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STAFF REPORT

Staff Analysis of Proposed Efficiency Standards for Landscape Irrigation Controllers

2023 Appliance Efficiency Pre-Rulemaking

Docket Number 17-AAER-10

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California Energy Commission

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PREFACE

On March 14, 2012, the California Energy Commission (CEC) issued an order instituting rulemaking (OIR) to consider standards, test procedures, labeling requirements, and other efficiency measures to amend the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through Section 1609). In the OIR, the CEC identified a variety of appliances with the potential to save energy or water or both. The OIR also authorizes the CEC to investigate and adopt, if appropriate, additional priority measures as determined by the Lead Commissioner.

On April 21, 2017, the CEC released an invitation to participate to provide interested parties the opportunity to inform the CEC about the product, market, and industry characteristics of the appliances identified in the OIR, as well as additional appliances. The CEC reviewed the information and data received in the docket and hosted staff workshops on July 19 through 21, 2017, to vet this information publicly.

On July 18, 2017, the CEC released an invitation to seek proposals for standards, test procedures, labeling requirements, and other measures to improve efficiency and reduce the energy or water consumption of specified appliances. The Energy Commission reviewed the proposals received in the docket and hosted a staff webinar to vet those proposals on October 24, 2017.

On December 17, 2019, staff conducted a webinar on proposed water efficiency regulations for landscape irrigation controllers, including information related to definitions, test methods, and performance requirements. Staff invited stakeholders to join a CEC workgroup to gather comments on the proposal. Staff reviewed and considered all comments received.

This staff report includes analysis of the statewide benefits, cost-effectiveness, and technical feasibility of the proposed standard in support of the requirements of Section 25402(c)(1) of the Public Resources Code.

ABSTRACT

Assembly Bill 1928 (Campos, Chapter 326, Statutes of 2016) requires the California Energy Commission (CEC) to adopt performance standards and labeling requirements for landscape irrigation equipment.

This staff report focuses on landscape irrigation controllers, a component of landscape irrigation systems. The water consumption of landscape irrigation controllers varies greatly, depending upon how the controller decides to apply water to a landscape. To date, no federal or state regulations mandate cost-effective, readily available technologies to improve the performance of less efficient models.

This report proposes an addition to the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 to 1609). CEC staff analyzed the cost-effectiveness and feasibility of proposed water efficiency standards for landscape irrigation controllers. The statewide water and energy (electricity) use and savings and other related environmental impacts and benefits are included in this analysis.

The proposed updates to Title 20 would set test methods and performance standards for landscape irrigation controllers. The update will require all landscape irrigation controllers to adjust irrigation schedules to maintain an adequate soil moisture balance in response to weather or soil moisture conditions.

The proposed standard is cost-effective, technically feasible, and would save about 4 billion gallons of water and 14 gigawatt-hours (GWh) of electricity for the first year the standard is in effect and about 60 billion gallons per year and 213 GWh of electricity at full stock turnover. Consumers will save about $915 per landscape irrigation controller over the life of the device through reduced water use.

Keywords: Appliance Efficiency Regulations, appliance regulations, water efficiency, energy efficiency, irrigation equipment, landscape irrigation, landscape irrigation controllers, rain sensors, soil moisture-based irrigation controller, weather-based irrigation controllers, smart irrigation controllers

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EXECUTIVE SUMMARY

The California Energy Commission's (CEC) Appliance Efficiency Program has analyzed water efficiency opportunities for landscape irrigation controllers and has developed proposals that address water efficiency opportunities through Title 20 appliance efficiency regulations. Staff analysis shows that proposed landscape irrigation controller standards are technically feasible, cost-effective to consumers, and would save a significant amount of water and electricity statewide.

The proposed standards would apply to all residential, commercial, and industrial landscape irrigation controllers sold or offered for sale in California, except manual watering timers, that are manufactured on or after one year from the date of adoption by the CEC. The proposed standards and test procedures are aligned with U.S. Environmental Protection Agency's (EPA) WaterSense program specifications for weather-based irrigation controllers or soil moisture-based irrigation controllers. The proposed regulations include a field of data collected for compliance verifications. However, beyond the basics of manufacture date, manufacturer name, and model number, physical labels are not proposed.

The proposed landscape irrigation controller standards will save about 60 billion gallons of water and 213.3 gigawatt-hours (GWh) of electricity per year statewide, which equates to about $275.2 million of water cost savings annually after the existing stock is replaced.

The proposed standards save about 15 percent of water used for landscape irrigation. Staff estimates each unit of compliant landscape irrigation controllers saves about 13,265 gallons of water annually. The proposed standards are cost-effective as each unit of compliant irrigation controller provides life-cycle savings of about $915.03, while it costs an incremental cost of about $24.83. Therefore, proposed standards are cost effective with a payback period of about four months.

The proposed standards are also technically feasible as there are more than 960 models on the market that meet the proposed requirements.

Moreover, reducing water consumption will improve air quality by reducing greenhouse gases emitted in the production of electricity used to transport and treat California's water.

CHAPTER 1:
Legislative Criteria and Policy

The Warren-Alquist Act[1] establishes the California Energy Commission (CEC) as California's primary energy policy and planning agency. Section 25402(c)(1) of the Public Resources Code directs the CEC to reduce the inefficient consumption of energy and water by prescribing efficiency standards and other cost-effective measures[2] for appliances whose use requires a significant amount of energy or water statewide. Such standards must be technically feasible and attainable and must not result in any added total cost to the consumer over the designed life of the appliance.

For nearly five decades, California has regularly increased the energy and water efficiency requirements for new appliances sold and new buildings constructed in the state. Through the Appliance Efficiency Program, appliance efficiency standards have shifted the marketplace toward more efficient products and practices, reaping large benefits for California's consumers. The state's Title 20 appliance efficiency regulations, along with federal appliance standards encompassing a variety of appliance types, saved an estimated 34,707 gigawatt-hours (GWh) of electricity in 2017 alone, resulting in about $8.26 billion in savings to California consumers.[3] Since the mid-1970s, California has regularly increased the energy efficiency requirements for new appliances sold and new buildings constructed in the state. In addition, the California Public Utilities Commission (CPUC) in the 1990s decoupled the utilities' financial results from their direct energy sales, promoting utility support for efficiency programs. These efforts have reduced peak load needs by more than 8,645 megawatts (MW) and continue to save about 32,594 GWh per year of electricity.[4] There remains immense potential for additional savings by increasing the energy efficiency of appliances.

In determining cost-effectiveness, the CEC considers the value of the water or energy saved, the effect on product efficacy for the consumer, and the life-cycle cost of complying with the standard to the consumer. The Commission also considers other relevant factors including, but not limited to, the effect on housing costs, the statewide costs and benefits of the standard over the lifetime of the standard, the economic impact on California businesses, and alternative approaches and the associated costs.

Section 25401.9 of the Public Resources Code requires the CEC, to the extent that funds are available, to adopt by regulation, performance standards and labeling requirements for

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1 The Warren-Alquist State Energy Resources Conservation and Development Act, Division 15 of the Public Resources Code, § 25000 et seq.

2 These include energy and water consumption labeling, fleet averaging, incentive programs, and consumer education programs.

3 California Energy Commission. 2017 IEPR Workshops, Notices and Documents, Docket # 17-IEPR-01, https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2017-integrated-energy-policy-report/2017-iepr.

4 California Energy Commission. January 2016. *California Energy Demand 2016-2026 Revised Electricity Forecast*, https://efiling.energy.ca.gov/GetDocument.aspx?tn=207439&DocumentContentId=21362.

landscape irrigation equipment, including, but not limited to, irrigation controllers, moisture sensors, emission devices, and valves.

Improving California's Resiliency to Future Drought

On January 17, 2014, with California facing water shortfalls in the driest year in recorded state history, former Governor Edmund G. Brown Jr. proclaimed a state of emergency and directed state officials to take all necessary actions to prepare for and respond to drought conditions. On September 13, 2016, former Governor Brown signed the Water Efficiency: Landscape Irrigation Equipment Act (Assembly Bill 1928, Campos, Chapter 326, Statutes of 2016) requiring the CEC to adopt by January 1, 2019, performance standards and labeling requirements for landscape irrigation equipment, including, but not limited to, irrigation controllers, moisture sensors, emission devices, and valves. In response, the CEC began considering standards and test procedures, labeling requirements, and other efficiency measures for several appliances including irrigation controllers.[5] Between 2020 and 2022, California once again experienced severe to exceptional drought statewide, and January, February, and March 2022 were the driest on record dating back over 100 years, [6] confirming the need to ensure that water conservation remains a California way of life.

Water-Energy Nexus

Urban water use, including landscape irrigation, consumes significant energy to move and treat water. A 2005 Commission study estimated 7,500 GWh per year or roughly 3 percent of California state electrical energy is consumed to supply and treat water intended for urban consumption.[7] A more recent study by the Codes and Standards Enhancement (CASE) Team using data provided by the CPUC estimated the energy to supply water as 3,565 kilowatt-hours (kWh) per million gallons.[8] Consequently, appliance standards leading to the efficient use of water will lead to significant energy savings for California.

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5 California Energy Commission. 2022. *Final 2021 Integrated Energy Policy Report, Volume I: Building Decarbonization*. California Energy Commission. Publication Number: CEC-100-2021-001-V1, pg. 49. https://efiling.energy.ca.gov/GetDocument.aspx?tn=241599.

6 California Drought Update. 2022. California Drought Update May 31, 2022. https://drought.ca.gov/media/2022/06/Weekly-CA-Drought-Update-05312022.pdf

7 Navigant Consulting, Inc. 2006. *Refining Estimates of Water - Related Energy Use in California*. California Energy Commission, PIER Industrial/Agricultural/Water End Use Energy Efficiency Program. CEC - 500 - 2006 - 118. Pg. 16.

8 Pike, Ed and Daniela Urigwe, *Codes and Standards Enhancement (CASE) Response to Invitation to Submit Proposals- Irrigation Spray Sprinkler Bodies*, pg. 49, September 18, 2017.https://efiling.energy.ca.gov/GetDocument.aspx?tn=221224&DocumentContentId=26740.

Reducing Electrical Energy Consumption to Address Climate Change

Appliance energy efficiency is a key to achieving the greenhouse gas emission reduction goals of Senate Bill 100 (De León, Chapter 312, Statutes of 2018)[9] and Assembly Bill 3232 (Friedman, Chapter 373, Statutes of 2018)[10], as well as the recommendations contained in the California Air Resources Board's 2022 Scoping Plan for Achieving Carbon Neutrality.[11] Energy efficiency regulations are also identified as key components in reducing electrical energy consumption in the 2021 Integrated Energy Policy Report (IEPR) and the 2021 California Building Decarbonization Assessment.[12,13]

On October 7, 2015, former Governor Brown signed the Clean Energy and Pollution Reduction Act of 2015 or Senate Bill 350 (De León, Chapter 547, Statutes of 2015)[14], requiring the CEC to establish annual targets for statewide energy efficiency savings and demand reduction that will achieve a doubling of energy savings in buildings and retail end uses through energy efficiency and conservation by 2030. Appliance efficiency standards will be critical in meeting this goal, and water end-use efficiency is one of several strategies identified to increase efficiency in existing buildings.

Expanding Energy Efficiency in Low-Income and Disadvantaged Communities

California is working to ensure that clean energy transformation benefits are realized by all Californians, especially those in low-income, disadvantaged, or rural communities. In the SB 350 Low-Income Barriers Study, Part A, the CEC studied the barriers to energy efficiency and weatherization investments for low-income customers, including those in disadvantaged communities, and made recommendations on how to increase access.[15] The CEC and its partner agencies have since taken steps to implement the recommendations in the Barriers Study, including convening the Disadvantaged Communities Advisory Group in 2018, adopting

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9 Senate Bill 100, California Renewables Portfolio Standard Program: emissions of greenhouse gases, available at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100 .

10 Assembly Bill 3232, *Zero-emissions buildings and sources of heat energy*, available at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232 .

11 California Air Resources Board, *2022 Scoping Plan for Achieving Carbon Neutrality.* available at https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf

12 Bailey, Stephanie, Jane Berner, David Erne, Noemí Gallardo, Quentin Gee, Akruti Gupta, Heidi Javanbakht, Hilary Poore, John Reid, and Kristen Widdifield. 2023. Final 2022 Integrated Energy Policy Report. California Energy Commission. Publication Number: CEC-100-2022-001-CMD.

13 Kenney, Michael, Nicholas Janusch, Ingrid Neumann, and Mike Jaske. 2021. California Building Decarbonization Assessment. California Energy Commission. Publication Number: CEC-400-2021-006-CMF.

14 De León. 2015. *Senate Bill 350*, available at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350.

15 Scavo, Jordan, Suzanne Korosec, Esteban Guerrero, Bill Pennington, and Pamela Doughman. 2016. Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-income customers and Small Business Contracting Opportunities in Disadvantaged Communities. California Energy Commission. Publication Number: CEC-300-2016-009-CMF.

a Clean Energy in Low-Income Multifamily Buildings (CLIMB) Action Plan,[16] and tracking and updating key metrics to better understand energy barriers.[17] The CEC developed an online interactive map to display energy equity indicators and highlight key opportunities to advance clean energy in low-income and disadvantaged communities. More work is needed to remove financing barriers and develop the local workforce needed to implement clean energy solutions.

16 Actions to implement energy and water efficiency, demand response, on-site renewable energy, electric vehicle infrastructure installation, and energy storage for multifamily housing in California: *Clean Energy in Low-Income Multifamily Buildings Action Plan | California Energy Commission*, available at https://www.energy.ca.gov/publications/2018/clean-energy-low-income-multifamily-buildings-action-plan.
[17] California Energy Commission, June 2018, Energy Equity Indicators Tracking Progress, available at https://www.energy.ca.gov/sites/default/files/2019-12/energy_equity_indicators_ada.pdf

CHAPTER 2:
Background

Landscape Irrigation Controllers

Landscape irrigation controllers automate the scheduling of the time and day of irrigation and length of application. Irrigation controllers send an electrical signal to open the irrigation valve to allow the flow of water to the sprinklers or emitters. Before this invention, the property owner had to open and close the irrigation valve manually to water the landscape.

Moody Sprinkler Company introduced the first residential landscape irrigation controller in the 1950s that relied upon an electronic clock and hydraulic mechanism. These controllers were upgraded to an electromechanical timer to replace the hydraulic mechanism. In the 1970s and 1980s, controllers moved to solid-state circuitry and microprocessors. Under pressure to conserve water, manufacturers began to incorporate water saving features such as soil moisture sensing and weather-based control methods in the 2000s. Landscape irrigation controllers have been widely used to irrigate urban landscapes.

Figure 2-1: 1950s Landscape Irrigation Controller

Illustration Credit: Irrigation Museum

The California Department of Water Resources estimates that 29 percent of urban water use, or roughly 750 billion gallons per year, is to irrigate residential landscapes. Large landscapes account for an additional 9 percent, or 235 billion gallons per year. [18] Statewide landscape water use is approximately equal to indoor home water use. Water-saving opportunities in landscape irrigation include user education and the use of efficient landscape irrigation equipment.

Landscape Irrigation Methods

Residential and commercial property owners and occupants maintain their landscapes through several methods of irrigation, including hand watering, sprinkler systems, and drip irrigation systems. Hand watering is performed typically with a hose and a portable sprinkler that may

18 California Department of Water Resources. June 2019. *California Water Plan Update 2018*, Table 1-1, pg. 1-4, https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/California-Water-Plan/Docs/Update2018/Final/California-Water-Plan-Update-2018.pdf.

be moved about the landscape. Sprinkler systems are permanently plumbed systems relying upon subterranean piping, valves, and landscape emitters to spray water from fixed locations and rely on a landscape irrigation controller to schedule irrigation events. Drip irrigation systems rely on a system of hoses and micro-emitters to deliver water as droplets to plantings.

Figure 2-2: Hand, Lawn Sprinkler, and Drip Irrigation Systems

Illustration Credit: Home Depot

Landscape irrigation controllers irrigate 61 percent[19] to 73 percent[20] of landscapes. Thus, due to the large water use of these landscape irrigation controllers, increasing the irrigation scheduling efficiency of landscape irrigation controllers is a key component of California's efforts to make water conservation a way of life.

Challenges to Water Efficiency

Overirrigation

Overirrigation of landscapes is common in California and across the United States.[21] Overirrigation occurs when more water is applied to a landscape than can be used by the plants. The excess water is lost through deep percolation, runoff, and evaporation, as shown in Figure 2-3.

