Response to Public Comments Received on January 2011 WaterSense® Revised Draft Specification for Weather-Based Irrigation Controllers

November 3, 2011

Background

This document provides WaterSense's responses to public comments received on the January 2011 *Revised Draft Specification for Weather-Based Irrigation Controllers*. For purposes of this document, the comments are summarized. The actual comments in their entirety can be viewed at http://www.epa.gov/watersense/partners/controller_background.html.

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I. Comments on Section 1.0 Scope and Objective

Scope Language

a. One commenter supported the scope language change from the first draft to include controllers that do not directly use evapotranspiration (ET) data.

Response: WaterSense thanks the commenter for the comment and agrees that products that do not directly use ET data fall under the scope of the specification.

b. One commenter noted that the language in Section 1.0 excluding rain sensors when used alone is sufficient clarification regarding weather-related sensors (i.e., soil moisture sensors).

Response: WaterSense appreciates the comment regarding the clarification.

c. Multiple commenters recommended language changes to the bullets in Section 1.0 that describe the type of controller to which the specification applies. These commenters expressed that the language was still biased toward the concept of ET. Specifically, the commenters noted that ET is only a benchmark for determining the effectiveness of a controller's ability to model landscape water needs. The commenters further indicated that the specification should not stifle manufacturing innovation, but allow for different, but equally effective approaches. Commenters recommend language changes as described below:

One commenter suggested a sentence stating the following:

> "This specification applies to controllers that create or modify irrigation schedules reliably comparable to evapotranspiration (ET) principles and methods such as: (followed by the bullet list in section 1.0 with "or" after each bullet)."

Another commenter suggested that the language describing the ET principles should be modified as follows:

> ". . .based on ~~evapotranspiration (ET)~~ *weather-based irrigation scheduling* principles . . .
> - Storing historical ~~crop evapotranspiration~~ data *on weather or irrigation needs* and characteristics of the site and modifying these data with an onsite sensor*; or*
> - Using onsite sensors as a basis for calculating real time ~~Et_c~~ *irrigation need; or*
> - *Systems* using a ~~central~~ *remote* weather station as a basis for ~~ET_c~~ irrigation calculations *and the transmission ~~of~~ data to individual ~~users~~ controllers from remote sites; or*…
>
> ….Because rain sensors do not modify ~~ET_c~~ *irrigation schedule programming* but interrupt . . ."

One commenter indicated that EPA should consider using terms such as "weather-based controllers using a water balance approach" or something similarly generic in nature. The commenter suggested the following language change:

> "This specification applies to controllers that create or modify irrigation schedules that adequately supply water without excess compared to a soil moisture balance that is calculated using crop evapotranspiration rates based upon the American Society of Civil Engrineers (ASCE) Standardized Penman-Monteith equation by:
>
> - Storing historical crop water use data characteristics of the site and modifying these data with an onsite sensor;
> - Using onsite sensors as a basis for calculating real time plant water requirement;
> - Using a central weather station as a basis for determining plant water requirements and transmitting the data to individual users from remote sites; or
> - Using onsite weather, climate or environmental sensors."

Another commenter suggested modifying the referenced list as follows:

- "Storing historical crop evapotranspiration data characteristics of the site and modifying these data with an onsite sensor *or real-time weather inputs transmitted daily to the controller;*
- Using onsite sensors as a basis for calculating real time *irrigation schedule adjustments based on ET principles;*
- *Using a cen*tral weather station as the basis for *irrigation schedule adjustments based on ET principles* and transmitting the data *to individual users from remote sites."*

One commenter suggested changing the last bullet to:

> "Using non-ET-based weather or climate sensors."

One commenter recommended changing the scope language from using crop evapotranspiration (Etc) to reference evapotranspiration (ETo). ETc may not be appropriate for stand-alone controllers, the commenter suggested, because it requires a very large amount of resources and may not be applicable in a specific landscape environment, and ETo is much broader. The commenter suggested changing the language as follows:

- "Using onsite sensors collecting ETo as a basis for approximating real time ETc;
- Using a central weather station collecting ETo as a basis for ETc approximations and transmitting the data to individual users from remote sites; or…"

In addition, the commenter suggested the following language:

> "Because rain sensors do not modify ETo or Etc, but interrupt irrigation events based on rainfall, they do not meet this onsite sensor requirement when used alone. "

One commenter requested that EPA expand upon the terms in this section for those who may not be familiar, or reference the SWAT protocol. The commenter also suggested the following language for clarity:

> "Utilize onsite, non-plant, but climatologic sensors to generate estimates of ETo, then manipulate this estimate with additional estimates or coefficients that have been developed through transfer of remote research, ground-truthing methods, and long-term validation in the field and modified further for micro-climate and density."

The commenter also requested the third bullet be changed for the people who have no background in irrigation to:

> "Using a remote weather station as a basis for ETo and subsequent ETc calculations, transmission of the data to individual users at remote user sites."

Response: WaterSense understands the concern of the commenters with respect to the emphasis on ET. The intent of the language "based on ET principles" does not require a product to use an ET equation nor ET data, but rather to use some type of weather data related to ET (e.g., temperature or solar radiation). In addition, the language closely mirrors what is currently included in the eighth draft of the Smart Water Application (SWAT) protocol for climatologically based controllers (SWAT protocol), which is the basis for the performance test for this specification. Therefore, WaterSense has decided to retain the language from the WaterSense *Revised Draft Specification for Weather-Based Irrigation Controllers* (revised draft specification).

d. One commenter requested that EPA change the name of the test protocol and subject device. The commenter suggested the name "climatologically-based controllers" rather than "weather-based" because "weather-based" misrepresents the capabilities of these products. In lieu of changing the specification name, the commenter requested that a sticker or prominent sign be placed on the device clarifying its functionality, for example, "Not a weather forecasting or weather predictive controller." The concern expressed is that the general public may assume that the controller has weather prediction or forecasting capabilities, based current language.

Response: WaterSense retained the title of the specification in order to be consistent with the more commonly used industry and publically recognizable term of "weather-based irrigation controllers," rather that "climatologically-based controllers." WaterSense maintains that product information adequately describes the function of weather-based controllers.

Inclusion of Large Commercial Controllers

e. Multiple commenters noted that the SWAT protocol was developed to test products designed and sold for residential and light commercial applications and is not suited to test large commercial products. Two commenters specifically noted that central control systems are more complex and diverse than what the SWAT protocol was developed to test. The commenters recommended the following language changes:

One commenter suggested replacing the last sentence in Section 1.0 with:

> "This specification applies to controllers used at homes and similar scale light commercial and institutional properties. This specification does not apply to central control systems."

To provide further clarification the commenter suggested changing the definition for stand-alone controller to:

> "This includes a single controlling device (i.e. the irrigation controller) and all of the onsite sensors and/or onsite receiver for direct climatological data without intermediary hardware/software."

Another commenter suggested deleting all references to central control throughout the protocol. The commenter suggested that EPA change the last sentence in Section 1.0 to say:

> "The specification applies to controllers capable of *accommodating no more than 48 irrigation stations designed* for use in residential *and/*or *light* commercial settings."

Another commenter suggested changing the last sentence in Section 1.0 to:

> "This specification applies to controllers for use in residential or commercial settings, not to exceed a maximum of 48 stations. Irrigation control systems that are often referred to as 'central control' systems are excluded for labeling."

Two commenters suggested adding central control system to the definitions section. One commenter suggested the following definition:

> "Central control system: A system of one or more controllers connected to a central processing unit or other intermediary hardware/software interface between the controller and a weather station."

A second commenter suggested the following definition:

> "Irrigation Central Control System: A computerized system that manages the operation of multiple controllers at one or more sites."

Response: WaterSense decided not to exclude large commercial or central controllers from this specification. EPA determined that the specification's performance test protocol adequately tested these products functionality. EPA agrees that these controllers should have a more rigorous test protocol, but since there is no such protocol in existence at this time it would include them in this specification and consider additional requirements for a future version. Including these products broadens the scope of the specification to more applications and increases the water savings potential from weather-based irrigation controllers used in commercial and institutional settings.

II. Comments on Section 2.0 Summary of Criteria

All comments regarding the Summary of Criteria are included in the relevant sections below.

III. Comments on Section 3.0 Performance Criteria

Adoption of SWAT Test Protocol

a. One commenter stated the SWAT test protocol is not robust enough for the WaterSense labeling process because it is a bench test of the hardware and not a measure of the actual performance of the equipment in the field. The commenter recommended that EPA include a field test protocol for the irrigation controller.

Response: At this time, a field test protocol to determine the performance of weather-based irrigation controllers has not been developed nor accepted by the irrigation industry, utilities, or other WaterSense stakeholders. In addition, WaterSense has decided not to pursue a field test at this time due to the intensive resources that would be required for product certification and extended test length. WaterSense has determined that the SWAT protocol performance measures of irrigation adequacy and irrigation excess are appropriate for gauging product performance. Therefore, WaterSense has based the performance test protocol for this specification (with modification as listed in Section 3.1 of the specification) on the SWAT test protocol for climatologically based controllers.

b. One commenter expressed concern that, because the SWAT protocol is incorporated by reference, when changes or updates are made to the protocol it would affect the WaterSense specification, perhaps even without EPA's knowledge or consent. The commenter recommended that EPA review and approve any proposed changes to the SWAT protocol. Specifically the commenter suggested modifying the first sentence in Section 3.0 to read

   "…tested in accordance with the most recent ***EPA-approved*** version of the Smart Water Application Technologies (SWAT) test protocol for climatologically based controllers…"

Response: WaterSense changed the language to reference the eighth draft of the SWAT protocol and included the protocol as an appendix to the specification. This allows readers to have all of the pertinent information in one document.

