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# ATTACHMENT A

## STAFF PAPER

# Revised Standardized Regulatory Impact Assessment: Water Efficiency Standards for Spray Sprinkler Bodies

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## PREFACE

On March 14, 2012, the California Energy Commission 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 Energy Commission identified a variety of appliances with the potential to save energy or water or both. The OIR also authorizes the Energy Commission to investigate, if appropriate, additional priority measures as determined by the lead commissioner.

On April 21, 2017, the Energy Commission released an invitation to participate to provide interested parties the opportunity to inform the Commission about the product, market, and industry characteristics of the appliances identified in the OIR, as well as additional appliances.

On July 18, 2017, the Energy Commission released an invitation to seek proposals for standards, test procedures, labeling requirements, and other measures to improve the 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 February 12, 2018, staff released a draft analysis of the proposed standard and held a workshop on March 14, 2018, to receive comments from the public. This staff analysis proposed standards for spray sprinkler bodies and contained the basis for such standards. The report included analysis of the cost-effectiveness, technical feasibility, and statewide benefits of the proposed standard.

The pre-rulemaking indicated that the proposed regulations could have potential water and energy savings and incremental product improvement costs that would exceed the \$50 million per year threshold to require a standardized regulatory impact assessment under Senate Bill 617 (Calderon, Chapter 496, Statutes of 2011). Therefore, the Energy Commission provides this standardized regulatory impact assessment for spray sprinkler bodies to assess the statewide economic impact of the proposed and alternative regulations. Staff provided the standardized regulatory analysis on November 19, 2018, to the California Department of Finance. The California Department of Finance provided comments on December 21, 2018. In this revised standardized regulatory impact analysis, staff responds to those comments.

## ABSTRACT

Assembly Bill 1928 (Campos, Chapter 326, Statutes of 2016) requires the California Energy Commission to adopt performance standards and labeling requirements for landscape irrigation equipment on or before January 1, 2019.

This standardized regulatory impact assessment prepared by the Energy Commission analyzes spray sprinkler bodies, a component of landscape irrigation systems. The water consumption of spray sprinkler bodies varies greatly, even within models of similar sizes and feature sets. To date, no state or federal regulations mandate cost-effective, readily available technologies to improve the performance of less efficient models.

Energy Commission staff analyzed proposed water efficiency standards for spray sprinkler bodies. The proposed standard for landscape sprinklers is cost-effective, technically feasible, and would save about 15 billion gallons of water and 54 gigawatt-hours (GWh) of embedded electricity for the first year the standard is in effect and more than 152 billion gallons per year and 543 GWh of embedded electricity at full stock turnover. Consumers will save about \$22 per device over the life of the device through reduced water use. The statewide water and energy (electricity) use and savings and other related environmental impacts and benefits are included in this analysis.

The analysis considers impacts to California jobs, businesses, competitive advantages and disadvantages, state investment, incentives for innovation, and benefits and costs to Californians. Estimated job-years will increase by 5,041 under the proposed regulations. In addition, the proposed standards yield an estimated \$3.5 billion increase in real disposable personal income between 2020 through 2029, which benefits the California economy.

**Keywords:** Appliance Efficiency Regulations, appliance regulations, economic impact, water efficiency, energy efficiency, irrigation equipment, landscape irrigation, sprinkler heads, spray sprinklers, spray sprinkler bodies

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## EXECUTIVE SUMMARY

California Energy Commission staff prepared this report to comply with the rulemaking requirements for major regulations contained within Senate Bill 617 (Calderon/Pavley, Chapter 496, Statutes of 2011) and the California Department of Finance regulations. The report analyzes the economic impact to California of adopting new minimum efficiency standards for spray sprinkler bodies, a component of a type of sprinkler. Specifically, the Energy Commission is considering standards based upon the test method and pressure regulation performance standard of the U.S. Environmental Protection Agency's WaterSense Specification for Spray Sprinkler Bodies, Version 1.0. The proposal would require all spray sprinkler bodies manufactured on or after the effective date and sold or offered for sale in California to be certified to the Energy Commission and meet minimum performance standards for pressure regulation when tested per the WaterSense test method.

The regulations would set minimum reporting and performance levels that are required to lawfully sell or offer to sell spray sprinkler bodies in California. The effect achieved is a market transformation toward more efficient products being offered for sale within the state. This change in product offering can lead to increased first costs as the products that meet the standard are more expensive to manufacture. However, statutory requirements for the Energy Commission require that the standard be set at a level at which a consumer is left with a net financial benefit over the life of the product from reduced utility bills.

The Energy Commission held public workshops to scope, collect data and proposals on, and evaluate the proposed appliance standards. On April 21, 2017, the Energy Commission released an invitation to participate encouraging stakeholders to submit data regarding the appliances included in the proceeding. On July 18, 2017, the Energy Commission issued a request for proposals from interested parties that would outline ways for the Energy Commission to attain identified potential efficiency gains. Staff used these proposals, data, and its own research to draft proposed regulations to further solicit feedback before beginning the formal rulemaking. The Energy Commission issued a staff report on February 12, 2018, and held a workshop in March 2018 to solicit oral and written feedback on proposed standards for spray sprinkler bodies.

For this report, staff analyzed the proposed regulation and two alternatives: (1) a regulations package with more stringent energy efficiency standards and (2) a regulations package with less stringent standards. Staff modeled and evaluated the three scenarios (more stringent, proposed, and less stringent).

The proposed standards would save roughly 15 billion gallons of water and 54 gigawatt-hours (GWh) of electricity for the first year the standard is in effect. At full stock turnover (10 years), the standards would reduce annual water usage by more than 152 billion gallons and electricity by 543 GWh and will have a significant positive impact on the environment by reducing the diversion of billions of gallons of water from waterways and habitat. **Table ES-1** summarizes the direct benefits and cost of the proposal and the alternatives considered.

**Table ES-1: Summary of Direct Costs and Benefits**

<b>Category</b>	<b>Proposed: Cumulative Savings or Costs 2020-2029 (\$M)</b>	<b>Alternative 1 More Stringent: Cumulative Savings or Costs 2020-2029 (\$M)</b>	<b>Alternative 2 Less Stringent: Cumulative Savings or Costs 2020-2029 (\$M)</b>
Water Savings	<u>\$4,824</u>	<u>\$5,172</u>	<u>\$348</u>
Electricity Savings	<u>\$427</u>	<u>\$458</u>	<u>\$31</u>
Air Pollution and GHG Benefits	<u>\$115</u>	<u>\$124</u>	<u>\$9</u>
Environmental Benefits	<u>\$70</u>	<u>\$74</u>	<u>\$4</u>
Increased Cost of Spray Sprinkler Bodies	<u>-\$1,286</u>	<u>-\$1,490</u>	<u>-\$530</u>
Net Benefit	<u>\$4,150</u>	<u>\$4,338</u>	<u>-\$138</u>

Source: California Energy Commission staff and Evergreen Economics

Energy Commission staff collaborated with Evergreen Economics to analyze the proposed new efficiency standards for spray sprinkler bodies to reasonably assess the economic impacts necessary for a complete assessment. Evergreen Economics used Impact Analysis for Planning (IMPLAN) modeling software to estimate how the proposed standards will affect California homes, businesses, and government buildings with irrigated landscaping, as well as spray sprinkler manufacturers based in California. **Table ES-2** summarizes the results of the macroeconomic analysis performed by Evergreen Economics in the areas of interest for the standardized economic regulatory assessment.

