigation Excess	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

SWAT Simulation
Oct-04

Historical ETo 3.23	ETo 3.06	Rain 2.32

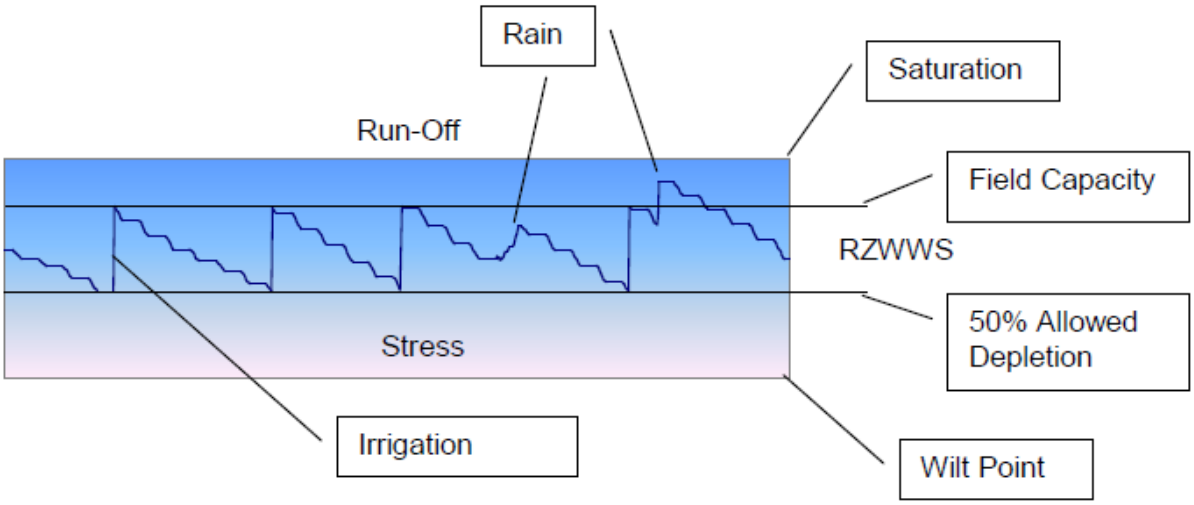
Parameter	Zone #1	Zone #2	Zone #3	Zone #4	Zone #5	Zone #6	Average
Irr. Adequacy	100.0%	100.0%	100.0%	100.0%	100.0%	97.5%	99.6%
Sch. Eff.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Irrigation Excess	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Both simulations had no Irrigation Excess and the average Irrigation Adequacy was 99%. The simulated test did not expose the fact that the controller was not self-adjusting. Under the proposed EPA standard of 80% Irrigation Adequacy and 5% Irrigation Excess, a non-self adjusting controller could earn the WaterSense Mark. Currently published test results are above 90%. The tests done at the University of Florida demonstrated most controllers were over 90%. With the bar at 80%, too many controllers will be given the WaterSense Mark and fail to produce the anticipated water savings. The test needs to verify a controller really is smart.
Suggested Change (or Language): If the EPA chooses to not tighten the Standard and improve the scoring approach, then the average score to achieve the Water Sense Mark should be at least 90%.

Topic 10: Improved Scoring
Comment: The current "scoring" system is having negative consequences. As shown in the University of Florida report, some controllers are watering too often and in short cycles. The "fix", added by the EPA, was to add a 3-minute minimum run time. This fails to solve the core problem.
Rationale: The boundaries of the Root Zone Water Working Storage are 1) Allowed Depletion 2) Field Capacity. If a controller crosses these limits then the score is impacted. This is influencing controller settings during a test and also becomes the governing principle of control

logic designed into a controller. Please do not forget the science behind Allowed Depletion and Field Capacity. Allowed Depletion is not a limit to "stay away from" but a target to be reached. And Field Capacity is not a maximum limit, but a target to refill the soil reservoir. The concept is simple; the controller should wait until soil moisture has reached Allowed Depletion, then irrigate and return soil moisture to Field Capacity. A new paradigm needs to emerge. Scoring should be based on how close a controller allows soil moisture to be depleted to an allowed level, then how closely it restores soil moisture to Field Capacity by controlling the irrigation system. In the example below this watering schedule over 30 days should score a perfect score.

- Moisture was depleted to an allowable level.
- The root-zone was refilled to field capacity.
- It recognized the light rain brought soil moisture above Field Capacity and kept watering off.



A similar problem exists with Cycle and Soak to avoid run-off. Controller settings are resulting in too many short cycles to avoid run-off. A controller should minimize the number of cycles while avoiding run-off. Every time the sprinklers come on water is wasted. A sprinklers job is NOT to get the plants wet but get water INTO the soil. Watering should be done as infrequently as possible and with the fewest number of cycles while avoiding run-off.

Suggested Change (or Language):

1) Develop a new scoring system that rates the effectiveness of each irrigation event initiated by the controller.

2) The score for Irrigation Adequacy shall be based on two factors:
   a. 100% for Irrigation Adequacy shall be given if the cycle began when soil moisture reached Allowed Depletion.
   b. Points shall be deducted from the Irrigation Adequacy Score if too many cycles are run. Cycle length shall be long enough to make sure it applied as much water as possible in a cycle to avoid run-off.

3) The score for Irrigation Excess shall be based on two factors:
   a. The scoring system shall recognize multiple cycles and score the combined cycles with the highest possible score if soil moisture was returned to Field Capacity.
   b. If the cycle time exceeds the maximum allowed cycle time then run-off has occurred and should be reflected in the score.

4) The Zone score shall be the average score for each irrigation event.

Topic 11: Protocol Documentation
Comment: The University of Florida Report states: "The SWAT protocol document does not appear to be organized with the intent for implementation by labs other than CIT. The vague nature of many details will make then protocol very difficult to implement by independent testing labs."
Rationale: It has been inferred in meetings with the EPA that a revised document will be prepared. Stake holders should have an opportunity to review and comment on a revised document.
Suggested Change (or Language): Improve the SWAT Protocol Document and provide an opportunity for public comment.

Topic 12: Hourly Time Step
Comment: If a controller being tested per the current SWAT test protocol starts a watering cycle at 2:00 in the morning and then at 8:00 in the evening it rains, the controller is "penalized" for over watering. This is unfair and absurd. In the future, Smart Controllers may be expected to be smarter and forecast rain, but for now the controller should only be expected to react to real-time conditions.
Rationale: This can happen because the Moisture Balance model implemented by CIT for the SWAT test uses a daily time step. The solution to this problem is simple, run the 10 Moisture Balance calculation on an hourly time step. Per ASCE, ET is calculated hourly. Rainfall is typically measured hourly. Effective rain can be calculated very easily with an hourly time step of the Moisture Balance. This simple change fixes two problems 1) The "rainfall penalty" 2) the means to improve the better determination of effective rain.
Suggested Change (or Language): The Moisture Balance calculation shall be run with an hourly time step.

Topic 13: 16 stations
Comment: The number of stations is irrelevant. Any control manufacturer should be able to bring any controller to be tested and if it correctly manages the irrigation water requirement it should earn the Water Sense Mark.
Rationale: The Standard by which controllers are measured should be universal and represent the Best Management Principles we know today regardless of the number of stations.
Suggested Change (or Language): Remove reference to the number of stations.

Topic 14: Crop Coefficients
Comment: The SWAT Protocol requires the use of Table 2 (Monthly Crop Coefficients) on stations 1, 2 & 6. I agree that Kc values can change but there are several compelling arguments to eliminate the requirement.
Rationale:
1) The test protocol process does not verify that the controller has the capability of changing the Kc value each month. The test period is only 30 days. If the test runs a calendar month, there is no change in the Kc value.
2) A controller that uses a fixed Kc value tested for 30 days beginning on the first of the month will not score the same results if the test began on the 15th of the month. A test protocol should produce the same results regardless of when the test is conducted.

3) The values in this table are based on research in southern California. These values may vary across the country. Dr. Kilgren in the Horticulture Department at Utah State University has reviewed the research and is not convinced of its accuracy. He has been doing research and intends to publish his findings. There has not been sufficient research across the country to provide accurate seasonal Kc values. More research needs to be done; there must be consensus in the scientific community before control products must be designed to implement it.
4) This is a "residential" controller. Many sophisticated "computer central control systems do not support this feature.
5) Incorporating a seasonal Kc table that is unique for all 6 zones in the protocol requires a level of sophistication in a controller that 99.9% of the end users will not understand how to implement. If a controller manufacturer incorporated the table values to satisfy the "test" these tables become a disservice to other parts of the country where these values do not apply.
6) Landscape water managers who have been implementing ET-based control for the last 20 years typically use a constant Kc value.
7) The Irrigation Association BMP teaches a static Kc value incorporated into the KL value (Landscape Coefficient). There is no reference to a dynamic Kc.
8) The Kc Table makes no reference to the transition between months. Some advanced control systems use monthly Kc values to define a curve. The test protocol is following a stepped implementation of the Kc value, having an abrupt change at the end of the month. A device that interpolated Kc over the course of the month would be penalized by the test protocol.

Suggested Change (or Language):

1) Eliminate the seasonal Kc table from the protocol and use a fixed KL value for each zone per the Irrigation Association BMPs.
2) Table 1: "Description of Zones" Shall be changed as follows:

- Zone 1, Item #6 Crop (turf) Coefficient (Kc) change to 0.64 = (Species factor - Cool Season Grass 0.8 x Microclimate factor - Low 0.8 x Density factor – Average 1.0)
- Zone 2, Item #6 Crop (turf) Coefficient (Kc) change to 0.6 = (Species factor - Warm Season Grass 0.6 x Microclimate factor - Average 1.0 x Density factor – average 1.0)
- Zone 6, Item #6 Crop (turf) Coefficient (Kc) change to 0.6 = (Species factor - Warm Season Grass 0.6 x Microclimate factor - Average 1.0 x Density factor – average 1.0)

Topic 15: Non-Volatile Memory

Comment: Section 4.1 states "The controller shall include a storage device or mechanism to preserve the contents of the irrigation program and settings when the power source is lost and no backup battery is available." What test shall be conducted to verify this?

Rationale: There are various methods that can be used to preserve settings, some more effective than others.

~~**Suggested Change (or Language):** Define the process to verify the requirement or eliminate it.~~

Topic 16: "High-Performing Irrigation Controller"

Comment: Section 4.2 states: "If the controller loses the real-time weather input or signal, the controller shall default to a high-performing conservation controller with the features outlined below." This seems to be the premise for having a list of features a controller must have. It is assuming a controller will fail, and if it does, what it needs to do. We are right back where we started; a dumb controller. If a controller looses real-time conditions then add the requirement that the controller must default to monthly Historical ET.

Rationale: It appears that section 4.0 was added because there is a lack of faith in the SWAT test, so section 4 is a backup means to make sure a controller will work. Again, it is a band-aid approach. Most of the features described in this section are needed to pass the test. Do not tie

the hands of the creative minds in this industry by requiring a feature set. Remove the list of features, clearly define the problem to be solved and the process by which EPA will verify the solution is embodied in a product.
Suggested Change (or Language):
1) Remove Section 4.2, 4.3 and 4.5.
2) Improve the performance test and scoring method.
3) Add verification of a Historical ET backup function.

Topic 17: Testing Add-on Controllers
Comment: Appendix A 3.0 states: "Add-on controllers shall be tested with at least one standard irrigation controller chosen by the LCB." The feature set of the controller should be defined by a committee comprised of manufacturers of "Add-on" devices.
Rationale: This feature set should be presented and approved by the IA SWAT Technical Committee then given to EPA for final approval. I am willing to be involved on this proposed committee.
Suggested Change (or Language): Provide the requirements for the controller to be used when testing an Add-on Device.

Topic 18: Publish Results
Comment: Some Weather-Based Controllers perform better than others. When a product earns the Water Sense Mark the results should be available to the consumer.
Rationale: The EPA's goal is to help consumers make better decisions when purchasing a Weather-Based Irrigation Controller. A Water Sense Mark for Weather-Based Controllers should help in this effort. The EPA currently follows this practice; for example Mile per Gallon on Vehicles and Energy Efficiency of water heaters, furnaces, refrigerators, etc.
Suggested Change (or Language): Publish the test results in addition to allowing the Manufacturer to add the WaterSense Mark

Topic 19: Deficit Irrigation
Comment: Page 8 of the Supporting Statement says: "Additionally, it is important to acknowledge that weather-based controllers are designed to deliver a targeted amount of water required by the landscape (usually 100 percent of ETo). In some areas of the country where water conservation is promoted, consumers are practicing deficit irrigation, which is watering at less than 100 percent of ETo." There is a misconception here. Climate-Based Controllers are designed to deliver the water required by the landscape and can be programmed to use a percent of ET.
Rationale: When calculating ETo the result is the potential for evaporation from the soil surface and transpiration from the reference plant. Crop coefficients applied to ETo result in ETc which becomes a crop specific potential for evaporation. Deficit irrigation is watering below ETc not watering below ETo.
Suggested Change (or Language): Remove the paragraph or change ETo to ETc.

Commenter: Mike Gummeson
Affiliation: NDS, Inc.
Comment Date: January 15, 2010

To Whom It May Concern:

Attached are comments related to WaterSense draft specification for Weather-Based Irrigation Controllers.