A 2009 study of smart irrigation controllers by the Metropolitan Water District of Southern California and the East Bay Municipal Utility District revealed how landscape irrigation practices vary in California. The study presents an application ratio, a comparison of how much water is applied versus how much water is needed. An application ratio of 100 percent means the water applied to the landscape would exactly meet the irrigation needs of the landscape.

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19 *California Investor-Owned Utilities Comments Response to Invitation to Participate — Landscape Irrigation Controllers,* September 18, 2017, https://efiling.energy.ca.gov/GetDocument.aspx?tn=221225&DocumentContentId=26788.

20 The Metropolitan Water District of Southern California. October 31, 2013. *Landscape Water Use Efficiency Research Project, Final Project Report, Prepared for the Metropolitan Water District of Southern California*, page 5, https://www.usbr.gov/lc/socal/reports/MWDLandscapeWUEResearch.pdf.

21 Metropolitan Council. December 2016. *Efficient Water Use on Twin Cities Lawns Through Assessment, Research, and Demonstration*, https://metrocouncil.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/Twin-Cities-Lawn-Irrigation-System-Surveys-And-Ass.aspx.

Figure 2-3: Overirrigation Water Losses

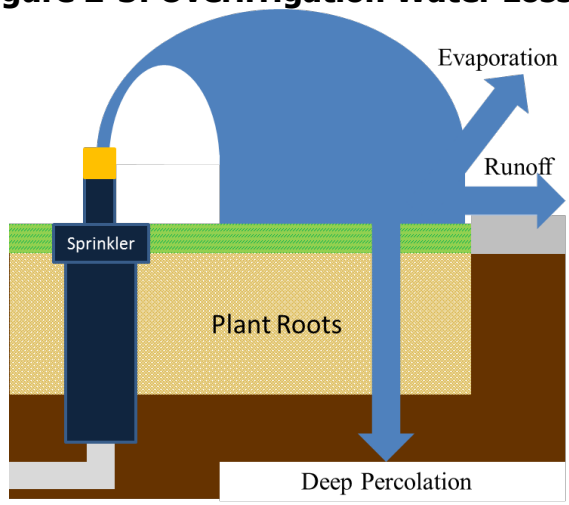


Illustration Credit: CEC

On average, Californians apply 50 percent more water than is needed.[22] Another survey of homeowners performed by the Metropolitan Water District of Southern California showed about half of homeowners water three to four days a week that is well in excess of what is needed to maintain a landscape.[23] An additional study of homeowners by the Irvine Ranch Water District found more than half of the irrigation controllers set for every day or every other day irrigation. Residents were unaware that water needs of turf, shrubs, and trees differ.[24]

Landscape Irrigation Scheduling Efficiency

Landscape irrigation provides water to supplement demands of the landscape when rainfall is not enough. Landscape irrigation requirements vary because of many factors including type of vegetation, soil type, geographic location, shading, time of year and recent weather events. **Figure 2-4** illustrates how landscape irrigation requirements vary based upon location and time of year. In the winter when California's weather is cool and rainfall more frequent, the need for irrigation is low. In the summer when the weather is hot and rainfall rare, more irrigation is needed. Landscape irrigation controllers can vary the irrigation schedule to meet the needs of the varying landscape while using less water.

22 Mayer, Peter, et al. *Evaluation of California Weather Based "Smart" Irrigation Controller Programs,* 2009, pg. 95, available at http://ucanr.edu/sites/UrbanHort/files/99641.pdf.

23 Metropolitan Water District of Southern California. October 31, 2013. *Landscape Water Use Efficiency Research Final Project Report*, pg. 7, https://www.usbr.gov/lc/socal/reports/MWDLandscapeWUEResearch.pdf.

24 Hunt, Theodore; Lessick, Dale; et al. (Irvine Ranch Water District.) June 2001. *Residential Weather-Based Irrigation Scheduling: Evidence from the Irvine "ET Controller" Study,* pg. 14, https://irrigatesmart.com/wp-content/uploads/2019/02/Residential-Weather-Based-Irrigation-Scheduling-Study-ET-Controllers.pdf.

Figure 2-4: Landscape Irrigation Needs Vary by Season and Location

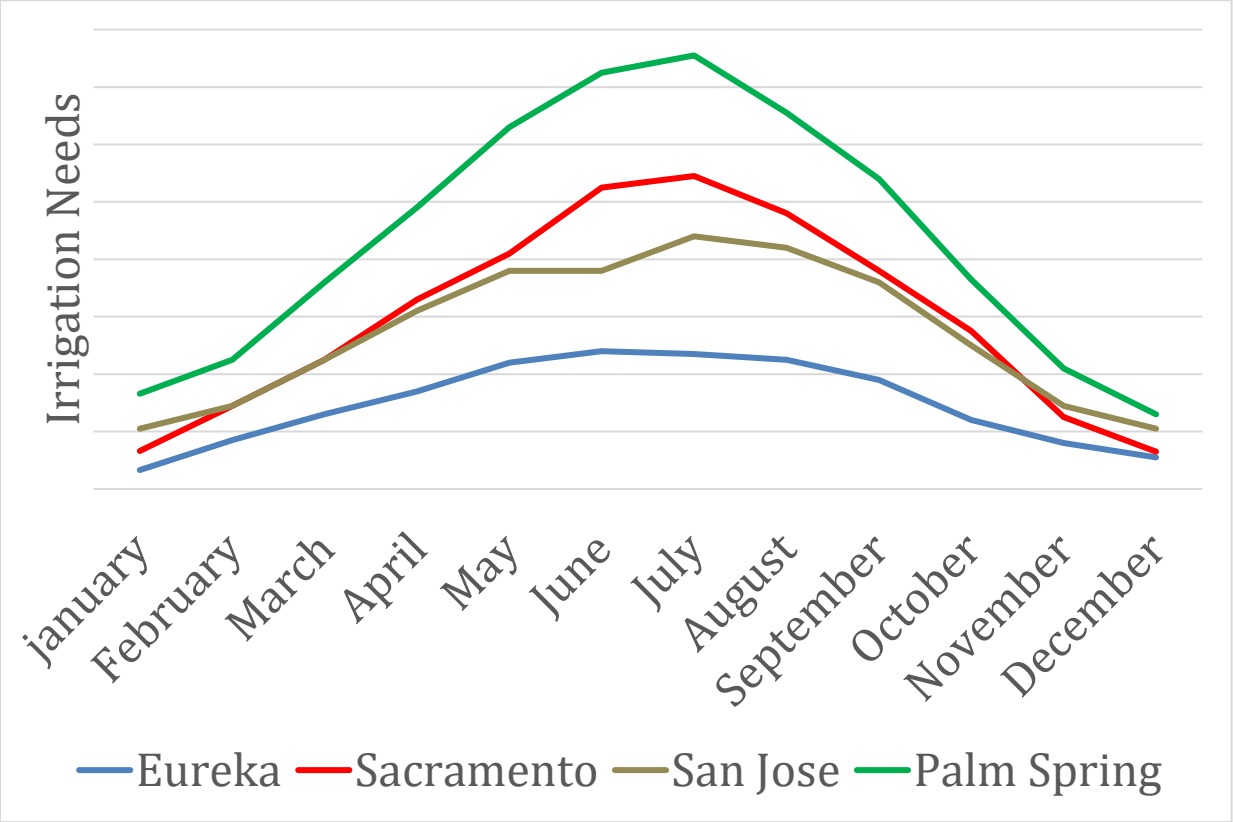


Illustration Credit: CEC with data from University of California Agriculture and Natural Resources

Figure 2-5 provides an example of the water savings from a landscape irrigation controller that can schedule irrigation based upon the needs of the landscape versus the typical homeowner scheduling, as found during a study by the Irvine Ranch Water District.[25]

The lower line is the irrigation required to support the landscape while the upper line is the average irrigation applied by the homeowners in the study. The shaded area between the two lines represents the savings potential of a landscape irrigation controller that can alter the irrigation schedule.

25 Hunt, Theodore; Lessick, Dale; et al. (Irvine Ranch Water District.) June 2001, pg. 22. *Residential Weather-Based Irrigation Scheduling: Evidence from the Irvine "ET Controller" Study,* https://irrigatesmart.com/wp-content/uploads/2019/02/Residential-Weather-Based-Irrigation-Scheduling-Study-ET-Controllers.pdf.

Figure 2-5: Example of Water Savings Through Better Irrigation Scheduling

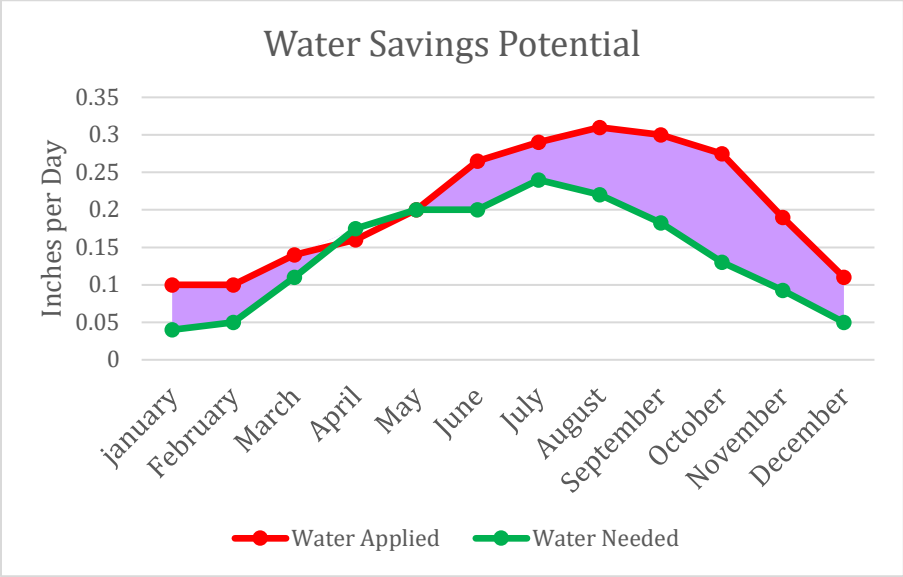


Illustration Credit: CEC with Irvine Ranch Water District Data

Landscape Irrigation Equipment

The irrigation industry provides a wide variety of landscape irrigation controllers. Landscape irrigation controllers are categorized according to the method of irrigation scheduling and installation. Additional devices considered are rain devices and soil moisture sensors that provide inputs to an irrigation controller. **Figure 2-6** shows the structure of the definitions proposed by staff.

Figure 2-6: Landscape Irrigation Equipment

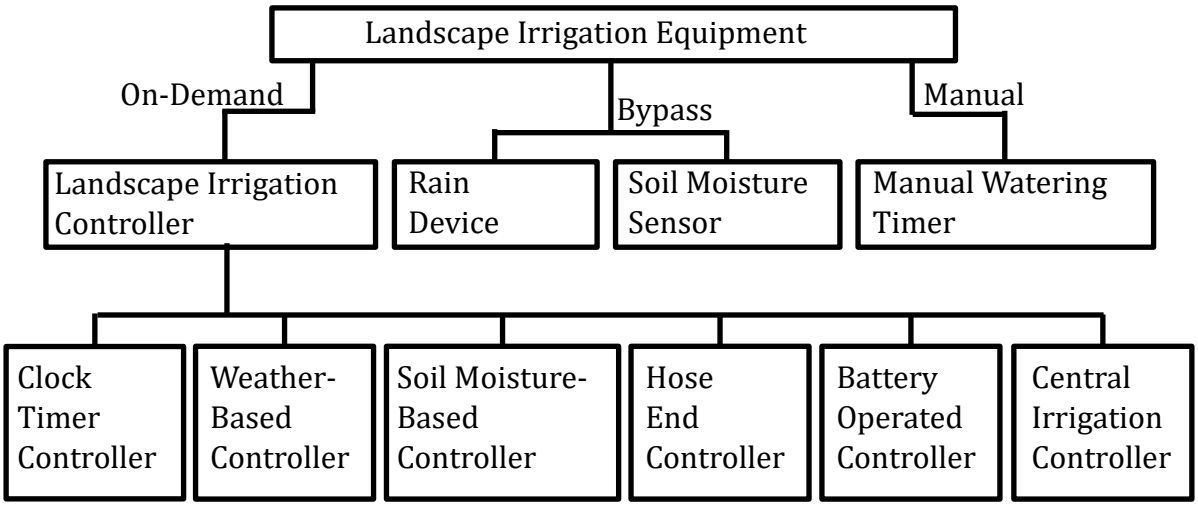


Illustration Credit: CEC

Landscape Irrigation Controllers and Equipment

A landscape irrigation controller schedules irrigation and commands the irrigation valves open and close. It may use a clock, rely on weather data, or measure conditions such as soil moisture to decide when to allow irrigation. **Figure 2-7** provides a block diagram of typical setup where the controller is remote from the irrigation valve and connected electrically.

Figure 2-7: Schematic of Signal Connections in Irrigation Controllers

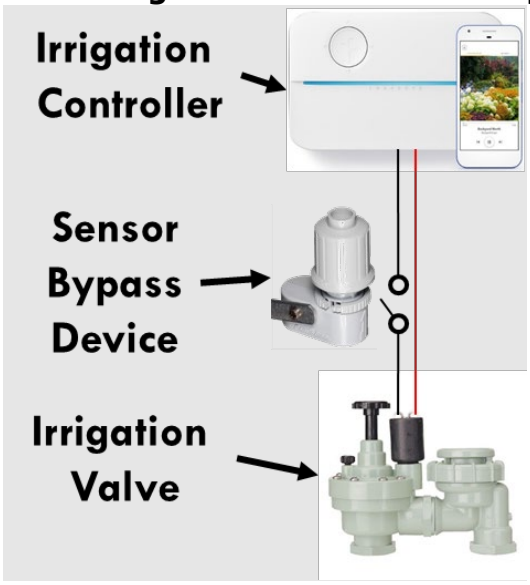


Illustration Credit: CEC

Clock Timer Controllers

A clock timer controller relies upon a clock and a user defined schedule for irrigation. The user sets the start and run times of each landscape zone. The controller will run the scheduled irrigation without regard to landscape moisture conditions.

Figure 2-8: Clock Timer Controllers

Photo Credit: Rain Bird

Weather-Based Controllers

Weather-based controllers rely upon historical weather data, remote weather data, or on-site sensors to vary the irrigation schedule to meet the irrigation needs of the landscape. The approach to setting the irrigation schedules varies greatly by manufacturer and irrigation controller model. Possible inputs include maximum and minimum air temperature, net solar radiation, average vapor pressure, and average wind speed. Some controllers may have historical records of the weather data that they rely on to perform calculations.[26]

Figure 2-9: Weather-Based Controllers

Photo Credit: Rachio

Soil Moisture-Based Controllers

Soil-moisture-based controllers sample the soil conditions with a soil sensor within the area the controller irrigates to determine if irrigation is needed. Most controllers will be set to maintain the soil moisture level safely above the wilting point — the point where irrecoverable degradation of the landscape occurs.

Figure 2-10: Soil Moisture-Based Controllers

Photo Credit: Baseline Inc.

26 U.S. Department of Interior, Bureau of Reclamation. August 2018. *Weather- and Soil Moisture- Based Landscape Irrigation Scheduling Devices*, pp 9-10, https://www.usbr.gov/watersmart/docs/2018/6thEd_WeatherSoilMoistureBasedLandscapeIrrigationSchedulingDevices.pdf.

U.S. EPA WaterSense Plug-In and Add-On Controllers

U.S. EPA WaterSense provides definitions for products to serve the retrofit market to upgrade clock-timer controllers with weather-based irrigation controllers.[27] The plug-in and add-on controllers rely on a time-clock controller and, when sold without a clock-timer controller, would not meet the proposed definition for a landscape irrigation controller. However, plug-in and add-on devices can provide a pathway for compliance of basic irrigation controllers with the proposed standards if sold together and the overall product meets the proposed standards when tested per the proposed test procedure.

Hose-Bib Controllers

The hose-bib controller threads over a hose bib. The controller may be a clock timer or a weather-based controller and is typically-battery operated. Hose-bib sprinkler systems can flow water comparable to an inground irrigation system.[28]

Figure 2-12: Hose-Bibb Controllers

Photo Credit: Orbit Irrigation Products LLC

The controllers are offered with one or more outlets. The controllers are also marketed with garden hose splitters that allow several single-outlet irrigation controllers to be attached to a single-hose bib. Hose-bib controllers possess the same utility and capability as other landscape irrigation controllers and are within the scope of the proposed standard.

27 U.S. EPA WaterSense. September 2, 2021. *WaterSense Specification for Weather-Based Irrigation Controllers, Version 1.1,* https://www.epa.gov/system/files/documents/2021-09/ws-outdoor-product-specification-wbic-revised-v1.1.pdf.