**Table ES-2: Summary of Indirect Economic Impacts From Proposed Regulation**

<b>Category</b>	<b>Proposed</b>	<b>Alternative 1 More Stringent:</b>	<b>Alternative 2: Less Stringent:</b>
Jobs	<u>5,041</u>	<u>5,359</u>	<u>182</u>
Change to Gross State Product	<u>\$843M</u>	<u>\$899M</u>	<u>\$41M</u>

Source: California Energy Commission staff and Evergreen Economics

# CHAPTER 1:

## Introduction

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### Legislative History

The Warren-Alquist Act<sup>1</sup> establishes the California Energy Commission as California’s primary energy policy and planning agency. The act mandates the Energy Commission to reduce the wasteful and inefficient consumption of energy and water in the state by prescribing standards for minimum levels of operating efficiency for appliances that consume a significant amount of energy or water statewide.

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<sup>2</sup> and directed state officials to take all necessary actions to prepare for and respond to drought conditions. On September 13, 2016, the former Governor signed Water Efficiency: Landscape Irrigation Equipment Act (Assembly Bill 1928, Campos, Chapter 326), requiring the Energy Commission 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 Energy Commission initiated a formal process to consider standards and test procedures, labeling requirements, and other efficiency measures for spray sprinkler bodies and irrigation controllers.<sup>3</sup> Although the drought has ended, the Energy Commission remains committed to helping ensure that water conservation remains a California way of life.

This standardized regulatory impact assessment analyzes the economic impact of adopting new minimum efficiency standards for certain landscape irrigation sprinklers.

### Landscape Emission Devices

The irrigation industry provides a wide variety of landscape emission devices adapted to best fit the needs of various landscapes. Emission devices are categorized according to the method of water delivery, water delivery rate, and installation. **Figure 1-1** shows the structure of the International Code Council (ICC) *802-2014 Landscape Irrigation Sprinkler and Emission Standard* definitions. This report follows this system of definitions in the discussion of landscape emission devices.

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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., available at <http://www.energy.ca.gov/2015publications/CEC-140-2015-002/CEC-140-2015-002.pdf>.

2 Office of Edmund G. Brown Jr. January 17, 2014. “Governor Brown Declares Drought State of Emergency.” Retrieved from <http://gov.ca.gov/news.php?id=18368>.

3 California Energy Commission. 2017. *2017 Integrated Energy Policy Report*. California Energy Commission. Publication Number: CEC-100-2017-001-CMD, pg. 58.

**Figure 1-1: Landscape Emission Device Definitions**

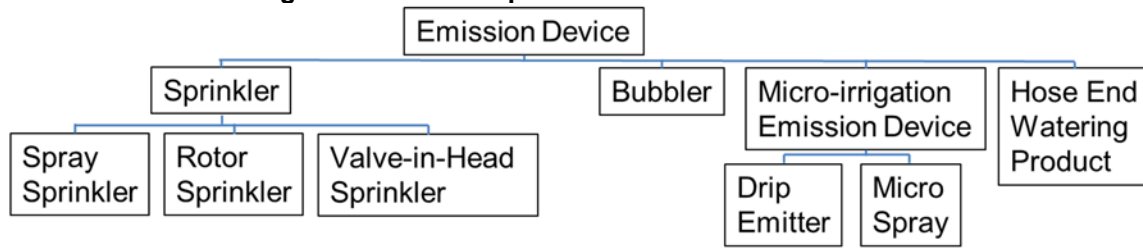


Illustration Credit: California Energy Commission

## Sprinklers

Sprinklers are irrigation devices that convert irrigation water pressure to high-velocity water discharge through the air. Sprinklers are divided into three types: spray sprinklers, rotor sprinklers, and valve-in-head sprinklers. Each device is typically capable of a flow rate of more than 0.5 gallon per minute.<sup>4</sup>

### Spray Sprinklers

A spray sprinkler relies upon a nonrotating nozzle to provide water over a continuous area. Spray sprinklers may be outfitted with a variety of nozzles, and the design of the sprinkler body may also vary depending upon the inclusion of a pop-up stem or retraction spring. Sprinklers with a spray sprinkler body are proposed to be within the scope of the standard, while all other sprinklers and landscape irrigation devices would be outside the scope.

**Figure 1-2: Spray Sprinkler Body**



Photo Credit: Rain Bird

### Rotor Sprinklers

A rotor sprinkler rotates the nozzle or orifice to cover the irrigated area. The rotation may be driven by various means such as gear-driven turbines or impact mechanisms.

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<sup>4</sup> International Code Council, *Landscape Irrigation Sprinkler and Emitter Standard*, ANSI/ASABE/ICC 802-2014 Chapter 2, [http://codes.iccsafe.org/app/book/content/2014\\_AMERICAN%20NATIONAL%20STANDARD/ICC%20802/CHAPTER%20%20DEFINITIONS.html](http://codes.iccsafe.org/app/book/content/2014_AMERICAN%20NATIONAL%20STANDARD/ICC%20802/CHAPTER%20%20DEFINITIONS.html).

## Valve-in-Head Sprinklers

Valve-in-head sprinklers contain an integral valve used to remotely control the operation of sprinklers. The sprinklers are typically found on landscapes where there is a need for a high level of control, such as a golf course.

## Bubblers

Bubblers are emission devices that are used to flood the soil and are typically used for the deep watering of shrubs and trees. The water spreads through the ground from the point of emission rather than being projected in a sprinkler system.<sup>5</sup>

Figure 1-3: Bubbler



Photo Credit: Hunter Industries

## Microirrigation Emission Devices

Drip emitters, drip-line emitters, and microspray emitters discharge water in the form of droplets at very slow flow rates. Microirrigation systems typically have many distribution points. Microirrigation systems may be placed upon the surface of the landscape or may be buried below the surface.<sup>6</sup>

Figure 1-4: Types of Drip Emitters

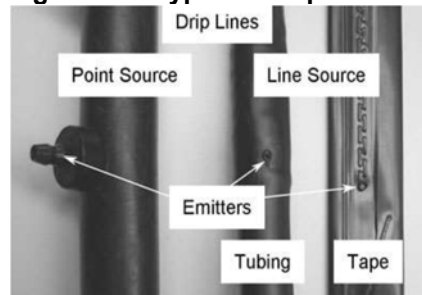


Photo Credit: New Mexico State University

<sup>5</sup> Hunter Industries, "Bubblers and Bubbler Nozzles," <http://www.hunterindustries.com/irrigation-product/nozzles/bubblers-bubbler-nozzles>.