Testing Modifications to the SWAT Protocol—General Comments

c. One commenter noted that the modifications recommended in Section 3.1 of the specification are based on flawed logic. The commenter stated that the irrigation industry's effort to develop a smart controller was an attempt to integrate the effects of soils, plant physiology, climate, topography and the irrigation system to provide effective and efficient use of water. Further, it was recognized that to minimize irrigation water requirements, the effects of rainfall needed to be maximized. It was also considered critical that the system operate without human intervention. The commenter noted that a testing protocol was developed and used to evaluate the degree of effectiveness of 25-30 controllers over a period of 5 to 6 years.

Response: WaterSense made modifications to the SWAT test protocol based on two independent research studies conducted by the University of Florida. Details on the study results are located at http://www.epa.gov/watersense/partners/controller_background.html. Details and reasoning regarding these modifications are located in the supporting statement located at http://www.epa.gov/watersense/partners/controller_background.html.

d. One commenter suggested adding a Section 3.1.6, "Particularly Critical Challenges for Future Consideration," with the following language: "At this time, the SWAT protocol assumes uniformity in soil physical properties throughout and slightly even beyond 2 feet in depth, which is reasonable for woody plants and trees. Users with plants and trees, particularly micro-drip irrigated ones, will be advised by manufacturers that periodic evaluation of the soil moisture content will be required with this first generation of controllers,

since the controller may be incapable of integrating variable soil properties below 10 to 12 inches, thus incapable of rendering a true estimate of soil moisture depletion verifiable by laboratory analysis."

Response: WaterSense did not include this language because it does not directly relate to the modifications to the SWAT test protocol as listed in Section 3.1 of the specification.

Testing Modifications to the SWAT Protocol—Section 3.1.1 Minimum Runtimes

e. Multiple commenters suggested that EPA reduce the minimum runtime (to as low as 30 seconds) or delete the requirement all together.

Many commenters noted that there are situations where reasonable programming instruction may lead to cycles of less than 3 minutes (i.e., clay soils or steep slopes where cycle and soak is needed). Several commenters also pointed out that in some circumstances a 3-minute runtime could even cause wasted water from runoff.

One commenter noted that this modification had no scientific basis and suggested it be eliminated.

In addition, one commenter noted that some products are not currently designed to have a 3-minute minimum runtime, and it could cost manufacturers a significant amount of money to include this requirement, while saving little to no water.

f. As an alternative to eliminating or shortening this requirement, several commenters suggested language changes with respect to the minimum runtime and cycle-soak schedules.

Two commenters suggested the following language:

> "Irrigation days shall have a minimum of 3 minutes of run time, either as a single application or applied in a 'cycle and soak' strategy, so that a minimum of 3 minutes of runtime is achieved and the soak time does not exceed 30 minutes between cycle starts."

Two commenters suggested that the aggregate of irrigation cycles within a 24-hour period of time be a minimum of 3 minutes. One commenter suggested the following language:

> "The total station daily runtime (sum of all the daily irrigation cycles) that occurs during the test period must be greater than 3 minutes in duration. The total water applied to an individual station during a day's irrigation events totaling 3 minutes or less shall be excluded from the daily water balance calculation."

g. One commenter supported the idea of a 3-minute runtime, however, cautioned EPA to recognize that there are certain other functions an irrigation system could also serve (e.g., filling a pond, flushing a filter, or cooling turf) where a runtime of less than 3 minutes may be necessary. To address these applications, the commenter suggested that EPA make clear to the certifying bodies the intent of the 3-minute runtime. The commenter noted that a controller manufacturer may design a controller to actuate a valve for less than 3 minutes,

which should be allowed. This would not affect the testing for the minimum runtime and suggested that the specification should continue to ignore runtimes less than 3 minutes. However, the commenter proposed the minimum runtime be changed to 2 minutes and 55 seconds to allow for a slight margin of error in the station timing and the logging process.

d. Due to the attributes of Zone #2 in the SWAT protocol virtual landscape (e.g., soil type, slope and root zone working water storage), one commenter requested that, either the 3-minute runtime requirement change or the 6.60 minute maximum runtime be increased for Zone #2 to approximately 12 minutes. This can be achieved by changing the soil type, slope or both.

Response: WaterSense has decided to maintain the 3-minute minimum runtime requirement. The University of Florida research indicated that during testing, some controllers scheduled irrigation events with unrealistically short runtimes—in some cases, less than 2 minutes. Runtimes of this length may not fill the irrigation system and in the field would not deliver the intended water to the landscape. The current SWAT protocol does not have a minimum runtime, allowing for these unrealistically short runtimes. Requiring a minimum runtime will help ensure that weather-based irrigation controllers schedule irrigation during testing that will mimic realistic schedules found in the field. This requirement does prevent products bring being capable of runtimes of less than 3 minutes, it is only applicable to the product performance test. With respect to making the intent of this requirement clear to the licensed certifying bodies, EPA will discuss this modification and its purpose at future performance test protocol trainings.

h. One commenter asked if this section was intended to read “each zone must run for 3 minutes.”

Response: The intent with the minimum runtime requirement is that each zone cannot run for less than 3 minutes, as discussed in the response above.

Testing Modifications to the SWAT Protocol—Section 3.1.2 Missing Data from the Reference Weather Station

i. Two commenters supported EPA’s approach for addressing missing reference data.

Response: WaterSense thanks the commenters for their support on this topic.

j. b. Two commenters recommended language changes regarding the use of the term ET data under this requirement.

One commenter requested that “ET” be replaced with “ETo” because “ET” can be easily mistaken for other types of ET.

Another commenter recommended that the missing weather data be referred to as “weather inputs” instead of “ET data” because the term ET data is erroneous at its core and not directly measurable. The source of the data should be more flexible, the commenter said, and not limited to an ET gauge as the specification language may currently imply. The commenter also requested that the term “reference weather station” be replaced with “weather source data.”

Response: WaterSense has decided to not to revise this language in the specification from ”ET data” to “ weather inputs” because the SWAT protocol requires the use of ET data to calculate the performance criteria of irrigation adequacy and irrigation excess. However, WaterSense agrees with the comment regarding designation of reference evapotranspiration, or ETo, and has replaced “ET” with “ETo.”

Testing Modifications to the SWAT Protocol—Section 3.1.3 Root Zone Working Water Storage (RZWWS) Starting Point

k. One commenter agreed with the change to require a full RZWWS, but noted that there is a problem with this requirement. Specifically, the problem is related to the time of day when the test starts, when the smart controller receives or calculates ET, and if rain occurs on the first day. The commenter suggested several options EPA could consider to resolve these issues:
   - Implementing moisture balance calculations on an hourly time step;
   - Allow the licensed certifying body to adjust rainfall or ET values on the first day; or
   - Require that testing begins early in the morning.

l. Multiple commenters recommended that the RZWWS start at half full, as currently designated in the SWAT protocol.

One commenter noted that starting at full could lead to an over-irrigation condition of an otherwise fully qualified controller.

Another commenter noted that manufacturers have been following the half-full requirement under the current SWAT protocol, and changing this to full this late in the process would unfairly penalize manufacturers. In addition, the commenter noted that, if the controller comes out of the box set to anticipate a full root zone, users must saturate the irrigated area or they will think the product is not working when watering does not occur soon enough. The commenter also noted that the irrigation excess threshold starting with a full root zone strongly favors controllers that use more complex inputs over controllers with simple user interfaces. Finally, the commenter noted that the RZWWS is a fixed number for each zone, so starting the test tracking spreadsheet with a full or half full RZWWS is equally as easy.

Another commenter explained that few homeowners or irrigation professionals know their root zone working water storage starting point when programming their controllers. Therefore, in order to make programming more user-friendly, many manufacturers do not require the user to enter a starting point. For those that are required, most professionals assume a 50 percent starting point for ease. Therefore, using 50 percent is the most representative of how the controller will be used. In addition, the commenter stated that instead of manufacturers sharing the universal goal of bringing the landscape up to field capacity immediately, the controllers would immediately begin reducing irrigation times, leading to widespread landscape stress and consumer dissatisfaction. In reaction, consumers could increase their water budget or even abandon their smart controller.

One commenter stated that there is no scientific basis for this change and explained that if rainfall is to be used effectively, a portion of the RZWWS should be left unfilled to allow for the storage of rainfall. The commenter noted that even in dry periods, there is no incentive to completely fill the root zone and risk runoff in the wet portion of the sprinkler pattern.

Another commenter stated that it is unreasonable to begin with a full root zone. Any irrigation on the first or second watering day would result in a potentially large surplus, causing most controllers to fail by exceeding the strict 5 percent surplus requirement.

One commenter explained that the controller can't anticipate where the 30-day test cycle will begin. It needs weather data to make decisions. Having the test cycle start in the middle of the RZWWS allows the weather-based controller to make the appropriate adjustments.

Response: WaterSense deleted the modification that the RZWWS start at full after determining that licensed certifying bodies could determine a root zone working water storage of "half full," ensuring consistent performance testing across laboratories. This returns the starting point of the RZWWS as designated in the SWAT protocol. Note that this aspect of the performance test applies only to the test itself and does not determine how controllers are programmed in the field.

m. Two commenters expressed concern that if the RZWWS started at full, then some zones may never irrigate. The commenters recommend that an irrigation event be required to occur in each zone.