28 Washington Suburban Sanitary Commission. "Water Usage, Outdoor Water Consumption," https://www.wsscwater.com/understandusage.

Figure 2-13: Multiple-Zone Hose-Bibb Controller Configurations

Single Outlet Controllers With Hose Bibb Splitter

Multiple Outlet Controller

Photo Credit: Orbit Irrigation Products LLC

Battery-Operated Controllers

Manufacturers offer battery-operated landscape irrigation controllers for applications such as a street median. The devices are capable of actuating irrigation valves and handling several zones of irrigation. CEC staff found battery-operated controllers can accept an input from a soil moisture sensor and are within the scope of the staff proposal.

Figure 2-14: Battery-Operated Landscape Irrigation Controller

Photo Credit: Hunter Industries

Rain Devices

Rain devices are a type of bypass add-on or plug-in device that prevent irrigation after rainfall when it is not needed. Most rain devices act as a switch that opens because of rainfall and prevents the controller from sending the signal to the irrigation valve to open. **Figure 2-15** provides examples of the tipping bucket and expanding disk rain devices. The expanding disk is far more common in a landscape irrigation system.

Figure 2-15: Battery-Operated Landscape Irrigation Controllers

Photo Credit: Rain Bird and Argent Systems

Basic irrigation controllers merely sold with add-on or plug-in rain devices do not comply with the proposed standards.

Soil Moisture Sensors

Soil moisture sensors detect the level of water content within the soil. Soil moisture sensors are mostly found as part of a bypass device to prevent a landscape irrigation controller from sending a valve open signal. There are several underlying technologies for soil moisture sensors, including tension meters that measure the soil moisture tension. Volumetric sensors that measure the actual volume of the water in the soil is another technology used for soil moisture sensors.

Figure 2-16: Soil Moisture Interrupt Module and Probe

Photo Credit: Hunter Industries

Manual Watering Timers

A manual watering timer allows a limited irrigation time without requiring the user to return to turn off the water. The devices are typically mechanical and cannot initiate irrigation without the user manually turning it on. Manual watering timers are not in the scope of the proposed regulation for landscape irrigation controllers.

Figure 2-17: Manual Watering Timer

Photo Credit: Orbit Irrigation Products LLC

Central Irrigation Controllers

A central irrigation controller is an advanced system used to control irrigation at large landscapes such as sports fields and golf courses. The systems can control irrigation at several facilities. Central irrigation controllers are in the scope of proposed regulation for landscape irrigation controllers.

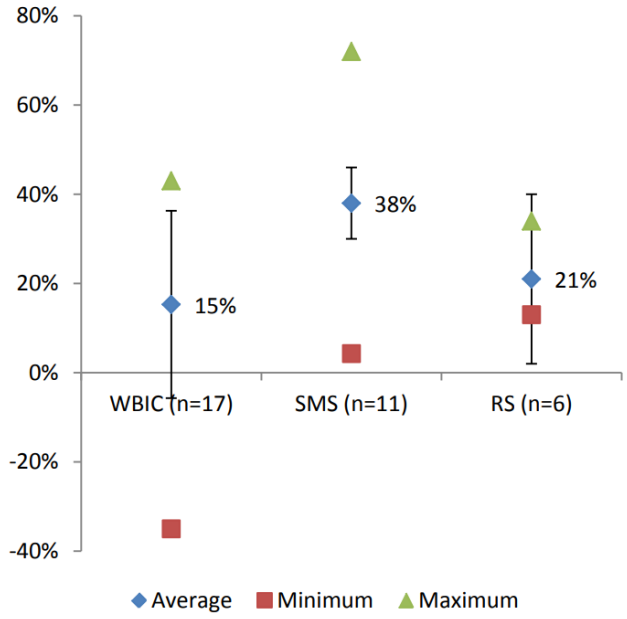
Figure 2-18: Central Irrigation Controller

Photo Credit: Hunter

Comparison of Water Savings Among Irrigation Control Technologies

Lawrence Berkeley National Labs (LBNL) published a comparison of various studies of weather-based irrigation controllers, rain sensors and soil moisture sensors. The study concluded that each technology could provide significant savings over manual watering or clock-based irrigation controllers. **Figure 2-19** presents the results of the comparison.[29]

Figure 2-19: Savings by Irrigation Control Technology



Illustrated Credit: Lawrence Berkeley National Laboratory

29 Williams, Alison, Heidi Fuchs, and Camilla Dunham Whitehead, Environmental Energy Technologies Division, Lawrence Berkeley National Labs, *Estimates of Savings Achievable From Irrigation Controller,* April 1, 2014, pg. 8, https://eta-publications.lbl.gov/sites/default/files/lbnl-6604e.pdf.

CHAPTER 3:
Regulatory Context

CEC staff considered and studied regulatory pathways to achieve water savings for landscape irrigation controllers. Staff evaluated voluntary standards, including the U.S. Environmental Protection Agency (EPA) WaterSense Specifications, and existing regulations and other approaches to ensure water efficiency and water conservation.

Voluntary Standards

Irrigation Association (IA)

The Irrigation Association developed and released several test methods with the Smart Water Application Technologies (SWAT) initiative. These test procedures established the foundation for other landscape irrigation equipment test procedures and standards, in particular the U.S. EPA WaterSense Specifications and the standards from the American Society of Agriculture and Biology Engineers (ASABE).

IA released the *SWAT 8th Testing Protocol for Climatologically Based Controllers* in September 2008.[30] The protocol tests the controller for irrigation adequacy, scheduling efficiency and runoff potential. The test defines the description of six virtual irrigation stations (zones) that vary in soil texture, ground slope, sun exposure, root zone, vegetation type irrigation system. The test is conducted over a minimum 30-day test period with requirements for varying weather conditions. The test procedure defines the method to measure performance but does not set a performance standard.

IA released the *SWAT Laboratory Screening Tests for Soil Moisture-Based Controllers* V.3.0 in August 2011.[31] The procedure measures performance of the controller for irrigation adequacy and scheduling efficiency. The test procedure has a laboratory screen phase where the controllers are tested over six to eight months in controlled conditions followed by an operational test on a virtual landscape like the IA SWAT Testing Protocol for Climatologically Based Controllers. The test method does not set a performance standard.

IA released the *SWAT Testing Protocol Version 3.0 for Rainfall Shutoff Devices* in October 2009. The test applies water to a sample of eight devices by a rainfall simulator. The devices are monitored to determine the specific time that the device detects switches to interrupt mode to prevent the irrigation controller from opening the irrigation valve. By having eight samples, the accuracy and precision of the design and manufacturing of the rainfall devices can be determined. The test yields information on the rainfall threshold before interrupt mode,

30 Irrigation Association. September 2008. *Smart Water Application Technologies Climatologically Based Controllers 8th Testing Protocol,* https://www.irrigation.org/IA/FileUploads/SWAT/Climate-Based-Controllers-Testing-Protocol-Version-8-September-2008.pdf.

31Irrigation Association. August 2011. *Smart Water Application Technologies, Laboratory Screening Tests for Soil Moisture-Based Controllers V.3.0 in August 2011,* https://www.irrigation.org/IA/FileUploads/SWAT/Soil-Moisture-Sensor-Based-Controllers-Testing-Protocol-Version-3.0-August-2011.pdf.

accuracy, precision, and coefficient of variation. The test method does not set a performance standard.[32]

U.S. Environmental Protection Agency (EPA) WaterSense

The U.S. EPA WaterSense program developed a voluntary test method and standard based on IA SWAT's Climatologically Based Controller test protocol. The EPA evaluated the test method and measured landscape irrigation controller performance for the ability to schedule irrigation adequacy, the ability to supply a minimum amount of water to keep a landscape healthy, and irrigation excess or measure of waste with the goal of eliminating overirrigation. The EPA made several modifications to the protocol based on the research results from work performed at the University of Florida. On November 3, 2011, the EPA published the *WaterSense Specification for Weather-Based Irrigation Controllers, Version 1.0*.[33] On December 20, 2018, the EPA began a review of specifications as required by the America's Water Infrastructure Act of 2018. On April 10, 2020, EPA issued a request for information regarding the completion of its review and decision to not update any specifications.[34] However, on September 2, 2021, the U.S. EPA published an updated *WaterSense® Specification, Version 1.1, for Weather-Based Irrigation Controllers* to directly reference the ANSI/ASABE S627 standard adopted by the American Society of Agriculture and Biology Engineers (ASABE) in December 2020 and to make other smaller modifications. In practice, the specification has remained unchanged since 2011.

On February 11, 2021, the U.S. EPA released a specification for soil moisture-based irrigation controllers to earn the WaterSense label.[35] This specification was developed in partnership with ASABE, and the specification established performance criteria on the function, precision, response to change in soil moisture and function following freeze conditions.

American Society of Agriculture and Biology Engineers (ASABE)

In December 2020, ASABE published the standard ANSI/ASABE S627 Weather-Based Landscape Irrigation Control Systems. This standard was a collaboration between the IA and the ASABE, and the testing is similar to the IA's climatological based test method with modifications for rainfall events, simulated soil types, and root zones. In October 2022, the standard revision ANSI/ASABE S627.1 was published, which corrected errors identified in equations within the standard and ensured that terms and abbreviations were used

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32 Irrigation Association. October 2009. *Smart Water Application Technologies Testing Protocol Version 3.0 for Rainfall Shutoff Devices,* https://www.irrigation.org/IA/FileUploads/SWAT/Rain-Shutoff-Devices-Testing-Protocol-Version-3.0-October-2009.pdf.

33 U.S. Environmental Protection Agency. November 3, 2011. *WaterSense® Specification for Weather-Based Irrigation Controllers Supporting Statement,* https://www.epa.gov/sites/production/files/2017-01/documents/ws-products-support-statement-irrigation-controllers.pdf.

34 85 FR 20268. April 10, 2020. *"Notice of Recent Specifications Review and Request for Information on WaterSense Program,"* available at https://www.epa.gov/sites/production/files/2020-04/documents/ws-frn-notice_of_review_and_rfi.pdf.

35 U.S. EPA. February 11, 2021. *WaterSense® Specification for Soil Moisture-Based Irrigation Controllers,* https://www.epa.gov/sites/default/files/2021-02/documents/watersense_specification_for_soil_moisture-based_irrigation_controllers.pdf.

consistently and appropriately.[36] The CEC was an active participant in the technical review of the necessary revisions, and in July 2023, the revision received a 2023 ASABE Standards Development Award.[37]

In May 2020, the ASABE released a test protocol, ANSI/ASABE S633, Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies, for bypass-type soil-moisture sensors. [38] The standard defines a procedure to test a soil moisture sensor's response to changes in soil moisture conditions in a media that simulates soil and to determine if the sensor will enable/disable an irrigation event at preset or selected soil water values.

International Association of Plumbing and Mechanical Officials

In November 2017, IAPMO released the 2017 Water Efficiency and Sanitation Standard (2017 WE Stand) that replaced the Green Plumbing & Mechanical Code Supplement. In October 2021, a second edition of this standard was published (2020 WE Stand).[39] This standard serves as a resource for jurisdictions implementing green building and water efficiency programs. The standard remains voluntary and requires the landscape irrigation control system to adjust the irrigation schedule automatically to respond to the water needs of the plant determined by weather or soil moisture conditions. This standard further requires the use of on-site sensors to suspend irrigation when adequate soil moisture is present or during rainfall or freezing conditions.

Leadership in Energy and Environmental Design (LEED) High-Efficiency Irrigation System for Mid-Rise Buildings

LEED is a green building rating system that provides framework to measure healthfulness, efficiency, and cost savings of green buildings. LEED provides credits for buildings that install landscape irrigation controllers that activate the valves for each watering zone at the best time of day to minimize evaporative losses and obey local regulations. Additional credits may be earned by installing a soil moisture sensor controller or rain delay controller.[40]

Existing Regulations and Other Approaches

California Model Water-Efficient Landscape Ordinance

Per Executive Order B-29-15 of April 1, 2015, the Department of Water Resources (DWR) updated the State's Model Water Efficient Landscape Ordinance (MWELO) through expedited

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36 American Society of Agricultural and Biological Engineers. October, 2022. Weather-Based Landscape Irrigation Control Systems, available at https://webstore.ansi.org/standards/asabe/ansiasabes627oct2022.

37 American Society of Agricultural and Biological Engineers. Standards Development Awards, available at: https://www.asabe.org/Awards-Competitions/Standards-Development-Awards

38 American Society of Agricultural and Biological Engineers. May, 2020. Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies, available at: https://elibrary.asabe.org/abstract.asp?aid=51227&t=3&redir=&redirType=.

39 International Association of Plumbing and Mechanical Officials. October 2021. *"Water Efficiency and Sanitation Standard (WE•STAND),"* available at: http://www.iapmo.org/we-stand.

40 U.S. Green Building Council. *"High-Efficiency Irrigation System for MID-RISE, Minimize Outdoor Demand for Water Through Water-Efficient Irrigation,"* available at: https://www.usgbc.org/credits/homes/v2008/wec2.

regulation. Cities and counties are responsible for adopting and reporting a water-efficient landscape ordinance.

MWELO applies to:

- New construction projects with an aggregate, or combined, landscape area equal to or greater than 500 square feet requiring a building or landscape permit, plan check, or design review.
- Rehabilitated landscape projects with an aggregate landscape area equal to or greater than 2,500 square feet requiring a building landscape permit, plan check, or design review.
- Cemeteries.
- Existing landscapes installed before December 1, 2015, greater than 1 acre.

MWELO includes requirements for the inclusion of automatic irrigation controllers using either evapotranspiration or soil moisture sensor data for irrigation design plans. MWELO also requires sensors to alter or suspend irrigation when weather conditions are unfavorable. However, these requirements are applied in design and construction and could possibly be omitted in the adoption of comparable regulations by local authorities.

California Efficient Outdoor Residential Water Use Standards

The California State Legislature in 2018 directed the DWR, in consultation with the State Water Resources Control Board (State Water Board), to conduct necessary studies and investigations and recommend standards for efficient outdoor residential water use for adoption by the State Water Board.[41] This is part of an effort to establish an Urban Water Use Objective.[42] DWR's recommendations for outdoor residential water use efficiency standard was published September 2022,[43] and these recommendations currently being considered for adoption by the State Water Board.

California State Water Resources Control Board Measures

Per Executive Orders B-37-16 and B-40-17, the California State Water Resources Control Board (State Water Board) issued regulations to prohibit certain wasteful water uses permanently.[44] The regulations added Chapter 3.5, Article 2, *Wasteful and Unreasonable Water Uses*, to Title 23, division 3 of the California Code of Regulations. Section 963(b)(1) provides several

41 Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman)

42 California State Water Resources Control Board. "Urban Water Use Efficiency Standards, Variances and Performance Measures," available at: https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/Urban-Water-Use-Efficiency-Standards-Variances-and-Performance-Measures

43 Department of Water Resources. September 2022. *Recommendations for Outdoor Residential Water Use Efficiency Standard*, available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/Performance-Measures/ORWUS_STD_WUES-DWR-2021-02_COMPLETE.pdf.

44 California State Water Resources Control Board. "*Regulation on Wasteful and Unreasonable Water Uses*," available at: https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/regs/wasteful_water_uses.html#documents.

prohibitions that apply to a variety of water users including homeowners, homeowners' associations, cities, and counties.

Wasteful and unreasonable water uses prohibitions include the following:

- Don't allow runoff from irrigated landscapes.
- Don't irrigate in the rain.
- Don't irrigate turf on medians and "parkways," unless the landscape performs a neighborhood function.

Additionally, the State Water Board adopted in 2022 water conservation emergency regulations, which remain in effect until December 2023 or June 2024.[45]

Regulations in Other States

Florida statutes require that "[a]ny person who purchases and installs an automatic landscape irrigation system must properly install, maintain, and operate technology that inhibits or interrupts operation of the system during periods of sufficient moisture."[46]

Minnesota statutes require "[a]ll automatically operated landscape irrigation systems shall have furnished and installed technology that inhibits or interrupts operation of the landscape irrigation system during periods of sufficient moisture."[47]

There are no federal efficiency standards for landscape irrigation controllers, rain devices, or soil moisture sensors.

The CEC's Pre-Rulemaking on Landscape Irrigation Controllers

The CEC has received extensive feedback from stakeholders since the CEC released an invitation to participate in April 2017. Initial comments highlighted the need to align with the WaterSense specification on weather-based irrigation controllers and the forthcoming ASABE S627 standard.

