

This presentation premiered at WaterSmart Innovations

watersmartinnovations.com



SMART WATER APPLICATION TECHNOLOGIES 2009 UPDATE

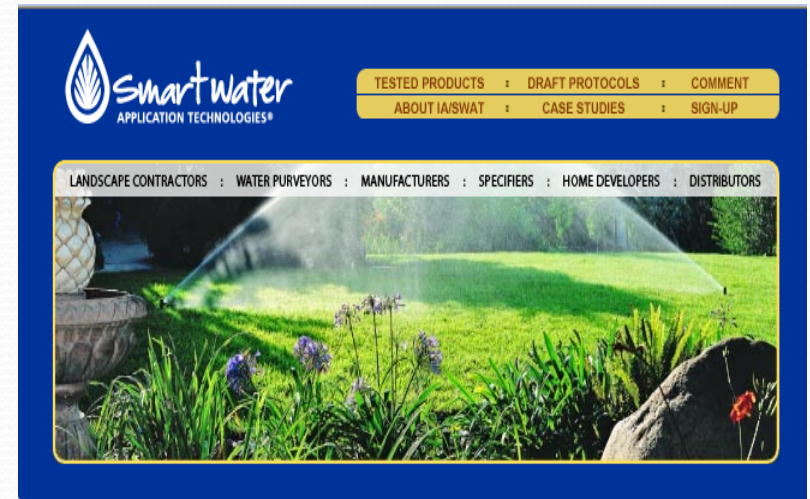


Brian E. Vinchesi, President
Irrigation Consulting, Inc.
Pepperell, Massachusetts

Chairman, Irrigation Association
Smart Water Application
Technology Committee

WHAT IS SWAT?

- SWAT is a coalition of water purveyors, equipment manufacturers, and irrigation practitioners with shared interests in the Smart Water Application Technologies (SWAT) initiative.
- Mission: to encourage outdoor irrigation efficiency and water conservation through the use of smart water application technologies.



Join the effort to maximize outdoor irrigation efficiency through the use of "Smart" Water Application Technologies™

Smart Water Application Technologies, or SWAT, is a national partnership initiative of water purveyors and irrigation industry representatives created to promote landscape water use efficiency through the application of state-of-the-art irrigation technologies. This website will help you discover how "smart" irrigation technologies are changing the face of landscape irrigation and the benefits of taking part in promoting efficient water use.



Landscape Contractors

Find out how "smart" irrigation technologies can help you grow your business and improve client satisfaction.

[learn more](#)

Manufacturers

Join the "smart" irrigation technologies revolution by supporting Smart Water Application Technologies efforts.

[learn more](#)

New Home Developers

Learn how "smart" irrigation technologies add value and maximize limited water resources to help meet growing water demands.

[learn more](#)

Water Purveyors

Irrigation Designers and

Specifiers

Distributors



SWAT HISTORY



- Started in 2001 at Irrigation Association Meeting
- Initiative of the Irrigation Association Board of Directors
- Meets Every Year at the Irrigation Show (12/3-12/5)
- Other meetings as necessary
 - February 2002 – Smart Controllers
 - April 2007 – Rain Sensors
 - January 2008 – Soil Moisture Sensors

STRUCTURE

- **Initiative of the Irrigation Association**
 - **Technology Working Group**
 - Kent Sovocool, SNWA – Kelly Koppe, USU
 - Testing Protocols
 - Reports
 - **Promotions Working Group**
 - Karen Guz, SAWS – Norm Davis – Tampa Bay Water
 - Marketing & Promotions
 - Fundraising
 - **Executive Committee**
 - Brian Vinchesi, Irrigation Consulting
 - Oversight
 - Communication with EPA, IA Board and other groups
- **SWAT participation is voluntary!**

SWAT TOOLS FOR WATER PROVIDERS

- **Marketing toolkit**
 - Smart controller statement stuffers
 - Homeowner smart controller direct mail package, self-mailer and jumbo postcard
 - Contractor smart controller self-mailer and jumbo postcard
- **Customizable web template**
 - Web pages to promote smart technologies
 - Website resources – www.swatirrigation.org

Homeowner Direct Mail



Keep your yard looking great and save hundreds of dollars a year on your water bill.