One commenter suggested that EPA add the following statement to Section 3.0:

> "At a minimum every virtual zone must cycle at least twice during the performance period before a test may be deemed completed. The test must continue until this threshold is achieved."

The commenter further suggested that EPA interview manufacturers regarding their assumptions that are made about initial conditions before the decision to implement a full initial RZWWS assumption is finalized.

Another commenter requested that the RZWWS start at half full and each zone be required to irrigate once during the test period for the test to be valid.

Response: WaterSense understands the concern of the commenters, but decided not to add this requirement to the specification due to its potential unintended consequence of extending the test length past the 30-day test duration requirement. The University of Florida study showed that in a sufficiently rainy climate some zones may never or almost never require supplemental irrigation in a reasonable time frame for product testing. WaterSense believes this is a desirable outcome and demonstrates that the controllers are actually only providing irrigation when needed.

n. One commenter recommended that EPA modify the RZWWS calculations table in the SWAT protocol to shallower root systems resulting in RZWWS values ranging from 0.27 to a maximum of 1.14 inches. The commenter explained that 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. The commenter suggested the following RZWWS values:

Zone 1: 5" root depth = 0.42"
Zone 2: 4" root depth = 0.27"
Zone 3: 12" root depth = 0.54"
Zone 4: 16" root depth = 1.14"
Zone 5: 20" root depth = 1.8"
Zone 6: 6" root depth = 0.35"

Response: WaterSense decided not make this change to the specification because this recommendation is not directly related to the SWAT protocol modifications in Section 3.1 of the WaterSense specification, but rather on the SWAT protocol itself, which is not currently open for public comment. Comments on protocol details such as this one should be made to the SWAT committee during the protocol's next public comment period.

o. One commenter noted that the RZWWS, as defined in the SWAT Protocol, must be programmed as full at the beginning of the test. By full, the commenter indicated, turf zones should be at field capacity, and that Zones 3, 4, and 5 must also be fully wetted zones. The commenter said future amendments to this specification must address such realities as: 1) usually less than 50 percent of the micro-drip irrigated areas are actually wetted, yet full production is easily achieved, albeit not without more frequent irrigation deliveries and (theoretically) closer attention to plant nutrition; 2) criteria should embrace "xeriscapes," whereby there are often significant spaces where plant canopy cover is incomplete; 3) for nearly all new landscapes, canopies and root systems expand and/or become more dense, which effectively reduces the application rates; and 4) conventional calculations of "precipitation rate" may need better explanation and assessment. All four items, the commenter said, put pressure on to further explore the term RZWWS in non-turf zones.

Response: WaterSense will keep this recommendation in mind for future specification revisions. Comments on protocol details, such as changes to the definition of RZWWS, should be made to the SWAT committee during the protocol's next public comment period.

Testing Modifications to the SWAT Protocol—Section 3.1.3 Rainfall Requirement

p. Two commenters generally supported the rainfall requirement.

One commenter noted that the requirement may lengthen the time the controllers will be in testing mode to meet the minimum ET and rainfall requirements set forth by the specification.

Another commenter suggested adding the word "gross" to paragraph 3.1.4:

"….four days during the test period with 0.10 inches or greater of *gross* precipitation …"

This will provide consistency with the definition of gross rainfall (R) in the SWAT protocol, the commenter noted. Alternatively, the commenter recommended that the soil moisture model should more accurately reflect real-time conditions. The commenter offered the following changes to the SWAT protocol language in relation to the rainfall requirement:

- Change the Moisture Balance Spread Sheet calculations to an hourly time step. This means rainfall, ET, and irrigation would be accounted for on an hourly basis. The model is far more accurate, according to the commenter.
- Eliminate RN = 0.8 (R), inches from the protocol and quantify effective rain based on the soil intake rate by ignoring rain that falls faster than the soil can absorb. Note from the commenter: The SWAT protocol already recognizes the soil intake rate to ignore run-off from sprinklers, this should be applied to quantify effective rain.
- Change the protocol to recognize the difference between saturation and field capacity.

q. Multiple commenters expressed concern that this requirement may be difficult to achieve or is restrictive to certain areas of the country—for example, in Fresno, California, where SWAT testing currently occurs.

One commenter suggested keeping the current 30-day requirements but reducing the requirement of 0.10 inch rain days from four to three.

Another commenter suggested keeping the general requirement, but instead of using an average of 0.10 inches of rainfall across the country, recommended using a minimum based upon the specific area of the country and a maximum expected time to test the unit. As an example, the minimum rainfall would be 0.025 inches over four events and, with this criteria, the test would be expected to last no more than 60 days.

r. One commenter noted a lack of science behind the conclusion upon which the rainfall requirement is based. In addition, the commenter explained, the variability of scores is not related to the SWAT test transferability; the scores are an indication of how well each manufacturer has dealt with the challenge of integrating the influences of the sciences involved. The commenter noted that the best way to increase the opportunity for adequate rainfall events is to change the test period length from 1 to 2 months and increase the minimum rainfall requirement to 0.80 inches.

Response: WaterSense understands the concerns of stakeholders regarding the potential extension of the test duration or limited test locations due to the modified rainfall requirement. Results from the University of Florida research, which tested controllers during a rainy period, indicated that performance scores are not transferable from dry to wet climates. In order to ensure that the controllers will perform in a wet climate, they must be tested under frequent rainfall conditions.

Recognizing that the modified rainfall requirement may affect where and when the products may be tested, WaterSense analyzed precipitation data from the National Climatic Data Center for 22 cities across the country to determine the extent of the potential impact on potential testing locations. While some cities would not be able to meet the requirements throughout a typical year, at least 12 of the cities at any given time were able to meet the requirement during a typical year. In addition, during portions of the year, such as March, 21 of the 22 cities were able to meet the rainfall criteria during a typical year. Based on this analysis, WaterSense determined that across the country there are many cities that can meet this requirement, and if laboratories are available, these cities could serve as a testing location.

WaterSense agrees with the need to clarify that the reference to the precipitation is in fact "gross" precipitation and has added the term "gross" to Section 3.1.4 as suggested to be consistent with the terminology used in the SWAT protocol.

Testing Modifications to the SWAT Protocol—Section 3.1.4 Order of Operations

s. Multiple commenters requested that the order of operations be kept as currently calculated in the SWAT protocol.

Two commenters noted that the approach taken in the SWAT protocol is to maximize the effectiveness of rainfall first. Irrigation is meant to be supplemental, meaning that irrigation takes place when there is insufficient precipitation to meet the water need of plants. Two commenters noted that this change in the order of operations would allow products to more easily achieve the WaterSense label and that it discourages the development of products that have the ability to assess the likely probability of rain.

One commenter stated that the new order of operations proposed by EPA puts all ET sensors that do not measure rainfall at a disadvantage. Another commenter expressed concern that the order of operations should not be what is "fair to the controllers," but measure how well the controllers manage to minimize use of supplemental irrigation and allow maximum use of rainfall. If some controllers manage this better than others by either not completely filling soil with water, by having more accurate rain devices (tipping buckets or better rain sensors), or by using more complete weather data to anticipate rainfall to prevent irrigation this commenter said, then that should be reflected in the results for consumers.

t. One commenter was in support of this change, noting that controllers should not be expected to predict rain events. This change prevents penalizing a controller's test score for watering before a rain event occurs.

Response: WaterSense has decided to retain this modification to the order of operations. The University of Florida research conducted in 2010 concluded that the order of operations, as specified in the SWAT protocol, impacted performance scores because the moisture balance unfairly penalized controllers for not being able to predict rainfall. WaterSense understands the concern of stakeholders that prefer that the test protocol measure a controller's ability to predict rainfall, but at this time the majority of the products on the market do not have such predictive capabilities. This is a characteristic WaterSense would like to see products be able to incorporate in the future and will consider revising the order of operations in future versions of this specification. The current version provides WaterSense with an adequate performance test that remains fair to the products currently on the market.

Requirement for Each Zone to Pass the Performance Criteria

u. Multiple commenters were in support of this requirement.

One commenter noted that in many parts of the country, irrigation of turfgrass does not represent the major use of an irrigation system (e.g., parts of the desert southwest). It is

reasonable for both utilities and customers to expect that a WaterSense labeled product be able to perform in this type of environment as in any other, the commenter said.

One commenter noted that a passing rate for each zone rather than an average of six zones clearly demonstrates the performance of the controller.

One commenter agreed that the performance values should not be averaged across zones, but stressed that the 95 percent threshold for scheduling efficiency is purely arbitrary and has never been written into the SWAT testing protocol. The commenter noted that the SWAT testing protocol reports the values for each zone, and that averaging values was instituted by the SWAT committee. As originally visualized, the commenter said, the threshold values were best set by individual water purveyors. In chronically water short areas, the commenter noted, high values could be justified. National standards may not be practical, the commenter said, and the values obtained represent the current "state of the art."

v. Multiple commenters were not in support of the requirement of each zone having to pass the thresholds and requested that the average of performance across zones be used instead.

One commenter stated that this requirement does not match the SWAT protocol, which states that the average of all stations must be greater than or equal to 80 percent. The commenter noted that it would be difficult to achieve 80 percent or more efficiency and 5 percent or less excess.

Another commenter recommended that WaterSense maintain the overall efficiency at 5 percent but allow one or two zones to exceed the excess by some figure between 5 and 10 percent.