Best Regards,

Dan Nourian
NDS, Inc.
559-431-2003 x3014

Template for Public Comment Submission on WaterSense Documents

Commenter Name: Mike Gummeson, President
Commenter Affiliation: NDS, Inc.
Date of Comment Submission: January 15, 2010

Topic:
Weather-Based Irrigation Controllers Draft Spec (v1.0 November 19, 2009)
1.0 Scope and Objective
Comment:
The language in the draft specification significantly deviates from the SWAT protocol and its intent. The current language in this section limits the range of smart controller products to which it can, or in the future could apply. Those ineligible products have been designed to the protocol and have performed well in testing under those protocol guidelines.
Rationale:

- There is not sufficient experiential or scientific consensus supporting this limitation. There is consensus on the comparable SWAT language, which does not contain this limitation; "… *This specification applies to controllers that calculate real-time crop evapotranspiration (ETc) …*"
- Limiting this specification only to technologies that rely on the controller calculating irrigation schedules stifles innovation—exactly the opposite, we are certain, of what EPA intends.
- The current draft limited language will render uncompetitive—and probably soon, illegal—many other technological approaches currently in use, fully capable of meeting performance standards, and approved by local jurisdictions. These include ETc / ETo methodologies as well as those that use onsite sensors, current weather data, and some modified form of ET principles for adjusting baseline irrigation schedules.
- Evidence is available, such as SWAT published data, which demonstrates there are no significant performance difference between controllers that calculate real-time ETc versus controllers that don't and instead use some form of modified ET principles and onsite sensors to adjust irrigation schedules throughout the year.

- To encourage innovation, it seems better to use the more general language we propose and rely more on performance rather than technology objectives.
- The proposed language allows for alternate means of using ET principles to establish baseline irrigation schedules (such as scheduling software) and allows for the use of current, well performing technologies. This will significantly broaden acceptance and facilitate faster adoption of WaterSense program objectives.

Suggested Change (or Language):

OPTION A:

This specification establishes the criteria for weather-based irrigation controllers labeled under the U.S. Environmental Protection Agency's (EPA's) WaterSense program. It applies to both stand-alone and add-on controllers (collectively referred to in this specification as controllers) that utilize current climatological data and some form of evapotranspiration (ET) **principles** as a basis for scheduling irrigation by:

- **Using onsite sensor(s) to calculate schedule adjustments;**
- Using onsite sensor(s) to calculate ETo;
- Using onsite sensor(s) to modify historical ETo;
- Receiving weather data from a real-time remote source to calculate ETo; or
- Receiving direct ETo data from a remote source.

…etc.

…OR…

OPTION B:

Align language that is consistent and more in-line with the Introduction section of Draft 8 of the IA SWAT protocol.

Topic:

Weather-Based Irrigation Controllers Draft Spec (v1.0 November 19, 2009)

3.1 Minimum Runtimes

Comment:

The language in the draft specification deviates from the SWAT protocol and is expanding or adding a new feature to the protocol.

Rationale:

There is no strong experiential or scientific justification for this required minimum. In fact, little data supports the utility of it. It will be a confusing requirement that undercuts the credibility of the specification if testing requires three minutes but actual field applications do not. Several existing, well performing controllers have been designed to the current protocol and have performed well in testing under those protocol guidelines and might not otherwise have capabilities to address this new feature. For water conservation, we surely do not want to mandate a three minute minimum or longer field irrigation application.

Suggested Change (or Language):

Eliminate the three minute minimum runtime performance criteria.
Also, in 4.2.3 change the example "three minutes" to "one minute".

Topic:

Weather-Based Irrigation Controllers Draft Spec (v1.0 November 19, 2009)

4.5 Rain Management

Comment:

The language in this section should be written to allow for several existing technologies such as hygroscopic discs, as well as tipping bucket rain sensing devices.

Rationale:

Some controllers use tipping buckets as a rain sensing device which do not send an on or off signal to the controller. Some of these devices simply send the amount of rain that has fallen to the controller and allows the controller to determine when to shut-off or turn-on after a rain event.

Suggested Change (or Language):

Include language that allows a manufacture to supply a rain sensing device with their controller, as well as interface with a common standard hygroscopic disc switch type device. The language should be intent driven and not specific to one technology.

Commenter: Jeffery Kremicki
Affiliation: Hunter Industries
Comment Date: January 15, 2010

Please find attached comments in regard to the EPA WaterSense Draft Specification for Weather-Based Controllers.

Jeff Kremicki
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January 15, 2010
WaterSense
U.S. Environmental Protection Agency
Office of Wastewater Management
1200 Pennsylvania Ave. N.W.
Washington, DC 20460

Comments Related to WaterSense Draft Specification for Weather-Based Irrigation Controllers
The following comments are presented to the Environmental Protection Agency in regard to the EPA WaterSense Draft Specification for Weather-Based Controllers. Hunter Industries also met collaboratively with members of the Alliance for Water Efficiency (AWE) in support of the comments provided to the EPA from the AWE.

1.0 Scope and Objective
Independent studies have shown that, while weather-based irrigation control does achieve water savings, individual savings will vary by end-user, depending upon their current irrigation practice and habits. It is our understanding that the EPA WaterSense Program is primarily focused on the residential end user. Users within this segment of the market commonly lack the knowledge and experience necessary to program conventional controllers, let alone, grasp the understanding the concepts associated with evapotranspiration.
The scope of this specification indicates that controllers utilize climatological data to calculate ETo either through on-site sensors or from weather data (ETo) transmitted from a remote source, which is used for irrigation scheduling. The specification further references controllers that calculate ETc based upon reference ETo. While many products utilize ETo and calculate ETc, some do not. Including ET in the scope of the specification would limit some products that currently provide real water savings, and prevent the innovation of new technologies that may offer benefits in the future.

3.0 Performance Criteria
The EPA's adoption of the Irrigation Association's SWAT test protocols as a means to determine product performance provides consistency in overall controller product testing

occurring within the industry. The SWAT Group, which includes water purveyors, manufacturers, and industry representatives, has, over the last several years, developed testing protocols for weather-based controllers. We feel the SWAT test protocol provides an adequate means to determine product performance. In addition, the SWAT protocol process provides a way for the industry to comment and, when necessary, revise the test protocols on a regular basis. As such, it is important that WaterSense incorporate a review process in their Weather-Based Controller Specification to allow for review, comment and revision by industry participants on a consistent basis. For example, the SWAT Group conducts a formal review of testing protocols on a 3-year interval.

4.0 Supplemental Features

All controllers, even "smart" controllers, require some level of interaction by the end user, both in the initial controller product setup and to make required adjustments to fine tune their system. While many of the features identified may seem beneficial in terms of water conservation and feasible from a product development standpoint, some consideration needs to be given to the increased programming complexity associated with some of these features. The WaterSense program is primarily developed for residential end users. We find that a majority of the end users within this segment of the market lack the understanding of evapotranspiration and the factors involved with the calculation of plant watering requirements. It seems that the inclusion of supplemental features in 4.0 were meant to address two situations: 1) when a controller is either disabled from its automatic weather-based scheduling functionality, which can occur through the loss of the data connection or of the end user physically disable the ET function, and, 2) when local agencies impose additional scheduling restrictions on controllers. Supplemental features should be focused on a minimum feature set more on maintaining controller reliability (i.e non-volatile memory, diagnostics, expected life, etc.) than on specific scheduling functionality required to compensate for situations when the controller is disabled from performing its automatic weather-based control. If not careful, the specification will end up defining what features a conventional controller must have to make it a "smart" controller.

4.3 Zone-by-Zone Control

4.3.1 - 4.3.4 The requirements for zone-by-zone control specified in the draft specification essentially require that all controller products be developed specifically to calculate ET based upon the end user programming specific site parameters into the controller by zone (i.e. plant type, soil type, sprinkler type, and site characteristics). Not only does this increase the complexity in programming, creating a higher potential for mis-programming the controller, this requirement imposes a restriction on manufacturers to develop products based upon a single methodology. WaterSense should allow manufacturers the opportunity to continue to innovate and develop products that meet the WaterSense performance criteria, but allow them with the opportunity to utilize a variety of methods and technologies to achieve the same minimum performance criteria. There are several weather-based controller products currently available that are very effective at saving water that do not require programming requirements as outlined in 4.3. The goal of the WaterSense program is to maximize the market adoption of weather-based controller products. This program can achieve a higher participation through the introduction of product designs that are focused on water savings while minimizing programming complexity. The requirements in 4.3 place significant restrictions on future product development and should be deleted from the specification.

4.3.5 Cycle/Soak is also listed as a supplemental feature in 4.2.2 and is redundant. The requirement in 4.2.2 should state that the irrigation controller should have multiple start time capability or cycle/soak.
Therefore, we recommend that 4.3 be removed from the specification.

4.4.3 Even/odd Day Exclusion
Further clarification may be needed for this feature. An even/odd scheduling day exclusion is not a feature that is typically required by customers. It is common for a day(s) exclusion feature to be used primarily in conjunction with interval watering. For example, an end user may program the controller to water every third day, however, the landscape maintenance personnel comes on Saturday to mow. However, day exclusion may also be required if someone schedules an odd/even day watering schedule also. Most of the water day demands required by end users and imposed by water agencies can be accommodated through specific day of the week, odd/even, and interval water day scheduling.

4.5 Rain Management
If a controller is designed for use with rain sensor shutoff devices, the controller should also have the capability to manually operate the controller for system inspection and maintenance, even though the rain sensor may have the controller disabled due to a rain event.

4.5.2 If the controller is designed to accept a rain sensor in 4.5.1, then this requirement is not required. The common rain sensor is a fairly simple device, from a product design standpoint. Most irrigation controllers are designed to rely on a switch closure or open to indicate whether a rain event has occurred or the sensor has dried out. It would be difficult for existing irrigation controllers to make a determination on whether an open circuit on the rain sensor circuitry was caused by a rain event, or whether it was caused by a rain sensor not being connected to the sensor terminals.

6.0 Definitions
The draft specification states that the definitions for add-on controllers versus stand-alone controllers were taken from the SWAT test protocol for climatologically based controllers (Draft 8, September 2008). I cannot find reference that, for stand-alone controllers utilizing a plug-in (or wired) device, that the device be sold together with the controller. We have developed weather-based controller products that are capable of upgrading existing Hunter irrigation controller installations to weather-based control, simply by attaching the product, which includes a programming module wired to the controller and an on-site weather sensor (wired or wireless) that communicates to the module. These products are considered to be stand-alone control products by SWAT because they integrate with Hunter irrigation controllers only. This product design approach provides the end user with the opportunity to comply with WaterSense requirements, without having to incur the added expense of removing and replacing their existing irrigation controller. There exists a very large population of controllers already in the field that can be upgraded to weather-based control, potentially resulting in higher overall participation in the WaterSense program. In addition, the combination of irrigation controllers and both wired and wireless versions of ET sensors can be quite large, thus imposing a heavy inventory burden on both the professional and retail distribution channel to support. Therefore, while the weather-based control products can be certified by WaterSense, they do not necessarily have to be sold together.

Hunter Industries currently has two weather-based control products within our controller product offerings, both of which have been tested to the SWAT test protocols. One product relies on programming features and requirements as outlined in 4.3 of this specification, while the other product utilizes a simpler approach, from a programming, adjustment, and operation standpoint. We experience higher demand and increased customer satisfaction from residential users that have used the product designed to be less complex, and still achieves a similar result in water savings. “Smart” controller products provide real watering savings and each product typically utilizes a slightly different method or technology for calculating or communicating watering schedules to the controller. Standardized performance testing provides a means for the irrigation industry to evaluate individual product performance and technology. That being said, it is important to allow the manufacturers freedom to innovate and develop products, utilizing the latest methods and technology.

I hope this information is helpful as the EPA proceeds with the development of performance standards and labeling requirements for irrigation equipment. Please do not hesitate to contact me if you have any questions or need additional support.

Respectfully,

Jeff Kremicki
Product Marketing Manager – Electronics
Hunter Industries
760-591-7061

Commenter: Dana Lonn
Affiliation: The Toro Company
Comment Date: January 18, 2010

WaterSense Draft Specification for Weather-Based Irrigation Controllers - Input

SWAT Climatologically Based Controllers 8th Testing Protocol
Although the WaterSense position is that any comments on changes to the SWAT protocol should be submitted through the SWAT public comment and revision process, because the SWAT protocol is an integral part of the WaterSense Specification it is necessary to comment on some of the deficiencies of the SWAT protocol. These comments have been submitted to the SWAT committee during previous comment periods and the necessary revisions and improvements have not been incorporated.

- It does not contain sufficient information for other independent labs to perform the test.
  - Mentioned also in the Dukes report p.4 "the protocol documentation should be clearer for WaterSense adoption to ensure uniform implementation and results across different labs."
- Protocol section 4.8 references a weather station available only to a test site near the weather station. This should be expanded upon to allow other independent testing facilities to conduct the test. It also contradicts section 4.7 in that you can use any accredited weather data source and the same source would need to be used for data for on-site weather devices.
- Minimum rainfall requirement of 0.40 inches over 30days is not enough to fully test a controller's ability to perform well during a wet period.
  - On p.4 of the Dukes report, it states that:
    - "It is likely that scheduling efficiency results were lower due to increased rainfall compared to the official SWAT test rainfall depths; however, this relationship was difficult to substantiate due to limited rainfall during testing."
  - They state that they had "limited rainfall", yet they had nearly 4 times the amount of rainfall required by the protocol. Scheduling efficiency seems to be affected by the quantity of rainfall.
- Order of calculations for moisture balance
  - On pages 10 and 11 of the Dukes report, it is suggested that the order of calculations for moisture balance affect the results of the testing. The order of calculations should be performed so as to best mimic how a controller calculates how to irrigate. A controller doesn't know if it is going to rain after an irrigation event only before and should therefore not be penalized if it does rain afterward.