Install a "smart" sprinkler controller today.

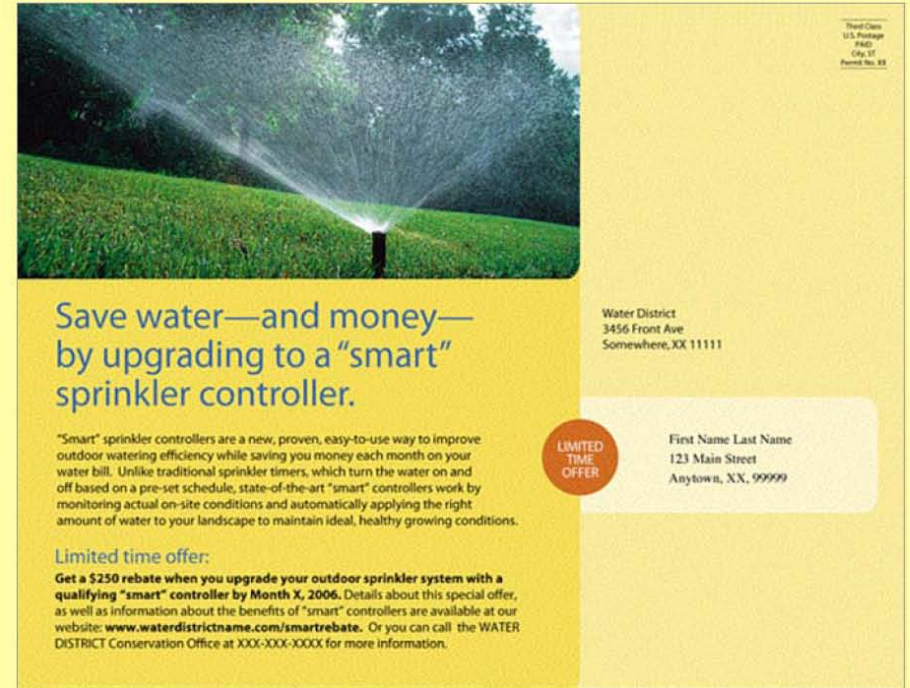
Get a \$250 rebate on any qualifying "smart" controller.

Visit www.waterdistrictname.com/smartrebate for details.

Water District Logo Here

The front of the postcard features a blue header with yellow text. Below the header is a photograph of a sprinkler system watering a lush green lawn. A yellow circular callout is positioned on the right side of the image. At the bottom left, there is a small white box with the text 'Water District Logo Here'.

Homeowner Jumbo Postcard-Front



Save water—and money—by upgrading to a "smart" sprinkler controller.

"Smart" sprinkler controllers are a new, proven, easy-to-use way to improve outdoor watering efficiency while saving you money each month on your water bill. Unlike traditional sprinkler timers, which turn the water on and off based on a pre-set schedule, state-of-the-art "smart" controllers work by monitoring actual on-site conditions and automatically applying the right amount of water to your landscape to maintain ideal, healthy growing conditions.

Limited time offer:
Get a \$250 rebate when you upgrade your outdoor sprinkler system with a qualifying "smart" controller by Month X, 2006. Details about this special offer, as well as information about the benefits of "smart" controllers are available at our website: www.waterdistrictname.com/smartrebate. Or you can call the WATER DISTRICT Conservation Office at XXX-XXX-XXXX for more information.

Water District
3456 Front Ave
Somewhere, XX 11111

First Name Last Name
123 Main Street
Anytown, XX, 99999

LIMITED TIME OFFER

Head Office
U.S. Postage
PAID
City, ST
Permit No. 88

The back of the postcard has a yellow background. It features a photograph of a sprinkler head in operation on a lawn. Text is arranged in columns. A red circular 'LIMITED TIME OFFER' badge is on the left. A white rounded rectangle on the right contains the recipient's name and address. The top right corner has a postage meter stamp.