One commenter agreed that irrigation adequacy should be greater than or equal to 80 percent for each zone, but strongly disagreed that the irrigation excess requirement be applied to each zone. Instead, the commenter said, the irrigation excess requirements should be applied to the average across the zones. The commenter explained that the industry has worked with, designed to, and invested millions of dollars in developing products based on the expectation that excess would be measured as the average of the six SWAT zones. Changing this measure now will inhibit or prevent some very good products from earning the label, succeeding in the market, and thereby saving more water, the commenter noted. In addition, the commenter said, due to some design constraints, weather-based irrigation controllers that are much easier for average homeowners to understand generally will not perform as well on the WaterSense test; however, they are easy to use, will appeal to the mass market, and as a result they will be priced much lower than many other models. If sold with the WaterSense label, the commenter said, these products will get installed in more homes and save much more water. Limiting excess to 5 percent on each zone instead of the average of the six zones will not save much, if any, additional water, and meeting a 5 percent average excess is very efficient compared with controllers in use today, the commenter noted.

Another commenter noted that extreme conditions make compliance with some of the virtual landscape zones less probable than would be expected with less exotic, real-world conditions. Requiring each zone to pass individually raises the performance threshold on manufacturers beyond a point of benefit for the majority of customers, the commenter said. The landscape

parameters being tested represent a wide range of conditions and restrictions, the commenter noted, with hydrozones 3, 4 and 5 being fairly exotic. By requiring each controller to pass individual zones, the commenter said, manufacturers will need to increase the cost of their product to address the wide range of requirements; measuring on combined results would be more representative of the majority of users.

Response: WaterSense has decided to retain the criteria that each zone must pass the performance threshold but has changed the irrigation excess threshold from 5 percent to 10 percent for each zone as discussed below. Retaining this requirement for each zone to pass will ensure labeled products are capable of performing well in a variety of landscape conditions.

Irrigation Adequacy Performance Criteria

w. One commenter recommended that EPA provide for gradient terms such as maximum efficiency (80 percent) to acceptable efficiency (100 to 105 percent) or something similar. The commenter explained that the minimum of 80 percent irrigation adequacy infers a poorer performance than a 100 percent adequacy, which the manufacturer may pursue by adjusting the controller, yet the 80 percent achieves the greater water conservation. Although 80 percent is considered excellent from a conservation perspective, the commenter noted, it is instinctive for a consumer to look for 100 percent. Therefore, the commenter said, the manufacturers are trying to get adequacy closer to 100 percent than to 80 percent, which is a detriment to getting the controllers to function well and not overwater. The commenter noted that this may explain why some controllers are not saving as much water as expected. If the metric were re-worded in some way such that it was a proportion of how close it got to the 80 percent, the commenter said, perhaps it could address this concern (in other words, make it sound good to be close to 80 percent instead of close to 100 percent).

Response: WaterSense agrees that not watering at 100 percent of ET is good practice for achieving water efficiency in the landscape. This information will be included in educational materials, but WaterSense has determined it was not appropriate to change the functionality of the SWAT protocol and scoring at this time. Additionally, the WaterSense specification provides a pass/fail threshold, and WaterSense will not be publishing scores, thus eliminating the incentive to score 100 percent instead of 80 percent.

Irrigation Excess Performance Criteria

x. Two commenters disagreed with the irrigation excess performance criteria of 5 percent for each zone.

One commenter stated that the irrigation excess threshold of 5 percent is too low and requested that EPA increase the threshold to 10 percent. The commenter noted that 5 percent is less than the normal leaching requirement practiced for salinity management (10 percent).

One commenter suggested that the irrigation excess for the six zones should not exceed a 5 percent average, or 10 percent in any zone. The commenter stated that strictly adhering to a 5 percent surplus per zone in combination while starting with a full root zone makes it

unreasonably difficult to pass for many controllers. The commenter explained that it will be difficult for controllers with three programs to satisfy six diverse irrigation needs of the virtual landscape, which will rarely if ever be present in a real landscape environment. Imposing a strict 5 percent surplus per zone in addition to that limitation is not reasonable, the commenter said, particularly starting with a full root zone.

Response: WaterSense agrees with these commenters that requiring a maximum of 5 percent excess on each zone for this version of the specification would require a level of performance that may be very difficult to achieve, considering the other modifications WaterSense made to the SWAT protocol. Therefore, WaterSense changed the irrigation excess performance criteria to be less than or equal to 10 percent for each zone. WaterSense maintained the 5 percent threshold by additionally requiring the average of the irrigation excess scores calculated across the six zones to be less than or equal to 5 percent. This prevents any one zone from scoring in extreme excess of the 10 percent zone requirement. WaterSense is confident that these combined performance thresholds provide an adequate level of performance with respect to irrigation excess.

Difficulty Meeting the Specification Due to the Combination of Requirements

y. One commenter expressed concern that the combination of three "Testing Modifications to the IA SWAT Protocol" requirements are too restrictive, including
   1) A minimum runtime of three minutes;
   2) Starting with a full root zone; and
   3) Requiring "each zone" to pass adequacy and excess requirements.

The commenter expressed the following concerns:

- It will be a confusing requirement that undercuts the credibility of the WaterSense specification if testing requires 3-minute runtimes but actual field applications do not. Actual field applications and conditions could exist where slopes, plant species, and soil types require less than 3 minutes of irrigation to prevent run-off. For water conservation, the commenter suggested EPA does not want to mandate a 3-minute minimum for testing that may also impact longer field irrigation application when not necessary.
- There is no experiential or scientific data supporting the full RZWWS change requirement to the SWAT protocol. A half-full RZWWS starting point is a good starting point, the commenter said, as actual conditions in the field will vary and the extreme of either full or empty RZWWS in the field is likely unrealistic.
- Each zone and real life field landscape designs vary. The SWAT protocol mixes various soil types and is just one representation of many potential landscape applications mixed together. The test is to rate the performance of the controller as a whole, the commenter noted, not one specific zone or one specific set of landscape parameters. Using an average of the six zones is a better representation of performance when actual real life landscape designs, irrigation method/components, and scheduling methods vary, the commenter said. It was noted that EPA reported that many who commented recommended the average of six zones be used to meet the performance criteria. These recommendations are from professionals that have been in the irrigation industry for many years and have a passion for water conservation and a desire to make smart controllers and the WaterSense program successful, the commenter noted.

The commenter suggested the following language:

- Revise Section 3.1.1 language to 1-minute minimum runtime.
- Remove the 3.1.3 RZWSS section.
- Revise Sections 3.2.1 and 3.2.2 to reflect "average irrigation adequacy" and "average irrigation excess."

Response: WaterSense agrees that the combination of these modifications to the SWAT protocol and performance criteria were excessively stringent for the first version of this specification. As discussed above, WaterSense deleted the modification changing the starting point of the RZWWS to start at full. In addition, WaterSense changed the irrigation excess criteria to require each zone to be less than or equal to 10 percent, while the average irrigation excess across zones shall be less than or equal to 5 percent. WaterSense is confident that the combination of the performance criteria and modifications to the SWAT protocol will result in WaterSense labeled products that are capable performing well in the landscape setting.

IV. Comments on Section 4.0 Supplementary Feature Requirements

General Comments

a. One commenter supported most of the changes WaterSense made to this section from the first draft specification to the revised draft specification. The commenter noted that the table format of the January 2011 draft specification is concise, readable and easy to understand and that the current language in Section 4.0 is for the most part performance-based.

Response: WaterSense thanks the commenter for this input.

b. Two commenters recommended removing the columns indicating “smart mode” versus “standard mode.”

One commenter noted that the capability 4.2 and 4.3 should be required in smart mode. Section 4.7 clearly describes the performance requirements, the commenter said; having the two columns to differentiate between smart mode and standard mode does not add clarity.

Another commenter noted that the formatting of Table 4.0 is confusing and that a controller that has the WaterSense label will be “smart” and should always be in some smart mode. If the controller has lost communication with its signal or local sensor it should still be in some “smart” mode, the commenter said. The commenter noted that by removing the columns labeled “Required in Smart Mode” and “Required in Standard Mode,” these will just be requirements that all WaterSense controllers must meet.

Response: WaterSense agreed that the smart mode verses standard mode language needed clarification and simplified this language by removing the table indicating the appropriate mode

for each capability. In the final specification, all capabilities listed apply to both smart and standard mode.

Section 4.1 Capability of Non-Volatile Memory

c. Two commenters noted that it is unclear how long the controller must be capable of preserving the settings. One commenter suggested a time frame of two weeks. The other commenter recommended 72 hours.

Response: WaterSense has decided to retain the language from the revised draft specification and did not include a time limit recommended by commenters in order to avoid being too prescriptive for this capability. In addition, WaterSense modified the language to remove the correct calendar date and time to further reduce the prescriptive nature of this capability.

d. One commenter stated that many manufacturers have different means and methods of preserving the contents of the irrigation program settings and date/time without the use of a battery. The commenter agreed this is an important requirement and stated that EPA should not need to dictate whether a battery can or cannot be used (i.e., means and methods), since it neither promotes nor helps conserve water in any fashion. The commenter recommended the following language: "The controller shall be capable of preserving the contents of the irrigation program settings and the correct calendar date and time when the power source is lost and power restored to the controller."