WaterSense Draft Specification for Weather-Based Irrigation Controllers Supporting Statement
Good to see that the Specification "excludes products that only rely on historical ETo."
P.6 "Potential Water Savings" section – depending upon the type of water shed, water is not always "saved" but rather its use is reduced. (Perry, C. 2007. Efficient Irrigation; Inefficient Communication; Flawed Recommendations. Irrigation and Drainage, 56:367-378.) Suggested edits shown below

Potential Water ~~Savings~~ Use Reductions

Note: Refer to Appendix A for the assumptions and calculations used to derive these estimates.

Weather-based irrigation controllers have the potential to ~~save~~ significantly reduce the amount~~s~~ of water used both individually and at the national level. Assuming that a household lawn with a weather-based irrigation controller installed will use 20 percent less water than one with a standard clock timer controller, a household could ~~save~~ reduce their usage 11,600 gallons per year based on an average seasonal outdoor water use of 58,000 gallons per year.

EPA received data from the 2005 Residential Energy Consumption Survey conducted by the Energy Information Administration (EIA) that 13.5 million single family detached homes have automatic irrigation systems, or about 19 percent of all single family detached homes. Assuming that 95 percent of these are candidates for installing a weather-based irrigation controller, 12,800,000 households could be candidates for a weather-based irrigation controller. If all 12.8 million households installed weather-based irrigation controllers, the measure could ~~save~~ reduce water use by nearly 150 billion gallons of water per year nationwide.

Energy savings realized by water utilities will accompany any national water ~~savings~~ use reductions. If all candidate households install weather-based irrigation controllers, it could reduce energy consumption of water utilities by 223 million kilowatt-hours of electricity.

P.6 – last sentence – "The payback period would decrease on properties that use more water than the estimated 58,000 gallons per year."

It doesn't seem right to include this sentence without also including one that states that the payback period would increase if you use less water.

P.7 – Section IV. third paragraph – "set-up based upon instruction from the manufacturer"

This may be okay, but the set-up language within the controller should match somewhat the zones that they are intending to water or the end user will never be able to set-up the controller properly. The manufacturer should not be allowed to set-up the controller in a way that allows them to pass the test but is not representative of how the end user would set it up. The Dukes report on p.4 states "Controllers for the Florida test were programmed with settings that do not necessarily describe the landscape specified in the protocol to create a smaller RZWWS than specified for the zone." This would seem to indicate that the manufacturer is setting-up the controller to pass the test but that if set-up like the end user would, according to the language in the controller, it may or may not pass.

P.7 – Section V. first paragraph – "Second, the weather-based irrigation controller must be installed and programmed properly."

See above statement – again, if the controller can be setup in any configuration to pass the test and the language doesn't match the irrigation zones, how will the end user program it correctly?

Please feel free to contact me with any questions about these comments.

Dana

Dana R. Lonn, PE
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Commenter: Don Clark
Affiliation: Rain Bird Corporation
Comment Date: January 18, 2010

Stephanie,

On behalf of the Rain Bird Corporation, I am submitting our formal response to the EPA WaterSense WBIC Specification - Draft 1 (see attached document).

If you like to discuss the contents of our response in more detail, please feel free to contact me at (760) 419-4210.

Sincerely,

Don Clark
Senior Product Manager
Rain Bird Corporation

Template for Public Comment Submission on WaterSense® Documents

WaterSense® Specification for Weather-Based Irrigation Controllers (WBIC) – Draft 1.0
Commenter Name: Don Clark on behalf of the Rain Bird Corporation
Commenter Affiliation: Rain Bird Corporation
Date of Comment Submission: January 18, 2010

Topic: Use of the term "controllers" throughout the WBIC specification document
Comment: While the specification permits the use of add-on devices, the text often refers to the "controller" rather than "control system" which might be more appropriately inclusive. By applying this specification to an irrigation control system, the specification would include all items associated with making the control system "weather-based". This includes, but is not limited to manuals, inclusive software to aid in programming and set-up, and any add-on devices that have been performance tested for use with any given controller.
Rationale: As currently written, much of Section 4.0 would be redundant for any add-on device capability. For example: A base controller may not have all of the required minimum features as set forth in Section 4.0, but when combined with the add-on device ("irrigation control system") would meet the minimum feature requirements of Section 4.0.
Suggested Change (or language): Include a definition of "controller" that includes the controller *per se* and its manual, software, and any add-on devices that are connected to the unit.

Topic: Section 1.0 Scope and Objective: Description of the controller products eligible for WaterSense label according to the specification must use some form of ET for scheduling.
Comment: The specification title indicates that it is for weather-based irrigation controllers. However, the introductory text of Section 1.0 narrows the scope to include only devices that utilize ET. Removing all language that references ETo from the first paragraph and including an additional bullet point that states "Control Systems that utilize climatolgical sensor(s)" would widen the scope allowing increased innovation opportunities.

Rationale: While ET is the benchmark that WBIC units are tested and measured against for this specification, we should not stifle innovation by forcing all labeled products to use ET as the basis for scheduling.
Suggested Change (or Language): See above comment.

Topic: Section 1.0 Scope and Objective – Number of stations specified
Comment: Currently, there are stand-alone Weather-Based Irrigation Controller (WBIC) families that range in station count from 4 stations to 48 stations that are used on residential and light commercial projects. It is recommended that the specification language be modified to include all stand-alone controllers (non-central control) that are 48 stations and fewer.
Rationale: The current specification would be difficult to manage and enforce by the EPA as there are WBIC controllers currently sold that are modular in nature. For example, a modular controller that has a 12 station base model may have three additional expansion slots in which the customer can insert up to three, 12 station expansion modules, creating up to a 48 station count model. In the example above, would the EPA label just the base model controller and then be involved with enforcing how many modules can be inserted into the base model? This approach does not seem enforceable as the base controller and expansion modules may not be sold and/or packaged together.
Suggested Change (or Language): The specification applies to residential or light commercial products with 48 or fewer stations that are designed and sold for use at homes and similar light commercial and institutional properties.

Topic: Section 2.0 Summary of Criteria
Comment: Rain Bird supports the specification language as written in WaterSense Draft Specification for Weather-Based Irrigation Controllers - Draft Version 1.0, dated November 19, 2009

Topic: Section 3.0 Performance Criteria
Comment: Delete paragraph 3.1 on Minimum Runtimes.
Rationale: Irrigation controllers frequently operate with runtimes of less than three minutes. Runtimes are set based on factors such as the precipitation rates of sprinklers, the plant material being watered, the soil type, the slope of the site, etc. Requiring runtimes of greater than three minutes may preclude the controller being tested from operating in the most efficient manner possible for that controller. This could have the effect of creating a disadvantage in the testing and labeling process for controllers which rely on shorter runtimes to perform at their best. It is our understanding that this requirement has been added to the Draft WaterSense Specification as a means of addressing a perceived shortcoming in the SWAT testing protocols. If this is in fact the case, we suggest that any such concerns be addressed in the SWAT protocols. It is our view that the WaterSense specification should not be burdened with requirements that preclude controllers from operating within a portion of their designed-in capabilities.
Suggested Change (or Language): Delete paragraph 3.1 in its entirety.

Topic: Section 3.0 Performance Criteria
Comment: Recommend changing the language in Section 3.2 and Section 3.3 to further clarify that the average *Irrigation Adequacy* and average *Irrigation Excess* will be used.
Rationale: Eliminate any potential misunderstanding regarding the performance metrics (*Adequacy* and *Excess*) used in Section 2.0. The current language is not clear as it could be that each individual zone must meet the performance metrics, rather than the average of all six zones used in the SWAT Protocol Testing.
Suggested Change (or Language):
Section 3.2 Average Irrigation Adequacy, as defined by the SWAT protocol, shall be greater than or equal to 80 percent.
Section 3.3 Average Irrigation Excess, as defined by the SWAT protocol, shall be less than or equal to 5 percent.

Topic: Section 4.0 Supplementary Feature Requirement (Preferred Approach)
Comment: As Rain Bird stated in the public comment forum in San Antonio, Texas on December 5th, we strongly believe that Section 4.0 be eliminated entirely, as it is believed that the Specification should be entirely "performance based" and not "prescriptive".
Rationale: The exhaustive list of prescribed features may or may not influence water savings, but will definitely:

1. Increase Product Cost
2. Increase Product Complexity
3. Curtail Product Innovation
4. Favor add-on devices over stand-alone controllers

Requiring that WaterSense labeled controllers contain all of the features shown in Section 4.0 will tend to make these controllers expensive and difficult to use. It is our view that this will limit the adoption of weather-based controllers, and as a result, the opportunity to save water through the use of these proven technologies will be missed. The complexity of the user interface required to support the entire feature set called for in Section 4.0 will also tend to encourage incomplete use, or even abandonment, of WaterSense labeled controllers by the non-technical homeowner. Further, this prescriptive set of requirements will inhibit the inclusion of innovative new developments that could have an even greater effect on water savings.
Rain Bird strongly supports the use of weather-based add-on devices for irrigation and do believe they should be eligible to earn the WaterSense label. Such devices are proven to save water. However, the inclusion of Section 4.0 will give an advantage in the market place to weather–based irrigation control systems that utilize add-on devices. Add-on devices which earn the WaterSense label will in most if not all, cases be compatible with controllers which do not have the exhaustive list of feature shown in Section 4.0. Manufacturers of stand-alone controllers will have to invest substantially more in their product development effort to include all these features to earn the WaterSense specification. Water sense labeled devices paired with minimally featured irrigation controllers which do not meet the requirements of Section 4.0 will have a price advantage in the market place relative to stand-alone controllers.
Suggested Change (or Language): Eliminate Section 4.0 completely

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Topic: Section 4.0 Supplementary Feature Requirement (Alternative Proposal)

Comment: To provide an alternative to the total elimination of Section 4.0 as recommended above, Rain Bird personnel have met with many key stakeholders, including members of the Alliance of Water Efficiency (AWE) to better understand the needs of each stakeholder group. From this research, Rain Bird has crafted a new *Section 4.0 – Minimum Feature Requirements.*
Rationale: Eliminate features that are not needed by any of the key stakeholder groups and remove any ambiguity that previously existed in the language that described some of the features.
Suggested Change (or Language): Replace all of *Section 4.0 Supplementary Requirements* with the following language and layout:

5.0 Minimum Feature Requirements - The Weather-Based Irrigation Control system shall have the following minimum features.

- 5.1 The control system shall include a storage device or means to preserve the contents of the irrigation program settings when the power source is lost and no backup battery is available.
- 5.2 Multiple programming capabilities – The control system shall have independent zone specific programming or be capable of storing a minimum of three different programs to allow for separate schedules for zones with differing water needs.
- 5.3 For areas prone to runoff, the control system shall have the ability to initiate irrigation at least three times for each zone in a 24 hour period.
- 5.4 The control system shall have a means of indicating to the user when it is not receiving a signal or local sensor input, and the control system is not adjusting irrigation based on current weather conditions.
- 5.5 Rain shut-off device – The control system shall be equipped to either include or interface with a rain shut-off device. The rain shut-off device shall meet the following requirements.
  - 5.5.1 The control system will prevent irrigation from occurring when the rain shut-off device is activated by the presence of rain and will continue to prevent irrigation while the rain shut-off device is still wet from rain.
  - 5.5.2 The control system shall have a means for indicating to the user when the rain shut-off device has suspended irrigation.
  - 5.5.3 If the rain shut-off device is not integral to the product, the control system shall provide a dedicated terminal connection to allow a rain shut-off device to be connected during or after the installation of the control system.
- 5.6 Zone level control – The control system shall have the capability to irrigate appropriately for the specific water requirements of each zone. The resulting control system setup can be accomplished by either entering information directly into the controller or by providing appropriate means that allow the user to determine operating parameters like runtimes which can then be entered into the control system. The following attributes shall be included in the control system setup methodology.
  - 5.6.1 Plant characteristics
  - 5.6.2 Soil characteristics
  - 5.6.3 Slope
  - 5.6.4 Irrigation device characteristics or precipitation rate
  - 5.6.5 Sun exposure

5.7 The control system shall have the ability to accommodate a variety of watering restrictions. It shall have the following capabilities.

5.7.1 Operating on any prescribed day-of-week schedule (for example, Monday-Wednesday-Friday, Tuesday-Thursday-Saturday, any two days, or any single day, etc…).

5.7.2 Even day or odd day scheduling.

5.7.3 The ability to set irrigation runtimes to avoid a prohibited time of day. (for example, irrigation will not occur between 9 AM and 9 PM)

5.7.4 Complete shutoff for total elimination of outdoor irrigation.

5.8 If the primary source of weather information is not present, the control system will revert to either a proxy of historical weather or a percent adjust (water budget) feature.

5.8.1 The percent adjust (water budget) feature is defined as having the means to increase or decrease the runtimes or application rates for all zones by a prescribed amount by means of one adjustment without modifying the settings for each individual zone.