Homeowner Jumbo Postcard-Back

Homeowner Direct Mail #3: Jumbo Postcard



Landscaper Direct Mail

Water District
3456 Front Ave
Somewhere, XX 11111

Water District
3456 Front Ave
Somewhere, XX 11111

Water District
3456 Front Ave
Somewhere, XX 11111

BUSINESS REPLY MAIL

PERMIT NO. 1000
POST OFFICE BOX 11111
SOMEBODY, XX 11111

POSTAGE WILL BE PAID BY ADDRESSEE

Water District
3456 Front Ave
Somewhere, XX 11111

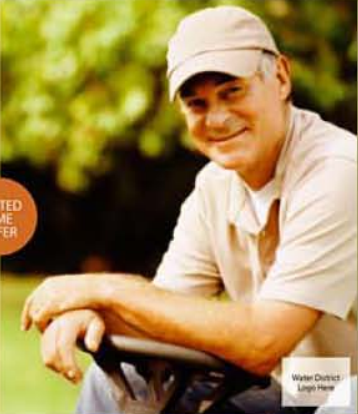
"Smart" irrigation controllers
is where your business is
headed. ARE YOU READY?
See inside for details.

**LIMITED
TIME
OFFER**

First Name Last Name
123 Main Street
Anytown, XX, 99999

**Grow your
business
with "Smart"
Controllers.**

Discover how "smart" irrigation controllers and special, limited time incentives for <Water District> offer new, exciting growth opportunities for your business.



**LIMITED
TIME
OFFER**

Water District
Logo Here

Landscaper Self-Mailer-Outside

Grow your business while helping <Water District> reduce outdoor water use.



Reducing outdoor water use has become a top priority in communities across the U.S., including ours. As a landscape professional, you have an important opportunity—and a vested interest—in helping to conserve our water resources for the future, and "smart" irrigation controllers are a key part of the solution.

What are "smart" irrigation controllers?

"Smart" controllers are a relatively new type of irrigation controller that work by monitoring and using information about site conditions (such as soil moisture, rain, wind, slope, soil and plant type, and more) to apply just the right amount of water to the landscape to maintain optimal growing conditions. And studies have proven that this reduces outdoor water use, often by as much as 30%.

Even better, "smart" controllers don't require ongoing monitoring and manual adjustments like traditional irrigation timers. Once a "smart" controller is installed and initial testing has assured the accuracy of

settings, the "smart" controller automatically takes care of seasonal weather/site specific adjustments. So you don't have to.

How "smart" irrigation controllers help you grow your business.

"Smart" irrigation controllers provide an exciting opportunity for landscape and irrigation professionals to expand and differentiate their service offerings in the growing area of water use efficiency and conservation. And right now, WATER DISTRICT is offering our customers special limited time incentives when they install a "smart" irrigation controller in place of their conventional timer.

The proper installation and initial set-up of "smart" irrigation controllers generally require an in-depth knowledge of soils, precipitation rates, slope measurements and related factors. WATER DISTRICT is strongly recommending to our customers that they work with a licensed landscape contractor who is specifically experienced and certified in the installation of "smart" irrigation controllers. That "Smart" Certified Irrigation Contractor could be you!

It's easy to become a <Water District> Certified "Smart" Irrigation Contractor. All you need is to be a state licensed landscape or irrigation contractor and attend a WATER DISTRICT "Smart" Irrigation Contractor Workshop in your area.

In this workshop you'll learn about the different types of "smart" controllers, which models have been tested and approved for this program, how to properly install them, the importance of a full system audit, special smart controller discount incentives currently available to qualified customers, and more.



To get started, simply fill out and return this postage-paid card and we'll send you more information and a list of upcoming workshops in your area. Or visit our website at www.waterdistrictname.com/smartcontractor.

Water District
Logo Here

Please send me more information about becoming a <Water District> Certified "Smart" Irrigation Contractor and a list of upcoming training workshops.