<sup>6</sup> Hunter Industries, "Subsurface Irrigation Under Turf, Gardens, Small Shrubs," <http://www.hunterindustries.com/irrigation-product/nozzles/bubblers-bubbler-nozzles>.

## Hose-End Watering Products

Hose-end watering products are intended for temporary placement by the user. Examples include portable lawn sprinklers and hand-held sprayers.

**Figure 1-5: Hose-End Watering Products**



Photo Credit: Nelson Irrigation

## Landscape Emission Device Water Efficiency Technologies

### Pressure Regulation

Pressure regulation provides for a uniform output pressure so that the emission device will perform at the designed pressure conditions. Manufacturers sell pressure regulation devices either incorporated into the emission device or as a separate device to be installed close to the water source connection. The pressure-regulating device adjusts the outlet pressure as the inlet pressure varies to prevent overpressurization of the landscape emission device or irrigation system.<sup>7</sup>

### Sprinkler Pressure Regulation

Sprinklers with pressure regulation control the output pressure to the spray nozzle to maintain the manufacturer-recommended operating pressure as the input pressure varies. Pressure-regulated sprinklers prevent excessive water flow rates, misting, wind drift, evaporation, and poor uniformity. Sprinklers are sold with and without pressure regulation.<sup>8</sup>

Typically, these devices feature a spring-operated flow tube centered within the sprinkler stem, which can move up and down between seats on either end of the flow tube. The movement of the tube relative to the inlet seat regulates how much water can flow through the stem, thus regulating water pressure at the outlet to the nozzle. The level of outlet-pressure regulation is determined by the strength of the spring. Different manufacturers may implement specific pressure regulation features differently and often have patented technologies.<sup>9</sup>

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7 Palumbo, Greg and David Perl. Rain Bird Corporation. *Saving Water With Pressure Regulation and Check Valves- Introduction to Hydraulics*, pg. 16-30, <https://www.rainbird.com/landscape/resources/webinars/Saving%20Water%20%20-%20Intro%20to%20Hydraulics.pdf>.

8 Lacey, Dustin. *Project PRS: How Much Water Can You Really Save?* Rain Bird Corporation, pg. 6-12, <https://www.watersmartinnovations.com/documents/sessions/2015/2015-T-1536.pdf>.

9 Senninger Irrigation. *How Does a Pressure Regulator Work?* <http://www.senninger.com/how-does-a-pressure-regulator-work/>.

## **Drain Check Valve**

A drain check valve closes the irrigation system to prevent the flow of water when the system is not operating. Irrigation systems may have drain check valves that are integral to the emission device, installed in-line with the irrigation piping, or installed underneath an emission device. Check valves can be added to most irrigation spray heads in the field as an add-on or sold as integral parts of the sprinkler head assembly.<sup>10</sup>

## **Missing Nozzle**

Some sprinkler manufacturers offer a missing-nozzle flow feature called a flow-interrupting device.<sup>11</sup> The feature may reduce or stop water flow from the sprinkler when a nozzle or pop-up stem is missing or damaged.

## **Pressure-Compensating Screens**

Some irrigation spray sprinkler bodies and bubblers are available with pressure-compensating screens to reduce outlet pressure.<sup>12</sup> Pressure-compensating screens are passive and fit inside the irrigation body pop-up stem. They have no moving parts. Pressure-compensating screens do not regulate pressure but impart a pressure drop by acting as an additional obstruction to water flow within the pop-up stem. The screens permit the outlet pressure to fluctuate as the irrigation system inlet pressure fluctuates.<sup>13</sup>

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10 Palumbo, Greg and David Perl. Rain Bird Corporation. *Saving Water With Pressure Regulation and Check Valves-Introduction to Hydraulics*, pg. 10, <https://www.rainbird.com/landscape/resources/webinars/Saving%20Water%20%20-%20Intro%20to%20Hydraulics.pdf>.

11 Qualified Water Efficient Landscaper. "QWEL Curriculum, Class 11, New Technology," pg. 17-18, <http://www.qwel.net/wp-content/uploads/2011/04/QWEL-Class-11-2012.pdf>.

12 Sprinkler Warehouse. "Hunter PCB-20 PCB Bubbler Nozzle," <http://www.sprinklerwarehouse.com/Hunter-Sprinkler-Spray-Nozzles-p/pcb-20.htm>.

13 <http://www.irrigationtutorials.com/irrigation-sprinkler-head-selection/>.



# CHAPTER 2:

## Baseline and Scenarios Analyzed

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### Model

The macroeconomic model used was IMPLAN with 2016 California economic data. Staff prepared inputs to the model, including reduced sales of water and electricity and expected costs of implementing new standards. Evergreen Economics used the estimates to model the macroeconomic impacts of proposed and alternative SSB efficiency standards. The results discussed below provide the changes to statewide economic effects using the direct savings and incremental costs. The impacts were modeled over 10 years (2020-2029).

### Baseline

#### Outreach and Data Gathering

Energy Commission staff obtained information to establish baseline conditions within California's existing sprinkler stock and market for sprinklers and landscape emission devices. The baseline characterizes how the relevant sprinkler market operates today or would operate in the absence of any additional water efficiency regulation. The baseline characteristics were established using existing studies, stakeholder comments, and staff research. The incremental cost of baseline products is considered to be \$0, and costs associated with improved products consist solely of the incremental costs relative to baseline products.

The spray sprinkler body market is assumed to be stable in aspects relevant to statewide economic evaluation. The numbers of shipments, the baseline cost, and the performance of the spray sprinkler bodies are not expected to differ significantly year-over-year in the absence of regulation.

#### Estimating the Landscape Irrigation Water Use

The California Department of Water Resources estimates that 34 percent of urban water use, or roughly 1.1 trillion gallons, are used each year to irrigate residential landscapes. Large landscapes require an additional 10 percent, or 325 billion gallons per year, for irrigation. Statewide landscape water use exceeds indoor home water use.<sup>14</sup> Water-saving opportunities in landscape irrigation include the use of irrigation controllers, user education, and the use of efficient landscape irrigation equipment.<sup>15</sup>

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 be

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14 California Department of Water Resources. *California Water Plan Update 2013, Volume 3*, Chapter 3, pg. 3-10, [http://www.water.ca.gov/waterplan/docs/cwpu2013/Final/Vol3\\_Ch03\\_UrbanWUE.pdf](http://www.water.ca.gov/waterplan/docs/cwpu2013/Final/Vol3_Ch03_UrbanWUE.pdf).