5.9 Manual operation – The control system shall allow for manual operation and troubleshooting test cycle at the physical location of the controller installation.

Commenter: George Alexanian
Affiliation: Alex-Tronix Controls
Comment Date: January 18, 2010

Attached are comments pertaining to the WaterSense draft specifications for weather based irrigation controllers. The same comments will be sent separately from another PC with the scanned attachments listed within these comments. Since the attachments comprise 3 megs of data, I want to make sure that at least the comments are received.
Thanks,
George Alexanian
Alex-Tronix Controls

WATERSENSE LABELING SUPPLEMENTAL COMMENTS FOR WEATHER BASED IRRIGATION CONTROLLERS
By George Alexanian, President and founder of Alex-Tronix Controls
January 18, 2009 Rev 1

BACKGROUND AND PURPOSE

Alex-Tronix has been designing and manufacturing agricultural and landscape irrigation controllers that save water and energy since 1977 and awarded a grant by the U.S. Dept of Energy to continue this endeavor.
I support the EPA WaterSense labeling concept and the SWAT testing protocol as the qualifying measure for labeling weather based irrigation controllers.

Based upon personal and company experience, I previously provided recommendations to the draft specifications for logistical and practical reasons. The following additional recommendations are intended to expedite the implementation of water and energy conservation in keeping with the Alex-Tronix commitment to the Dept of Energy.

FACTS

a. There are at least 12 million irrigation controllers in current use in the U.S., with much fewer than 1% of them of the smart variety.
b. Virtually all smart irrigation controllers available today are ET based.
c. Most homeowners or commercial users will not want to spend money for a new smart irrigation controller with an estimated 15 year payback, specially in the current economic climate.
d. Most users do not want to pay a monthly ET service fee required by some ET based controllers
e. Most ET smart controllers require the hiring of a professional for installation, water audit, and programming assistance.
f. Installers do not want frequently required call backs just to reprogram the new smart controller or re-explain its operation to homeowners.
g. All ET based smart controllers change the watering schedules. The homeowner is no longer comfortable in knowing if his controller is working because he cannot see it coming on at the same time each day it was programmed to come on.

h. ET based controllers do not generally take into account local watering restrictions. There is basic incompatibility between an ET based controller and municipal watering day restrictions.
i. ET based calculations of landscape plant watering needs are not necessarily accurate. An analytical study was conducted by Catteano and Upham that compared four of the most popular ET equations, including the Pennman-Monteith favored by CIMIS, and SWAT committee, among others. The analysis showed that the Pennman-Monteith, using the same CIMIS data over the same time period, called for as much as 60% more water at certain times of the year than the other three ET equations. Therefore, there is not a high degree of consistency between the various ET calculations. The summary of their findings is attached to these comments.
j. Because of the continued drought in California, many water districts are opting for mandatory watering schedules rather than smart controllers as a more immediate and effective means of water conservation.
k. A study sponsored by the Irrigation Association reported in 2003 that most of the landscape irrigation water is wasted (outside the system inefficiency and not using a rain switch) because controllers are only adjusted 2-5 times a year. Furthermore, most of that waste occurs during the fall and spring months.
l. The Aquacraft, Inc Water and Management entitled “Evaluation of California WBIC Program” dated July 2009 showed that ET controllers are only as smart as their users. It showed that 42% of the 3112 smart controllers in the study actually used more water than the previously used conventional controllers, resulting in a rather disappointing average overall landscape water saving, with 3112 ET controllers saving 330 acre feet of water statewide. Some may cite reasons for these results, but the reality is that when the homeowners buy and install, with or without professional help, their own smart controllers and they are not closely monitored and personally assisted, these are the realistic results to be expected from a relatively complicated new smart controller.
m. The California Energy Commission suspended their work toward implementation of California Assembly bill 1881 that would have required only smart controllers or add ons that can make controllers smart starting on January 1, 2012 for financial reasons and disappointing results of the ET controller results reported by Aquacraft
ANALYSIS AND FIELD STUDY

1. Alex-Tronix performed an analytical study in 2003 that indicated that a non-ET based algorithm that takes current weather, location, and historical data into account is within 5% of ET year round. That chart is attached to these comments.
2. SWAT testing of that non ET based algorithm with two different model controllers confirmed the analytical study report. The posted SWAT testing results are included with these comments.
n. A recent study was just completed by the City of Indian Wells in the Coachella Valley of California showing that 16 of the Alex-Tronix non ET based smart controllers saved 7.3 million gallons of water, or over 22 acre feet. In comparison, 3112 controllers saved 330 acre feet of water reported in the Aquacraft study.

RECOMMENDATIONS

Based on the foregoing, the following recommendations are made:

1. Allow add on devices that can make existing controllers smart to be WaterSense labeled. This will provide the following advantages:
    a. The homeowner keeps his existing controller which he is familiar with
    b. An add-on device will probably cost less than half of the cost of a new smart controller, resulting in much faster payback.
    c. Due to the simple installation and programming, typically no professional assistance will be required.
    d. If the add-on is not ET based, no monthly service fees will be required.
    e. The homeowner will not have to learn to program a new controller.
    f. There will be much fewer programming errors that lead to water waste and runoff. Also, the homeowner is less likely to disable the smart controller function if he is more comfortable with the existing controller operation which he understands.
    g. The result of using a non ET add-on or a controller that is not ET based is to remove most, if not all of the roadblocks currently posed by smart controllers, resulting in faster implementation of water conservation. This will be further expedited if the add-on is universal so it can be used with any existing controller, any model, any number of stations and can also comply with local watering restrictions
2. Recommend to water districts that their rebate programs be extended to smart add ons. If the EPA will allow WaterSense labeling for rain switches and ground moisture sensors, I point out that those are also add-ons as are site installed weather stations. Other existing add ons are the Hunter Solar Sync and ET System, the Rain Bird ET Manager, the Weather Matic weather station, among other current models. Some of the other ET controllers do not have add ons but have monthly ET service fees.
3. Do not limit smart SWAT tested technology of controllers or add ons to ET if simplicity, cost, and implementation are significant factors. The provided analytical study, the Aquacraft report, and the field testing prove that non ET based smart technology can be as good as, if not better than ET.
4. It is far more likely for homeowners to buy and install an add on that is simple and inexpensive and can save more water with a much faster payback, than limit their choice to an ET based controller that is much more expensive and complicated and will probably be misprogrammed, wasting more water and causing runoff. I would rather save real water than theoretically estimated and questionable ET water.

IRRIGATION ASSOCIATION
6540 Arlington Boulevard
Falls Church, VA 22042
Tel: 703-536-7080
www.irrigation.org

Smart Water Application Technology™ (SWAT™) Performance Report

Testing Agency: Center for Irrigation Technology www.californiawater.org

Product: Alex-Tronix Enercon Plus

Product Type: Climatologically Based Controller

Product Description: The Alex-Tronix Enercon Plus is a pedestal mounted battery-operated controller with temperature and rain sensors.

SWAT™ Protocol*: Turf and Landscape Equipment Climatologically Based Controllers 7th Draft Testing Protocol (November 2006)

The concept of climatologically controlling irrigation systems has an extensive history of scientific study and documentation. The objective of this protocol is to evaluate how well current commercial technology has integrated the scientific data into a practical system that meets the agronomic needs of turf and landscape plants. The evaluation is accomplished by creating a virtual landscape subjected to a representative climate to evaluate the ability of individual controllers to adequately and efficiently irrigate that landscape. After initial programming and calibration the controller is expected to perform without further intervention during the test period. Performance results indicate to what degree the controller maintained root zone moistures within an acceptable range. If moisture levels are maintained without deficit, it can be assumed the crop growth and quality will be adequate. If moisture levels are maintained without excess it can be assumed that scheduling is efficient.

***All SWAT™ Protocol may be viewed at www.irrigation.org**

Alex-Tronix Enercon Plus Controller SWAT™ Performance Summary

Irrigation Adequacy	Irrigation Excess
Minimum of 6 test zones: 100% **Maximum of 6 test zones: 100%** **Mean/Average of 6 test zones: 100%** **Irrigation Adequacy** represents how well irrigation met the needs of the plant material. This reflects the percentage of required water for turf or plant material supplied by rainfall and controller-scheduled irrigations. Research suggests that if this value is between 80% and 100%, the acceptable quality of vegetation will be maintained.	**Minimum of 6 test zones: 0%** **Maximum of 6 test zones: 3.6%** **Mean/Average of 6 test zones: 1%** **Irrigation Excess** represents how much irrigation water was applied beyond the needs of the plant material. This reflects the percentage of water applied in excess of 100% of required water according to data from CIMIS station #80 Fresno State, Fresno County during the test period.

Product Detail Supplied by Manufacturer

Alex-Tronix Enercon Plus www.alex-tronix.com

Installation	Data Source	Data Link	Initial Purchase	Additional Hardware	Additional Fees
Replaces existing controller or is installed on a new system.	Tested with on site temperature sensor with optional rain sensor.	Hard wired	Purchase price includes temperature sensor mounted within pedestal.	❑ Rain Switch Pole mount ❑ Rain and Temperature Sensors Pole mount ❑ Latching Solenoid ❑ Lightning Protection	None

Additional Features

Zones	Time of Day	Day of Week	Other	If Data Link is Discontinued
Available in a base model of 4 zones; can control up to 24 by installing additional station modules in groups of 4.	Capable of restricting the time of day for watering.	Capable of restricting watering days by selection or interval.	❑ Multiple start times ❑ Programmable rain delay ❑ 5-yr Battery life with low battery indication	Enercon Plus may be used as a standard irrigation controller including percent adjust and 4 independent programs with multiple start times.

IRRIGATION ASSOCIATION

6540 Arlington Boulevard
Falls Church, VA 22042

Tel: 703-536-7080
www.irrigation.org

Smart Water Application Technology™ (SWAT™) Performance Report

Testing Agency: Center for Irrigation Technology www.californiawater.org

Product: Alex-Tronix Smart Clock®

Product Type: Climatologically Based Controller

Product Description: The Alex-Tronix Smart Clock® is a battery-operated controller with temperature and rain sensors.

SWAT™ Protocol*: Turf and Landscape Equipment Climatologically Based Controllers 7th Draft Testing Protocol (November 2006)

The concept of climatologically controlling irrigation systems has an extensive history of scientific study and documentation. The objective of this protocol is to evaluate how well current commercial technology has integrated the scientific data into a practical system that meets the agronomic needs of turf and landscape plants. The evaluation is accomplished by creating a virtual landscape subjected to a representative climate to evaluate the ability of individual controllers to adequately and efficiently irrigate that landscape. After initial programming and calibration the controller is expected to perform without further intervention during the test period. Performance results indicate to what degree the controller maintained root zone moistures within an acceptable range. If moisture levels are maintained without deficit, it can be assumed the crop growth and quality will be adequate. If moisture levels are maintained without excess it can be assumed that scheduling is efficient.

***All SWAT™ Protocol may be viewed at www.irrigation.org**

Alex-Tronix Smart Clock® Controller SWAT™ Performance Summary

Irrigation Adequacy	Irrigation Excess
Minimum of 6 test zones: 100% **Maximum of 6 test zones: 100%** **Mean/Average of 6 test zones: 100%** **Irrigation Adequacy** represents how well irrigation met the needs of the plant material. This reflects the percentage of required water for turf or plant material supplied by rainfall and controller-scheduled irrigations. Research suggests that if this value is between 80% and 100%, the acceptable quality of vegetation will be maintained.	**Minimum of 6 test zones: 0%** **Maximum of 6 test zones: 1.1%** **Mean/Average of 6 test zones: 0.2%** **Irrigation Excess** represents how much irrigation water was applied beyond the needs of the plant material. This reflects the percentage of water applied in excess of 100% of required water according to data from CIMIS station #80 Fresno State, Fresno County during the test period.

Product Detail Supplied by Manufacturer

Alex-Tronix Smart Clock® www.alex-tronix.com

Installation	Data Source	Data Link	Initial Purchase	Additional Hardware	Additional Fees
Replaces existing controller or is installed on a new system.	Tested with on site temperature sensor with optional rain sensor.	Hard wired	Purchase price includes temperature sensor.	❑ Rain Switch Pole mount ❑ Rain and Temperature Sensors Pole mount ❑ Latching Solenoid ❑ Stainless Steel Pedestal mount	None

Additional Features

Zones	Time of Day	Day of Week	Other	If Data Link is Discontinued
Available with 6 zones	Capable of restricting the time of day for watering.	Capable of restricting watering days by selection or interval.	❑ Multiple start times ❑ Programmable rain delay ❑ 5-yr Battery life with low battery indication	Smart Clock may be used as a standard irrigation controller including percent adjust and 4 independent programs with multiple start times.