Name _____

Company _____

Title _____

Address _____

City _____ State _____ Zip _____

Phone (____) _____

Email Address _____

For faster response, please visit our website at www.waterdistrictname.com/smartcontractor Or call the WATER DISTRICT Conservation Office at XXX-XXX-XXXX.

Landscaper Self-Mailer-Inside

Landscaper Direct Mail #1: Self-Mailer



SWAT PROTOCOLS

- Follows the International Standards Organization (ISO) process except for voting.
- Developed by the IA, stakeholders and independent testing groups
 - Each draft receives a 90 day review
 - All comments reviewed by the technical committee
 - Changes made by the entity leading the protocol development
 - Last draft (minor issues) receives a 30 day review
- Requires major review every three years



COMMENTING

- Notice of comment period being open is posted on website, emailed, announced in E-times and press released
- Comments only through website:
www.swatirrigation.org
- All comments are posted and identify who made the comment
- Reminders are sent to email list
- After technical committee review, decisions on comments are posted

CLIMATE BASED CONTROLLERS

- Drafts: 8
- Residential and Small Commercial Controllers
- Results: 21 Controllers tested and posted
- Status: EPA working on draft specification for public comment that incorporates the protocol
- Add on device opinions solicited, two drafts and results forwarded to EPA.
- Lead: Center for Irrigation Technology



Smart Water Application Technology™ (SWAT™) Performance Report

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

Product: Hunter ET System with Pro-C 300 Controller

Product Type: Climatologically Based Controller

Product Description: ET SYSTEM is an onsite ET sensor suite with outdoor interface ET module, for direct connection to Hunter SmartPort® enabled controllers.

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

Hunter ET System with Pro-C 300 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: 2.3% Mean/Average of 6 test zones: 0.5% 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

Hunter ET System www.hunterindustries.com

Installation	Data Source	Data Link	Initial Purchase	Additional Hardware	Additional Fees
Retrofit to Hunter SmartPort® enabled controllers.	ET System onsite sensor suite	Direct low voltage wiring into Hunter SmartPort®	ET System must be purchased separately from compatible Hunter controller model: SRC, Pro-C and ICC	<input type="checkbox"/> ET WIND is an optional anemometer for measuring wind speed	None

Additional Features

Zones	Time of Day	Day of Week	Other	If Data Link is Discontinued
The original Hunter controller may have up to 48 zones depending on the model.	Separately programmable start times for ET controlled zones. NOTE: ET System WiltGard™ will override time of day restrictions.	ET System has day of week, even/odd date, and interval Day scheduling (up to 31 days). NOTE: ET System WiltGard™ will override day of week restrictions	<input type="checkbox"/> WiltGard™ technology Enables it to trigger protective watering when extreme conditions threaten your plants <input type="checkbox"/> ET information combines with each zone's particular plant, soil, sun, and sprinkler data <input type="checkbox"/> Easily upgrades most Hunter controllers to weather-based control with no high voltage AC wiring required <input type="checkbox"/> Non-volatile memory	If wiring to on-site ET System sensor is removed, system displays fault message and operates on last full 24 hour ET average. Traditional controller schedules may be selected manually if sensor service is required.

Smart Water Application Technology™ (SWAT™) Performance Report

Irrigation Adequacy

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.

Irrigation Excess

Minimum of 6 test zones: 0%

Maximum of 6 test zones: 2.3%

Mean/Average of 6 test zones: 0.5%

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.

Smart Water Application Technology™ (SWAT™) Performance Report	
Testing Agency: Center for Irrigation Technology	www.californiawater.org
Testing Date: October-November 2005	Weather Station: CIMIS 75 Irvine, Orange
Product Type: Climatologically Based Controller	Reference #: 100588
Product: Toro Intelli-Sense [Model Number TIS-12-OD, Serial # 100588]	
Product Description: Toro Intelli-Sense climatological adjustment uses WeatherTRAK ET Everywhere™ ET/rainfall data and WeatherTRAK Scheduling Engine™ to provide custom schedules.	
SWAT™ Protocol*: Turf and Landscape Equipment Climatologically Based Controllers 6 th Draft Testing Protocol (Dec 3, 2005)	
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	