Following the webinar hosted by the CEC in December 2019, stakeholder comments emphasized the need for the standards to allow weather-based irrigation controllers as well as soil moisture-based irrigation controllers to comply with the standards. This request was to ensure that the standards do not impede innovation and to allow products meeting the WaterSense specification for soil moisture-based irrigation controllers to be sold in California.

In December 2021, the CEC shared draft proposed regulatory language to an informal workgroup established for the pre-rulemaking. Comments on the proposed regulatory language suggested clarifications to the regulatory text and stressed the need to define the scope of the regulations clearly. The staff proposal included in this draft staff report reflects

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45 California State Water Resources Control Board. "Water Conservation Emergency Regulations," available at: https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/regs/emergency_regulation.html

46 *Florida Statutes Title XXVIII Chapter 373 Section 62,* available at: https://www.flsenate.gov/Laws/Statutes/2022/0373.62.

47 Minnesota Statutes, Chapter 103G, Section 298, *LANDSCAPE IRRIGATION SYSTEMS,* available at: https://www.revisor.mn.gov/statutes/cite/103G.298.

the comments received and the CEC welcomes the continued engagement of stakeholders to improve the forthcoming regulations on landscape irrigation controllers.

CHAPTER 4:
Proposed Standards for Landscape Irrigation Controllers

CEC staff has analyzed equipment and practices of landscape irrigation, as well as the cost-effectiveness and technical feasibility of regulating landscape irrigation controllers. Staff proposes standards that meet either WaterSense® specification for soil moisture-based irrigation controllers Version 1.0[48] or WaterSense® specification for weather-based irrigation controllers Version 1.1[49] for potential regulations. As the next chapters will show, these standards are cost-effective to consumers, are technically feasible to achieve, and will result in significant water savings. Staff has determined that the water savings under the proposed standard are significant while imparting a small incremental cost to consumers. The proposed standard is attainable with products currently available in the market.

Scope

CEC staff reviewed the readiness of the various types of landscape irrigation equipment discussed in this report for water-saving regulations. Staff reviewed available test procedures, availability of products with irrigation scheduling capability, and the possibility that the products meeting the standard would provide significant water savings. Staff proposed regulations for landscape irrigation controllers because of the availability of test methods, test data, currently available compliant products, and significant cost-effective water savings.

Table 4-1 shows examples of the landscape irrigation devices that are in-scope or out-of-scope of the regulation. In-scope devices exert a positive control over the irrigation system by initiating the start and stop of the irrigation schedule such as by providing a command current to the solenoid in a landscape irrigation valve. Out-of-scope devices cannot provide this command. The ability to start an irrigation cycle when weather and soil moisture conditions indicate irrigation is needed reduces water waste.

Staff chose to exclude manual-watering timers from the proposed regulation. Chapter 2 describes the landscape irrigation devices, including manual watering timers.

Products within the scope of proposed regulations include residential and commercial irrigation controllers. Although staff could not identify any commercial-grade irrigation controllers that don't comply with the proposed standards, they are included in the scope to prevent potential loopholes from forming.

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48 The U.S. EPA WaterSense. February 2021. *WaterSense® Specification for Soil Moisture-Based Irrigation Controllers, Version 1.0,* available at: https://www.epa.gov/sites/default/files/2021-02/documents/watersense_specification_for_soil_moisture-based_irrigation_controllers.pdf.

49 The U.S. EPA WaterSense. September 2, 2021. *WaterSense® Specification for Weather-Based Irrigation Controllers, Version 1.1,* available at: https://www.epa.gov/system/files/documents/2021-09/ws-outdoor-product-specification-wbic-revised-v1.1.pdf.

Table 4-1: Examples of In- and Out-of-Scope Landscape Irrigation Controllers

In-Scope Devices	Out-of-Scope Devices
Clock timer controllers Weather-based controllers Soil moisture-based controllers Hose-bib controllers Battery-operated controllers Central control irrigation systems	Manual-watering timers

Source: CEC

Test Procedures

Staff proposes to use ANSI/ASABE S627.1 (October 2022) with some modifications as the test procedure for weather-based landscape irrigation controllers which is aligned with the U.S. EPA *WaterSense Specification for Weather-Based Irrigation Controllers, V.1.1 September 2, 2021*. All weather-based landscape irrigation controllers, manufactured on or after the date that is one year after the adoption of the proposed regulation, must show compliance by the weather-based irrigation controllers criteria and be certified as tested in a lab approved by the CEC.

Staff proposes to use ANSI/ASABE S633 (May 2020) with some modifications as the test procedure for soil moisture-based irrigation controllers which is aligned with the test procedure for the U.S. EPA *WaterSense Specification for Soil Moisture-Based Irrigation Control Technologies, V1.0 February 1, 2021*. All soil-moisture based landscape irrigation controllers manufactured on or after the date that is one year after the adoption of the proposed regulation must be tested and show compliance with soil moisture-based irrigation controllers criteria that are aligned with the *WaterSense Specification for Soil Moisture-Based Irrigation Control Technologies, V1.0, February 1, 2021*.

Staff proposes landscape irrigation controllers that are a combination of weather-based and soil moisture-based landscape irrigation controllers to be tested according to both test procedures for the weather-based landscape irrigation controllers and soil moisture-based landscape irrigation controllers.

Standard

Staff proposes all landscape irrigation controllers sold or offered for sale in California be weather-based irrigation controllers, soil moisture-based irrigation controllers, or both.

Staff's proposed standard for weather-based landscape irrigation controllers sold or offered for sale in California align with the *U.S. EPA WaterSense Specification for Weather-Based Irrigation Controllers, V.1.1 September 2, 2021*.[50] Specifically, all weather-based landscape irrigation controllers manufactured on or after the date that is one year after the adoption of

50 U.S. EPA WaterSense. September 2, 2021. *WaterSense® Specification for Weather-Based Irrigation Controllers, Version 1.1,* available at: https://www.epa.gov/system/files/documents/2021-09/ws-outdoor-product-specification-wbic-revised-v1.1.pdf.

the proposed regulation must be certified to the CEC as meeting the following requirements when tested per proposed test procedure for weather-based landscape irrigation controllers:

- Irrigation adequacy, the ability to supply a minimum amount of water to keep a landscape healthy, shall be greater than or equal to 80 percent for each zone.
- Irrigation excess or measure of waste with the goal of eliminating overirrigation shall be less than or equal to 10 percent for each zone and average irrigation excess across the six zones shall be less than or equal to 5 percent.
- Have the following capabilities:
    - Be capable of preserving the contents of the programmed irrigation settings when the power source is lost and without relying on an external battery backup.
    - Either be capable of independent, zone-specific programming or storing at least three programs to allow separate schedules for zones with differing water needs.
    - Be capable of indicating to the user when it is not receiving a signal or local sensor input and is not adjusting irrigation based on current weather conditions.
    - Be capable of interfacing with a rainfall device or soil moisture sensor.
    - Be capable of accommodating watering restrictions as follows:
        - Operation on a prescribed day(s)-of-week schedule (for example, Monday-Wednesday-Friday, Tuesday-Thursday-Saturday; any two days; any single day).
        - Either even-day or odd-day scheduling, or any day interval scheduling between two and seven days.
        - The ability to set irrigation runtimes to avoid watering during a prohibited time of day (for example, between 9:00 a.m. and 9:00 p.m.).
        - Complete shutoff (for example, on/off switch) to accommodate outdoor irrigation prohibition restrictions.
    - Include a feature to increase or decrease the runtimes or application rates for zones by means of one adjustment without modifying the settings for each zone (percentage adjustment for water budget).
    - Be capable of reverting to either a proxy of historical weather data or a percentage adjustment (water budget) feature if the primary source of weather information is lost.
    - Be capable of allowing for a manual operation troubleshooting test cycle and automatically return to weather-based mode within a set period as designated by the manufacturer.

The WaterSense test method and performance standard found within the specification were well vetted by the EPA in a public proceeding and the EPA-sponsored efforts by the University of Florida to suggest improvements to the underlying IA SWAT's Climatologically Based

Controller test protocol. The EPA showed the test method reveals differences in the ability of landscape irrigation controllers to provide adequate irrigation while minimizing water waste. Testing by the EPA showed the standard of the specification as technically feasible and yielding significant water savings.

Proposed standards for soil moisture-based landscape irrigation controllers sold or offered for sale in California align with the U.S. EPA WaterSense Specification *for Soil Moisture-Based Irrigation Control Technologies, V1.0, February 1, 2021*.[51] Specifically, all soil moisture-based landscape irrigation controllers manufactured on or after the date that is one year after the adoption of the proposed regulation must be certified to the CEC as being sold with a soil moisture sensor (SMS) meeting the following requirements when tested according to the proposed test procedure:

- Landscape irrigation controllers using soil moisture data shall enable and disable irrigation at each of the three depletion levels specified in the test procedure.
- Landscape irrigation controllers using soil moisture data shall have a relative average deviation (RAD) of the readings at which the replicate SMSs enable and disable irrigation, less than or equal to 10 percent when averaged across all water depletion level readings.
- The absolute value of the slope of the line generated from three depletion levels data points, specified in the test procedure, for both irrigation-enabled and irrigation-disabled readings, by using a least square regression plot for each replica, shall be greater than zero.
- Each SMS evaluated shall enable and disable irrigation after the sensor mechanism is placed in a freezer for three days and thawed to prefreeze medium temperature.
- Have the following capabilities:
    - Be capable of preserving the contents of the programmed irrigation settings and sensor mechanism settings when the power source is lost and without relying on an external battery backup.
    - Either be capable of independent, zone-specific programming or storing at least three programs to allow for separate schedules for zones with differing water needs.
    - Be capable of indicating to the user when it is not receiving sensor mechanism input and is not adjusting irrigation based on soil moisture content in the landscape.
    - Be capable of interfacing with a rainfall device.
    - Be capable of accommodating watering restrictions as follows:
        - Operation on a prescribed day(s)-of-week schedule (for example, Monday-Wednesday-Friday, Tuesday-Thursday-Saturday; any two days; any single day).

51 U.S. EPA WaterSense. February 2021. *WaterSense® Specification for Soil Moisture-Based Irrigation Controllers, Version 1.0,* available at: https://www.epa.gov/sites/default/files/2021-02/documents/watersense_specification_for_soil_moisture-based_irrigation_controllers.pdf.

        - Either even-day or odd-day scheduling, or any day interval scheduling between two and seven days.
        - The ability to set irrigation runtimes to prevent watering during a prohibited time of day (for example, between 9:00 a.m. and 9:00 p.m.).
        - Complete shutoff (for example, on/off switch) to accommodate outdoor irrigation prohibition restrictions.
    - Include a water budget feature to increase or decrease the runtimes or application rates for zones by means of one adjustment without modifying the settings for each zone.
    - Be capable of reverting to a percentage adjustment (water budget) feature if the sensor mechanism signal is lost.
    - Be capable of allowing for a manual operation troubleshooting test cycle and shall automatically return to soil moisture mode within a set period as designated by the manufacturer.

Staff also proposes landscape irrigation controllers that are combination of weather-based and soil moisture-based irrigation controllers that are sold or offered for sale in California after the effective date of the proposed regulation to meet requirements aligned with the U.S. EPA *WaterSense Specification for Weather-Based Irrigation Controllers, V.1.1, September 2, 2021,* and *WaterSense Specification for Soil Moisture-Based Irrigation Control Technologies, V1.0, February 1, 2021*.

The WaterSense test method and performance standard found within the specifications were well vetted by the EPA in a public proceeding and the EPA-sponsored efforts by the University of Florida to suggest improvements to the underlying ANSI/ASABE S633, Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies.[52] The EPA showed the test method reveals differences in the ability of landscape irrigation controllers to provide adequate irrigation while minimizing water waste. Testing by the EPA showed the standard of the specification as technically feasible and yielding significant water savings.

The regulation will result in water savings by creating mandatory standards for products sold or offered for sale in California. Based on its independent analysis of the available data, staff has concluded that these proposed regulations are cost-effective and technically feasible. Staff assumptions and calculations are provided in Appendix A.

52 American Society of Agricultural and Biological Engineers. May 14, 2020. News Release: *"ASABE Publishes New Test Protocol for Landscape Irrigation Devices,"* available at: https://www.asabe.org/LinkClick.aspx?fileticket=S4HKyDWMzuY%3d&portalid=0.

Certification

Manufacturers would be required to certify each model of landscape irrigation controllers to the CEC's appliance efficiency database. Certifying each model will allow effective enforcement of the proposed standard by providing regulators with a list of products that could be legally sold in California. Certifying will also allow distributors and retailers to verify that products can be legally sold before sale.

Marking

There are no specific marking and labeling requirements beyond general marking requirements. All appliances will need to be marked with the manufacturer name, brand name, or trademark; the model number; and the date of manufacture, permanently, legibly, and conspicuously on an accessible place on each unit. The date of manufacture marking shall provide at a minimum the month and year that the product was produced. The marking will enable effective enforcement by requiring landscape irrigation controllers within the scope of the regulations to be identifiable.

CHAPTER 5:
Alternatives Considered for Landscape Irrigation Controllers

The CEC staff proposal was analyzed to determine whether it meets the legislative criteria for the CEC's prescription of appliance efficiency standards. Staff also reviewed and analyzed the U.S. EPA WaterSense specification, as well as other state and local standards. Staff will continue to analyze and consider alternative proposals as they are provided to the CEC.

Alternative 1: Include Rain Sensor with Landscape Irrigation Controller Standard

Staff studied proposing that a rain sensor be included with each landscape irrigation controller sold or offered for sale since many rain sensors are available and many landscape irrigation controllers are compatible with a rain sensor. Rain sensors would provide significant water savings. When combined with the previous work performed by the University of Florida, there is enough information to analyze cost-effectiveness, technical feasibility, and statewide water savings. Staff believes although this proposal saves water, it lacks a consensus test procedure and minimum performance standard to allow implementation of this standard. Moreover, in absence of a rainfall, this proposal would not provide adequate watering adjustments resulting in water savings that is far less than other available options. Therefore, staff did not consider this alternative.

Alternative 2: Soil Moisture-Based Landscape Irrigation Controller Standard

For this proposal, a soil-moisture sensor would be included with each landscape irrigation controller sold or offered for sale. This proposal would be aligned with the U.S. EPA's *WaterSense Specification for Soil Moisture-Based Irrigation Controllers, Version 1.0* (February 2021).[53] If applied correctly, this alternative would provide the most water savings of the alternatives considered by staff. However, the estimated potential water savings are fully realized only when moisture sensors adequately estimate the moisture levels of the irrigated area. For large areas or for areas with varying topology or soil textures, multiple irrigation zones and soil moisture sensors might be needed to provide more adequate irrigation. Also, there are few complying models on the market. Therefore, requiring a standard that could be met only by soil moisture-based irrigation controllers might not be the most water-efficient alternative for all applications and might cause supply chain issue for California consumers.

53 *WaterSense® Specification for Soil Moisture-Based Irrigation Controllers,* available at: https://www.epa.gov/sites/default/files/2021-02/documents/watersense_specification_for_soil_moisture-based_irrigation_controllers.pdf.

Alternative 3: Weather-Based Landscape Irrigation Controller Standard

Staff studied proposing that landscape irrigation controllers meet the *U.S. EPA WaterSense Specification for Weather-Based Irrigation Controllers*[54] since this would create a performance standard with an available test method. There are enough performance data to demonstrate cost-effectiveness and technical feasibility of the controllers that meet this specification. Staff believes that although the savings from this proposal would be significant, it may preclude soil moisture-sensing technologies that have been shown to be technically feasible and cost-effective.

Staff Proposal

As stated in Chapter 4, staff is proposing a standard that would be a combination of Alternatives 2 and 3. In this proposal, a landscape irrigation controller would need to meet the requirements of Alternative 2 or Alternative 3 but not the requirements of both alternatives. This proposal would provide more flexibility to manufacturers of landscape irrigation controllers and provide consumers with additional options for managing their landscape irrigation while achieving significant cost-effective water savings.

54 *WaterSense® Specification for Soil Weather-Based Irrigation Controllers,* available at: https://www.epa.gov/system/files/documents/2021-09/ws-outdoor-product-specification-wbic-revised-v1.1.pdf.

CHAPTER 6:
Technical Feasibility

Compliant Product Availability

U.S. EPA WaterSense-Labeled Products

As of July 2023, the U.S. EPA WaterSense product website showed more than 960 weather-based landscape irrigation controller models with the WaterSense label.[55] The WaterSense compliant product list shows landscape irrigation controller models are available from several manufacturers. Since the proposed standard is identical to the WaterSense program, the proposed standard is technically feasible. The variety of products available from multiple manufacturers confirms compliant product availability and a lack of any intellectual property barriers that could otherwise prevent competition.