Methods to calculate Evapotranspiration: differences and choices

by
Diego Cattaneo, and Luke Upham

Evaporation is the process whereby liquid water is converted to water vapour (vaporization) and removed from the evaporating surface (vapour removal)
Transpiration is the vaporization of liquid water contained in plant tissues and the vapour removal to the atmosphere.
Evaporation and Transpiration occur simultaneously and there is no easy way of distinguishing between the two processes. Apart from the water availability in the topsoil, the evaporation from a cropped soil is mainly determined by the fraction of the solar radiation reaching the soil surface. When the crop is small, water is predominately lost by soil evaporation, but once the crop is well developed and completely covers the soil, transpiration becomes the main process. At sowing nearly 100% of ET comes from evaporation, while at full crop cover more than 90% of ET comes from transpiration.
The Penman – Monteith formula is recommended as the sole method to have an ET reference; the follow formula is taken from the Fao web site:

$$\lambda ET_p\left(T, U_2, \frac{n}{N}, El, SolarRadiation\right) = \frac{\Delta(R_n - G) + \rho_a c_p \cdot \frac{(e_s - e_a)}{r_a}}{\Delta + \gamma \cdot \left(1 + \frac{r_s}{r_a}\right)}$$

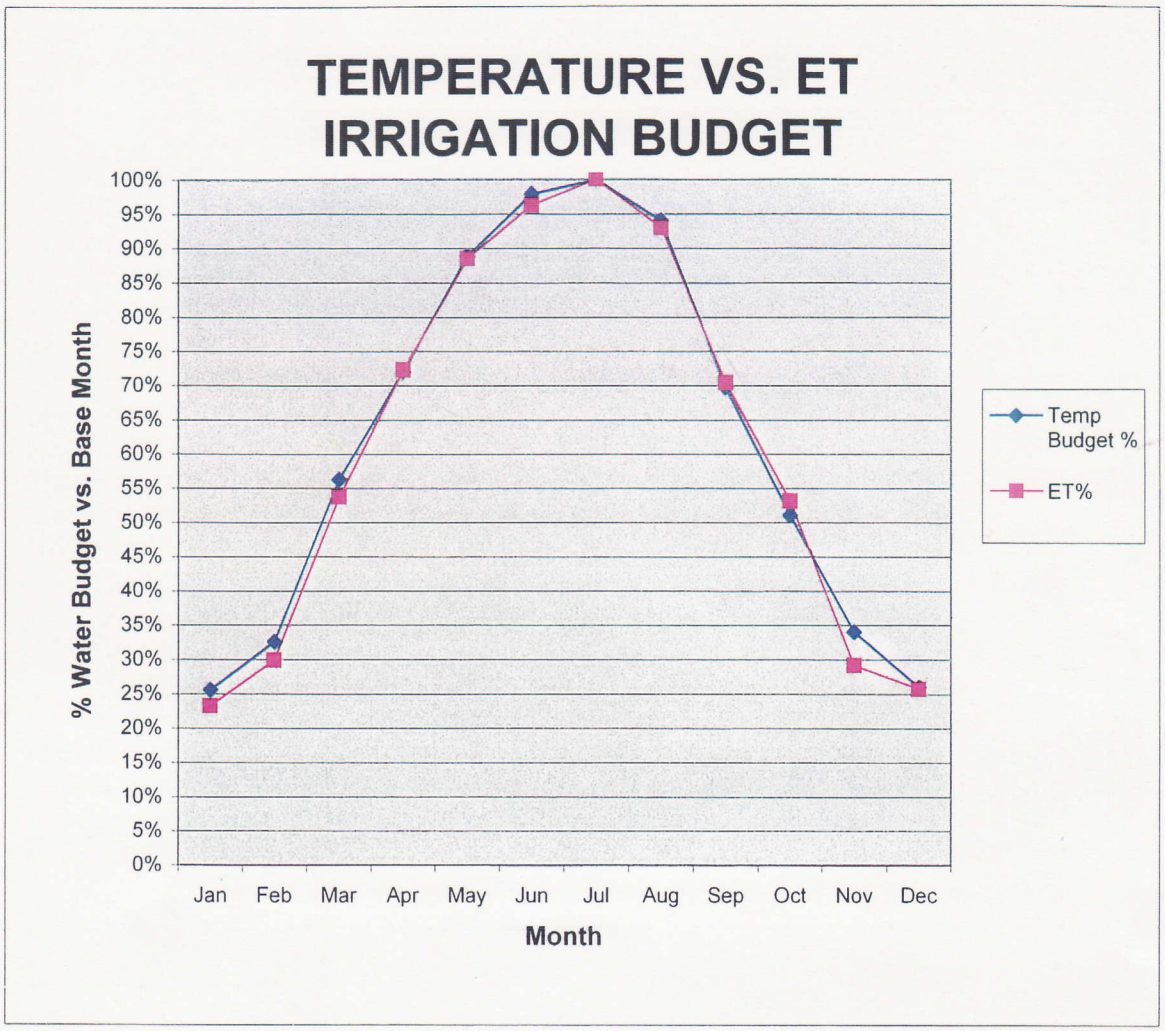
In accordance with the "Estimated and Measured Evapotranspiration for Florida Climate, Crops and Soils" *(Jones, et al., 1984)* explained in the IFAS Bulletin 840 we can use the easier Penman method to estimate ET in Florida; the formula to calculate ET is:

$$ET_p\left(T, U_2, \frac{n}{N}\right) = \frac{\Delta \cdot \frac{R_n}{L}}{\Delta + \gamma} + \frac{\gamma \cdot E_a}{\Delta + \gamma}$$

To calculate ET with this formula we can determinate the different variables with the Schwab method, the traditional system proposed in the bulletin 840 or the program developed in the toolbox help.

The variables that each single method used are explained in the following table:

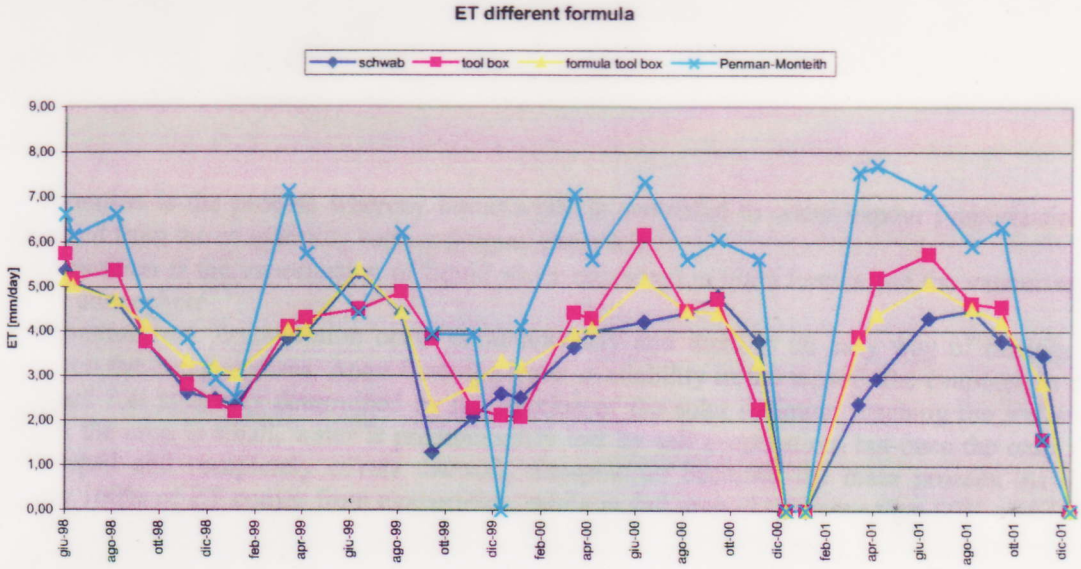
Variables	ET [mm·day]			
	Penman-Monteith	Penman (Schwab)	Penman (Formula)	Penman (Program)
Date				X
Latitude				X
Avarage speed wind	X	X	X	X
Air temperature	X	X	X	X
Dew Point	X	X	X	
Ratio hours sunshine	X	X	X	
Elevation	X	X		



All data obtained from the CIMIS web site. Five Year Average (1997 - 2001) of ET data from 25 California weather stations was compared to Temperature Budgeting from the same 25 weather stations on a monthly basis. July used as the base month. Basic Temperature Budgeting Formula is "TB (temperature budget) = Tmax (average maximum monthly temperature) x RA (extraterrestrial radiation factor.) **PATENT PENDING**

Month	Temp Budget	ET
Jan	25.61%	23.18%
Feb	32.61%	29.82%
Mar	56.31%	53.62%
Apr	72.02%	72.23%
May	88.90%	88.47%
Jun	97.90%	96.19%
Jul	100.00%	100.00%
Aug	94.09%	92.93%
Sep	69.78%	70.39%
Oct	51.06%	53.07%
Nov	34.09%	29.09%
Dec	25.98%	25.67%

Developed by George Alexanian, President of Alex-Tronix, A Division of GNA Industries, Inc.



The Fao web site indicates the Penman-Monteith method overestimates true ET formula but it can adapt to different conditions; this affirmation is confirmed from our results. Also, from the comparison between applications, we can understand witch Penman results are acceptable.
To estimate ET in Florida we must choose one of the other 3 methods; the Schwab formula is too generic for a specific application and the Tool program never considers the Relative Humidity in the air; the solution is individuated in the application of the Penman formula with the following characteristics:

- $\Delta[mb \cdot °C^{-1}] = 33.8639 \cdot (0.05904 \cdot (0.00738 * T_{avg} + 0.8072)^{7} - 0.0000342)$
- $\lambda[Cal \cdot cm^{2} \cdot mm] = 58$
- $\gamma[mb \cdot °C^{-1}] = 0.66$
- $e_x[mb] = 33,8639 \cdot ((0.00738 \cdot T_x + 0,8072)^{8} - 0.000019 * (1.8 \cdot T_x + 48) + 0.001316)$
- $R_s[\text{Cal} \cdot \text{cm}^2 \cdot day^{-1}] = (0.35 + 0.61 \cdot Rsh) \cdot \text{Rso}$
  - Rso = Mean solar radiation for cloudless skies
  - Rsh = Incoming solar radiation
- $R_n[\text{Cal} \cdot \text{cm}^2 \cdot day^{-1}] = (1-\alpha) \cdot R_S - 11.71 \cdot 10^{-8} \cdot T_{\text{Kelvin}}^4 \cdot (0.56 - 0.08\sqrt{e_d}) * (1.42 \cdot \frac{R_s}{R_{so}} - 0,42)$
- $E_a[\text{Cal} \cdot \text{cm}^2 \cdot day^{-1}] = (0.263 \cdot (e_a - e_d) \cdot (0.5 + 0.0062 \cdot U_2))$
  - U_2 = wind speed in km/day at 2 meters from soil level

Commenter: Amy Vickers
Affiliation: Amy Vickers & Associates, Inc.
Comment Date: January 18, 2010

PUBLIC COMMENT SUBMISSION ON EPA WATERSENSE DRAFT WEATHER-BASED IRRIGATION CONTROLLER SPECIFICATION AND SUPPORTING DOCUMENTS

Commenter Name: Amy Vickers
Commenter Affiliation: President, Amy Vickers & Associates, Inc., Amherst, MA
Date of Comment Submission: January 18, 2010

Topic: Appropriateness of Labeling Weather-Based Irrigation Controllers at this Time
Comment: EPA should NOT give weather-based irrigation controllers the WaterSense label at this time.
Rationale: How could EPA justify putting the WaterSense label on a product that at best produces meager water savings–far below the 20 percent water savings that the WaterSense label represents–and at a significant number of test sites has been documented to *increase* water use by irrigation systems?
There is a glaring lack of evidence to demonstrate the ability of current weather-based irrigation controller (WBIC) products to save water on a consistent and reliable basis. Further, two major studies of WBICs released in July 2009 report the troubling fact that at a significant number of study sites, some of these devices actually increased irrigation water demands–the exact opposite of what the WaterSense label is designed to achieve.
These excepts from the 2009 California and Texas A&M studies document why current WBIC technology and products fall far short of the water savings and performance expected from a WaterSense-labeled product and why WBICs should be denied a label at this time:

> "Overall, outdoor water use was reduced by an average of 47.3 kgal per site (-6.1% of average outdoor use) across the 2,294 sites examined in this study as part of the California Weather-Based Irrigation Controller Programs."
> *–Mayer, P., et al. "Evaluation of California Weather-based "Smart" Irrigation Controller Programs." Presented to the Calif. Dept of Water Resources by the Metropolitan Water District of Southern California and the East Bay Municipal Utility District. July 1, 2009 (Aquacraft, Inc., Boulder, CO), page xvii.*
> *http://www.aquacraft.com/Download_Reports/Evaluation_of_California_Smart_Controller_Programs_-_Final_Report.pdf*
> "… it should not be ignored that 41.8% of study sites experienced an increase in weather-normalized irrigation application ratio after the installation of a smart controller."
> *–Mayer, P., et al. July 1, 2009, page xx.*
> "Compared to the recommended irrigation volumes from Texas ET, all the controllers produced irrigation amounts significantly higher. The bench-tested controllers exceeded recommended irrigation amounts 100% of the time, applying on average 6.73 inches more. The outdoor-tested controllers exceeded the recommended amount 75% of the time applying on average 1.88 inches more water."
> *–Swanson, C. and Fipps, G. "Evaluation of Smart Irrigation Controllers: Initial Bench Testing Results. Texas Water Resources Institute Technical Report (Texas A&M University-College Station) July 2009, page 7. http://twri.tamu.edu/reports/2009/tr354.pdf*

> "Based on the findings of this study, all six smart controllers evaluated produced excessive irrigation amounts…. Further phases of testing are recommended before wide-spread mandating of smart controllers occurs in Texas."
> *–Swanson, C. and Fipps, G. July 2009, page 10.*

In sum, based on the most recent empirical evidence brought forth by independent researchers, current WBIC technology fails to save water and perform to the standards set forth by EPA for the WaterSense label. The most obvious of these failings is that there are no metered water use data to document on a consistent and reliable basis that WBICs as a product group are "about 20 percent more water-efficient" than conventional irrigation controllers. Similarly, where are the independent field and research findings to show that WBICs "perform as well or better" than conventional irrigation controllers? ("The WaterSense Label: What it Means." http://www.epa.gov/watersense/about_us/watersense_label.html).