15 Ibid., pg. 3-12 to 3-14.

moved about the landscape. Sprinkler systems are permanently plumbed systems relying upon subterranean piping, valves, and landscape emitters to spray water from fixed locations. Drip irrigation systems rely on a system of hoses and microemitters to deliver water as droplets to plantings.<sup>16</sup>

**Figure 2-1: Hand, Lawn Sprinkler, and Drip Irrigation Systems**



Photo Credit: Home Depot

Lawn sprinklers irrigate from 50 percent<sup>17</sup> to 78 percent<sup>18</sup> of landscapes. Thus, because of the large water use of these sprinklers, increasing the irrigation efficiency of lawn sprinklers is a key component of California’s efforts to make water conservation a way of life, as well as its energy efficiency strategy.

### Estimating the Opportunity for Water Savings

Overirrigation of landscapes is common in California and across the United States.<sup>19</sup>

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 on Figure 2-2.

16 “Water Use It Wisely Campaign, Efficiency Irrigation,” <http://wateruseitwisely.com/100-ways-to-serve/landscape-care/principles-of-xeriscape-design/efficient-irrigation/#pros>.

17 Pike, Ed and Daniela Urigwe. September 18, 2017. *Statewide Codes and Standards Enhancement (CASE) Team Response to Request for Proposals: Irrigation Spray Sprinkler Bodies*, pg. 39.

18 Aquacraft. 2011. *Embedded Energy in Water Studies Study 3: End-Use Water Demand Profiles*. Prepared for the California Public Utilities Commission. April 29, 2011. [http://www.energy.ca.gov/appliances/2013rulemaking/documents/responses/Water\\_Appliances\\_12-AAER-2C/California\\_IJU\\_Response\\_to\\_CEC\\_Invitation\\_to\\_Participate-Lavatory\\_Faucets\\_and\\_Faucet\\_Accessories\\_REFERENCES/CPUC\\_2011a\\_Embedded\\_Energy\\_in\\_Water\\_Studies-Study\\_3.PDF](http://www.energy.ca.gov/appliances/2013rulemaking/documents/responses/Water_Appliances_12-AAER-2C/California_IJU_Response_to_CEC_Invitation_to_Participate-Lavatory_Faucets_and_Faucet_Accessories_REFERENCES/CPUC_2011a_Embedded_Energy_in_Water_Studies-Study_3.PDF).

19 North Texas Municipal Water District, *One Out of Three North Texans Admit to Watering Their Lawns Three or More Times a Week*, June 14, 2011; Dale J. Bremer, Steven J. Keeley, Abigail Jager, Jack D. Fry, and Cathie Lavis, “In-Ground Irrigation Systems Affect Lawn-Watering Behaviors of Residential Homeowners,” American Society of Horticultural Science, *HortTechnology Electronic Journal*, October 2012; Metropolitan Council, *Efficient Water Use on Twin Cities Lawns Through Assessment, Research and Demonstration*, December 2016, available at <https://metro council.org/Wastewater-Water/Publications-And-Resources/WATER-SUPPLY-PLANNING/Twin-Cities-Lawn-Irrigation-System-Surveys-And-Ass.aspx>.

**Figure 2-2: Overirrigation Water Losses**

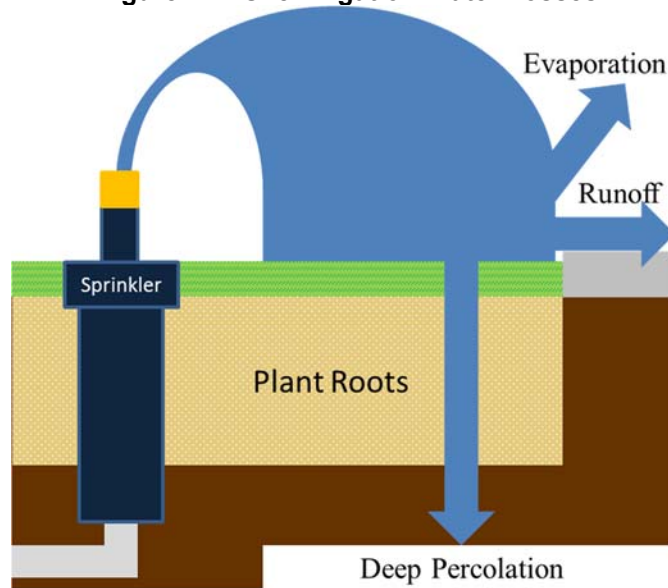


Illustration Credit: California Energy Commission

A study of smart irrigation controllers 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. On average, Californians apply 50 percent more water than is needed.<sup>20</sup>

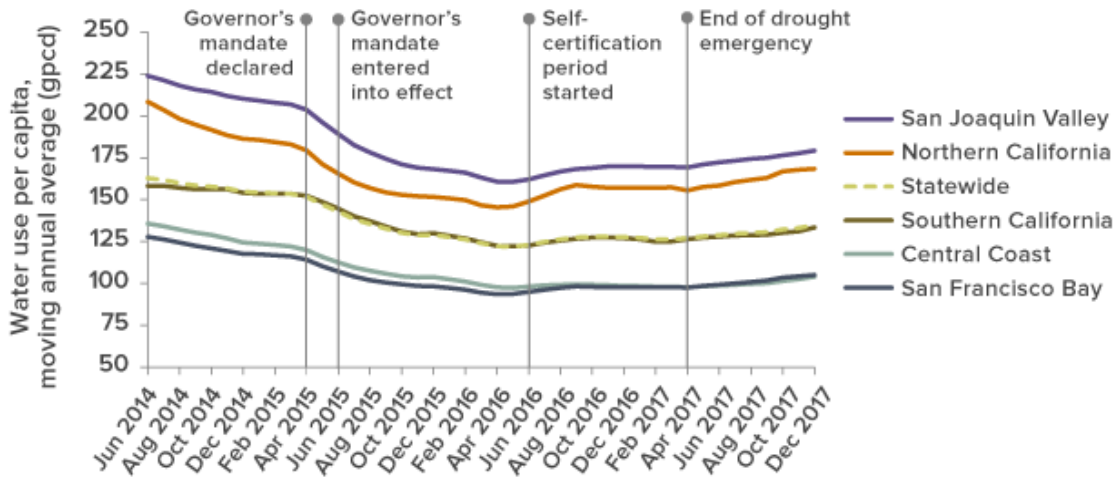
**Figure 2-3** shows urban water use before and during the time that mandatory water restrictions were imposed in response to the state's drought.<sup>21</sup> While water use has declined since before the most recent drought, water use has increased since the water restrictions were removed. Measures to make irrigation equipment more water-efficient will help preserve savings while making California communities more drought-resilient.