Toro Intelli-Sense Full Technical SWAT Performance Report						
Input Data: CIMIS #75 reference crop is turfgrass using the Penman-Monteith formula						
For more information: www.cimis.water.ca.gov						
Parameters: For field installation, these values would normally be collected during a landscape audit.	Zone #1	Zone #2	Zone #3	Zone #4	Zone #5	Zone #6
Soil Type: Affects how water is absorbed and amount of water storage in the soil reservoir	Loam	Silty Clay	Loamy Sand	Sandy Loam	Clay Loam	Clay
Vegetation: Determines the crop coefficient and therefore the water required for healthy plant growth	Fescue 75% Shade	Bermuda Full Sun	Ground Cover Full Sun	Woody Shrubs 50% Shade	Trees & Ground Cover Full Sun	Bermuda Full Sun
Crop Coefficient: Defines water required for healthy plant growth (see detail on last page of report)	0.45	0.57	0.55	0.40	0.61	0.57
Slope, %: Affects run-off potential	6%	10%	8%	12%	2%	20%
Root Zone Working Storage (inches): Affects water available to plant and watering intervals	0.85	0.55	0.90	2.00	2.25	0.55
Precipitation Rate (inches/hour): Affects duration of watering time	1.60	1.60	1.40	1.40	0.20	0.35
Application Efficiency, %: The percent of water applied by irrigation distribution system that is absorbed in to the root zone working storage and is not lost due to spray drift and pattern loss	55%	60%	70%	75%	80%	65%
Area (square feet): Frames a virtual yard. Is not used in efficiency calculations.	1000	1200	800	500	650	1600
Soil Intake Rate (inches/hour): Affects watering duration & soak intervals of watering time	0.35	0.15	0.50	0.40	0.20	0.10
Allowable Surface Accumulation (inches): Affects watering duration & soak intervals of watering time	0.25	0.16	0.26	0.24	0.26	0.10
Maximum Allowable Run Time (minutes): Limits run time options to avoid potential runoff	12.0	6.6	17.3	14.4	N/A	24.0

Performance results are only valid if the controller must make adjustments for varying weather conditions such as rain and evapotranspiration (Eto). Therefore actual time undergoing testing may be longer than one month. Valid performance data is then downloaded from the 30 consecutive day period exhibiting the required minimum 0.40 of gross rainfall and minimum 2.50 inches of Eto.

Toro Intelli-Sense Full Technical SWAT Performance Report						
Evaluation Summary: Evaluation summary of performance during a 30-day period in which the controller was required to adjust for actual weather conditions including significant ET _o and rain events without intervention.						
Performance Parameters: Total inches for the test period are listed for each zone/crop	Zone #1	Zone #2	Zone #3	Zone #4	Zone #5	Zone #6
ET_o (inches): Actual ET from weather station, reference crop is cool season grass? CIMIS	2.55	2.55	2.55	2.55	2.55	2.55
ET_c (inches): ET _o requirement modified by the crop coefficient (determined by the vegetation in each zone)	1.19	1.51	1.44	1.01	1.56	1.51
Rainfall (inches): Rainfall recorded at the weather station	0.39	0.39	0.39	0.39	0.39	0.39
Net Rainfall (inches): Allows an arbitrary loss of 20% R _(net) = 0.8 (R)	0.31	0.31	0.31	0.31	0.31	0.31
Effective Rainfall (inches): Rainfall that was effectively stored in root zone working storage for use by crop.	0.31	0.31	0.31	0.31	0.31	0.31
Gross Irrigation (inches): Actual water applied	1.81	1.98	1.60	0.84	1.15	1.86
Direct Run-off (inches): Water applied that exceeded maximum allowable runtime	0.00	0.00	0.00	0.00	0.00	0.00
Soak Run-off (inches): Runoff loss attributable to scheduling multiple irrigation cycles without allowing sufficient soak time between cycles.	0.00	0.00	0.00	0.00	0.00	0.00
Effective Irrigation (inches): Water applied that was added to root zone working storage and usable by crop	1.01	1.23	1.10	0.60	0.90	1.23
Deficit (inches): Required water that was not available in the root zone working storage	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (inches): Water applied in excess of root zone working storage	0.00	0.00	0.00	0.00	0.00	0.00
*Irrigation Adequacy, %: Reflects how well irrigation met the consumptive use of vegetation. $\text{Irrigation Adequacy}(\%) = \left(\frac{\text{ETc, in} - \text{Deficit, in}}{\text{ETc, in}} \right) 100$	100%	100%	100%	100%	100%	100%
Schedule Efficiency, %: Reflects how well irrigation cycles avoided direct, soak runoff and exceeding the root zone working storage capacity. Scheduling Losses (in.) = Direct Runoff (in.) + Soak Runoff (in.) + Surplus (in.) $\text{Sch. eff} (\%) = \left(\frac{\text{Irr. (Net, in)} - \text{Sch. losses (in.)}}{\text{Irr. (Net, in)}} \right) 100$	100%	100%	100%	100%	100%	100%
*Irrigation Scheduling Excess, %: Reflects water applied in excess of consumptive use of vegetation. Irr. Excess = 100 - Schedule Efficiency, %	0%	0%	0%	0%	0%	0%