We need hard facts based on empirical data, not hope and optimism, that WBIC products sold to consumers can meet the 20 percent water savings standard and other performance indicators of the WaterSense label before EPA puts the credibility of the WaterSense label on the line.

The concept behind WBIC technology may be a good one, but proven water savings must match its promise. The credibility of the WaterSense label–and its public sector and business partners–may be damaged in the marketplace if it used prematurely to anoint a so-called water efficiency product that continues to be reported to increase irrigation water demands at a significant number of sites. Lastly, consumer ire–at EPA, manufacturers, water utilities, and other WaterSense labeled products–could be severe for those who pay hundreds dollars for what they thought would be a water- and cost-saving product but which turns out to be exactly the opposite.

In closing, until manufacturers can produce WBIC products that consistently and reliably meet the 20 percent water savings and related performance standards that the WaterSense label implies, EPA should withhold the WaterSense label.

Suggested Change (or Language): N/A

Commenter: Thomas O'Connor
Affiliation: WaterOptimizer
Comment Date: January 18, 2010

Dear Water Sense:
Attached please find our comments to Draft Specification for Weather-Based Irrigation Controllers.

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Loc Truong
WATER OPTIMIZER, LLC
TAMPA - JACKSONVILLE - SARASOTA - MIAMI - AUSTIN - DALLAS
4921 Memorial Highway, Suite 300, Tampa, FL 33634
V: 866-880-4030 F: 866-657-3665
http://WaterOptimizer.com

January 18, 2010

EPA (Via e-mail)

Re: Response to WaterSense Draft Specification for
Weather-Based irrigation Controllers

To Whom It May Concern :

Thank you providing WaterOptimizer the opportunity to comment on the recent WaterSense Draft Specification for Weather-Based Irrigation Controllers. Our comments (italicized) are on the following pages.

Thank you for consideration of our comments. We would be happy to further clarify if necessary. Please do not hesitate to contact me.

Sincerely,

Thomas M. O'Connor
Manager

TOC/LPT/daa

1.0 Scope and Objective
This specification establishes the criteria for weather-based irrigation controllers labeled under the U.S. Environmental Protection Agency's (EPA's) WaterSense program. It applies to both stand-alone and add-on controllers (collectively referred to in this specification as controllers) that utilize current climatological data and some form of evapotranspiration (ET) data as a basis for scheduling irrigation. This specification applies to controllers that calculate real-time crop evapotranspiration (ETc) based on reference evapotranspiration (ETo) by:

- Using onsite sensor(s) to calculate ETo;
- Using onsite sensor(s) to modify historical ETo;

- Receiving weather data from a real-time remote source to calculate ETo; or
- Receiving direct ETo data from a remote source.

This specification is designed to ensure the controller has the ability to provide adequate and efficient irrigation while minimizing potential runoff.
This specification is applies to residential or light commercial products with 16 or fewer stations that are designed and sold for use at homes and similar scale light commercial and institutional properties.

RESPONSE: *We do not understand why the specification should be restricted to 16 or fewer stations. This seems to be purely subjective. Any manufacture could be financially impacted by EPA allowing this arbitrary restrictive criteria.*
Would a controller that is expandable qualify for the WaterSense label as long as it is 16 stations or less for the base configuration? If not, this subjective language could negatively impact our ability to conduct business since a community may only provide rebates to products that have WaterSense labeling.

2.0 Summary of Criteria
Controllers must meet criteria in the following areas, as applicable:

- Irrigation adequacy shall be greater than or equal to 80 percent and irrigation excess shall be less than or equal to 5 percent, as specified in Section 3.0.
- The controller must conform to the supplementary feature requirements specified in Section 4.0.

RESPONSE: *No comment*

3.0 Performance Criteria
The controller shall be tested in accordance with the Smart Water Application Technologies ™ test protocol for climatologically based controllers (Draft 8, September 2008) with the additional requirement listed in Section 3.1, and shall meet the criteria in Sections 3.2 and 3.3.

RESPONSE: *If EPA is going to use SWAT testing protocol, why should a firm have to go back through the cost and time of re-testing the product. I would think that those manufactures would be "grandfathered". Should EPA criteria create their own protocol in lieu of adopting third party association's criteria? It may ultimately be identical to the SWAT protocol. Who decides if the criteria should be adjusted in the future?*

3.1 Minimum Runtimes – All runtimes (irrigation cycles) that occur during the test period must be greater than three minutes in duration.

RESPONSE: *Why require the test times to be greater than three minutes? Depending on current or future SWAT protocol this could skew the actual performance of controllers. This seems to be purely subjective.*

3.2 Irrigation adequacy, as defined in the SWAT protocol, shall be greater than or equal to 80 percent.

RESPONSE: *No comment.*

3.3 Irrigation excess, as defined in the SWAT protocol, shall be less than or equal to 5 percent.

RESPONSE: *No comment.*

4.0 Supplementary Feature Requirements

The controller shall meet the following supplementary feature requirements:

RESPONSE: *It was my understanding from EPA's presentation at the Irrigation Show held in San Antonio that this is essentially a "wish list". As another manufacture commented at the December conference, these supplementary features could restrict innovation and creativity of the irrigation control industry.*

Many of these features seem to be purely subjective and orientated to user preferences. Is there scientific data to support certain criteria? For example: 3 minute runtimes, three different programs, schedule criteria, and water budget. Many of these features may not relate to any impact to conservation which appears to be the main goal of EPA.

We are also concerned on how a third party test lab may interpret this criteria. WaterOptimizer irrigation controller leverages the latest wireless technology (machine to machine) and is equipped with wireless communications and includes a web portal access via the Internet for full monitoring and control of the irrigation system (controller). As such, the capabilities specified in Section 4 are accomplished via a secured web portal, which is part of our irrigation controller "system". The web portal allows the user to set up policies for the controller, such as certain times of days that the controller is prohibited from operating.

If you are going to proceed with some of these supplementary features, we would respectfully request that that the specification be changed from "irrigation controller" to "irrigation control system" to allow for consideration of our advanced irrigation technology.

4.1. Non-Volatile Memory – The controller shall include a storage device or mechanism to preserve the contents of the irrigation program and settings when the power source is lost and no backup battery is available.

RESPONSE: *No comment.*

4.2. High-Performing Irrigation Controller – If the controller loses the real-time weather input or signal, the controller shall default to a high-performing conservation controller with the features outlined below.

RESPONSE: *No comment.*

4.2.1. Multiple programming capabilities – The controller shall be capable of storing a minimum of three different programs to allow for separate schedules for zones with differing landscape needs.

RESPONSE: *Why three? Why not just state multiple?*

4.2.2. Multiple start times (cycling, cycle/soak, stackable start times) – The controller shall be capable of a minimum of three different start times to allow for multiple irrigation cycles per day on the same zone for areas prone to runoff.

RESPONSE: *Why three? Why not just state multiple?*

4.2.3. Variable runtimes – The controller shall be capable of varying runtimes, for example three minutes to a minimum of one hour.

RESPONSE: *Why three minutes?*

4.2.4. Variable scheduling – The controller shall be capable of interval scheduling (up to a minimum of 14 days) to allow for watering on even day scheduling, odd day scheduling, calendar day scheduling, and interval scheduling.

RESPONSE: *Why 14 days?*

4.2.5. Diagnostic circuitry – The controller shall have some mechanism for informing the user when the signal is lost and the controller is not operating in weather-based mode.

RESPONSE: *No Comment*

4.2.6. Percent adjust (water budget) feature – The controller shall include a "percent up/down adjust" feature (or "water budget" feature) such as a button or dial that permits the user to increase or decrease the runtimes or application rates for each zone by a prescribed amount or percent, by means of one adjustment without modifying the settings for that individual zone.

RESPONSE: *The intent of a smart irrigation controller operating in weather based mode is to provide more efficient scheduling using real time weather data. As stated in the EPA's "Weather-Based Irrigation Controllers Supporting Statement, November 19, 2009".*
"Weather-based irrigation controllers make these schedule adjustments automatically by tailoring the amount, frequency, and timing of irrigation events based on current weather data and landscape conditions."

By requiring irrigation controllers to be equipped with a "water budget or percent up/down adjust" feature, it diminishes the intelligence of a smart irrigation controller that uses real time weather data to adjust runtimes. The "water budget" feature is nothing more than a "fudge factor" that a homeowner would use to adjust the runtime, thereby "bypassing" the real time weather data that should be used to adjust runtimes. We suggest removing this requirement as it will likely diminish the efficiency of smart irrigation controller.

4.3. Zone-by-Zone Control – The controller shall have the capability to implement runtimes specific for each zone (station) at a minimum using the following attributes:
- 4.3.1. Plant type, crop coefficient values, and/or depth of root zone
- 4.3.2. Soil type
- 4.3.3. Slope
- 4.3.4. Sprinkler type and/or precipitation rate
- 4.3.5. Cycle/soak (either manually programmed into the controller or through automatic calculations)

RESPONSE: *No Comment.*

4.4. Ability to Comply With Potential Utility Drought Restrictions – When operating in ET mode, the controller shall have the following capabilities in order to comply with potential utility drought restrictions:

RESPONSE: *Many of these features seem to be purely subjective and orientated to user preferences. Is there scientific data to support certain criteria? For example: 3 minute runtimes, three different programs, schedule criteria, and water budget. Many of these features may not relate to any impact to conservation which appears to be the main goal of EPA.*

We are also concerned on how a third party test lab may interpret this criteria. WaterOptimizer irrigation controller leverages the latest wireless technology (machine to machine) and is equipped with wireless communications and includes a web portal access via the Internet for full monitoring and control of the irrigation system (controller). As such, the capabilities specified in Section 4 are accomplished via a secured web portal, which is part of our irrigation controller "system". The web portal allows the user to set up policies for the controller, such as certain times of days that the controller is prohibited from operating

If you are going to proceed with some of these supplementary features, we would respectfully request that the specification be changed from "irrigation controller" to "irrigation control system" to allow for consideration of our advanced irrigation technology

4.4.1. Assigned day of week scheduling – Ability to operate on any prescribed day of the week schedule (for example, Monday-Wednesday-Friday, or Tuesday-Thursday-Saturday, or Tuesday-Friday, etc.).

RESPONSE: *This seems to be subjective. Please refer to our comment on 4.4.*

4.4.2. Skip-day interval scheduling – Ability to operate on an every-other-day or every-third day schedule. Alternatively, the controller could operate on a skip interval between 0 and 30 days.

RESPONSE: *This seems to be subjective. Please refer to our comment on 4.4.*

4.4.3. Even/odd scheduling accommodating a day exclusion – This feature allows the exclusion of a mow day or if a jurisdiction prohibits a specific day for all users.

RESPONSE: *This seems to be subjective. Please refer to our comment on 4.4.*

4.4.4. Minimum of three start times per program within a 24-hour period.

Response: *Why three starts per day? Why not say multiple starts?*

4.4.5. Ability to set irrigation runtimes to avoid a prohibited time of day – For example, irrigation will not occur between 9 a.m. and 9 p.m.

RESPONSE: *No Comment.*

4.4.6. Complete shutoff capability for total elimination of outdoor irrigation.

RESPONSE: *No Comment.*

4.4.7. Percent adjust (water budget) feature – The controller shall include a "percent up/down adjust" feature (or "water budget" feature) such as a button or dial that permits the user to increase or decrease the runtimes or application rates for each zone by a prescribed amount or percent, by means of one adjustment without modifying the settings for that individual zone.

RESPONSE: *The intent of a smart irrigation controller operating in weather based mode is to provide more efficient scheduling using real time weather data. As stated in the EPA's "Weather-Based Irrigation Controllers Supporting Statement, November 19, 2009".*

"Weather-based irrigation controllers make these schedule adjustments automatically by tailoring the amount, frequency, and timing of irrigation events based on current weather data and landscape conditions."
By requiring irrigation controllers to be equipped with a "water budget or percent up/down adjust" feature, it diminishes the intelligence of a smart irrigation controller that uses real time weather data to adjust runtimes. The "water budget" feature is nothing more than a "fudge factor" that a homeowner would use to adjust the runtime, thereby "bypassing" the real time weather data that should be used to adjust runtimes. We suggest removing this requirement as it will likely diminish the efficiency of smart irrigation controller.

4.5. Rain Management – The controller shall be equipped to interface with a rain device.
- 4.5.1. The controller shall provide an appropriate "simple" terminal connection to allow a rain device to be connected during or after initial installation of the controller; i.e., retrofittable.
- 4.5.2. The controller shall recognize a rain device once it is connected.
- 4.5.3. The controller shall have the capability to stop and/or prevent an irrigation cycle from occurring when a "wet" signal is received from the rain device.
- 4.5.4. The controller shall prevent all irrigation cycles from occurring until the rain device provides a "dry" signal.
- 4.5.5. The controller shall provide some form of visual display to indicate when the rain device has suspended irrigation.