Response: WaterSense has decided to retain the language from the revised draft specification, because it was the intent of the working group that drafted this language that a battery not be used for backup storage. Stakeholders voiced concern that a backup battery may not be reliable for the long term if power is lost.

e. One commenter noted that this model uses a checkbook method, and that value is present, yet inaccessible. The processor calculates estimated soil water balance and acts upon those calculations, the commenter said; continuous-moving 30 days of time and date stamps associated with the calculated RZWWS for each zone just preceding each cycle start should be stored and accessible through a simple data port. Additionally, the commenter noted, a button should be available, which when pressed at any point in time for each zone, will show the calculated current balance in each RZWWS by scrolling through stations on the display.

Response: WaterSense appreciates this comment, but did not make any changes because the suggestion is not related to non-volatile memory.

Section 4.2 Capability for Multi-Programmed Zone-by-Zone Control

f. One commenter recommended that the controller should either be capable of independent, zone-specific programming, or storing a minimum of three different programs to allow for separate schedules for zones with differing water needs. The commenter stated that the language used is vague and recommended the following change:

"The controller shall either be capable of independent, zone-specific programming or storing a minimum of three different programs to allow for separate schedules for zones with differing water needs."

Response: WaterSense made this change to clarify the language as recommended by the commenter.

Section 4.3 Capability to Indicate a Lost Signal

g. One commenter noted that the table titles for the columns make it unclear whether the indication of a lost signal capability is required when the controller interface indicates that the controller should be in smart/standard mode, or whether the capability is required when the controller is actually operating in smart/standard mode. For example, the commenter noted, if a dial on a controller is set for smart mode on the controller, and the weather sensor connection is lost, the controller interface says that the controller is in smart mode, but the controller is operating in standard mode. Adding an "X" to the smart mode column assures the capability for indicating to the user when the controller is not receiving a signal or local sensor input regardless of interface settings, the commenter suggested. User notification that a device is not adjusting irrigation based on current weather conditions due to an interruption in receiving signals and/or local sensor inputs is important for assuring water saving potential, the commenter said and recommended adding a second "X" under "Required in Smart Mode."

Response: WaterSense addressed this comment by removing the table with the columns indicating the operating mode for each capability. In the final specification, all capabilities are required in both smart and standard modes.

Section 4.4 Capability to Connect to a Rain Sensor

h. One commenter questioned the purpose of having a means for indicating to the user when the rain sensor has suspended irrigation. The commenter asked how long the message on the controller should appear and noted that this portion of the requirement is a "nice-to-have" feature rather than one that is consistent with water conservation mission of WaterSense. The commenter recommended removing the latter part of the requirement and proposed the following language:

"The controller shall either include a rain sensor or be capable of interfacing with a rain sensor to suspend irrigation."

Response: WaterSense agreed with the commenter and removed the requirement that the controller indicate when irrigation is suspended due to rain. WaterSense may consider adding this requirement into future versions of the specification.

i. One commenter requested that a tipping bucket rain gauge be recognized as a "rain sensor."

The commenter explained that rain input to a smart controller may come from a variety of sources, not just a traditional "rain sensor," often called a "rain shut-off device." The commenter recommended the following language:

> "4.4 The controller shall either include a rain sensor or be capable of interfacing with a rain sensor or *tipping bucket rain gauge* and shall have a means for indicating to the user when the rain *event* ~~sensor~~ has suspended irrigation."

Response: WaterSense agrees with the commenter that the term "rain sensor" excluded tipping bucket rain gauges, which was not the intent. Therefore, WaterSense has modified the term "rain sensor" to "rainfall device" and included a definition of "rainfall device" in the specification as follows:

> "Rainfall device: A device that either senses or measures rainfall to reduce or interrupt irrigation in response to rain events. For the purpose of this specification, this includes rainfall interrupt devices and tipping bucket rain gauges."

Section 4.5 Capability to Connect to a Flow Sensor [Commercial Controllers Only]

j. Multiple commenters requested that EPA delete this requirement.

Two commenters noted that reinserting language regarding number of stations at this juncture, especially a large number of stations such as 48, creates ambiguity regarding whether this specification might apply to central control irrigation systems. While Section 1.0 defines the controller as stand-alone, the commenter noted, it may be clearer to add language to exclude central control systems from testing and labeling in Section 1.0.

One commenter noted that Section 4.5 specifies a sensor unrelated to weather.

Two commenters expressed concern that there is currently no test protocol for flow sensors to assure performance.

One commenter recommended limiting the scope to controllers that control less than 48 stations, rather than allowing larger controllers and requiring the products be able to interface with a flow sensor. The commenter considered the portion of the sentence "shall either include a flow sensor or be capable of interfacing with a flow sensor" to be vague to the point of uselessness and insufficient to assure a flow sensor capable central control unit or, for that matter, a quality central control product.

k. One commenter noted that the relationship between station count and critical need for flow sensors may be a bit off point, but stated that station count seems to be the only categorization available. The commenter recommended that controllers with nine or more stations shall either include or be capable of interfacing with a flow sensor.

Response: WaterSense agrees with commenters that a flow sensor should not be used to define large commercial products and removed this capability from the specification.

Section 4.6 Accommodating Watering Restrictions

l. One commenter supported this requirement, offering appreciation that EPA attempted to assure that WaterSense labeled weather-based irrigation controllers will work well practically in field installations. The commenter commended EPA's attempts to accommodate jurisdictions' varying watering restrictions as demonstrated in this section. In practical terms, the commenter said, utilities and other jurisdictions have and will continue to have watering restrictions in response to possible water shortage conditions. The commenter noted that EPA has made a strong effort to try to assure that these products will align with restrictions by covering essentially all of the common types of restrictions in this supplemental capabilities section. This is much more feasible than expecting jurisdictions to implement special exemptions for those with smart controllers, the commenter said.

m. One commenter questioned whether the requirement provides water conservation or smart irrigation. The commenter noted that many times, individuals who have restrictions such as these will actually irrigate more. The commenter suggested that it be left to each state or local government entity to determine if they require these criteria.

Response: Because WaterSense is a national program and the label must apply across the country, WaterSense has decided to retain this requirement so that all state or local governments can rely on the WaterSense label to identify high performing products that are capable of complying with local watering restrictions.

n. One commenter asked why WaterSense included the following requirement: "The ability to set irrigation runtimes to avoid watering during a prohibited time of day (e.g., irrigation will not occur between 9:00 a.m. and 9:00 p.m.)" The commenter noted that this can already be done with any controller. The commenter said that a limited number of advanced control systems have a blackout period, and this type of feature adds complexity. In addition, the commenter said, most smart controllers do not have a blackout window. The commenter suggested eliminating this language and adding a requirement that would not recognize any watering occurring between 9:00 a.m. and 9:00 p.m. (similar to Section 3.1.1, which excludes any watering less than 3 minutes).

Response: WaterSense has decided to retain this specific ability to set irrigation runtimes to avoid watering during a prohibited time of day, because it was deemed to be important to utilities that implement these types of watering restrictions. Although the commenter pointed out that all controllers on the market have this capability, WaterSense maintains that it is important to ensure that new products entering the market also have this capability in order to bear the WaterSense label.

Section 4.7 Default Settings When Signal Is Lost

No comments were received on this section.

Section 4.8 Allow Manual Operation/Return to Default Mode

o. One commenter expressed concern that the language in Section 4.8 can be construed to confuse the manual operation and the troubleshooting functions. The manual operation function can be used for troubleshooting, the commenter said; therefore the language could be simplified. The commenter recommended the following language:

> "The controller shall be capable of allowing for manual operation. The window for manual operation shall be limited, and the controller shall automatically return to default mode, even if the switch is still positioned for manual operation."

p. Multiple commenters requested that WaterSense eliminate this requirement.

One commenter stated that this requirement would be very difficult to implement in controllers, specifically the part about automatically returning to default mode. In order to comply with this requirement, the commenter said, irrigation controllers would require a software-based switch that could be programmed with logic to automatically return to default mode after a set period of time. Currently the "dial" is used by many manufacturers as the way to scroll through the different programming functions, the commenter said, and noted that this requirement would add cost to the product and would change the design of current irrigation controllers significantly.

One commenter stated that this requirement is not needed and will only create problems. Every controller has manual station control, the commenter noted; if the user makes a mistake and leaves it in manual mode, water will be saved because the clock will not activate a valve automatically.

One commenter noted that troubleshooting is one of the many reasons landscape contractors utilize manual operation. Limiting the overall time a controller can run manual irrigation will require inefficient workarounds by landscape contractors to perform required operations, the commenter said. Troubleshooting is only one method of manual operation usage, the commenter noted; manual operation can also be used to learn station based flow (which helps find small leaks in the system) or syringe fertilizers put on the landscape. For higher station count controllers (48), learned flow takes about 4 minutes per station or about 3 and a half hours, the commenter said. Since manual operation will normally be performed by a landscape contractor while he/she is onsite, the commenter noted, it is unlikely that manual operation will be abused. The commenter recommended either removing this section entirely or revising this section as follows:

"The controller shall be capable of allowing for a manual operation troubleshooting test cycle. The manual operation shall be limited to 60 minutes per station per day. The controller shall automatically return to default mode even if a switch is still positioned for manual operation."

q. Two commenters questioned the purpose of limiting the manual operation to 2 hours.

One commenter suggested that, for a 48-station controller, each zone would only be allowed to run for 2.5 minutes, which is not sufficient time to perform any maintenance checks. The commenter requested removing the time limit in this requirement so that it reads as follows:

> "The controller shall be capable of allowing for a manual operation troubleshooting test cycle. The window for manual operation shall be user adjustable, and the controller shall automatically return to default mode, even if the switch is still positioned for manual operation."