As of the publication date of this report, the U.S. EPA's WaterSense compliant product list for soil moisture-based irrigation controllers shows four models from two manufacturers that meet the specification. Since the proposed standard is identical to the WaterSense program, the proposed standard is technically feasible. Although there are only a handful of soil moisture-based models available on the market, more models are expected to become available in the future.

Proposed standards provide flexibility for California consumers to choose from a growing list of more than 960 compliant models altogether.

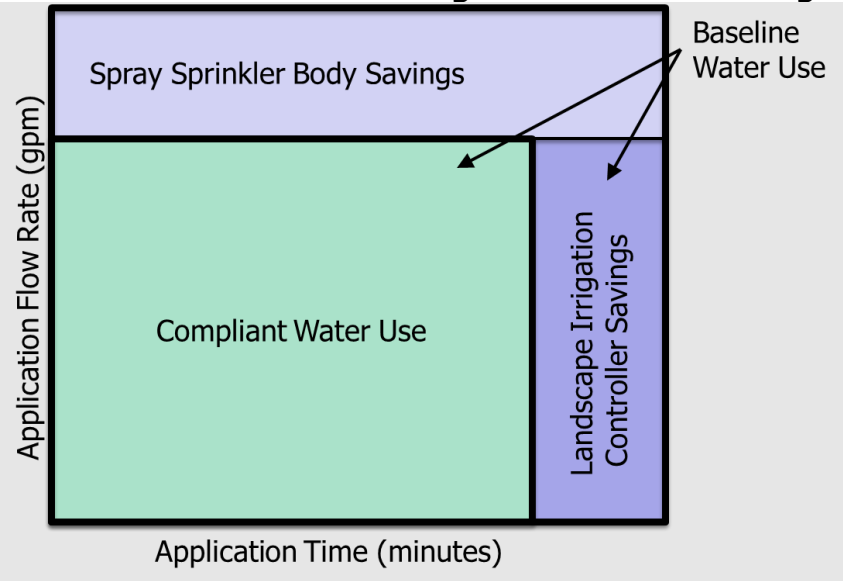
55 U.S. EPA. "WaterSense Product Search," available at: https://lookforwatersense.epa.gov/products/index.html.

CHAPTER 7:
Costs and Savings Analysis

The proposed standard for landscape irrigation controllers would significantly reduce water and energy consumption. CEC staff estimated per device water savings by reviewing the compilation of studies performed by Lawrence Berkeley National Laboratory (LBNL) on weather-based irrigation controllers (WBIC). The compilation showed that on average WBIC reduced water consumption by 15 percent.[56] And controllers with soil moisture sensors saved even more.

To calculate savings, staff also considered the adopted spray sprinkler body (SSB) appliance standard that significantly increases efficiency of landscape irrigation. Each measure will have a complementary effect. The SSB standard provides more efficient irrigation through reducing the application flow rate of the SSB while the landscape irrigation controller standard will reduce the irrigation time. Total irrigation can be visualized as an area equal to the product of application flow rate and the application time. **Figure 7-1** shows the interaction of landscape irrigation controller and SSB savings. Staff calculated water savings assuming a baseline that the spray sprinkler body standard is fully implemented. With this baseline, staff calculated the additional savings due to the proposed landscape irrigation controller standard.

Figure 7-1: Combined Water Savings From California Regulations



Source: CEC illustration

56 2014. Williams, Alison, Heidi Fuchs, and Camilla Dunham Whitehead. 2014. *Estimates of Savings Achievable from Irrigation Controllers.* Lawrence Berkeley National Laboratory, available at: https://eta-publications.lbl.gov/sites/default/files/lbnl-6604e.pdf.

Although weather-based and soil moisture-based irrigation controllers meet the proposed standards, staff used only weather-based controllers for costs and benefits analysis because they encompass most of the compliant products on the market.

The values in **Table 7-1** list the design life and per unit annual and life-cycle water savings. The estimates for the design life and water savings of a compliant irrigation controller is based on the U.S. EPA's WaterSense estimates.[57] The estimated baseline water use is from the staff estimate of annual water use after spray sprinkler body water efficiency standards went into effect October 1, 2020.[58]

Table 7-1: Per Unit Water Savings for WBIC

Product Type	Design Life (years)	Water Savings (%)	Baseline Water Use (Gal/yr)	Compliant Water Use (Gal/yr)	Water Savings (Gal/yr)	Life-Cycle Water Saving (Gal)
WBIC	15	15%	88,436	75,171	13,265	198,981

Source: CEC

Table 7-2 summarizes estimated initial costs and annual and life-cycle monetary savings. The average annual savings are the savings that consumers will receive once the compliant product is installed. To determine incremental costs of landscape irrigation controllers that meet the proposed standards, CEC staff gathered retail price data from landscape equipment vendor websites. Staff analyzed the data to estimate the cost difference to consumers with the addition of the weather-based irrigation-scheduling features. Staff applied a 3 percent discount rate to calculate the net present value of the anticipated savings over the design life.

Table 7-2: Per Unit Monetary Costs and Savings for WBIC ($2023)

Water Rate ($/1000 Gal)	Water Cost Life-Cycle Savings ($)	Incremental Costs ($)	Life-Cycle Net Benefit ($)	Pay Back Period (Years)	Benefits to Cost Ratio
$6.13	$915.03	$24.83	$890.20	0.33	36.85

Source: CEC

To estimate the monetary value of the water saved, an average metered water rate in California is needed. CEC staff used publicly available data from various sources such as the Department of Water Resources (DWR) audit reports for urban water suppliers,[59] California

57 U.S. EPA. *WaterSense® Specification for Weather-Based Irrigation Controllers Supporting Statement*, available at: https://www.epa.gov/sites/default/files/2017-01/documents/ws-products-support-statement-irrigation-controllers.pdf.

58 Steffensen, Sean. 2019. *Final Staff Analysis of Water Efficiency Standards for Spray Sprinkler Bodies.* California Energy Commission, CEC-400-2018-005-SF, available at: https://efiling.energy.ca.gov/GetDocument.aspx?tn=227860&DocumentContentId=59234

59 The Water Use Efficiency (WUE) data submitted to the Department of Water Resources: https://wuedata.water.ca.gov/default.asp.

Water Association (CWA),[60] and water utility providers websites to estimate the weighted average rate for water in California. The annual savings of each unit are calculated by multiplying the annual water savings by the water rate charge of $6.13 per 1,000 gallons.

The life-cycle benefit represents the savings the consumer will receive over the life of the appliance and is the product of the average annual savings multiplied by the average design life of the unit.

The net life-cycle benefit, which determines the cost-effectiveness of the proposed standards, is the difference between the life-cycle savings and the incremental cost of each compliant unit. A comparison of the initial cost to upgrade a noncomplying irrigation controller device to a complying device and the cost of water saved as a result of this regulation shows that this proposal is extremely cost-effective with a benefits-to-costs ration of more than 36 and a payback period of about four months.

Proposed standards will also result in significant electricity and natural gas savings attributed to reduction in water pumping, treatment, and delivery.[61] However, these embedded energy savings are not included in the costs analysis as the associated costs of electricity and natural gasses are included in the water rates. Staff used the data provided by the California investor-owned utilities (IOUs), indicating that every million gallons of water uses 3,565 kilowatt-hours (kWh), to estimate embedded electricity savings by the proposed standards shown in **Table 7-3**.

Table 7-3: Embedded Electricity Savings

1st Year Embedded Electricity Saving (kWh/yr per unit)	Embedded Electricity Saving over the Life of Product (kWh/unit)	Statewide 1st Year Embedded Electricity Savings (GWh/yr)	Statewide Stock Turnover Embedded Electricity Savings (GWh/yr)
47.29	709	14.3	213.3

Source: CEC

Although compliant irrigation controllers contribute to significant energy savings for embedded electricity used for water treatment and delivery, they typically result in higher standby power

60 California Water Association. "Regulated Water Utilities," available at: https://calwaterassn.com/about-cwa/regulated-water-utilities-in-california/.

61 *California Investor Owned Utilities Comments Response to Invitation to Participate — Landscape Irrigation Controllers,* June 16, 2017, available at: https://efiling.energy.ca.gov/GetDocument.aspx?tn=219251&DocumentContentId=26786.

consumption.[62] Therefore, there are power-saving opportunities that should be addressed through another CEC program, a low-power-mode roadmap.[63]

To arrive at an estimate for the existing inventory of automatic irrigation control systems currently installed in California homes, staff used 2023 demographic information from the California Department of Finance (DOF) to find the number of single-family and multifamily homes in California.[64] Staff then used the data provided by the California IOUs' comments in response to the invitation to participate for landscape irrigation controllers for an estimated percentage of homes that have an automatic irrigation system.[65] Staff used the data provided by the IOUs' comment indicating that 68 percent of California's single-family homes use automatic sprinkler system from which 89 percent use an irrigation timer to control the irrigation schedule to conclude that 60.5 percent of single-family homes in California use irrigation control system. Staff extended this conclusion to residential buildings containing multifamily homes.

Staff relied on this information to calculate that about 5.6 million irrigation controllers are in use in California. Assuming an average growth rate aligned with the growth rate for housing in California and a 15-year design life, staff estimates about 390,000 landscape irrigation controllers are shipped this year in California. Details of these calculations are in Appendix A.

The water saving of each residential unit is estimated by comparing the baseline water consumption for landscape irrigation controllers with the respective water consumption under the proposed standards. For the annual and accumulative statewide savings estimates, per unit savings are multiplied by the annual sales and by the total stock of compliant products in California. These calculations are available in **Appendix A**. In **Tables 7-4**, the potential statewide water and costs savings of the proposed standards are provided for the first year after the regulations take effect. Estimated water and cost savings are calculated assuming that 24.5 percent of irrigation controllers meet the proposed standards without regulations and therefore they are part of baseline estimates and don't contribute to the potential savings. Furthermore, staff assumed products compliant with the proposed standards grow by 0.5 percent without regulations year over year. With the proposed standards California consumers would save more than 4 billion gallons of water equating to $22.5 million in water cost savings in the first year after the regulations take effect.

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62 Brown, Rich Brown. Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory (LBNL). *"Energy Consumption of Irrigation Controllers,"* June 1, 2009: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjUy9Xmu4WBAxUqD0QIHQamANsQFnoECCQQAQ&url=https%3A%2F%2Fefiling.energy.ca.gov%2FGetDocument.aspx%3Ftn%3D52060%26DocumentContentId%3D37063&usg=AOvVaw1zGQ7luvo-eRpbLdkWPXqR&opi=89978449.

63 California Energy Commission. *"Low-Power Roadmap,"* https://www.energy.ca.gov/proceeding/low-power-mode.

64 California Department of Finance. *"E-5 Population and Housing Estimates for Cities, Counties, and the State, 2020–2023,"* https://dof.ca.gov/forecasting/demographics/estimates/e-5-population-and-housing-estimates-for-cities-counties-and-the-state-2020-2023/.

65 *California Investor Owned Utilities Comments Response to Invitation to Participate — Landscape Irrigation Controllers,* September 18, 2017, https://efiling.energy.ca.gov/GetDocument.aspx?tn=221225&DocumentContentId=26788.

Table 7-4: First-Year Statewide Costs and Water and Cost Savings ($2023)

Application	Per-unit Water Savings (gal/yr/unit)	1st Year Sales in CA (Units/yr)	Statewide 1st Year Water Savings (million gal/yr)	Statewide 1st Year Costs ($million/yr)	Statewide 1st Year Costs Savings ($million/yr)
Irrigation Controllers	13,265	399,846	4,005	$7.1	$22.5

Source: CEC

Staff calculations and assumptions used to estimate first-year savings and stock turnover savings are provided in **Appendix A**.

Table 7-5 shows the potential total water and costs savings after the existing stock of irrigation controllers in use is entirely turned over with compliant devices. As provided in **Table 7-5**, if all landscape irrigation controllers complied with the proposed standards (annual stock savings), California would save about 60 billion gallons of water, which equates to $275 million in water cost savings.

Table 7-5: Statewide Water and Cost Savings After Stock Turnover ($2023)

Application	Stock Turn Over Year	Statewide Stock Turnover Water Savings (million gal/yr)	Statewide Stock Turnover Costs Savings ($million/yr)
Irrigation Controllers	Year 15	59,830	$275

Source: CEC

In conclusion, the proposed standards are clearly cost-effective, as consumers will receive a net savings from the installation of landscape irrigation controllers over the life of the product.

CHAPTER 8:
Environmental Impacts and Benefits

This chapter provides the basis for the staff determination that adoption of the proposed amendments is exempt from the requirements of the California Environmental Quality Act (CEQA).

Proposed Notice of Exemption Finding

Categorial Exemptions, Classes 7 and 8 Exemptions

California Code of Regulations, Title 14, Sections 15307 and 15308, exempt actions taken by a regulatory agency to "assure the maintenance, restoration, or enhancement of a natural resource" and actions taken to "assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment." As demonstrated in this report, the proposed landscape irrigation controller standards will have no significant effect on the environment and fall squarely within the categorical exemptions of Sections 15307 and 15308.

The activities of this project are being undertaken in furtherance of the CEC's Title 20 appliance standards program to reduce water and energy consumption. The project is designed to benefit the environment and natural resources by reducing water and energy consumption in the state, thereby reducing irrigation excess, water waste, and the water supplied to keep a landscape healthy. This rulemaking directly addresses significant environmental impacts associated with excess water supply and energy and water consumption and is an action to assure the maintenance, restoration, or enhancement of a natural resource and protection of the environment.

Further, none of the exceptions to exemptions listed in the California Environmental Quality Act (CEQA) Guidelines Section 15300.2 apply to this project. Furthermore, there is no reasonable possibility that the activity will have a significant effect on the environment because of unusual circumstances. For these reasons, this project is exempt from CEQA.

Impacts

The proposed regulation requires landscape irrigation controllers manufactured on or after the effective date of this regulation to comply with the proposed standards. Landscape irrigation controllers are usually replaced when they are at the end of the useful lives; therefore, replacement of these appliances manufactured under current or past standards with appliances manufactured under the updated standards would present no additional impact to the environment beyond the natural cycle.

Typically, these devices feature a microprocessor and circuit board to keep time and initiate irrigation cycles. Weather-based irrigation controllers typically add more sophisticated software to determine when to begin and end an irrigation cycle. Adding a soil-moisture sensor to a landscape irrigation controller would not introduce any materials not already found in the

controller. The proposed standards do not require the use of any specific material to improve the efficiency of the product.

Since these improvements are already common practice, updating the water efficiency of landscape irrigation controllers is not likely to change industry practice, the landscape irrigation controller design, or the material composition of these landscape irrigation controllers. In addition, the materials found in the final product do not contain any hazardous materials, pose no harm to the user, and would not cause a significant environmental impact.

The marking requirement would require product information to appear on the appliance. The marking requirement could be accomplished with existing marking techniques and would not cause a significant environmental impact.

Benefits

The proposed standards would save significant amounts of water, estimated at about 60 billion gallons annually, after full-stock turnover. The proposed standards also save significant amount of electricity used for water pumping, treatment, and delivery. The embedded electricity saving is estimated to be about 213 GWh annually after full-stock turnover.

For homes and workplaces, reducing water consumption would reduce the demand for water supplies, which will help decrease the need for investing in costly, large-scale infrastructure projects. It will also result in reduced operating costs for water utilities, as it takes a significant amount of energy to get water to a home or business. Energy is needed to extract water from the source; treat, distribute, and use it; and collect and treat wastewater for release back into the environment.

Furthermore, reducing water consumption would improve water quality and help the state maintain higher water levels in lakes, rivers, and reservoirs. On the demand side, reducing water consumption will improve air quality by reducing greenhouse gases emitted in the production of energy used to transport and treat California’s water.

CHAPTER 9:
Equity of the Impacts and Benefits

To fulfil the CEC's commitment to ensure an equitable distribution of benefits, specially to the most vulnerable communities, staff analyzed how the cost and environmental impacts would affect low-income communities. Low-income households typically pay for their utilities, including water utility, at a discounted price. However, the initial higher cost to purchase compliant products remains the same. Staff applied a 30% discount for water rate when performing cost analysis to ensure proposed standards remain cost effective. **Table 9-1** shows the cost analysis results for each unit of irrigation controller for low-income households. The proposed standards remain extremely cost effective with a benefit to cost ratio of more than 25 and a payback period of less than six months. The proposed standards would result in about $615 of net savings over the life of the product.