RESPONSE: *No Comment.*

5.0 Effective Date
This specification is effective on TBD.

RESPONSE: *No Comment.*

6.0 Future Specification Revisions
EPA reserves the right to revise this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. Revisions to the specification would be made following discussions with industry partners and other interested stakeholders.

RESPONSE: *No Comment.*

Commenter: Mary Ann Dickinson
Affiliation: Alliance for Water Efficiency
Comment Date: January 18, 2010

Please accept the attached as public comment on the EPA WaterSense Draft Weather-Based Irrigation Controller Specification. Thank you for the opportunity.

Mary Ann

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Mary Ann Dickinson
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PUBLIC COMMENT SUBMISSION ON EPA WATERSENSE DRAFT WEATHER-BASED IRRIGATION CONTROLLER SPECIFICATION AND SUPPORTING DOCUMENTS

Commenter Name: Mary Ann Dickinson, President and CEO
Commenter Affiliation: Alliance for Water Efficiency
Date of Comment Submission: January 18, 2010

Topic:
Appropriateness of Labeling Weather-Based Irrigation Controllers at this Time
Comment:
The Alliance for Water Efficiency supports labeling of weather-based irrigation controllers.
Rationale:
Although the water savings measured in the large California field study were not as large as we wish and expect, AWE views weather-based irrigation control as an important technological improvement. The California study also showed conclusively that weather-based controllers can push irrigators towards a defined but adaptable irrigation target. That study also found the controllers were successful in a wide variety of climate zones and installation conditions. AWE is optimistic that as this technology matures and both professionals and consumers become more familiar with it, water savings will improve.
Suggested Change (or Language):
N/A

Topic:
Use of the Term “Controllers” Throughout the Specification
Comment:
While the specification permits the use of add-ons, the text often times refers to the "controller" rather than "irrigation control system" which might be more appropriately inclusive. By applying this specification to an irrigation control system, the specification would include manuals, software, and any add-on devices that have been performance tested for use with any given controller.
Rationale:
As currently written much of Section 4.0 would be redundant (capability) for an add-on device connected to a controller.
Suggested Change (or Language):
Include a definition of “irrigation controller” that includes the controller *per se* and its manual, software, and any add-on devices connected to the unit. The definition should exclude soil moisture sensors.

Topic:
Reference to *Smart Water Application Technologies* (SWAT) *Test Protocol* Throughout the Specification
Comment:
The specification will be more resilient if the date reference to the SWAT protocol was removed and replaced by “most current” SWAT protocol.
Rationale:
This change allows the specification to evolve without having to reopen the specification for revision.
Suggested Change (or Language):
See above Comment.

Topic:
Section 1.0 Scope and Objective: Number of Stations Specified
Comment:
The number of stations should be changed from a maximum of 16 to a maximum expanded capacity of 48 stations.
Rationale:
A smaller limit to number of active stations appears overly restrictive. There are currently SWAT testing results for several models of controllers that manufacturers have allowed to be posted on the IA website that are expandable up to 48 stations. These models meet the SWAT definition of residential and light commercial or they would not have been allowed to be tested. Furthermore, such controllers are most likely to be used in mid-sized multi-family or office campus settings that can be described as light commercial facilities. As written, the specification would probably include many of the models currently posted if it were sold with no more than 16 active stations, and exclude the same model if it was initially sold with more than 16 active stations. After purchase the consumer may choose to expand capability to more than 16 stations. Does this mean when the consumer activates additional zones the controller should no longer be eligible for WaterSense label it carried when initially purchased or no longer rated as a light commercial controller according to the EPA? More importantly, does expanding

to the maximum allowable number of stations change the water conservation potential for zones that the customer wishes to irrigate? We believe the answer to both of these questions is no.

Suggested Change (or Language):

See above Comment.

Topic:

Section 1.0 Scope and Objective: Description of the Controller Products Eligible for WaterSense Label According to the Specification

Comment:

The specification title indicates that it is for weather-based irrigation controllers. Unfortunately the introductory text of section 1.0 narrows the scope to include only devices that utilize ET. Removing all language regarding ET_o from the first paragraph and including an additional bullet point that lists "Controllers that utilize climatological sensor(s)" would widen the scope. If this bullet point is added it may be advisable to clarify that climatological sensors as used here do not include soil moisture sensors (probably best done in definitions).

Rationale:

While ET is and should be the benchmark that devices are tested against for this specification, it was not our understanding that the specification should stifle innovation by forcing the products to use ET as the basis for scheduling.

Suggested Change (or Language):

See above Comment.

Topic:

Section 2.0 Summary of Criteria

Comment:

The draft specification fails to include any criteria for energy efficiency. Energy performance data should be collected and energy performance criteria considered in any subsequent revision to the specification.

Rationale:

As the Alliance for Water Efficiency and many of its member organizations have noted for several years, it is important for many stakeholders that EPA's labeling programs consider both energy efficiency and water efficiency when developing labeling criteria for products that use both energy and water. As a result, water efficiency criteria have been successfully incorporated into Energy Star labeling criteria for residential dishwashers, clothes washers, commercial dishwashers, and commercial ice machines, and significant water savings will result. Conversely, WaterSense criteria for lavatory faucets and showerheads will have clear energy-saving benefits, but without the need for separately stated energy performance metrics. However, where WaterSense is taking the lead in developing a labeling specification for a product using both water and energy, and energy efficiency will not be adequately described by the water efficiency performance metrics, it is incumbent on WaterSense – for all the reasons previously discussed in the context of Energy Star – to consider whether energy efficiency can be effectively improved through the incorporation of energy efficiency criteria in the WaterSense specification. This issue was raised at the initial Tampa workshop on the development of the WaterSense irrigation controller specification, but unfortunately was not acted upon by the agency. We recognize that collection and analysis of energy data at this time would lead to considerable delay in the adoption of this version of the controller specification. However, we

recommend that EPA incorporate consideration of energy performance metrics in any subsequent revision of the specification.

Suggested Change (or Language):

N/A

Topic:

Section 4.0 Supplementary Feature Requirements

Comment:

Replace the above referenced section with the one below in the following *"Suggested Change (or Language)".*

Rationale:

Section 4.0 as written is very prescriptive. The features as written often force a method rather than outline performance expectations that can be met by current methods or future innovation. Also as written, language in 4.2 and 4.4 are nearly identical. Our suggested edits are the result of a collaborative work group of controller manufacturers and water purveyors. To the greatest extent possible our goal was to meet the intent of the original language, but to define performance parameters of a high performance controller that can be programmed to meet drought restrictions. We believe this language will invite innovation to meet these performance criteria rather than restrict innovation due to prescribed criteria.

Suggested Change (or Language):

6.0 Minimum Feature Requirements

The controller shall have the following minimum features:

- 6.1 The controller shall include a storage device or means to preserve the contents of the irrigation program settings when the power source is lost and no backup battery is available.
- 6.2 Multiple programming capabilities – The controller shall have independent zone specific programming or be capable of storing a minimum of three different programs to allow for separate schedules for zones with differing water needs.
- 6.3 For areas prone to runoff, the controller shall have the ability to initiate irrigation at least three times for each zone in a 24 hour period.
- 6.4 The controller shall have a means of indicating to the user when it is not receiving a signal or local sensor input, and the controller is not adjusting irrigation based on current weather conditions.
- 6.5 Rain shut-off device – The controller shall either include a rain shut-off device or be equipped to interface with a rain shut-off device. The controller shall meet the following requirements.
  - 6.5.1 If the rain shut-off device is not integral to the product, the controller shall provide a dedicated terminal connection to allow a rain shut-off device to be connected during or after the installation of the controller.
  - 6.5.2 The controller will prevent irrigation from occurring when the rain shut-off device is activated by the presence of rain and will continue to prevent irrigation while the rain shut-off device is still wet from rain.
  - 6.5.3 The controller shall have a means for indicating to the user when the rain shut-off device has suspended irrigation.
- 6.6 Zone level control – The controller shall have the capability to irrigate appropriately for the specific water requirements of each zone. The resulting zone setup can be accomplished by either entering information directly into the

controller or by providing appropriate means that allow the user to determine operating parameters such as runtimes which can then be entered into the controller. The following attributes shall be included in the controller setup methodology.

6.6.1 Plant characteristics
6.6.2 Soil characteristics
6.6.3 Slope
6.6.4 Irrigation device characteristics or precipitation rate
6.6.5 Sun exposure

6.7 The controller shall have the ability to accommodate a variety of watering restrictions. It shall have the following capabilities.

6.7.1 Operating on any prescribed day(s)-of-week schedule (for example, Monday-Wednesday-Friday, Tuesday-Thursday-Saturday, any two days, or any single day, etc…).
6.7.2 Even day or odd day scheduling.
6.7.3 The ability to set irrigation runtimes to avoid a prohibited time of day. (for example, irrigation will not occur between 9 AM and 9 PM)
6.7.4 Complete shutoff for total elimination of outdoor irrigation.
6.7.5 Allow for every other week watering on a defined day.

6.8 If the primary source of weather information is not present, the controller will revert to either a proxy of historical weather or a percent adjust (water budget) feature.

6.8.1 The percent adjust (water budget) feature is defined as having the means to increase or decrease the runtimes or application rates for all zones by a prescribed amount by means of one adjustment without modifying the settings for each individual zone.

6.9 Manual operation – The controller shall allow for manual operation and troubleshooting test cycle at the physical location of the controller installation.

Topic:
WaterSense Draft Specification for Weather-Based Irrigation Controllers Supporting Statement Version 1, Section V. Additional Issues for Consideration, Paragraph 3 - Top of Page 8.

Comment:
Replace the above referenced paragraph with the one below in the following *"Suggested Change (or Language)"*.

Rationale:
The original paragraph is technically inaccurate in several ways:

1) Deficit irrigation has a specific technical definition that we believe was not intended in the paragraph. The reference to deficit irrigation was removed. We believe the suggested edits provide more technically accurate language that meets the intent of the original text. As a reference here is a link to the IA glossary:
www.irrigation.org/gov/default.aspx?pg=glossary.htm&id=106#D
Deficit Irrigation: Irrigation water management alternative where the soil in the plant root zone is not refilled to field capacity in all or part of the field. (NRCS, 1997)

2) ET_o is reference ET for cool season grasses only. The notation of ET_c is used to reference the ET for a variety plants. The "c" is a placeholder for the K_c of each specific plant. The original wording, "…weather-based controllers are designed to deliver a

targeted amount of water required by the landscape (usually 100 percent of ET_o)" is not accurate since one of the great water efficiency improvements facilitated by a smart controller is being able to program according to the K_c of several varieties of plant material therefore we suggest changing evapotranspiration notation in this paragraph to ET_c. See page 45 of the pdf link below: www.kimberly.uidaho.edu/water/asceewri/main.pdf

3) The original text lacked any mention of the importance of irrigation system efficiency in allowing a lower percent of ET_c to apply enough water to sustain plant health throughout the landscape.
4) The original text did not include information regarding tuning the controller for optimal water conservation and landscape health.
5) The original text did not include information on validating retrofit controller weekly runtimes.

Suggested Change (or Language):

Additionally, it is important to acknowledge that weather-based controllers are designed to apply a targeted amount of water based on the landscape plant requirements (usually 100 percent of ET_c) and irrigation system efficiency. Although weather based irrigation controllers provide a great conservation potential, they must be properly installed and configured. A weather-based irrigation controller evaluation in California (Aquacraft 2009), reported many of the sites previously watering under ET_c increased water use after installation. Irrigation professionals with experience in these technologies will be able to address these issues in the field by tuning the controller and the irrigation system for optimum water conservation and landscape health. When replacing a conventional controller in a retrofit project the weather-based controller's weekly runtimes should be compared to the previous weekly runtimes of the conventional controller. If the new weekly runtimes exceed the previous weekly runtimes the weather-based controller settings should be adjusted to apply no more water than the conventional controller it replaced.

Commenter: Pat Halahan
Affiliation: ET Water, Inc.
Comment Date: January 18, 2010

We at ET Water Inc. have reviewed the draft specification for Weather based controllers. Based on this review that attached document in a .pdf format has our input.

Basically we would like to see the document allow for our web based type system. Such a system has a number of advantages because it is not just a stand alone controller.

I would be happy to send these comments in the form of a Word file if need be.

Thanks

Pat Halahan
VP Engineering
Mobile (707) 303 6960

Et Water has reviewed the WaterSense Draft specification version 1.0 as put forward in the file controller_draftspec508.pdf. Based on this review the following are our points of feedback.

The ET Water controller receives irrigation commands like length of irrigation and cycles from a server which uses the latest ETo to calculate the irrigation schedules. Based on this, change the wording on page 1 as shown below

This specification applies to controllers that calculate use real-time crop evapotranspiration (ETc) based on reference evapotranspiration (ETo) by:
• Using onsite sensor(s) to calculate ETo;
• Using onsite sensor(s) to modify historical ETo;
• Receiving weather data from a real-time remote source to calculate ETo; or
• Receiving direct ETo data from a remote source.
• *Or receiving irrigation schedules calculated based on ETo*

Further down page 1 is the following.
This specification is applies to residential or light commercial products with 16 or fewer stations that are designed and sold for use at homes and similar scale light commercial and institutional properties.
Why limit the specification to 16 or less stations? This paragraph should be removed

Section 4.2 does not allow for many controllers that keep going on the last ETo they received and if the lost communication period is small this is probably a better method than having the user go to the controller and modify its operation. To this end we suggest the section is modified as follows.
4.2. High-Performing Irrigation Controller – If the controller loses the real-time weather input or signal, the controller shall continue to function based on the last known ETo. Or the controller can be defaulted to a high-performing conservation controller with the features outlined below.