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

21 Hanak, Ellen and David Mitchell. Public Policy Institute of California. April 25, 2018. "Are California's Cities Ready for the Next Drought?" available at <http://www.ppic.org/blog/californias-cities-ready-next-drought/>.

**Figure 2-3: California Urban Water Use 2014-2017**



Source: Public Policy Institute of California

Manufacturers design irrigation spray nozzles to operate at a water pressure between 30 to 45 pounds per square inch (psi).<sup>22</sup> Supply water pressure above the design pressure of the device can lead to inefficient device operation with excessive water flow rates; water lost to misting, wind drift, and evaporation; and poor uniformity. The supply water pressure to an irrigation system or device may vary significantly from location or time of day. A recent survey of California landscape irrigation contractors found most irrigation connections provide an excessive water pressure with a statewide water pressure mean average of 65 psi.<sup>23</sup> Stakeholder comments provided a second average water pressure estimate of 81 psi based upon the California Department of Water Resources (DWR) Water Use Efficiency Data collected from more than 300 urban water suppliers.<sup>24</sup>

22 Mecham, Brent. September 18, 2017. Irrigation Association, *Spray Sprinkler Bodies Docket Number: 17-AAER-08*, TN 221200, pg. 2.

23 Pike, Ed and Daniela Urigwe. September 18, 2017. *Statewide Codes and Standards Enhancement (CASE) Team Response to Request for Proposals: Irrigation Spray Sprinkler Bodies*, pg. 94-95.

24 Quinn, Tracy. Natural Resources Defense Council. March 18, 2018. *Opening Comments of Tracy Quinn, Docket Number: 17-AAER-08*, TN 222958, pg. 4.

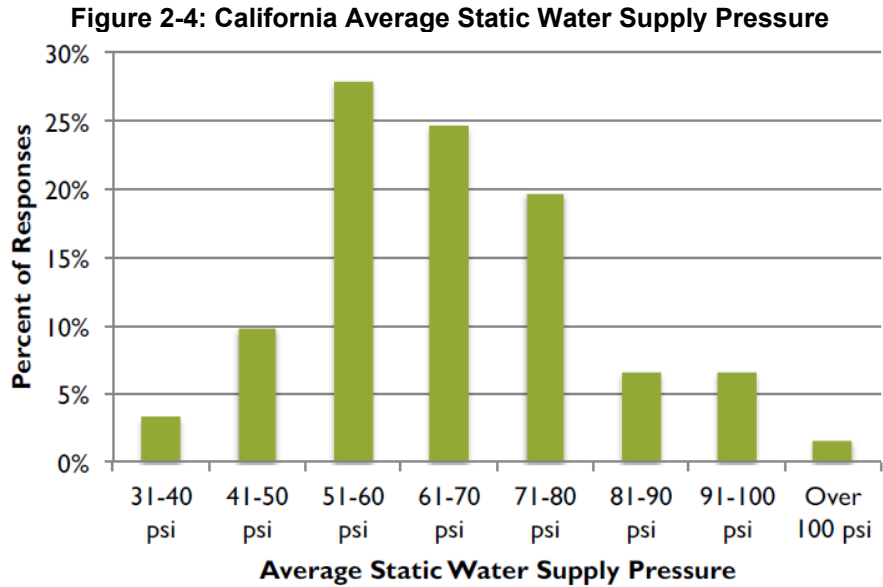


Illustration Credit: Evergreen Economics

Landscape irrigation components may be installed at differing elevations. If sprinkler heads are located at lower elevations than other parts of the system, then water may flow downhill and leak from the sprinkler heads when they're not operating.<sup>25</sup> The California investor-owned utilities' Codes and Standards Enhancement (CASE) team performed a survey of California to characterize the distribution of elevation changes within developed areas. The survey showed that elevation changes sufficient for system drainage occur in most landscapes in California.<sup>26</sup> The study suggests an opportunity for savings by preventing drainage from the sprinkler heads.