Table 9-1: Per Unit Monetary Costs and Savings for Low-Income Households ($2023)

Water Rate ($/1000 Gal)	Water Cost Life-Cycle Savings ($)	Incremental Costs ($)	Life-Cycle Net Benefit ($)	Pay Back Period (Years)	Benefits to Cost Ratio
$4.29	$640.52	$24.83	$615.69	0.48	25.80

Source: CEC

For low-income rental households, the cost saving benefits would be slightly higher as typically the upfront cost for the compliant product is paid by the landlords while tenants will receive the cost saving benefits.

Low-income families equally benefit from the environmental impacts as the lower water and electricity consumption results in reduced greenhouse gas and criteria pollutant emissions that benefits all Californians.

Acronyms

AB	Assembly Bill
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
ANSI	American National Standards Institute
ASABE	American Society of Agriculture and Biology Engineers
ASTM	American Society for Testing and Materials
CA	California
CASE	Codes and Standards Enhancement
CCR	California Code of Regulations
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CLIMB	Clean Energy in Low-Income Multifamily Buildings
CPUC	California Public Utilities Commission
CWA	California Water Association
DOF	Department of Finance
DWR	Department of Water Resources
EUL	Expected Useful Life
Gal	Gallon
GHG	greenhouse gas
GWh	gigawatt-hours
IA	Irrigation Association
IEPR	Integrated Energy Policy Report
IOU	Investor-Owned Utilities
kWh	kilowatt-hours
LBNL	Lawrence Berkeley National Laboratory
LEED	Leadership in Energy and Environmental Design
MW	megawatts
MWELO	Model Water Efficient Landscape Ordinance
MWh	Megawatt-hours
NPV	net present value

OIR	order instituting rulemaking
RAD	relative average deviation
SB	Senate Bill
SMS	soil moisture sensor
SSB	spray sprinkler body
SWAT	Smart Water Application Technologies
US EPA	United States Environmental Protection Agency
WBIC	weather-based irrigation controllers

GLOSSARY

Add-on device	An interface device separate from the main landscape irrigation controller (base controller) that communicates the sensor mechanism readings to the base controller through a wired or wireless connection and which are designed to work with multiple brands of base controllers (epa.gov/watersense).
Annual statewide stock water savings	The difference in statewide annual water use with and without proposed regulations for landscape irrigation controllers.
Annual statewide water savings	Statewide water savings from the portion of the annual sale of compliant landscape irrigation controllers resulted from the proposed regulation.
Baseline irrigation controller or basic irrigation controller	A landscape irrigation controller that is in the scope of the proposed regulations but does not comply with the proposed standards.
California Environmental Quality Act (CEQA)	California statute passed in 1970 that requires disclosure to the public of the significant environmental effects of a proposed discretionary project, through the preparation of an initial study, negative declaration, mitigated negative declaration, or environmental impact report.
Criteria air pollutant	An air pollutant for which acceptable levels of exposure can be determined and for which the U.S. Environmental Protection Agency has set an ambient air quality standard. Examples include ozone (O3), carbon monoxide (CO), nitrogen oxides (NOx), sulfur

	oxides (SOx), and particulate matter (PM10 and PM2.5).
Design Life, or Estimated Useful Life (EUL)	The average period that a product class of appliances or devices will perform the intended function fully, given proper care and maintenance.
Disadvantaged Communities	Disadvantaged communities refer to the areas throughout the state that most suffer from a combination of economic, health, and environmental burdens. These burdens include poverty, high unemployment, air and water pollution, presence of hazardous wastes, as well as high incidence of asthma and heart disease
Embedded Electricity	The electricity consumed for pumping, treatment, and delivery of water from its source to its destination.
Equity	The fair treatment, meaningful involvement, and strategic investment of resources through clean transportation programs, incentives, and processes for all Californians so that race, color, national origin, or income level are not barriers to increased opportunities and participation.
evapotranspiration (ET)	The combination of water transpired by vegetation and evaporated from soil, water, and plant surfaces (mm or inches of water per time period).
GigaWatt-Hour (GWh)	A unit of energy representing 1 billion (1,000,000,000) watt-hours and is equivalent to 1 million kilowatt-hours. A single watt-hour is a measure of electrical energy equivalent to a power consumption of 1 watt for 1 hour. A kilowatt-hour (kWh) is a unit of energy equal to 1 kilowatt of power sustained for 1 hour or to 3,600 kilojoules (3.6 megajoules). 1 million watt-hours = 1 megawatt-hour (MWh).
Greenhouse Gas (GHG)	Any gas that absorbs infrared radiation in the atmosphere. Common examples of greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs)

Hose Bib	Valve configured to be mounted on a wall having threads to accommodate the connection of a water hose (www.irrigation.org).
Incremental Cost or Initial Cost	The additional cost (average) at retail that a consumer would pay for an appliance that meets the proposed standard. This cost is the difference between an existing base model and the same model that has the added functionality to comply with the new appliance standards for landscape irrigation controllers.
Investor-Owned Utility	A private company that provides a utility, such as water, natural gas, or electricity, to a specific service area. The California Public Utilities Commission regulates investor-owned utilities that operate in California.
Life Cycle Water Savings	The amount of water saved over the life of a compliant landscape irrigation controller from upgrading a baseline product to a compliant product.
Life-Cycle Net Benefits	The difference between water cost life-cycle savings and the initial incremental cost.
Low-Income Communities/Households	Communities tracked by Census or households that are either at or below 80 percent of the statewide median income or at or below the threshold designated as low-income by the California Department of Housing and Community Developments Income Limits.
Pay Back Period	The amount of time it takes to recover the initial cost through the water cost savings.
Per Unit Baseline Water Use	Average water used with a baseline landscape irrigation controller for a single-family home.
Per Unit Compliant Water Use	Average water used with a compliant landscape irrigation controller for a single-family home.
Per Unit Water Savings	The difference between per unit baseline water use and per unit compliant water use.
Plug-in Devices	An interface device separate from the main landscape irrigation controller (base controller) which communicates the sensor mechanism readings to the

	base controller through a wired or wireless connection and which are designed to work with one brand of base controller (epa.gov/watersense).
Solenoid	A coil of wire that acts as an electromagnet when electric current is passed through it, often used to control the motion of metal objects, such as a swith or relay. Used in irrigation as a component of remote control valves (thefreedictionary.com).
Stock Turnover Year	The first year that all landscape irrigation controllers in use in the state are turned over to products compliant with the proposed standards.
Water Cost Life-Cycle Savings	The cost of life cycle water savings. A 3 percent annual discount rate is applied to the cost savings.

APPENDIX A:
Staff Assumptions, Calculations, Tables, and Equations

Appendix A discusses the information and calculations used for landscape irrigation controllers in California, the current water and energy use, and potential savings. CEC staff considered information from a variety of sources including information contained in the CASE and Irrigation Association proposals submitted to the CEC. Staff presents the approach to water and energy consumption and savings. Staff has rounded the results of the calculations as they are presented in this appendix. Unrounded numbers are used for subsequent calculations.

Assumptions

Table A-1 summarizes the values and assumptions used to analyze consumption and savings.

Table A-1: Summary of Values and Assumptions

Item	Value	Unit	Source
Expected useful life (EUL) of compliant product	15	Years	U.S. EPA WaterSense[66]
Compliant product's water saving	15%	Percent	U.S. EPA WaterSense[67]
Effective date	January 1, 2026	-	CEC Staff
Portion of single-family homes that use an automatic sprinkler	68%	Percent	California IOU CASE Team[68]
Portion of single-family homes with an automatic sprinkler that use a timer to control the irrigation schedule	89%	Percent	California IOU CASE Team[69]

66 *WaterSense Specification for Weather-Based Irrigation Controllers Supporting Statement*, November 3, 2011: https://www.epa.gov/sites/default/files/2017-01/documents/ws-products-support-statement-irrigation-controllers.pdf.

67 Ibid.

68 *California Investor Owned Utilities Comments Response to Invitation to Participate - Landscape Irrigation Controllers*, 9/18/2017: https://efiling.energy.ca.gov/GetDocument.aspx?tn=221225&DocumentContentId=26788

69 Ibid.

Item	Value	Unit	Source
Portion of single-family homes with automatic irrigation controller	60.5%	Percent	CEC Staff (68% x 89%)
Baseline average annual water used for irrigation for a single-family home	88,436	Gallon	CEC staff analysis report for spray sprinkler bodies[70]
Compliant product market share as of 2017	20%	Percent	California IOU CASE Team[71]
Annual compliant products market share increase without regulations	0.5%	Percent	CEC Staff
average water rate per 1000 gallons in California	$6.13	$/1000 Gallon	CEC Staff

Source: CEC and as noted

The proposed effective date of the proposed standards is one year from the date of adoption by the CEC. For this staff analysis, it is assumed that regulations become effective January 1, 2026.

Staff assumed that the market share for weather-based irrigation controllers is growing by 0.5 percent year over year and will continue to grow by the same rate without regulations. Market data provided by the California IOUs in their comment submitted in September 2017 estimated that about 20 percent of the irrigation controllers on the market are compliant with the proposed standards. Staff used these data to determine that by the effective date of the proposed regulations, assumed to be 2026, about 24.5 percent of the irrigation controllers on the market would meet the proposed standards. This portion of controllers are excluded from the water saving calculations. **Table A-2** shows the market share of compliant and noncompliant products over from 2026 through 2040 without regulations.

Table A-2: Market Share of Compliant and Noncompliant Controllers Without Regulations

Year	Percentage of Compliant Products W/O Regulation (%)	Percentage of Noncompliant Products W/O Regulation (%)
2026	24.50%	75.50%
2027	25.00%	75.00%

70 Steffensen, Sean. 2019. Final *Staff Analysis of Water Efficiency Standards for Spray Sprinkler Bodies*. California Energy Commission, CEC-400-2018-005-SF, Page A-11. Available at: https://efiling.energy.ca.gov/GetDocument.aspx?tn=227860&DocumentContentId=59234.

71 *California Investor Owned Utilities Comments Response to Invitation to Participate - Landscape Irrigation Controllers*, 9/18/2017: https://efiling.energy.ca.gov/GetDocument.aspx?tn=221225&DocumentContentId=26788.

Year	Percentage of Compliant Products W/O Regulation (%)	Percentage of Noncompliant Products W/O Regulation (%)
2028	25.50%	74.50%
2029	26.00%	74.00%
2030	26.50%	73.50%
2031	27.00%	73.00%
2032	27.50%	72.50%
2033	28.00%	72.00%
2034	28.50%	71.50%
2035	29.00%	71.00%
2036	29.50%	70.50%
2037	30.00%	70.00%
2038	30.50%	69.50%
2039	31.00%	69.00%
2040	31.50%	68.50%

Source: CEC

Water Rate

California Public Resources Code Section 25402(c)(1) requires any proposed water efficiency standard to be cost-effective to California consumers. Therefore, the average per unit water rate is needed to establish the cost-effectiveness of the proposed standards. Although these data are not published, there are scattered reports available from various water agencies.

California Water Association's (CWA) website provides a list of more than 90 water utilities serving about 15 percent of California population.[72] CWA's water utilities are grouped based on the number of service connections they provide; however, not all utilities listed have a website or have their rates published.

California Department of Water Resources (DWR) publishes audit reports from various urban water suppliers on its website.[73] The California Water Code defines an "urban water supplier" as a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. These reports contain a great deal of helpful information, including water rates. However, typically the data for some regions are reported for several years, the data for some regions are not reported consistently for most recent years, and some of the formats differ. Therefore, all reports must be reviewed to keep the most recent data and remove redundant reports. Also, typically water utility charges include two parts: a fixed service charge

72 California Water Association, https://calwaterassn.com/about-cwa/regulated-water-utilities-in-california/.

73 The Water Use Efficiency (WUE) data submitted to the Department of Water Resources: https://wuedata.water.ca.gov/default.asp.

and a metered per use charge. In addition, many water utilities have several tiers for metered portion of their charges. These details are not provided in these reports.

Staff used a combination of aforementioned resources, as well as the rate information provided directly by the water providers websites, to estimate a weighted average of $6.13 per 1000 gallon for the water rate. The weighting used for the average rate calculation is based on the number of service connection provided for each data entry.

Stock and Sales

Staff used California residential data to estimate the stock of landscape irrigation controllers because almost all commercial irrigation controllers on the market comply with the proposed standards and, therefore, are not used for water and cost savings estimates. Staff also reviewed estimates provided by the CASE team. The estimates provide a means of validation to the staff estimate since they are similar in magnitude.

To estimate the inventory of irrigations controllers in use, staff used California housing data because there is no published source for stock available. Staff assumed the following ratio of single-family and multifamily homes for each irrigation controller:

- One irrigation controller per one single-family detached home
- One irrigation controller per two single-family attached homes
- One irrigation controller per four multifamily homes (2–4 units)
- One irrigation controller per 30 multifamily homes (5-plus units)

Total Number of Residential Landscapes =

(Number of single-family detached homes/1) +

(Number of single-family attached homes/2) +

(Number of multifamily 2–4 units homes/4) +

(Number of multifamily 5-plus units homes/30)

Staff used the data provided by the IOUs indicating that 68 percent of California's single-family homes use automatic sprinkler system from which 89 percent use an irrigation timer to control the irrigation schedule.[74] Therefore, 68 percent times 89 percent, or 60.5 percent of single family homes in California use irrigation control system. Staff extended this conclusion to residential buildings containing multifamily homes. Total number of residential landscapes are multiplied by 60.5 percent to estimate the total number of residential landscape irrigation controllers in use. Staff repeated these calculations for 2019 through 2022 to estimate the growth rate of irrigation controller stock for each year then averaged them to estimate the average annual growth rate for stock and shipment of irrigation controllers to be 0.63 percent.

74 California Investor Owned Utilities Comments Response to Invitation to Participate - Landscape Irrigation Controllers, 9/18/2017: https://efiling.energy.ca.gov/GetDocument.aspx?tn=221225&DocumentContentId=26788.

Table A-3 shows the estimates for number of residential landscapes and landscape irrigation controller stock.

Table A-3: Estimate of Residential Landscapes as a Proxy for Number of Irrigation Controllers

Items	2019	2020	2021	2022	Average
CA Single-Family detached Homes (units)	8,190,950	8,264,309	8,294,195	8,341,577	8,272,758
CA Single-Family attached Homes (units)	994,710	1,002,826	1,006,435	1,010,851	1,003,706
CA Multifamily Units (2-4 units) (units)	1,132,562	1,148,977	1,157,442	1,168,669	1,151,913
CA Multifamily Units (5 plus units) (units)	3,357,051	3,416,231	3,452,743	3,500,674	3,431,675
Total Number of Residential Landscapes (units)	9,083,347	9,166,841	9,201,864	9,255,859	9,176,978
Stock of Irrigation Controllers in use (units)	5,497,242	5,547,772	5,568,968	5,601,646	5,553,907
Estimated Irrigation Controllers Annual Stock Growth Rate (%)	-	0.92%	0.38%	0.59%	0.63%

Source: CEC

Staff used the estimated stock of existing landscape irrigation controllers for 2022, along with the product life of 15 years and an average yearly growth rate of 0.63 percent to estimate the annual sale of 389,937 units in 2022. Staff then used the average annual growth rate to project annual sales and stocks of irrigation controllers for 2026 through 2042, as shown in Table A-4.

Table A-4: Estimated Annual Sales and Stock of Landscape Irrigation Controllers

Year	Shipment (units)	Stock (units)	Compliant Products' Market Share Without Regulations	Stock of Compliant Products Replacing Existing Units in Use (units)	Stock of Compliant Products Contributing to Savings (units)
2026	399,846	5,743,998	24.50%	399,846	301,884
2027	402,363	5,780,147	25.00%	802,209	603,656
2028	404,895	5,816,525	25.50%	1,207,104	905,303
2029	407,443	5,853,131	26.00%	1,614,548	1,206,811
2030	410,008	5,889,967	26.50%	2,024,555	1,508,167
2031	412,588	5,927,035	27.00%	2,437,143	1,809,356
2032	415,184	5,964,337	27.50%	2,852,327	2,110,364
2033	417,797	6,001,873	28.00%	3,270,125	2,411,179
2034	420,427	6,039,646	28.50%	3,690,552	2,711,784
2035	423,073	6,077,656	29.00%	4,113,625	3,012,165
2036	425,735	6,115,906	29.50%	4,539,360	3,312,309
2037	428,415	6,154,396	30.00%	4,967,775	3,612,199
2038	431,111	6,193,129	30.50%	5,398,886	3,911,821
2039	433,824	6,232,105	31.00%	5,832,710	4,211,160
2040	436,554	6,271,326	31.50%	6,269,264	4,510,200
2041	439,302	6,310,795	32.00%	6,308,719	4,808,925
2042	442,067	6,350,512	32.50%	6,348,423	5,107,320

Source: CEC

Baseline and Compliant Water Use

Landscape water usage may be calculated from recommendations on the water required by the landscape. CEC staff provided survey of several methods in the Spray Sprinkler Body (SBB) Staff Report. The baseline water values in this report are the assumed to be the compliant values after full stock turnover of the SSB standard. This assumption prevents double-counting savings due to the SSB standard.