* Listed on Performance Summary Report

Toro Intelli-Sense Controller Full Technical SWAT Performance Report

Overall Irrigation Efficiency Evaluation

The efficiency of an irrigation system is a function of four considerations: efficient irrigation controls, efficient application hardware, well-designed irrigation installation, and consistent maintenance. If all considerations are optimal in these four areas the irrigation system can be considered to be efficient over all.

Scheduling Efficiency is the only criteria tested by the Climatologically Based Controller protocol. This value is listed in the Performance Parameters part of this report.

Application Efficiency listed in the input parameter takes into account application hardware, installation and maintenance. This value is listed in the Input Parameters part of this report. These values are generally representative of industry norms and do not relate directly to any specific manufacturers product.

$$\text{Overall Efficiency, \%} = [\text{Schedule Efficiency, \%} \times \text{Application Efficiency, \%}]$$

Performance Parameters: Total inches for the test period are listed for each zone/crop	Zone #1	Zone #2	Zone #3	Zone #4	Zone #5	Zone #6
Schedule Efficiency, %: Reflects how well irrigation cycles avoided direct, soak runoff and exceeding the root zone working storage capacity. Scheduling Losses (in.) = Direct Runoff (in.) + Soak Runoff (in.) + Surplus (in.) $\text{Sch. eff (\%)} = \left(\frac{\text{Irr. (Net, in)} - \text{Sch. losses (in.)}}{\text{Irr. (Net, in)}} \right) 100$	100%	100%	100%	100%	100%	100%
Application Efficiency, %: The percent of water applied by irrigation distribution system that is absorbed in to the root zone working storage and is not lost due to spray drift and pattern loss	55%	60%	70%	75%	80%	65%
Overall Irrigation Efficiency, %:	55%	60%	70%	75%	80%	65%

Details on Crop Coefficients

The crop coefficient defines water required as a percent of total evapotranspiration rate downloaded from the data source. Water requirements have been thoroughly researched for many years. More information regarding this research is available from the Irrigation Association.

The WeatherTRAK scheduling engine used by Toro Intelli-Sense has default crop coefficients listed as plant names in the scheduling engine. Custom crop coefficients may be programmed into any station. Appropriate schedule development includes assessment of the plants within the zone to be watered and selecting from a list of default values based on the plant type, or if preferred, entering the crop coefficient for that plant material.