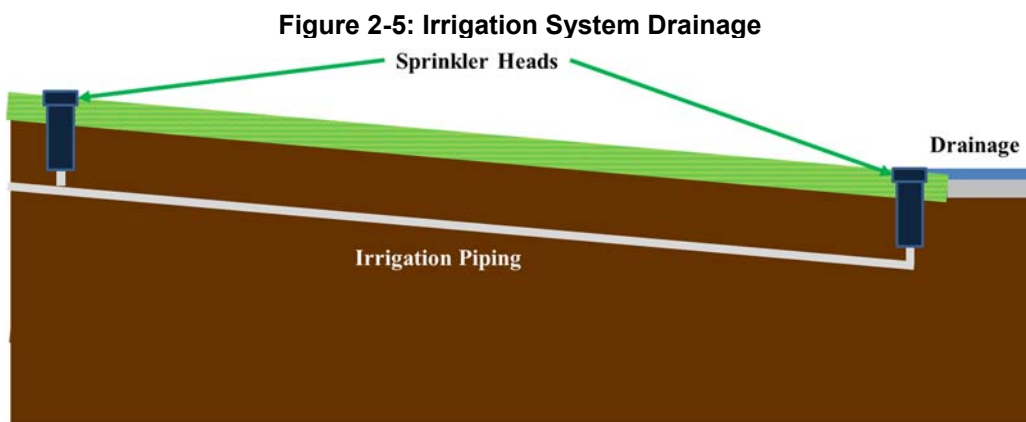


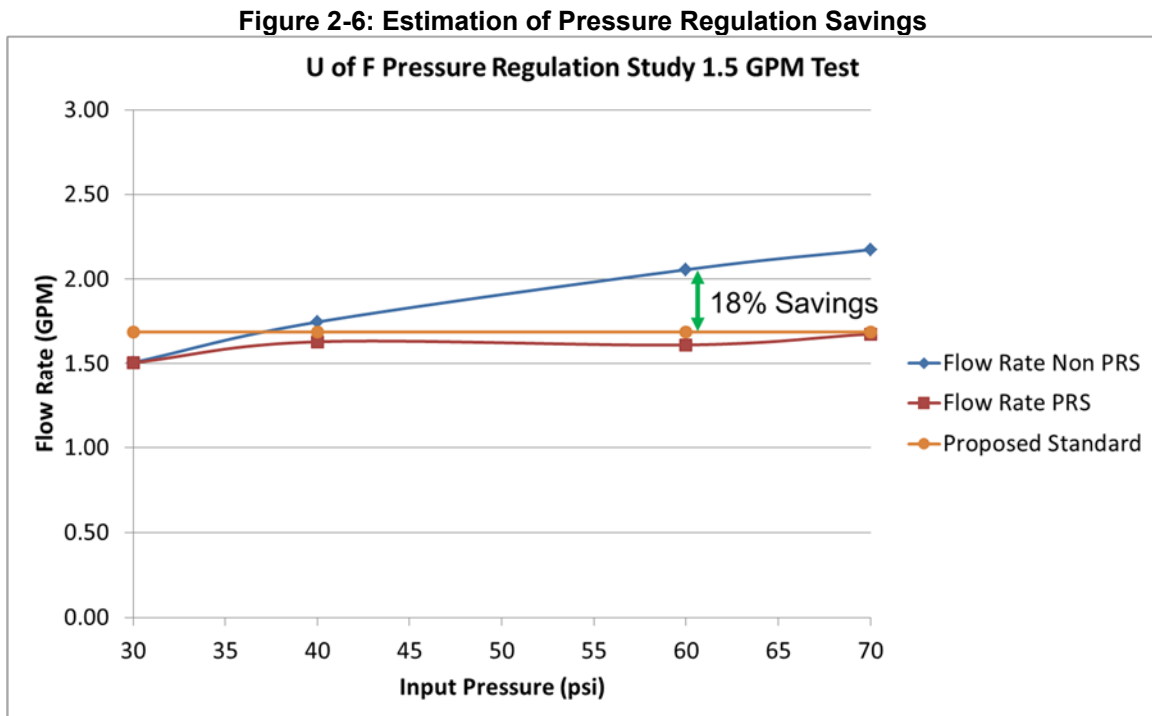
Illustration Credit: California Energy Commission

<sup>25</sup> Mecham, Brent. Irrigation Association. September 18, 2017. *Spray Sprinkler Bodies Docket Number: 17-AAER-05*, pg. 2.

<sup>26</sup> Pike, Ed and Daniela Urigwe. September 18, 2017. *Statewide Codes and Standards Enhancement (CASE) Team Response to Request for Proposals: Irrigation Spray Sprinkler Bodies*, pg. 24-25.

## Proposed Standard Pressure Regulation

Energy Commission staff reviewed the readiness of the various types of landscape emitters discussed in this report for water-saving regulations. Staff reviewed the scope of available test procedures, availability of products with pressure regulation, and the ability of the products meeting the standard to provide significant water savings. Staff proposed regulations for spray sprinkler bodies due to the availability of test methods, test data, currently compliant products, and significant cost-effective water savings. **Figure 2-6** displays the savings performance data gathered by the U.S. Environmental Protection Agency (U.S. EPA) WaterSense program that Commission staff used to estimate water savings from pressure regulation.



Source: California Energy Commission illustration with U.S. EPA WaterSense performance data

Energy Commission staff proposes pressure regulation for all spray sprinkler bodies by requiring all spray sprinkler bodies to be certified to the U.S. EPA as conforming to the WaterSense Specification for Spray Sprinkler Bodies. V.1.0 as the test procedure for spray sprinkler bodies. Pressure regulation provides significant water savings, and when combined with the previous work performed by WaterSense, there is sufficient information to analyze cost-effectiveness, technical feasibility, and statewide water savings.

## Alternatives

To develop alternative scenarios, Energy Commission staff looked to the proposals made by stakeholders in response to the July 2017 invitation to submit proposals and the March 2018 draft staff report and public meeting. The alternatives identified are based on adding a drain check valve to a baseline spray sprinkler body or adding a drain check valve and pressure regulation to a baseline spray sprinkler body. The addition of these devices to the spray

sprinkler bodies are the primary driver of water savings from the proposed regulations and, therefore, the most relevant to the economic impact of the proposed regulations on the state.

### **Alternative 1: Pressure Regulation and Drain Check Valve Combination**

Alternative 1 represents a combination of requiring a drain check valve per Alternative 2 and pressure regulation per the proposed regulation.

Staff studied proposing pressure regulation and check valves on all spray sprinkler bodies or spray sprinkler bodies with a drain check valve since these are common product offerings. Staff determined not to propose this alternative because of a lack of performance data to establish technical feasibility and cost-effectiveness for the drain check valve.

### **Alternative 2: Drain Check Valve Only**

A drain check valve closes the irrigation system to prevent the flow of water when the system is not operating. Check valves can be added to most irrigation spray heads in the field as an add-on or sold as integral parts of the sprinkler head assembly.<sup>27</sup>

At this time, there are no available performance data to demonstrate cost-effectiveness and technical feasibility of the drain check valve. Staff has determined not to include the drain check valve as a water-saving measure but would consider this feature in the future when information becomes available regarding drain check valve performance.

## **Estimating Costs and Benefits**

The Energy Commission staff estimated the costs and benefits of the proposed regulation and the two alternatives: (1) a regulations package with less stringent water efficiency standards of a drain check valve (no pressure regulation) and (2) a regulations package with a more stringent standard of pressure regulation and drain check valve combination. The proposed scenario uses the stringency level that the Energy Commission plans to introduce at the outset of the rulemaking. The less stringent level and more stringent level were selected from input provided by interested stakeholders in the pre-rulemaking and represent a technology that is widely available in the market.

### **Summary**

Information provided in **Table 2-1** summarizes the compliance rate, estimated costs, and savings per spray sprinkler body that staff found through its analysis. The life-cycle benefit reflects a 3 percent annual discount rate applied to the savings, so the incremental costs and savings can be compared in terms of net present value.

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27 Palumbo, Greg and David Perl. Rain Bird Corporation. *Saving Water With Pressure Regulation and Check Valves - Introduction to Hydraulics*, pg. 10, <https://www.rainbird.com/landscape/resources/webinars/Saving%20Water%20-%20Intro%20to%20Hydraulics.pdf>.

**Table 2-1: Summary Annual Water, Energy, and Monetary Savings per Spray Sprinkler Body**

Summary of Proposed and Alternative Standards	Design Life (Yr.)	Compliance Rate (%)	Annual Water Savings (gallons/Yr.)	Embedded Electricity Savings (kWh/Yr.)	Incremental costs (\$/unit)	Average Annual Savings (\$/Yr.)	Life Cycle Benefits (\$)
Proposed	10	10%	554	1.98	\$4.68	\$3.19	\$22.55
Alternative 1: More Stringent	10	10%	594	2.12	\$5.42	\$3.42	\$23.75
Alternative 2: Less Stringent	10	10%	40	0.14	\$1.93	\$0.23	\$0.03

Source: California Energy Commission

## Stock and Sales

Table 2-2 shows staff's estimate for residential landscape spray sprinkler bodies in California since no published source for stock sprinkler heads are available. Staff also reviewed estimates provided by the Codes and Standards Enhancement (CASE) team. The estimates provide a means of validating the staff estimate since they are similar in magnitude. Annual shipments are determined by dividing the estimated stock by the design life of the device.