Another commenter recommended eliminating the words "to 2 hours." The commenter explained that a specific limit on the window of watering during manual operation is not needed as long as the user must specify a specific time. There are occasions where watering a zone manually for more than two hours is appropriate, the commenter noted; however, having a timer-controlled manual operating mode and reverting to default operations following manual operation are important. Adding the brand new 2-hour manual watering limit requirement at this late date, the commenter noted, will require many manufacturers to redesign products and add development cost to meet a specification that will not save additional water. The commenter agreed that manual watering should be limited, just not to 2 hours. The feature of returning to smart operation following the completion of a manual cycle is good practice and should be incorporated into weather-based irrigation controllers, the commenter said.

r. One commenter noted that the manual operation window is a little vague, suggesting that the window of operation could be better defined by specifying a starting point. Manual operation can start with a zone or with an overall operation, going through a number of zones. The commenter recommended the following language:

> "The window of manual operation shall be limited to 2 hours from its last operator input and, if no further input is received from the operator within the last 2 hours, the controller shall automatically return to its default mode."

Response: WaterSense has decided to retain this requirement in the final specification. It is important that a controller not be left in automatic mode when its most efficient and intended mode is smart mode. WaterSense agrees with the commenters that indicated that a window for manual operation should not be designated as 2 hours, however, and has removed this language in order to be less prescriptive.

V. Packaging and Product Documentation Requirements

Packaging and Documentation

a. One commenter noted that the product should be packaged or marked to encourage initial adjustments of the default settings to maximize the potential water savings of smart controllers. An instruction or operator manual for a WaterSense labeled weather-based irrigation controller would align this specification with the homeowner education requirement (5.1 Operating Manual) in the *WaterSense Specification for Single-Family New Homes*, the commenter said. Efficient irrigation programming is complex and complicated by many variables, the commenter noted, including the plant water requirement, irrigation equipment and layout, routine maintenance, soil type, slope, and sun exposure, to name a few. In a practical sense, the commenter said, the defaults provided by smart controller manufacturers must cover a range of conditions. To maximize the potential water savings, the commenter suggested that the initial settings need to be adjusted or calibrated to the

unique conditions of the site. The commenter requested that WaterSense add a requirement that the product packaging include an instruction manual that lists how the default settings can be adjusted to apply more or less water to each zone if, after operating for two weeks, the root zone is determined to be too wet or too dry.

Response: WaterSense agrees watering techniques discussed by the commenter should be promoted in certain circumstances and plans to include information on these techniques in educational materials. WaterSense and other organizations may encourage manufacturers to promote these practices, but WaterSense has decided not to require this as part of the instruction manual at this time, because it directly relates to human behavior and not the functionality of the product itself.

b. One commenter supported the requirement that the product documentation for the add-on or plug-in device must list each base controller that the device was tested with to meet the requirements of the specification and with which the manufacturer intends to be connected. The commenter noted that it makes sense that, in order to enjoy the benefits of the WaterSense label, the product must be confirmed (through actual testing) to meet the criteria outlined in the test protocol with each controller.

c. Multiple commenters also disagreed that the product documentation for an add-on or plug in device should list each base controller the device was tested with to meet the requirements of the specification.

One commenter agreed with EPA's concerns that, just because an add-on achieved a particular level of performance with a given base controller, performance level is in no way guaranteed or evenly necessarily proximal to that which might be achieved with a different base controller. However, the commenter suggested, EPA's approach to require each add-on to be tested with every possible base controller will be impractical to implement. In addition, the commenter said, this approach could severely disadvantage add-on products and more importantly could hamper the overall adoption of smart controllers. The commenter noted that there are countless existing irrigation controllers in the residential sector alone, and the add-on controllers allow these traditional controllers to be made "smart" at a fraction of the cost. The commenter said the WaterSense program should do what it can to facilitate these products in the market. The commenter suggested that a different approach is needed and suggested the following language:

> "The add-on device is not required to be packaged with base controller(s) that it was tested with to meet the requirements of this specification. However, the product must include documentation on the outside packaging stating the base controller the add-on device was tested with and the number of programs, stations, and start times per station of said baseline controller. The language must be as follows: "*This is an add-on type of WaterSense (labeled) weather-based irrigation controller that was tested with a <manufacturer of base controller> <model of base controller>, an irrigation controller with <number of programs of base controller>, <number of stations of base controller>, and <number of start times per controller>. In principle, the device should provide smart control functionality when used with similar base controller configurations, but such functionality and performance cannot be guaranteed by this label."*

The commenter indicated that the above language is designed to give consumers practical information about the base controller specifications with which the device was tested, but does not force EPA into a guarantee of performance the Agency is unable to make.

One commenter requested that EPA modify the section that requires the listing of all the controllers that the add-on was tested with to say that it should list *the* controller it was tested with and that a list of other controllers that in combination with the add-on satisfy the WaterSense labeling is also provided.

One commenter noted that the biggest water savings will come from improvements to existing irrigation systems. The commenter explained that there is a market for a simple add-on device that will reduce water use and perform to the specification. The commenter recommended changing section 5.2 Add-On Devices to read:

> "The add-on device is not required to be packaged with the base controller(s) that it was tested with to meet the requirements of this specification. However, the product documentation for the add-on device must list ~~each~~ *the required specification* of the base controller model that the device was tested with to meet the requirements of this specification and with which the manufacturer intends it to be connected. The documentation must also contain a statement to the effect that the device is only WaterSense labeled when used in combination with a base controller that meets *the required specification* ~~on the provided list~~. *The add-on device shall be tested with a controller chosen by the licensed certifying body that meets the specification as published by the add-on device manufacturer.*

Response: All comments under this subsection pertain to testing configuration as discussed in Appendix A. Please see the comment response under Section VIII, c. of this document for a response to the comments above.

Instruction Manual

d. Two commenters expressed concern that the end user may try to use the performance test setting included in the instruction manual. One commenter requested that "instruction manual" be changed to "calibration certificate" since the end user will have access to the settings used for the performance test. In addition, the commenter suggested defining for whom the literature is intended. The other commenter requested removing the language altogether or making it clear to the user the purpose of the information provided.

Response: WaterSense has decided to retain this instruction manual requirement to ensure that the licensed certifying body programs the controller with the same information that the consumer receives when purchasing the product. If manufacturers are concerned with how a homeowner or irrigation professional might use this information, WaterSense suggests the manufacturer make it clear that the information included in the instruction manual was for the performance test only and does not apply to initial programming of the controller. This information can be included as a certificate, in the back of the manual, or in any way the manufacturer deems to be appropriate for the laboratory to receive the necessary information without confusing the end user.

Requirement Not to Encourage Operation in Standard Mode

e. One commenter recommended removing the sentence "The product shall not be packaged or marked to encourage operation of the controller in standard mode." The commenter indicated that the marking of the product package ought to mention, as part of its features, that it can be used in standard mode, because many users do put their controllers in standard mode on occasion. The commenter noted that this allows testing of the controller without interrupting or corrupting any of the weather-based data to which they will return. The commenter stated that the marking on the package ought to be left up to the manufacturer in accordance with good marketing practice. The standard mode of the controller is a very valuable feature for the user, the commenter noted, and it maintains the integrity of the weather-based operation and its programming.

Response: This marking requirement does not prevent controllers from having a standard mode; it only prevents product packaging from encouraging consumers to use it, particularly since it is not appropriate under most operating circumstances. The intended mode for water efficiency is smart mode, and the controller should run in this mode at all times, unless standard mode is needed for troubleshooting, testing irrigation system performance, etc. Manufacturers can include information about standard mode and how to use it in the instruction manual, but language should not encourage its use. Further, any instruction related to the maintenance of the product shall direct the user on how to return the controller to smart mode.

VI. Comments on Section 8.0 – Definitions

Add-On Device

a. One commenter explained that the distinction between an add-on and a plug-in is correct; however, the add-on *does not communicate* with the standard controller through a common wire connection, while a plug-in does communicate with the existing controller microprocessor by providing it data. The add-on is merely a switch that breaks the common line, the commenter noted; there is no data transfer between the add-on and controller, hence no communication by definition.

The commenter suggested redefining the add-on device as:

> "A product that modifies an existing system equipped with standard clock timer controller to use current climatological data as a basis for controlling the irrigation schedule. For the purposes of this specification, add-on devices are defined as those *that break the common line wire connection between a standard clock timer and one or more of its valves."* This revised definition can then properly apply to rain switches and soil moisture sensors, the commenter said.

b. One commenter recommended changing the definition of an add-on device to:

> "For purposes of this specification, add-on devices are defined as those that communicate with the standard controller through a *common wire connection or interface with a controller through a defined sensor input connection.*"

The commenter explained that such add-on devices may interface with a controller through a common wire connection or as a switch input to a defined auxiliary input connection (sensor port). Depending on an individual controller's capabilities, the commenter said, it may be better suited to interface as a sensor input rather than as a common interrupt device.

Response: WaterSense has decided to revise this definition to make it clear that add-on devices are those that are designed to work with any brand of controller and may connect through a variety of ways. This distinguishes add-on devices from plug-in devices, yet does not stifle innovation.

Flow Sensor

c. One commenter recommended the removal of the flow sensor requirement and its subsequent definition.