Staff reviewed studies of irrigation practices with weather-based controllers by Lawrence Berkley National Labs (LBNL), who published a comparison of various studies of weather-based irrigation controllers, rain sensors and soil moisture sensors. The study concluded that each technology could provide significant savings over manual watering or clock-based

irrigation controllers. **Figure A-1** presents the results of the comparison. For the savings analysis, staff assumed a reduction of 15 percent in water use.[75] This amount of water efficiency for compliant products is also aligned with the data provided by the California IOUs.[76]

The water use of the compliant product' is calculated as the baseline water use reduced by the water efficiency rate:

Compliant water use per device /yr = (1 - efficiency rate) x baseline water use per device /yr

Compliant water use per device /yr = (1-15%) x 88,436/ yr = 75,171 gal/yr

Similarly, the average water saving per device, is calculated by multiplying the baseline water use by the water efficiency rate of 15 percent.

Compliant water savings per device /yr = efficiency rate x baseline water use per device /yr

Compliant water savings per device /yr = 15% x 88,436/ yr = 13,265 gal/yr

75 Williams, Alison, Heidi Fuchs, and Camilla Dunham Whitehead. Lawrence Berkeley National Labs. April 1, 2014. *Estimates of Savings Achievable From Irrigation Controller,* https://eta-publications.lbl.gov/sites/default/files/lbnl-6604e.pdf.

76 *California Investor-Owned Utilities Comments Response to Invitation to Participate — Landscape Irrigation Controllers,* 9/18/2017: https://efiling.energy.ca.gov/GetDocument.aspx?tn=221225&DocumentContentId=26788.

Figure A-1: Savings by Irrigation Control Technology

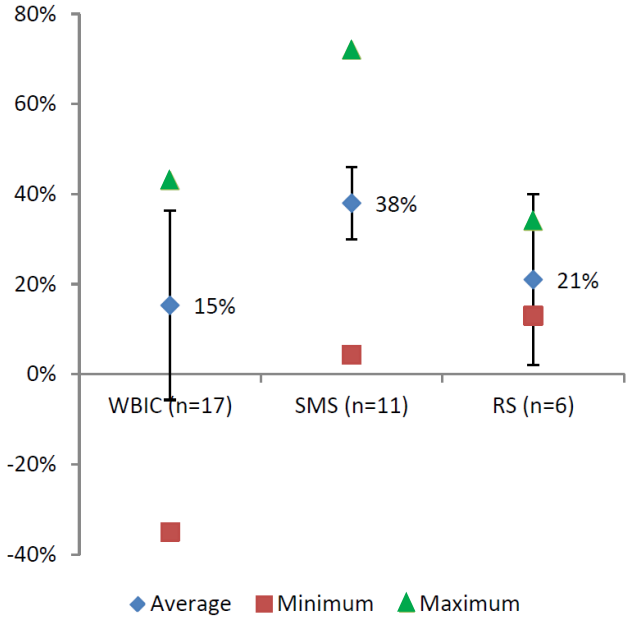

Illustration Credit: Lawrence Berkeley National Laboratory

Table A-5 shows the statewide water savings from the annual sale of compliant products, as well as the annual stock savings. Market share of products that are assumed to be compliant without any regulations are excluded from water savings.

Table A-5: Estimated Annual Statewide Water Savings

Year	Shipment (units)	Stock (units)	Percentage of Default Compliance (%)	Statewide Water Savings (Million Gal/yr)	Statewide Stock Water Savings (Million Gal/yr)
2026	399,846	5,743,998	24.50%	4,005	4,005
2027	402,363	5,780,147	25.00%	4,003	8,008
2028	404,895	5,816,525	25.50%	4,001	12,009
2029	407,443	5,853,131	26.00%	4,000	16,009
2030	410,008	5,889,967	26.50%	3,998	20,006
2031	412,588	5,927,035	27.00%	3,995	24,002
2032	415,184	5,964,337	27.50%	3,993	27,995
2033	417,797	6,001,873	28.00%	3,990	31,985
2034	420,427	6,039,646	28.50%	3,988	35,973
2035	423,073	6,077,656	29.00%	3,985	39,958
2036	425,735	6,115,906	29.50%	3,982	43,939
2037	428,415	6,154,396	30.00%	3,978	47,917
2038	431,111	6,193,129	30.50%	3,975	51,892
2039	433,824	6,232,105	31.00%	3,971	55,863
2040	436,554	6,271,326	31.50%	3,967	59,830
2041	439,302	6,310,795	32.00%	3,963	59,788
2042	442,067	6,350,512	32.50%	3,958	59,743

Source: CEC

Cost and Savings

To determine the per unit initial cost of upgrading a baseline irrigation controller to a compliant product, staff obtained retail price data for baseline and compliant products from online landscape equipment retailers. Staff grouped irrigation controllers based on associated zone capacity and calculated the cost difference between baseline and compliant products for each group. Staff then averaged the cost difference across all zone capacity groups to calculate the average upfront incremental cost for upgrading a baseline product to a compliant product. For cost calculations, staff did not include highly elaborative products with additional functionalities beyond what is required for compliance.

Staff calculated the average per unit incremental cost of $24.83 to upgrade an uncompliant baseline irrigation controller to a compliant unit with similar functionalities and number of irrigation stations. Staff also applied a 3 percent discount rate to calculate the net present

value of the annual statewide cost. To calculate the annual statewide cost, staff used the following equation:

Annual statewide cost = per unit cost x

(Total annual statewide sales – Annual statewide sales of compliant products without regulations) x (3 percent discount rate per year)

Table A-6 shows statewide annual costs and savings.

Table A-6: Estimated Annual Statewide Costs and Savings ($2023)

Year	Shipment (units)	Stock (units)	Percentage of Default Compliance (%)	Statewide Annual Cost (Million $/yr)	Statewide Annual Savings (Million $)	Statewide Stock Savings (Million $)
2026	399,846	5,743,998	24.50%	$7.07	$22.5	$22.5
2027	402,363	5,780,147	25.00%	$6.86	$21.8	$44.3
2028	404,895	5,816,525	25.50%	$6.65	$21.2	$65.4
2029	407,443	5,853,131	26.00%	$6.46	$20.5	$86.0
2030	410,008	5,889,967	26.50%	$6.27	$19.9	$105.9
2031	412,588	5,927,035	27.00%	$6.08	$19.3	$125.2
2032	415,184	5,964,337	27.50%	$5.90	$18.8	$144.0
2033	417,797	6,001,873	28.00%	$5.72	$18.2	$162.2
2034	420,427	6,039,646	28.50%	$5.72	$17.7	$179.8
2035	423,073	6,077,656	29.00%	$5.39	$17.1	$197.0
2036	425,735	6,115,906	29.50%	$5.23	$16.6	$213.6
2037	428,415	6,154,396	30.00%	$5.07	$16.1	$229.7
2038	431,111	6,193,129	30.50%	$4.92	$15.6	$245.4
2039	433,824	6,232,105	31.00%	$4.77	$15.2	$260.5
2040	436,554	6,271,326	31.50%	$4.63	$14.7	$275.2
2041	439,302	6,310,795	32.00%	$4.49	$14.3	$267.0
2042	442,067	6,350,512	32.50%	$4.35	$13.8	$259.1

Source: CEC

A discount rate of 3 percent is applied to the annual values for the costs and savings to calculate the values in terms of the value of Dollar in 2023.

$$Annual\ saving_i(\$2023) = Annual\ water\ saving_i\ x\ Water\ rate/(1 + Discount\ rate)^{(i-2023)}$$

Where:

$$i = 2026, 2027, \dots, 2042$$

Staff assumed each year's savings is materialized at the end of each year, while the annual costs happen at the beginning of each year because they are paid upfront.

$$Annual\ cost_i(\$2023) = Annual\ cost_i/(1 + Discount\ rate)^{(i-2023-1)}$$

Where:

$$Annual\ cost_i = (Annual\ shipment_i - \ Annual\ compliant\ by\ default\ shipment_i)\ x\ per\ unit\ cost$$

$$i = 2026, 2027, \dots, 2042$$

Embedded Electricity Savings

The embedded electricity savings are the electricity saved from the reduction in water pumping, treatment, and delivery. Staff assumed every million gallons of water uses 3,565 kilowatt-hours (kWh).[77] **Table A-7** shows the embedded electricity saved by each unit of a landscape irrigation controller over the life of the product.

77 *California Investor-Owned Utilities Comments Response to Invitation to Participate — Landscape Irrigation Controllers*, June 16, 2017, https://efiling.energy.ca.gov/GetDocument.aspx?tn=219251&DocumentContentId=26786.

Table A-7: Estimated Annual and Life-Cycle Embedded Electricity Saved per Unit

Life of Product (Years)	Annual Water Saving (Gal/yr per Unit)	Annual Embedded Electricity Saving (kWh/yr per Unit)	Water Saving Over the Life of Product (Gal/unit)	Embedded Electricity Saving Over the Life of Product (kWh/unit)
15	13,265	47.29	198,981	709

Source: CEC

Table A-8 shows estimated annual statewide embedded electricity savings. The electricity savings are calculated for annual sales and accumulated savings for the stock of products turned over to compliant irrigation controllers as a result of this regulation.

Table A-8: Estimated Annual Embedded Electricity Saved From Annual Sales and Stock

Year	Statewide Annual Water Savings (million Gal/yr)	Statewide Annual Embedded Electricity Savings (MWh/yr)	Statewide Stock Water Savings (million Gal/yr)	Statewide Stock Embedded Electricity Savings (GWh/yr)
2026	4,005	14,276	4,005	14.3
2027	4,003	14,271	8,008	28.5
2028	4,001	14,265	12,009	42.8
2029	4,000	14,259	16,009	57.1
2030	3,998	14,251	20,006	71.3
2031	3,995	14,244	24,002	85.6
2032	3,993	14,235	27,995	99.8
2033	3,990	14,226	31,985	114.0
2034	3,988	14,216	35,973	128.2
2035	3,985	14,205	39,958	142.4
2036	3,982	14,194	43,939	156.6
2037	3,978	14,182	47,917	170.8
2038	3,975	14,169	51,892	185.0
2039	3,971	14,156	55,863	199.2
2040	3,967	14,142	59,830	213.3
2041	3,963	14,127	59,788	213.1
2042	3,958	14,111	59,743	213.0

Source: CEC

APPENDIX B:
Proposed Regulatory Language

The proposed new language appears as underline (example) and proposed deletions appear as strikeout (~~example~~). Existing language appears as plain text. Three dots or "…" represents the substance of the regulations that exists between the proposed language and current language.

§ 1601. Scope.

This Article applies to the following types of new appliances, if they are sold or offered for sale in California, except those sold wholesale in California for final retail sale outside the state and those designed and sold exclusively for use in recreational vehicles, or other mobile equipment. Unless otherwise specified, each provision applies only to units manufactured on or after the effective date of the provision.

NOTE: For the applicability of these regulations to appliances installed in new building construction, see sections 110.0 and 110.1 of part 6 of Title 24 of the California Code of Regulations.

…[skipping first paragraph through (w)]

(x) Landscape irrigation equipment.

(1) Spray sprinkler bodies.

(2) Landscape irrigation controllers.

…[skipping the rest of section 1601]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a) - 25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor's Exec. Order No. B - 29 - 15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a) - 25402(c), 25402.5.4, and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B - 29 - 15 (April 1, 2015).

§ 1602. Definitions.

…[skipping (a) through (w)]

(x) Landscape Irrigation Equipment.

(1) All Landscape Irrigation Equipment.

"Landscape" means any areas that are planted or installed and designed to receive irrigation, including turf grass, ground covers, shrubs, trees, flowers, and similar plant materials. Landscape does not include agricultural crops grown and harvested for monetary return.

~~(1)~~(2) Spray Sprinkler Bodies.

…[skipping "Integral pressure regulator"]

~~"Landscape" means any areas that are planted or installed and designed to receive irrigation, including turf grass, ground covers, shrubs, trees, flowers, and similar plant materials. Landscape does not include agricultural crops grown and harvested for monetary return.~~

…[skipping the rest of (x)(1)]

(3) Landscape Irrigation Controllers.

"Combined Landscape Irrigation Controller" means a landscape irrigation controller that is a combination of soil moisture-based landscape irrigation controller and weather-based landscape irrigation controller.

"Irrigation adequacy" means a measure of how well the plant's or landscape's consumptive water needs are met, and shall be calculated in accordance with the test method of section 1604(x)(2)(A) of this Article.

"Irrigation excess" means a measure of water applied in excess of the plant's or landscape's consumptive needs, and shall be calculated in accordance with the test method of section 1604(x)(2)(A) of this Article.

"Irrigation Station" means a circuit on a controller that has the ability to be programmed with a run time unique and separate from other circuits and provides power to one or more remote control valves.

"Landscape irrigation controller" means a timing device that controls one or more valves used to engage irrigation of a landscape. Landscape Irrigation Controller does not include manual watering timers.

"Manual watering timer" means an irrigation timer device that is manually activated and is not capable of storing watering schedules beyond 24 hours.

"Percent adjust water budget feature" means the ability to increase or decrease the runtimes or application rates for zones by means of one adjustment without modifying the settings for each individual zone.

"Rainfall device" means a device that either senses or measures rainfall to reduce or interrupt irrigation in response to rain events.

"Reference weather station" means the weather station utilized by the licensed certifying body that produces the reference weather data used during the performance test of section 1604(x)(2)(A) of this Article.

"Soil moisture-based landscape irrigation controller" means a landscape irrigation controller that is sold with a soil moisture sensor mechanism and that enables or disables an irrigation event at preset or selected soil moisture values.

"Soil-moisture mode" means the operating mode in which the landscape irrigation controller is using readings from the sensor mechanism to modify the irrigation schedule.

"Soil moisture sensor mechanism" means the portion of the device that contacts the soil and measures physical properties that are related to the amount of moisture in the soil.

"Weather-Based Landscape Irrigation Controller" means a landscape irrigation controller that is capable of creating or modifying irrigation schedules based on evapotranspiration (ET) principles by:

1. Storing historical crop evapotranspiration (ETc) data characteristics of the site and modifying these data with an onsite sensor;

2. Using onsite weather sensors as a basis for calculating real-time ETc;

3. Using a central weather station as a basis for ETc calculations and transmitting the data to individual users from remote sites; or

4. Using onsite weather sensors.

"Weather-based mode" means the operating mode in which the landscape irrigation controller is using weather data to schedule irrigation or modify the irrigation schedule.

The following documents are incorporated by reference in section 1602.

Number	*Title*

…[skipping FEDERAL STATUES AND REGULATIONS through ANSI Z21.88 under AMERICAN NATIONAL STANDARDS INSTITUE (ANSI)]

Copies available from:	~~AMERICAN NATIONAL STANDARDS INSTITUTE~~American National Standards Institute ~~1819~~ 1899 L ~~STREET~~Street, NW, ~~6TH~~11th ~~FLOOR~~Floor ~~WASHINGTON~~Washington, DC 20036 ~~WWW.ANSI.ORG~~www.ansi.org ~~PHONE~~Phone: (202) 293-8020 FAX: (202) 293-9287

…[skipping AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) through the end of the section]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015).
Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c), 25402.5.4, and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B-29-15 (April 1, 2015).

§ 1602.1. Rule of Construction.

(No Change)

§ 1603. Testing All Appliances.

(No Change)

§ 1604. Test Methods for Specific Appliances.

…[skipping (a) through (w)]

(x) Landscape Irrigation Equipment.

…[skipping (x)(1)]

(2) Landscape Irrigation Controllers.

(A) The test method for weather-based landscape irrigation controllers is Section 4 (Test Method #1) of ANSI/ASABE S627.1 OCT2022 with the following test modifications:

1. The test period shall be 30 consecutive days. The test may run past the initial 30 days until a 30-day period occurs where all conditions in Section 4.6 (Weather requirements) of ANSI/ASABE S627.1 OCT2022 are met. The first valid 30-day test period shall be used to calculate irrigation adequacy and irrigation excess.

2. Landscape irrigation controllers with fewer than six irrigation stations shall meet the six-zone programming requirement of Section 4 (Test Method #1) of ANSI/ASABE S627.1 OCT2022 by programming and testing multiple landscape irrigation controllers of the same model at the same time.