**Table 2-2: Summary of Residential Stock and Shipment Estimates**

Estimate	Stock (units)	Shipment
Energy Commission	210 million	21.0 million
CASE Team <sup>28</sup>	170 million	18.6 million

Source: California Energy Commission and as noted

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28 Pike, Ed and Daniela Urigwe. September 18, 2017. *Statewide Codes and Standards Enhancement (CASE) Team Response to Request for Proposals: Irrigation Spray Sprinkler Bodies*, pg. 36.



**Figure 2-7: Head-to-Head Sprinkler Layout for Typical Turf Yard**

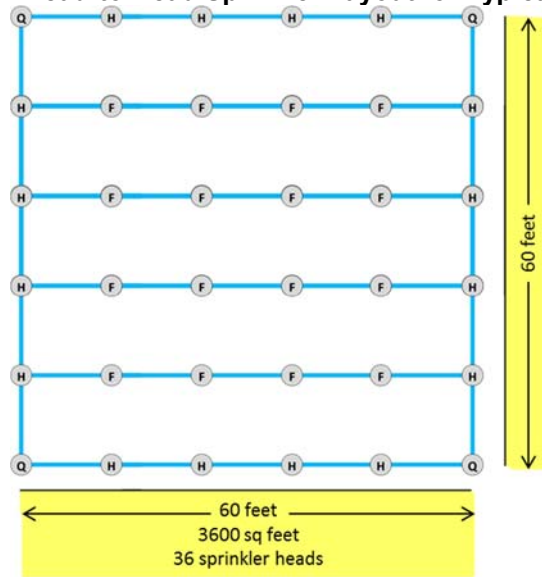


Illustration Credit: CASE team as modified by the Energy Commission

### Typical Yard Head-to-Head Spacing Calculation Method

Various irrigation manufacturer design guides recommend head-to-head spacing where the sprinkler heads are arranged so the spray from one sprinkler head will reach the adjacent sprinkler heads.<sup>29</sup> The overlapping sprays mean several sprinkler heads contribute to the watering of an area in the yard. Staff illustrated the head-to-head spacing for a 3,600-sq.-ft. yard, which is equivalent to the average California yard, as determined in the CALifornia Measurement Advisory Council (CALMAC) study for the California Public Utilities Commission.<sup>30</sup> Staff estimates this arrangement would require 36 sprinkler heads with a 12-foot radius of throw. Staff determined that roughly 5.8 million houses in California would have an automatic sprinkler system based upon data from the California Department of Finance and the CALMAC study.<sup>31 32</sup>

### Stock Calculation

Commercial and industrial water use estimates are shown in **Table 2-3**. The estimates are updated to 2016. Staff assumed that much of the water use at golf courses and schools would require sprinklers outside the proposed scope of the regulation, such as rotor sprinklers or sprinkler guns. Staff estimated the stock and shipments by dividing the total water use by the baseline water use per device.

29 Rain BIRD Sprinkler Manufacturing Corporation. 2000. *Landscape Irrigation Design Manual*, pg. 41.

30 Funk, Andrew and William DeOreo. 2011. *Embedded Energy in Water Studies Study 3: End-Use Water Demand Profiles*.

31 Ibid.

32 California Department of Finance. May 2016. "E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2016 With 2010 Census Benchmark." <http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/>.

Staff estimated the number of multifamily sprinklers based on estimates of the number of single-family attached and multifamily housing units in California. Staff assumed 429 square feet of irrigated ground per housing unit and that each sprinkler irrigates 100 square feet.<sup>33</sup> With these assumptions, staff determined there are roughly 23 million spray sprinkler bodies installed in multifamily housing in California.

**Table 2-3: Summary of Commercial Water Use**

<b>Commercial or Industrial Sector<sup>34</sup></b>	<b>2000 Landscape Use (Thousand Acre-ft./yr.)</b>	<b>2000 Landscape Use (MG/yr.)</b>	<b>2016 Landscape Use (MGal/yr.)</b>	<b>Water Use In-scope (%)</b>	<b>In-Scope Water Use (MGal/yr.)</b>
Offices	132	42,997	60,596	100%	60,596
Schools	180	58,632	82,632	20%	16,526
Restaurants	14	4,560	6,427	100%	6,427
Retail	23	7,492	10,558	100%	10,558
Hospitals	7	2,280	3,213	100%	3,213
Hotels	6	1,954	2,754	100%	2,754
Textiles	0.7	228	321	100%	321
Metals	1.6	521	735	100%	735
Food Processing	2.9	945	1,331	100%	1,331
Paper and Pulp	0.1	33	46	100%	46
High-Tech	6	1,954	2,754	100%	2,754
Laundries	1.5	489	689	100%	689
Golf Courses	420	136,808	192,807	10%	19,281
Other	170.2	55,440	78,133	100%	78,133
<b>Total</b>	<b>965</b>	<b>314,332</b>	<b>442,997</b>		<b>203,365</b>

Source: California Energy Commission

Evergreen Economics estimated the number of sprinklers around government offices as proportional to the employment in the government sector to the commercial sector. Based

33 City of Santa Cruz Water Department, *Residential and Commercial Baseline Water Use Survey*, May 2013, pg. 39. <http://www.cityofsantacruz.com/home/showdocument?id=32326>.

34 Gleick, Peter H., Dana Haasz, et al. 2003. *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, Pacific Institute, Appendix D, pg. 11.

upon the U.S. Bureau of Labor Statistics, Evergreen Economics estimates that government employment is 15 percent of commercial employment in California. Therefore, Evergreen Economics estimates that about 9.5 million sprinkler heads, or 15 percent of 63 million sprinkler heads, are found around government buildings.<sup>35</sup>

Population growth and the housing shortage in California will require nearly two million additional housing units to be built during the period of analysis, 2020-2029. The new housing units will have irrigated landscapes that contain sprinklers within the scope of the regulations. The sprinklers would be within the scope of the Model Landscape Water Efficiency Ordinance (MWELo). The ordinance contains similar requirements for pressure regulation as the Energy Commission’s proposed regulation. Commission staff chose not to estimate savings from sprinklers around new construction to avoid double-counting of water and utility bill savings occurring due to MWELo.