Response: WaterSense has removed this definition, because the requirement of a flow sensor was also removed from the specification.

Plug-In Device

d. One commenter suggested changing the term plug-in device to "proprietary device" in the definitions section and throughout the specification. The term "plug-in device" is not broadly known in the irrigation industry and may imply a level of broad performance that is not consistent with EPA's interests or aforementioned concerns, the commenter said. The commenter suggested the definition itself though should still work, however.

Response: WaterSense did not include the term "proprietary device" in the definition, but revised the definition to indicate that plug-in devices are those devices that are designed to work specifically with one brand of controller and may connect through a variety of ways.

VII. Comments on Appendix A: Testing Configuration and Programming

Testing Configuration and Programming – General

a. One commenter noted that the sentence "The controller shall be programmed according to the list of settings provided by the manufacturer in the product's instruction manual, as described in Section 5.1 of this specification" is confusing. The commenter recommended changing the language to:

> "The controller shall be programmed according to the list of settings provided by the manufacturer, as described in section 5.1 of this specification."

Response: WaterSense has decided to retain the language from the revised draft specification in order to specifically reference the instruction manual.

b. One commenter stated that manufacturers should provide input into the initial scheduling of the controller. The commenter noted that controllers face a lot of variability in the underlying conditions imposed by the environment in which they operate. The drafted testing approach is exacerbating this situation, the commenter said, particularly since each zone must pass individually. The commenter noted that the hydrozone parameters deviate widely from real-world landscape conditions and are not representative of a typical consumer experience. In particular, the commenter said, hydrozones 3, 4 and 5 are quite exotic in their conditions and restrictions; if manufacturers are not allowed to provide input as to how their controller should be initially programmed, they will be required to complicate their controller/user experience and instruction manual solely so the controller can be successfully tested. The commenter said the water savings benefits to the consumers will be minimal, as few will encounter the extremes being tested in the hydrozones. It could even be argued, the commenter said, that the consumer experience would be negatively impacted due to the increased complexity of the product and/or user manual. The commenter noted that giving the manufacturer input into the initial scheduling is also consistent with the certification goals. The two criteria being measured are irrigation adequacy and irrigation excess, which are intended measure how well controllers adjust irrigation with changes in the weather. The commenter noted that inaccurate initial programming can adversely impact the results of a controller that would otherwise adjust irrigation times appropriately, the commenter noted; the SWAT protocol recognizes this by allowing manufacturer's to fully program the controller prior to testing. If EPA wishes to test a typical consumer experience including both programming and weather adjustments, the commenter said, then the test criteria should be adjusted; hydrozones should be redefined to be typical of a consumer landscape and/or the testing should be aggregate results across zones. The commenter suggested the following language:

> "Manufacturers may program the controller initially or provide specific instructions on the initial programming of the controller for each hydrozone to accommodate the virtual landscape."

Response: The specification allows for manufacturers to provide initial input regarding the initial controller setup and programming, but those instructions shall be included in the instruction manual as discussed in Section 5.1 of the specification, and will be followed by test laboratory staff. The requirement also makes the setting used to pass the test publically available. Because one of the original issues with SWAT testing was that the settings used in testing were unknown and could not be verified in repeat testing or reviewed by utilities, including the test setting in the manual will make the process more transparent.

Testing Configuration and Programming – Add-on Devices

c. Multiple commenters disagreed with the requirement that add-on or plug-in devices be tested with each base controller with which the manufacturer intends them to be labeled with.

One commenter requested that for WaterSense labeling, an add-on device that only breaks the common line from a controller to valves must be SWAT tested with a conventional (non-smart) controller that in combination satisfies sections 3.0 and 4.0 testing and features criteria. Upon

the successful completion of that representative SWAT test, the commenter suggested the add-on device can bear the WaterSense label when used with the controllers that the manufacturer certifies are in compliance with Sections 3.0 and 4.0 of this specification.

Another commenter suggested the following language: "Add-on devices must be tested with ~~each~~ *a* base controller model *that meets the specification published by* ~~with which~~ the *add-on device* manufacturer ~~intends it to be connected~~. As a unit, the add-on device and the base controller must meet all of the requirements contained in this specification."

Another commenter expressed concern that requiring the testing and labeling of add-on or plug-in devices with every specific model of controller is too prescriptive, will inhibit innovation, and will drive up the cost of the device for manufacturers and ultimately consumers. The commenter explained that irrigation controllers are typically designed in "platforms" or model groups, which share the same basic infrastructure; new iterations of the same platform are introduced frequently to allow for cosmetic changes, variations in station count, market specific brands, etc. Functionally, the commenter said, these model groups have the same capabilities, and their compatibility with add-on or plug-in devices remains unchanged because the manufacturers want to manage costs and ensure compatibility with their own ancillary devices. These add-on or plug-in devices could be tested with a representative sample from each controller model group, the commenter suggested, since the outcome would be consistent across the controller capability set. The controller manufacturer would benefit from consolidated testing efforts. This would also reduce costs and inventory burdens for the retailer and reduce confusion for the consumer, the commenter said. Further, the controller manufacturer can provide labeling on its packaging that serves to identify what type of add-on or plug-in interface is compatible with its product platforms, the commenter noted, and the packaging for the add-on device can be labeled to match up with platform types. The commenter suggested that the controller could be labeled to indicate that it is "compatible with dry contact type switch closure devices, or compatible with common interrupt type add-on devices," and that the add-on device can be labeled that it was tested with certain controller model groups that use the appropriate interface capability.

The commenter recommended requiring the controller manufacturer to identify and display an interface capability based on model groups or platforms in order to allow integration of add-on or plug-in devices. The commenter indicated that the add-on device should not be required to be packaged with the base controller(s) that it was tested with to meet the requirements of this specification. However, the commenter said, the product documentation for the add-on device must list which controller model group(s) the device has been tested with and the interface capabilities necessary to perform as tested. The controller manufacturer must also provide a designation on the controller packaging to indicate its model group and interface capabilities required to ensure compatibility with the add-on device, the commenter said, and the documentation must also contain a statement to the effect that the device is only WaterSense labeled when used in combination with a controller identified as belonging to the same model group as tested and labeled. The commenter provided an example: The Acme Rain Switch is a dry contact type switch closure device. It has a WaterSense label <u>only when used in combination</u> with the following controllers: Coyote model groups A, C, F, and Yosemite model groups #1 and # 7S.

Response: WaterSense understands the concerns of commenters who are opposed to add-on or plug-in devices only being labeled when attached to the base controller with which they were tested, but in order to maintain the integrity of the label, WaterSense has decided to retain this requirement in the final specification. This requirement ensures that consumers who purchase these devices and connect them to a base controller with which the device has been tested will have some assurance that that combination will provide water efficiency and performance. The combination of the add-on or plug-in device and base controller met the specification; therefore, that combination shall be recognized as labeled.

As described in the *Supplemental Guidance for WaterSense Certification and Labeling of Weather-Based Irrigation Controllers* located at [http://www.epa.gov/watersense/partners/controller_final.html], it is important to note that this testing configuration requirement does not necessarily mean that the add-on or plug-in device must be tested with every individual base controller model available. The licensed certifying body may group base controller models based on models that provide the same functionality and performance, but that have non-performance related differences (e.g., only the station count varies). Based on its engineering judgment, the licensed certifying body may test the add-on or plug-in device with only one of the base controller models in a specific group, but may certify the add-on or plug-in device for use with any of the base controller models in that same group.

WaterSense is interested in the concept that an add-on or plug-in device could be tested with a base controller that meets a specification, and be considered labeled with all other controllers that meet that same specification, but currently no such specification exists. If in the future this specification becomes available, WaterSense will consider changing this requirement in a future version of this specification.

Similarly, if in the future, stakeholders define model groups of base controllers, as suggested by a commenter above, WaterSense would be interested in incorporating this into future versions of the specification.

VIII. Comments on Appendix B: Informative Annex for WaterSense Labeling

Conformity Assessment

a. One commenter supported the idea that tests be performed by qualified testers, not the manufacturer. Testing by non-biased third parties lends credence to the WaterSense label and prevents the input of illogical settings by the manufacturer, the commenter said.

Response: WaterSense thanks the commenter for this input. WaterSense relies on independent third-party certification to ensure that products meet and can continue to meet EPA's criteria for efficiency and performance. This is the key to maintaining the integrity of WaterSense labeled products.

WaterSense Labeling

b. One commenter suggested changing Appendix B section 3.2 to read as follows: "Only add-on devices certified to meet the requirements of this specification may bear the WaterSense label. Base controllers that the add-on devices are tested with and that are sold separately from the add-on devices shall not bear the WaterSense label. Product documentation shall indicate that the add-on device is only WaterSense labeled when used in combination with ~~the~~ a base controller~~(s)~~ that meets the *required specification* listed in product documentation as described in Section 5.0 of this specification."

Response: WaterSense retained the language from the revised draft specification, because there is currently no specification for base controllers for WaterSense to reference.

IX. Comments on Supplemental Guidance for WaterSense Certification and Labeling of Weather-Based Irrigation Controllers

a. One commenter recommended that manufacturers have some interaction with the device and certifying body before start of testing and during testing. The commenter noted:
   - Interaction should be allowed to validate the controller was set up and programmed correctly, as people can make mistakes or interpret instructions differently than what was intended.
   - Electronics and components (controller and test equipment) are not 100 percent fail-proof and could experience a failure at anytime.
   - As smart controller technology is not an exact science, and varying climates and/or geographic conditions can produce differing results; manufacturers should be given the accessibility to fine-tune irrigation schedules for the specific test location prior to the formal start of testing.
   - Manufacturers have invested a lot of time and resources in developing smart controllers. It would be a waste of time and money for the manufacturer and LCB if the controller was not set-up or programmed correctly or if an electronic failure occurred during testing, the commenter said.