3. The landscape irrigation controller shall be programmed according to the list of settings specified by the manufacturer in the instruction manual. Manufacturers shall have no interaction with the product during testing, including programming of the controller during setup or for the duration of the test.

4. No special accommodations shall be made during testing for the controller to select the reference weather station as its data source. The test report shall include the name and address of the reference weather station.

(B) The test method for soil moisture-based landscape irrigation controllers is ANSI/ASABE S633 MAY2020 with the following test modifications:

1. Soil moisture-based landscape irrigation controllers shall only be tested in the moderately coarse test medium and water with electrical conductivity (EC) of 3 dS/m, as defined in ANSI/ASABE S633 MAY2020.

2. The freeze test shall be conducted in the 40 percent water depletion container using the moderately coarse medium after the initial test is complete.

(C) Combined landscape irrigation controllers shall be tested according to the test procedures in section 1604(X)(2)(A) and 1604(X)(2)(B).

The following documents are incorporated by reference in section 1604.

…[skipping CALIFORNIA ENERGY COMMISSION TEST METHODS through ANSI C82.6-2005 under AMERICAN NATIONAL STANDARDS INSTITUE (ANSI)]

Section 2 through 4 of ANSI/ASABE S627.1 OCT2022	Weather-Based Landscape Irrigation Control Systems
ANSI/ASABE S633 MAY2020	Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies
…[skipping ANSI Z21.10.3-1998 through ANSI/AHRI 550-590(I-P)2011	
Copies available from:	American National Standards Institute ~~1819~~ 1899 L Street, NW, ~~6th~~ 11th Floor Washington, DC 20036 www.ansi.org Phone: (202) 293-8020 FAX: (202) 293-9287

…[skipping AMERICAN SOCIETY FOR MECHANICAL ENGINEERS (ASME) through the end of the section]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a) - 25402(c) and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B - 29 - 15 (April 1, 2015).

§ 1605. Energy Performance, Energy Design, Water Performance, and Water Design Standards: In General.

(No Change)

§ 1605.1. Federal and State Standards for Federally-Regulated Appliances.

…[skipping (a) through (x)]

The following documents are incorporated by reference in section 1605.1.

Number	*Title*

…[skipping FEDERAL STATUES AND REGULATIONS through ANSI C78.5 under AMERICAN NATIONAL STANDARDS INSTITUE (ANSI)]

Copies available from:	American National Standards Institute ~~1819~~ 1899 L Street, NW, ~~6th~~ 11th Floor Washington, DC 20036 www.ansi.org Phone: (202) 293-8020 FAX: (202) 293-9287

…[skipping ILLUMINATING ENGINEERING SOCIETY (IES) through the end of the section]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a) - 25402(c) and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B - 29 - 15 (April 1, 2015).

§ 1605.2. State Standards for Federally Regulated Appliances.

(No Change)

§ 1605.3. State Standards for Non-Federally Regulated Appliances.

…[skipping (a) through (w)]

(x) Landscape Irrigation Equipment.

…[skipping (x)(1)]

(2) Landscape Irrigation Controllers. Landscape irrigation controllers manufactured on or after January 1, 2025, shall comply with all of the following requirements:

(A) Shall be either weather-based landscape irrigation controller or soil moisture-based landscape irrigation controller or combined landscape irrigation controller.

(B) Landscape irrigation controllers shall be capable of preserving the contents of the programmed irrigation settings, and soil moisture sensor mechanism settings if applicable, when the power source is lost and without relying on an external battery backup.

(C) Landscape irrigation controllers 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.

(D) Landscape irrigation controllers shall be capable of indicating to the user when it is not receiving a signal or sensor input and is not adjusting irrigation based on current weather conditions or soil moisture content in the landscape.

(E) Landscape irrigation controllers shall be capable of accommodating the following watering restrictions:

1. Operation on a prescribed day or days-of-week schedule;

2. Any day interval scheduling between two and seven days including even day and odd day scheduling;

3. The ability to set irrigation runtimes to avoid watering during a prohibited time of day; and

4. Complete shutoff to accommodate outdoor irrigation prohibition restrictions.

(F) Landscape irrigation controllers shall include a percent adjust water budget feature;

(G) Landscape irrigation controllers shall be capable of reverting to either a proxy of historical weather data or a percent adjust water budget feature if the primary source of weather information or the soil moisture sensor mechanism signal is lost;

(H) Landscape irrigation controllers shall be capable of allowing for a manual operation troubleshooting test cycle and shall automatically return to weather-based or soil moisture-based mode within some period of time as designated by the manufacturer.

(I) Weather-based landscape irrigation controllers and combined landscape irrigation controllers shall meet the following requirements:

1. Be capable of interfacing with a rainfall device or soil moisture sensor;

2. Shall have irrigation adequacy of greater than or equal to 80 percent for each of the six zones;

3. Shall have irrigation excess of less than or equal to 10 percent for each of the six zones; and

4. The average of the irrigation excess scores calculated across the six zones shall be less than or equal to 5 percent.

(J) Soil moisture-based landscape irrigation controllers and combined landscape irrigation controllers shall meet the following requirements:

1. Be capable of interfacing with a rainfall device;

2. Shall enable and disable irrigation at each of the three depletion levels: 20 percent, 40 percent, 60 percent;

3. Shall have a relative average deviation of the enable and disable readings less than or equal to 10 percent. The relative average deviation shall be calculated per Equations 1 through 3 of Section 2.2.1.2 of the WaterSense® Specification for Soil Moisture-Based Irrigation Controllers Version 1.0, February 2021;

4. The absolute value of the slope of the linear line generated using least square regression with the enable readings on the y-axis and depletion levels on the x-axis shall be greater or equal to 0.01 for each of the three replicate soil moisture-based landscape irrigation controllers. The enable readings shall be expressed in percent of full scale of the product. The depletion levels shall be expressed in percent and all three depletion levels of 20 percent, 40 percent, and 60 percent shall be used in the calculation of the slope;

5. The absolute value of the slope of the linear line generated using least square regression with the disable readings on the y-axis and depletion levels on the x-axis shall be greater or equal to 0.01 for each of the three replicate soil moisture-based landscape irrigation controllers. The disable readings shall be expressed in percent of full scale of the product. The depletion levels shall be expressed in percent and all three depletion levels shall be used in the calculation of the slope; and

6. Shall enable and disable irrigation after the soil moisture sensor mechanism is placed in a freezer for three days and thawed to pre-freeze medium temperature when tested per section 1604(x)(2)(B) of this Article.

The following documents are incorporated by reference in section 1605.3.

Number	*Title*

…[skipping FEDERAL REQUIREMENTS through "Copies available from:" under UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA)]

	Section 2.2.1.2 of the WaterSense® Specification for Soil Moisture-Based Irrigation Controllers Version 1.0 (Dated February 2021)
Copies available from:	WaterSense® U.S. Environmental Protection Agency Office of Wastewater Management (4204M) 1200 Pennsylvania Ave N.W. Washington, D.C. 20460 https://www.epa.gov/watersense

…[skipping AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE (AHRI) through ANSI C78.377-2015 under AMERICAN NATIONAL STANDARDS INSTITUE (ANSI)]

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…[skipping THE ASSOCIATION OF POOL AND SPA PROFESSIONALS (APSP) through the end of the section]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a) - 25402(c) and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B - 29 - 15 (April 1, 2015).

§ 1606. Filing by Manufacturers; Listing of Appliances in MAEDbS.

a) Filing of Statements.

Each manufacturer shall electronically file with the Executive Director through the MAEDbS a statement for each appliance that is sold or offered for sale in California. The statement shall contain all of the information described in paragraphs (2) through (4) of this subsection and shall meet all of the requirements of paragraph (1) of this subsection and all other applicable requirements in this Article.

The effective dates of this section shall be the same as the effective dates shown in section 1605.1, 1605.2 or 1605.3 of this Article for appliances for which there is an energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article. For appliances with no energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article, the effective date of this

section shall be one year after they are added to section 1601 of this Article, unless a different effective date is specified.

…[skipping exceptions]

(1) General Rules.

(A) Format and Categories. Each statement shall be in a format (including but not limited to computer formats) and in categories specified by the Executive Director.

(B) When Different Statements Are Required. The Executive Director may establish, modify, and enforce schedules for the submittal of statements where it is reasonably necessary for orderly processing of submittals, for example when manufacturers or third parties often submit many statements simultaneously.

(C) Asterisks in Model Numbers. In filing any statement, the manufacturer may use asterisks as a substitute for letters, numbers, blanks, or other characters in the model number, provided that an asterisk (i) shall be used only for a part of the model number that does not indicate energy consumption, energy efficiency, water consumption, or water efficiency, or a design or feature affecting such efficiency or consumption; (ii) shall represent a single letter, number, blank, or other character at the asterisk's location in the model number; and (iii) shall not be used for any of the first four letters, numbers, blanks, or other characters in the model number.

(D) Different Functions. Except as provided in section 1606(a)(1)(G) of this Article, if the same appliance is sold or offered for sale as more than one type of appliance shown in Table X (for example, if the appliance can serve both water heating and pool heating functions), the manufacturer shall submit a separate statement for each appliance type. Each appliance type for which a statement is submitted must match all the common identifiers shown in Table X.

(E) Multiple Statements. A manufacturer may file statements for more than one appliance in a single submittal to the Executive Director. If a submittal contains statements for more than one appliance, there shall be only one statement for each appliance, except as provided in sections 1606(a)(1)(D) and 1606(a)(1)(G) of this Article. The Executive Director shall allow multiple statements to be submitted on the same sheet of paper or in the same electronic file under conditions she or he determines are reasonably necessary to ensure accuracy and compatibility with the database.

…[skipping the rest of (1)]

(2) Manufacturer Information.

(A) The name, address, telephone number, and, if available, fax number, URL (web site) address, and e-mail address of the manufacturer; provided, however, that if a parent entity is filing on behalf of a subsidiary entity, if a subsidiary entity is filing on behalf of a parent entity, or if an affiliate entity is filing on behalf of an affiliate entity, then each entity shall be clearly identified and the information shall be provided for both entities.

(B) The name, address, telephone number, and, if available, fax number and e-mail address of the individual to contact concerning the statement pursuant to section 1606(a)(4) of this

Article. There shall be only one individual to contact for each category (box) in the "Appliance" column of Table X, except that the individual may, during his or her absence, delegate his or her duties in this regard.

(C) The name, address, telephone number, and, if available, fax number and e-mail address of the person signing the declaration pursuant to section 1606(a)(4) of this Article.

(3) Testing and Performance Information.

(A) A statement that the appliance has been tested in accordance with all applicable requirements of sections 1603 and 1604 of this Article. If section 1604 of this Article provides more than one test method that may be used, the manufacturer shall identify which method was used.

…[skipping exceptions]

(B) The name and address and, if available, telephone number, fax number, URL (web site) address, and e-mail address of the laboratory or other institution where the testing required by sections 1603 and 1604 of this Article was performed.

(C) The applicable information listed in Table X; provided, however, that submittal of information marked with "1" is voluntary for federally regulated appliances, and that submittal of information marked with "2" is voluntary for state-regulated appliances. Where there is text in the "Permissible Answers" column, the information provided must be one of the answers shown. If the text in the "Permissible Answers" column states "other (specify)," the information provided must be a specific response for the "Required Information" category (e.g., a response of "other" is not acceptable).

…[skipping exceptions]

(D) How Tested Data Must Be Reported.

1. For any numerical value required by Table X that is produced by a test specified in section 1604 of this Article, the reported value shall be no higher for the value for which the consumer would prefer a high number, and no lower for the value for which the consumer would prefer a low number, than the values obtained by testing; unless different specific instructions are specified in the test method specified in Section 1604 of this Article.

2. For any numerical value required by Table X that is produced by calculation from measured numerical test results, the reported value shall be no higher for the values where the consumer would prefer a high number than the exact result of the calculation, and no lower than the exact result of the calculation where the consumer would prefer a low number, than the values obtained by calculating, unless different specific instructions are specified in the test method specified in section 1604 of this Article.

3. Manufacturers may report:

a. Numbers higher than tested values, where the consumer would, all other things being equal, prefer lower values (or is indifferent); and

b. Numbers lower than tested values, where the consumer would, all other things being equal, prefer higher values (or is indifferent).

…[skipping example]

Table X
Data Submittal Requirements

	Appliance	Required Information	Permissible Answers
	All Appliances	* Manufacturer's Name	
		* Brand Name	
		* Model Number	
		Date model to be displayed	
		Regulatory Status	Federally regulated consumer product, federally regulated commercial and industrial equipment, non-federally regulated

…[skipping sections (A)-(W) and (X) Spray Sprinkler Bodies of Table X]

	Appliance	Required Information	Permissible Answers
		Irrigation station capacity in base configuration	
		Maximum irrigation station capacity	
X	All Landscape Irrigation Controllers	landscape irrigation controller type	Weather-based landscape irrigation controller, Soil Moisture-based landscape irrigation controller, Combined landscape irrigation controller
		Capable of preserving the contents of the programmed irrigation settings as per section 1605.3(x)(2)(B) of this Article	True, false
		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	True, false
		Capable of indicating to the user when it is not receiving a signal or soil moisture sensor mechanism input as per section 1605.3(x)(2)(D) of this Article	True, false
		Capable of accommodating watering restrictions as per section 1605.3(x)(2)(E) of this Article	True, false
		Includes a percent adjust water budget feature	True, false
		Capable of reverting to either a proxy of historical weather data or a percent adjust water budget feature as per section 1605.3(x)(2)(G) of this Article	True, false
		Capable of allowing for a manual operation troubleshooting test cycle as per section 1605.3(x)(2)(H) of this Article	True, false

	Appliance	Required Information	Permissible Answers
	Landscape irrigation controllers tested per section 1604(x)(2)(A) of this Article	Capable of interfacing with a rainfall device or soil moisture sensor mechanism	True, false
		Irrigation adequacy zone 1, 2, 3, 4, 5, and 6 (%)	
		Irrigation excess zone 1, 2, 3, 4, 5, and 6 (%)	
		Average irrigation excess across the six zones (%)	
	Landscape irrigation controllers tested per section 1604(x)(2)(B) of this Article	Capable of interfacing with a rainfall device	True, false
		Enable and disable irrigation at each of the three depletion levels	True, false
		Relative average deviation (%)	
		Slope using enable readings for first, second, and third soil moisture-based landscape irrigation controller, calculated per section 1605.3(x)(2)(J)4. of this Article (unitless)	
		Slope using disable readings for first, second, and third soil moisture-based landscape irrigation controller, calculated per section 1605.3(x)(2)(J)5. of this Article (unitless)	

	Appliance	Required Information	Permissible Answers
		Enable and disable irrigation after the soil moisture sensor mechanism is placed in a freezer for three days and thawed to pre-freeze medium temperature	True, false

* "Identifier" information as described in section 1602(a) of this Article.

1 = Voluntary for federally regulated appliances

2 = Voluntary for state-regulated appliances

(4) Declaration.

(A) Each statement shall include a declaration, executed under penalty of perjury of the laws of California, that

1. All the information provided in the statement is true, complete, accurate, and in compliance with all applicable provisions of this Article;

2. If the statement is being filed electronically, that the requirements of section 1606(g) of this Article have been and are being complied with;

3. For appliances for which there is an energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article, that the appliance complies with the applicable standards;

4. The appliance was tested under the applicable test method specified in section 1604 of this Article,

…[skipping the rest of section 1606]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c) 25402.5.4, and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B-29-15 (April 1, 2015).

§ 1607. Marking of Appliances.

(a) Scope of Section 1607.

Every unit of every appliance within the scope of section 1601 of this Article shall comply with the applicable provisions of this section. The effective dates of this section shall be the same as the effective dates shown in section 1605.1, 1605.2 or 1605.3 of this Article for appliances for which there is an energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article. For appliances with no energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article, the effective date of this section shall be January 1, 2006.

(b) Name, Model Number, and Date.

Except as provided in section 1607(c) of this Article, the following information shall be permanently, legibly, and conspicuously displayed on an accessible place on each unit;

(1) Manufacturer's name or brand name or trademark (which shall be either the name, brand, or trademark of the listed manufacturer specified pursuant to section 1606(a)(2)(A) of this Article;

(2) Model number; and

(3) Date of manufacture, indicating (i) year and (ii) month or smaller (e.g. week) increment. If the date is in a code that is not readily understandable to the layperson, the manufacturer shall immediately, on request, provide the code to the Energy Commission.

…[skipping the rest of section 1607]

§ 1608. Compliance, Enforcement, and General Administrative Matters.

(No Change)

§ 1609. Administrative Civil Penalties.

(No Change)