SOIL MOISTURE SENSORS



- Drafts: Phase 1, 8
- Sensor Only
- Results: 4 Sensors Tested and Posted
- Status: Technical Working Group reviewing comments from 7th draft
- Lead: Center for Irrigation Technology

SOIL MOISTURE SENSORS



Smart Water Application Technologies/SWAT Calibration Report

Testing Agency: Center for Irrigation Technology	http://cati.csufresno.edu/cit/
Testing Period: April 2003 to May 2006	
Product Type: Soil Moisture Sensor	
Product Make and Model: Acclima Digital TDT Sensor Model #T003-004	
Product Description: Sensor measures soil volumetric water content	
SWAT Protocol¹: Turf and Landscape Irrigation Equipment - SOIL MOISTURE SENSORS	
Phase 1: Indoor Lab Screening Tests - 4th Draft Testing Protocol	
<p>The concept of soil moisture sensors has an extensive history of scientific study and documentation. The objective of Phase 1 lab tests is to determine sensor calibration curves over a range of conditions that affect soil moisture, including soil type, temperature and salinity. Phase 1 testing determines sensor response over manufacturer specified test ranges to continue into Phase 2. At that time the soil sensor will be integrated with an irrigation controller to measure irrigation adequacy and efficiency in a virtual landscape using the current performance criteria of 0.40 inches of rainfall and 2.50 inches of ETo.</p> <p>Phase 1 Soil Moisture Sensor testing does not test the efficacy of a sensor over the entire range of soil moisture conditions possible and does not measure the integration of a soil sensor with a controller to manage irrigation.</p> <p>Sensor performance curves were developed to determine the relationship between sensor readings and soil moisture content for a soil filled container. Relationships are determined for a range of soil textures, ambient temperatures and water conductivity values.</p> <p>*All SWAT protocols may be viewed at www.irrigation.org</p>	

Phase 1 SWAT Calibration Summary: Acclima Digital TDT Soil Moisture Sensor

Measures are between field capacity (i.e. practical soil water holding capacity) and a selected drying range specified by the manufacturer over which the sensor was tested.	Functions
Test of Soil Moisture Sensor	Response Function Developed ¹
Response in Fine-Textured Soil	Linear (Y = 0.562X + 0.175)
Response in Medium-Textured Soil	Linear (Y = 1.030X - 0.031)
Response in Coarse-Textured Soil	Linear (Y = 1.035X - 0.033)
Response in Soil at 20 °C (68 °F)	Linear (Y = 0.933X + 0.016)
Response in Soil at 30 °C (86 °F)	Linear (Y = 0.928X - 0.028)
Response in Soil Susceptible to Freezing	Linear (Y = 0.996X - 0.015)
Response in Fine-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear (Y = 0.401X + 0.263)
Response in Medium-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear (Y = 0.937X - 0.011)
Response in Medium-Textured Soil to Irrigation with 3.0 dS/m salinity water	Linear (Y = 0.855X - 0.007)
Response in Coarse-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear (Y = 1.030X - 0.033)

¹Regression equations of the data gathered vs. moisture content as measured by gravimetric sampling, or the measured weight of water in the soil samples. The dynamics of variable manufacture selected calibration endpoints preclude the applicability of correlation coefficients for inter-test or inter-sensor comparisons. A Nonlinear designation means a regression equation other than a straight line was used to best describe the relationship.

Product Detail Supplied by Manufacturer

Acclima TDT Soil Moisture Sensor		www.acclima.com
Operation	Features	Additional Hardware
Digital TDT Absolute-reading soil moisture sensor device	<ul style="list-style-type: none"> <input type="checkbox"/> Provides stable readings across wide range of soil temperature and EC conditions. <input type="checkbox"/> Can act as a moisture transducer in a closed-loop irrigation system without need for periodic adjustment. <input type="checkbox"/> Can measure soil and irrigation system properties, thereby can setup control system automatically. <input type="checkbox"/> After setup and install, no future adjustment needed. 	Closed-loop irrigation control systems available: <ul style="list-style-type: none"> <input type="checkbox"/> CS3500 Water on Demand: 2-wire, 64 zone, internet accessible, onboard data storage, 4 simultaneous zone scheduling with flow control, setup/reporting software <input type="checkbox"/> SC24/36 Suspended Cycle: Conventional wired, 24/36 zone, 4 simultaneous zone scheduling with flow control <input type="checkbox"/> SC6/12 Suspended Cycle: Conventional wired 6/12 zone residential, indoor and outdoor models, microclimate control <input type="checkbox"/> SCX Suspended Cycle Add on Device: Interrupts conventional timers, auto setup, performance reporting