The commenter suggested revising Section 3.2.2.2 of the supplemental guidance to allow the manufacturer the ability to:
- Check and accept set-up and programming parameters;
- Provide for a scheduling fine-tune period; and
- Review periodic test reports to monitor performance.

Response: As discussed above in Section VII, b. above, manufacturers are allowed to provide initial input to the licensed certifying body via the instruction manual. WaterSense expects that the instructions provided and the controller interface design will provide a sufficient basis for the licensed certifying body to set up the controller according to the manufacturers' desired setting.

b. One commenter noted that since the labeling has been extended to commercial systems, it is not practical or reasonable for retesting purposes that a product may be chosen from a job site by the licensed certifying body either annually or every five years, as described in Section 3.6.2 of the supplemental guidance. For example, the commenter said, if the existing controller is a pedestal-mounted controller as part of a central system, it would be totally unreasonable to ask that the pedestal unit be removed from the field in order for it to be SWAT tested at a different location. For one thing, the commenter noted, the field pedestal is not generally programmable by itself and is reliant upon a central computer system. The cost of a field mounted pedestal, cost of testing, and replacement may be well over $10,000, while the add-on device can be less than $100, the commenter said. This is another example where the add-on device can be certified to be compatible with the controller, the commenter suggested, if together they meet the Sections 3.0 and 4.0 requirements without separate SWAT testing.

Response: For clarification, the retesting requirement applies to new units of the model, rather than products that are functioning in the field. WaterSense is not requiring that licensed certifying bodies go out into the field and retest products that have already been sold. The intent with retesting products is to ensure that the manufacturer is continuing to produce products that meet the specification, not that products that have been installed continue to meet the specification.

c. One commenter stated that random testing every year is not realistic for a manufacturer with a small number of qualified devices. Many manufacturers of such equipment may only make a few items that are applicable for certification, the commenter noted. With fewer than five applicable devices, the commenter said, some products will have been tested multiple times within the five-year cycle. The commenter recommended requiring a random testing cycle relative to the number of products a manufacturer offers, for example:
    - Less than five products offered—one test in five years;
    - Six to 12 products offered—random testing every other year; and
    - Thirteen or more products offered—annual random testing of one product.

Response: WaterSense agrees with this comment and has modified the annual retesting requirements of the *WaterSense Product Certification System* to better represent all of the products on the market by requiring each licensed certifying body to sample 15 percent of all of the products it has certified each year, rather than retesting at least one controller per manufacturer per year. WaterSense has also placed restrictions upon which products can be selected for retesting, taking into consideration models that have been recently tested. Under these new requirements, not every manufacturer will have products retested each year; however, the number of products sampled will reflect the number of products the manufacturer has labeled. Please see the revised *WaterSense Product Certification System* available at http://www.epa.gov/watersense/partners/certification.html or the revised *Supplemental Guidance for Certification and Labeling of Weather-Based Irrigation Controllers* available at [http://www.epa.gov/watersense/partners/controller_final.html] for more information.

X. Additional Comments on the Specification and Supporting Documentation

Water Savings

a. One commenter stated that weather-based irrigation controller technology has not shown in field studies the consistent ability to deliver the 20 percent water savings over existing technology, specifically referencing the Evaluation of California Weather-Based "Smart" Irrigation Controller Programs report published in 2009. The commenter recommended that EPA clearly communicate to the potential end user that this technology will not deliver water savings unless properly used. The commenter suggested that package labeling clearly indicate that savings are not guaranteed, and that proper installation, operation, and maintenance are required for water savings to be realized.

Response: While the first year savings in the California study were 6 percent, a subset of controllers showed 16 percent savings in the third year after installation, demonstrating the long term savings of these products. WaterSense acknowledges that savings depend on a number of variables and plans to emphasize proper installation and programming to the end user and will encourage manufacturer, retailer, and distributor partners to also convey this message.

University of Florida Study

b. One commenter noted that the University of Florida study was an investigation that concentrated primarily on the subtleties involved in developing passing scores instead of being a critique of the science involved in the SWAT testing protocol.

Response: WaterSense developed the scope of the University of Florida research to focus on the transferability and repeatability of the SWAT protocol. In addition, the research examined stakeholder concerns regarding the protocol that needed to be examined and/or resolved before stakeholders would support the protocol and the specification. WaterSense is satisfied with the depth of this research and has made modifications to the protocol to reflect the research results.

Certification Body Weather Data

c. One commenter asked how the weather data will be provided to the certification body and noted that the Center for Irrigation Technology handled this situation by making the source of ET data available. The commenter noted that the WeatherTRAK controller utilizes ASCE-ET weather data to accurately calculate the amount of water a landscape needs and how often to irrigate. The commenter wanted to find out how to gain access to the weather data so that manufacturers can send the appropriate ET data to their controllers. In addition, the commenter wanted to know how a manufacturer would verify the quality of the weather data used by the certifying body, and noted that weather station equipment is subject to outdoor real-world conditions.

Response: The licensed certifying body can, at its discretion, provide the weather signal to the manufacturer, but is not required to do so according to WaterSense criteria. Decisions regarding this level of data sharing will be determined by the licensed certifying body.

Recommended Changes to the SWAT Protocol

d. One commenter noted that there was no detail in the specification to tell a certifying body how to deal with seasonal crop coefficients. The commenter recommended that SWAT eliminate the seasonal crop coefficient (Kc) value in the eighth draft of the SWAT protocol and use a fixed (or constant) Kc value for all zones. The commenter noted that the better solution is to provide seasonal Kc values for each testing location.

Response: WaterSense aimed to limit the modifications to the SWAT protocol to those that related to transferability and repeatability of the protocol. Additional requests for changes to the protocol should be relayed to the SWAT committee for consideration.

Additional ENERGY STAR® Requirement

e. One commenter requested that external power supply intended for use with the controller be tested and labeled in accordance with the most recent version of the ENERGY STAR specification for end-use products using external power supplies.

Response: The specification referenced by this commenter is no longer in existence[1]; therefore, is not referenced by this specification.

Support for Labeling Weather-Based Irrigation Controllers

f. Two commenters expressed their support for WaterSense labeling weather-based controllers at this time. They noted that this technology is important to outdoor water savings and provides for a standardized testing protocol to assure customers and utilities that the products are high performing. In addition, the label will differentiate products in the market place, the commenter said.

Response: WaterSense thanks the commenters for their support and agrees this is an important step for saving water in the landscape arena.

Specification Title Change

g. One commenter noted that an imperfect model is used to validate and assure citizens that a distant relative at a research facility has been mimicked in their man-made, non-conforming backyard and requested that the title of the specification be changed to “Weather-Based Irrigation Controllers for Conforming Facilities.”

[1] (http://www.energystar.gov/index.cfm?fuseaction=products_for_partners.showEPS)

Response: WaterSense did not make this change, as the specification was developed to apply nationally and to any landscape. WaterSense understands the concern that the SWAT protocol is limited in that it only tests six virtual landscapes, but at this time, it is the most appropriate performance test protocol available for WaterSense's use.

Manufacturer Ability to Choose Test Location

h. One commenter requested that the certifying bodies publish testing locations and that manufacturers be able to choose their testing locations. The commenter noted that smart control systems that use central weather stations as a basis for the ET calculations transmit data to remote sites and might not have available weather stations or communication infrastructure to any location in the United States.

Response: This specification has been established so that a passing score is an indication of acceptable performance in any part of the country. Manufacturers can contact certifying bodies to determine testing locations. If central weather station data are unavailable in certain areas of the country, the manufacturer should work with the licensed certifying body of its choosing to ensure an appropriate test. If products are not functional in all areas of the country, it is essential this is communicated by the manufacturer to the end user.

XI. Other Changes Not Specifically Commented On

a. WaterSense removed the language regarding manufacturer attestation of the supplemental capabilities in Section 4.0. Licensed certifying bodies shall verify these capabilities by examining the product and/or instruction manual.

b. WaterSense added language to Section 3.0 directing the licensed certifying body to select the irrigation adequacy and irrigation excess scores from the first valid 30-day test period. If the thresholds listed in Section 3.2 are not met, the test shall be restarted if the manufacturer would like to continue testing. WaterSense added this language to ensure that selection of the 30-day test period is consistent between licensed certifying bodies.

c. WaterSense added the percent adjust (water budget) feature as a supplemental capability (see Section 4.6). While this feature is included as an option in Section 4.7, WaterSense maintains that this is an important feature that allows end users to make adjustments to the amount of water applied to the landscape without changing the detailed settings. Therefore this capability is required to function in both smart and standard modes.

d. WaterSense added that the maximum station (or zone) count shall be included in the product instruction manual. This information will be displayed on the WaterSense website product listing to help purchasers determine the product that is appropriate for their application. In order for the licensing certifying body to collect this information, it must be included in the instruction manual.

e. WaterSense changed the language pertaining to performance test sampling in Appendix B to require the licensed certifying bodies to select one product at random from the entire

inventory of the manufacturers' packed production. The previous version of the specification followed the sampling guidelines included in the SWAT protocol, which were not consistent with current licensed certifying body practices.