The ET Water system will notify the user via email that the signal is lost. This is based on the server not getting a call from the controller. This we feel is a better system than the controller trying to get the users attention. The paragraph shown below should be changed as shown.
4.2.5. Diagnostic circuitry *system* – The controller *or supporting system* shall have some mechanism for informing the user when the signal is lost and the controller is not operating in weather-based mode.

Commenter: Gary Hartwell
Affiliation: City of Frisco
Comment Date: January 18, 2010

Please accept these comments regarding the use of the WaterSense label on smart controllers. As the Director of Public Works for the City of Frisco, Texas, I administer the city smart controller program. We require all new homes with irrigation systems to be equipped with a smart controller from our approved list. I developed the list based on SWAT testing and my own personal use of smart controllers since 2007. During that time, I have tested on my own landscape with a signal–based unit, an on-site weather monitor unit, and a soil moisture probe. I have used these units during summer and winter, and maintained daily logs to document operation. Based on my personal experience, I offer the following two major comments:

1. All units initially over-watered due to default settings programmed for excessive operation.

2. WaterSense labels should only be given to those units that provide for effective rainfall. If not, then that unit is simply a rain/freeze sensor, is not worthy of the WaterSense label, and would be essentially providing a false endorsement.

Gary R. Hartwell, P.E.
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Commenter: Chris Brown
Affiliation: California Urban Water Conservation Council
Comment Date: January 18, 2010

Chris Brown
Executive Director
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Template for Public Comment Submission on WaterSense Documents

Commenter Name: Chris Brown
Commenter Affiliation: California Urban Water Conservation Council
Date of Comment Submission: January 18, 2010

Topic: Use of SWAT protocol
Comment: The California Urban Water Conservation Council questions whether the published draft specification of controller testing is consistent with the supporting documentation published by the EPA in support of this specification.
Rationale: The Study of SWAT testing published by the EPA (Dukes, 2009) points out several the problems with the clarity of the SWAT protocol and the interpretation of elements of the protocol with regards to its repeatability by independent testing labs. This is a critical factor in approval of a national specification, and a performance standard which the EPA has met in establishing indoor water conservation labeling standard for high efficiency toilets.
Suggested Change (or Language): Add changes to protocol suggested in Florida Study, specifying the exact order of steps in calculating a water balance.

Topic: Reference to soil moisture and rain sensors being excluded specifically from the Weather Based Irrigation Controller Specification
Comment: Systems which include soil moisture sensors should not be excluded from the definition of Smart Controllers in the Water Sense program.
Rationale: The definitions of a smart controller in SWAT protocol include controller functions which interrupt irrigation cycles based upon estimated or measured soil moisture *(italics added*). The phrase replenishing water as needed also allows the use of rain sensors which are excluded by reference in the Water Sense support statement.:

> 3.11 Smart Controller Smart controllers estimate or *measure depletion of available plant soil moisture* in order to operate an irrigation system, *replenishing water as needed* while minimizing excess water use. A properly programmed smart controller requires initial site specific set-up and will make irrigation schedule adjustments, including run times and required cycles throughout the irrigation season without human intervention.

Suggested Change (or Language): If the Water Sense Program wishes to issues separate specifications for soil moisture and rain sensors it should do so at the same time as the irrigation controllers, as the irrigation control system as a whole (including the human installation, set-up, operation, and maintenance factors, all of which cannot be labeled) is responsible for total water management and savings in the landscape. Eliminating by reference sensors which can reduce

water use in landscape irrigation will result in lower and potentially no savings. A weather-based irrigation controller installed without such attention to the whole system may even increase water use on some sites as indicated by the WBIC study (Aquacraft, 2009).

Topic: The need for Field testing of irrigation controllers
Comment: Add a field testing component to the Weather based irrigation controller specification.
Rationale: The SWAT Protocol uses a virtual irrigation environment instead of testing controllers in a field setting. The SWAT tests determines the capacity of programmable logic chips to perform calculations and arrive at similar results to a data logger from a weather station. The Controllers are being bench tested and are not exposed to any of the actual conditions they might experience in the field, including rain, wind, and changes in temperature and humidity which could all potentially affect the controllers' performance. The variation found among SWAT approved controllers in the WBIC Study (Aquacraft 2009) is one indication that a field testing protocol should be adopted by EPA prior to determining which systems deserve the Water Sense label.
Suggested Change (or Language): Add a field testing component to the Weather based irrigation controller specification.

Topic: WaterSense Draft Specification for Weather-Based Irrigation Controllers Supporting Statement Version 1, Section V. Additional Issues for Consideration, Paragraph 3 - Top of Page 8.
Comment: The CUWCC supports the call to Replace the above referenced paragraph with the one below in the following *"Suggested Change (or Language)"*.
Rationale: The paragraph cites the WBIC field study of irrigation controllers and references deficit irrigation, which was not measured as part of that study. It is likely that the reason for irrigation use increasing with the use of weather based controllers in that study had to do with the plant material in the actual landscapes needing less water than the ETo equation suggest, either because of soil conditions, diverse plant palettes, or shade in the urban landscape**.**
Suggested Change (or Language): Additionally, it is important to acknowledge that weather-based controllers are designed to apply a targeted amount of water based on the landscape plant requirements (usually 100 percent of ET_c) and irrigation system efficiency. Although weather based irrigation controllers provide a great conservation potential, they must be properly installed and configured. A weather-based irrigation controller evaluation in California (Aquacraft 2009), reported many of the sites previously watering under ET_c increased water use after installation. Irrigation professionals with experience in these technologies will be able to address these issues in the field by tuning the controller and the irrigation system for optimum water conservation and landscape health. When replacing a conventional controller in a retrofit project the weather-based controller's weekly runtimes should be compared to the previous weekly runtimes of the conventional controller. If the new weekly runtimes exceed the previous weekly runtimes the weather-based controller settings should be adjusted to apply no more water than the conventional controller it replaced.

Topic: Section 1.0 Scope and Objective: Description of the Controller Products Eligible for WaterSense Label According to the Specification

Comment:
The specification title indicates that it is for weather-based irrigation controllers. Unfortunately the introductory text of section 1.0 narrows the scope to include only devices that utilize ETo. Removing all language regarding ET_o from the first paragraph and including an additional bullet point that lists "Controllers that utilize multiple on-site climatological sensors" would widen the scope.

Rationale:
While ET is and should be the benchmark that devices are tested against for this specification, it was not our understanding that the specification should stifle innovation by forcing the products to use ET as the basis for scheduling.

Commenter: Dennis Pittenger
Affiliation: University of California Riverside
Comment Date: January 19, 2010

My comments center on the general concept of specifying and labeling irrigation controllers as "water saving".

The scientific evidence on the performance of these devices clearly indicates installation of weather-based controllers results in little if any water conservation and savings will not likely reach the percentage spelled out in EPA WaterSense's own criteria for water savings (improved efficiency) of 20%. When I raised this question at the December public comment session, the WaterSense staff reply brushed off the fact that the devices had not demonstrated the required level of water savings. Also, the projected payback period for installing these products of as much as 15 years does not meet the cost effective criteria standard set by WaterSense.

The bottom line there is no science basis for specifying the installation of these products as a means of assuring landscape water conservation. Rather than taking a prescriptive approach, WaterSense will achieve more effective landscape water conservation by setting required water conservation (efficiency) standards but leaving the means of attaining the savings to the discretion and innovation of the site designer(s) and manager(s).

Sincerely,

Dennis R. Pittenger, M.S.
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Commenter: Carol Ward-Morris
Affiliation: Arizona Municipal Water Users Association
Comment Date: January 19, 2010

Dear WaterSense,

Attached are comments on the WaterSense Draft Specification for Weather Based Controllers. We apologize for the delay in submission, and we hope you will take them under consideration despite their late arrival. We appreciate EPA's efforts in developing this specification and the opportunity to provide input.

Best wishes,

Carol

_____
Carol M. Ward-Morris, Program Coordinator
Arizona Municipal Water Users Association
One for Water™

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Comments on the WaterSense Draft Specification for Weather-Based Controllers

Commenter Name: Carol M. Ward-Morris, Regional Conservation Program Coordinator
Commenter Affiliation: Arizona Municipal Water Users Association
Date of Comment Submission: 01/20/10

The Arizona Municipal Water Users Association (AMWUA) is a voluntary association of the municipalities of Avondale, Chandler, Gilbert, Glendale, Goodyear, Mesa, Peoria, Phoenix, Scottsdale, and Tempe, encompassing a population of nearly 3.5 million residents.

AMWUA supports the EPA's efforts to encourage the use of water-efficient landscapes. This is especially critical in the southwestern states where irrigation is most often a necessity in residential landscaping due to limited precipitation and where over-watering is too common and occurrence. We commend the EPA's program to test and certify irrigation technologies that will reduce the excess usage, and we appreciate the opportunity to submit the following comments.

1.0 Scope and objective:

AMWUA disagrees with the decision to exclude controllers that rely on historical ET without additional sensors from testing. It is AMWUA's position that the historical-only ET controllers should be tested and allowed to pass or fail based on their performance. There is nothing to be lost in allowing these controllers to be tested.

There appears to be a generally accepted perception that historical-only ET controllers will not perform to the level of the more expensive controllers with add-on sensors or controllers

that receive ET data from a remote source; however, testing is necessary to verify that assumption. In the case of controllers that receive ET data from remote sources, this assumption may well prove true; however, there is little long-term testing of the on-site sensors that modify the ET values. Professionally maintained weather station sensor data points are carefully monitored to see if there are fluctuations in what is being recorded. What they are looking for is something referred to as sensor drift. The loss in accuracy of these professional grade sensors happens much sooner than one might think. While the protocols have a provision for these controllers to alert the end owner of a sensor failure and how to respond to it, there appear to be no requirements for the accuracy tolerance of these sensors. The low-cost sensors that are now becoming common in this market segment have the potential to drift substantially, causing the landscape to be either under-watered, which will cause a loss of trust in the technology by the end users, or to be over-watered, reducing conservation. The potential for over-watering due to sensor drift could recreate the problem of the original 1.6GPF toilets, where if the wrong flapper was installed, it reverted to being a 3.5GPF toilet. In short, irrigation experts are not entirely confident of the long term water conservation potentials of low-cost sensors, especially when the end user will have little or no knowledge to determine if they are functioning properly, but time will tell.

2.0 Summary of Criteria:

AMWUA supports the decision to allow the controller to apply an excess of irrigation of up to or less than 5 percent. While perfect irrigation application is an admirable goal, it must be realized that it is not always possible. With local research data showing that many landscapes in Arizona are watered at 2 to 5 times their actual needs, achieving even 80% of the potential savings would have a significant impact.

3.0 Performance Criteria:

3.1 Minimum run times: Certain soil and irrigation conditions do require short irrigation cycles in order to prevent runoff. A fixed pattern spray zone will have an average precipitation rate of 1.5”/hour. This is likely the highest precipitation rate that would be encountered in most irrigation systems. With a 3-minute run time, 0.075” of water will be applied. In the event that short run times are used to control runoff, adjustments must be made to the testing protocols to ensure that sufficient water is applied during the entire irrigation event to adequately water the root zone of the intended plant material. This has been a long-standing concern with the SWAT testing protocols. When the balance sheet is tallied up at the end of the month for irrigation adequacy, short, frequent irrigation events may add up correctly, but it is the individual irrigation event that must meet the irrigation adequacy requirement.

4.0 Supplementary Feature Requirements:

4.2 High-Performing Irrigation Controller: This section designates that in the event that the controller loses the real-time weather input or signal, it shall default to functioning as a high-performing conservation controller. The outlined criteria describe nothing more than what a standard irrigation controller on the market is capable of. Most of the current standard controllers are quite capable of being high-performance conservation controllers when properly adjusted. It is AMWUA’s position that should a weather-based controller lose its signal or real-time weather

input, it should revert to a historical ET controller and continue to modify the schedule based on historical ET. Allowing a controller to revert to the current level of industry standard controllers without the ability to continue automatic adjustment of the irrigation schedule defeats the purpose of the certification.

Additional Comments:

1. Looking toward the future, how will the protocols accommodate new technologies that don't rely on ET? Current smart controllers are based on ET, and so the protocols are focused accordingly, but this should not inhibit the development of new technologies that might prove to be even more effective.
2. The methods manufacturers use to adjust irrigation vary. Some modify the watering by adjusting the run times only, which may be perfectly adequate in areas with short irrigation seasons where the minimum and maximum ET values are not wildly different. In the southern US and the southwest in particular, however, adjusting the run time without also adjusting frequency will cause short, shallow irrigation events that fail to adequately irrigate root zones, negatively affecting the plants, despite the fact that the total amount of irrigation over the course of the month may be correct. AMWUA would like to see adjustment to the certification or the labeling of these controllers to make it easier to determine if the controller adjusts the frequency of the irrigation schedules, so that we may more easily recommend certified controllers that are more appropriate to our region.