SOIL MOISTURE SENSORS



- Drafts: Phase II, 4
- Includes Controller
- Results: None
- Status: Running pilot test program
- Lead: Center for Irrigation Technology

RAIN SENSORS



- Drafts: 2
- Equipment Functionality
- Results: None
- Status: Complete
- Lead: University of Florida
- Considering a Phase II – Field Testing on Turfgrass

RAIN SENSORS



TO GET SWAT SUPPORT

- Technologies must meet the following criteria:
 - Require the development of a technology promotion strategy and testing protocols to increase market acceptability.
 - Are able to be tested and measured for water efficiency based upon SWAT-approved testing protocols.
 - Show potential for widespread market acceptance.
 - Have general consensus that the technology will improve water efficiency.

NEW TECHNOLOGIES

- The technology must:
 - Be an irrigation technology that improves the water efficiency of irrigation systems, specifically for urban landscapes.
 - Be available to both the residential and commercial market.
 - Be able to be used on an existing or new, automatic sprinkler or drip irrigation systems.
 - Improve the water efficiency of automatic irrigation systems, without negatively impacting customer satisfaction.
 - Be easily installed by a trained irrigation professional.

NEXT TECHNOLOGIES

- Multiple Stream Multiple Trajectory Nozzles (MSMT)
 - Hunter MPRotator
 - Rain Bird Rotary Nozzle
 - Toro MPR Plus Spray Nozzle
- Lead: Kelly Koppe
Utah State University
- Pressure Regulating Sprinklers
- Lead: Gary Grabow
North Carolina State University



SMART CONTROLLER RESULTS

- Water being saved is erratic at best and not consistent with the testing results
- Studies are inconsistent but may include other factors such as how weather is normalized
- The controller is highly dependent on who installed it
- Follow up after installation is essential
- Smart controllers require a good knowledge of irrigation concepts and equipment – just changing the controller will never save water

SOLUTIONS

- Ad-hoc working group formed to identify the issues and develop solutions
 - ROI marketing sheet
 - Web based calculator for ROI
 - On line training program
 - Rebate guidelines – low qualified bid
 - Contractor Requirements

CONTROVERSEY

- California Energy Commission
 - Lack of Funding
 - No Basis to Compare
 - AquaCraft Study
 - Multiple Year Study
- Texas A & M University
 - Evaluation of Smart Controllers: Initial Bench Test Results
 - “controllers could not be programmed with all the parameters required to define these virtual landscapes”
 - Water use not compared to SWAT protocol but what Texas A&M would recommend

LEARNING MORE

- To participate in the SWAT working groups and task teams, contact me.
- To receive periodic SWAT email updates on technical and/or marketing efforts, sign-up at www.irrigation.org/swat.
- Keep an eye on our website: www.swatirrigation.org
- To contribute to SWAT, contact the Irrigation Association at 703-536-7080.

FUTURE

- Climate Based Controllers receive EPA WaterSense Label Spring 2010
- Moisture Sensor Based Controller Protocol sent to EPA late 2009
- Develop MSMT Protocol and Pressure Regulating Sprinkler Protocol and Review 1st and 2nd Draft Protocols in 2010
- Develop Solutions to Barriers
- Move SWAT in Additional Directions

QUESTIONS



www.swatirrigation.org

RAINFALL TESTING

- Tested the same controller using a live weather feed from the University of Florida in Gainesville, Florida and from the Mansfield Weather station in Southern New Jersey.
- 90 Day Tests
- EPA has reviewed the Florida test and will soon be reviewing the New Jersey Test

	Average Adequacy	Average Efficiency
CALIFORNIA	100.0%	98.5%
FLORIDA	97.9%	98.4%
NEW JERSEY	99.3%	100.0%