**Table 2-4: Summary of Residential, Commercial, and Government Stock and Sales of Spray Sprinkler Bodies**

<b>Application</b>	<b>First-Year Sales (Annual Units)</b>	<b>Stock (Units)</b>	<b>Design Life (years)</b>
<u>Residential – Single Family</u>	20,980,742	209,807,418	10
<u>Residential - Multifamily</u>	<u>2,285,088</u>	<u>22,850,878</u>	<u>10</u>
Commercial Excluding Schools	6,322,809	63,288,088	10
Government	948,421	9,484,211	10
<b>Total</b>	<b><u>30,537,060</u></b>	<b><u>305,370,596</u></b>	<b>N/A</b>

Source: California Energy Commission and Evergreen Economics

## Baseline Water and Energy Use

Landscape water usage may be calculated from recommendations on the water required by the landscape. Staff gathered irrigation data from the University of California, Division of Agriculture and Natural Resources (UC ANR) regarding recommended weekly sprinkler run times. Recommended run times vary by season and climate region and are expressed in minutes, assuming a precipitation rate of 1 inch per hour.<sup>36</sup> The recommendation considers the irrigation efficiency, effects of percolation, and incident rainfall. Staff converted the run times to inches of precipitation per year and then averaged the regions to arrive at the average

35 Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 9.

36 University of California, Agriculture and Natural Resources. “Lawn Watering Guide for California,” Publication 8044, <http://anrcatalog.ucanr.edu/pdf/8044.pdf>.

required inches of precipitation the sprinklers must provide. The total volume of water provided by sprinklers is then calculated by multiplying the inches of precipitation by the area of the yard. The per-device volume of water is calculated by dividing the volume of water delivered to the yard by the number of devices.

Alternatively, water usage may also be estimated based upon data gathered in the CALMAC study of 415 single-family homes.<sup>37</sup> The study estimates that on average 93,900 gallons are used for outdoor water use.<sup>38</sup> The 93,900-gallon value agrees well with the 112,476-gallon value calculated by the UC ANR method.

The Smart Irrigation Controller report found an average total precipitation of 52.5 inches per year.<sup>39</sup> Staff used the same method as the UC UNR method to estimate per device and statewide water use.

The CASE team provides a statewide baseline water use estimate of 551,000 million gallons per year. Staff divided the baseline estimate by the estimated stock to determine the per-device use.

**Table 2-5** compares the estimated water use for each calculation method. Staff chose the average among the four methods to estimate the water use per device. The baseline use is the weighted average of compliant and noncompliant devices. Staff used 2,955 gallons per device for the remainder of the analysis. Embedded electricity is estimated using the value from the CASE team report of 3,565 kWh/million gallons.<sup>40</sup>

**Table 2-5: Baseline Water and Energy Use Residential Estimates**

Calculation Method	Water per Device (gal/yr.)	Water per Residence (gal/yr.)	Statewide Water Use (Mgal/yr.)	Embedded Electricity (GWh/yr.)
UC ANR	3,124	112,476	655,508	2,337
CALMAC	2,608	93,900	547,248	1,951
Smart Irrigation	3,462	124,650	726,455	2,590
CASE Team	2,626	94,544	551,000	1,964

Source: California Energy Commission

37 Funk, Andrew and William DeOreo. 2011. *Embedded Energy in Water Studies Study 3: End-Use Water Demand Profiles*, pg. 54.

38 Ibid., pg. 88.

39 Mayer, Peter, William DeOreo, et al. 2009. *Evaluation of California Weather-Based "Smart" Irrigation Controller Programs*, pg. 86, <http://ucanr.edu/sites/UrbanHort/files/99641.pdf>.

40 Pike, Ed and Daniela Urigwe. September 18, 2017. *Statewide Codes and Standards Enhancement (CASE) Team Response to Request for Proposals: Irrigation Spray Sprinkler Bodies*, pg. 64.

**Table 2-6 Baseline Water and Energy Use**

<b>Application</b>	<b>Water per Device (gal/yr.)</b>	<b>Water per Residence (gal/yr.)</b>	<b>Statewide Water Use (Mgal/yr.)</b>	<b>Embedded Electricity (GWh/yr.)</b>
<u>Residential – Single-Family</u>	2,955	106,392	620,053	2,210
<u>Residential - Multifamily</u>	<u>2,955</u>	<u>12,678</u>	<u>67,532</u>	<u>241</u>
Commercial Excluding Schools	2,955	N/A	186,839	666
Government	2,955	N/A	28,026	100
<b>Total</b>	N/A	N/A	<b><u>902,450</u></b>	<b><u>3,217</u></b>

Source: California Energy Commission

The Irrigation Association estimated that 10 percent of current sprinkler spray bodies comply with the proposed pressure regulation standard.<sup>41</sup>

### **Compliant Water and Energy Use**

The University of Florida performed testing per the EPA WaterSense Specification for Spray Sprinkler Bodies and provided data to compare performance of products with and without pressure regulation. Staff reduced the data to provide the average output flow for spray sprinkler bodies with and without pressure regulating devices. The data are graphed in **Figure 2-6**.

Staff calculated the water pressure at the spray sprinkler body by assuming 81 psi at the supply inlet and subtracting 10 psi for irrigation valve losses and 10 psi for pipe losses. Staff updated the average water pressure and irrigation valve and pipe losses in response to stakeholder comments.

The water savings rate was calculated by determining the difference between the nonpressure-regulated flow rate and the maximum flow rate allowed by the proposed standard. The calculation was performed using performance values at a water pressure of 61 psi. Staff estimated the water savings rate as 18.4 percent.

Drain check valve savings were estimated as the amount of water that will drain from a noncompliant spray sprinkler body when not operating. The CASE team gathered data on elevation change and pipe characteristics to estimate roughly 40 gallons per year would drain from a noncompliant spray sprinkler body.

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<sup>41</sup> Mecham, Brent. Irrigation Association. September 18, 2017. *Spray Sprinkler Bodies Docket Number: 17-AAER-05*, pg. 45.

Staff assumes no change in duty cycle when compliant products replace noncompliant products. Since the baseline usage per device is the weighted average use of compliant and noncompliant devices, staff calculates the water use for compliant and noncompliant devices using the savings rate found above and the compliance rate provided by the Irrigation Association.

**Table 2-7: Proposal Compliant Water and Energy Use**

<b>Application</b>	<b>Water per Device (gal/yr.)</b>	<b>Water per Location (gal/yr.)</b>	<b>Statewide Water Use (Mgal/yr.)</b>	<b>Embedded Electricity (GWh/yr.)</b>
<u>Residential – Single-Family</u>	2,457	88,436	<u>515,406</u>	1,837
<u>Residential - Multifamily</u>	<u>2,457</u>	<u>10,539</u>	<u>56,135</u>	<u>200</u>
<u>Commercial Excluding Schools</u>	2,457	N/A	<u>155,324</u>	554
Government	2,457	N/A	<u>23,299</u>	83
Total	N/A	N/A	<u>750,164</u>	<u>2,674</u>

Source: California Energy Commission

**Table 2-8: Alternative 1 More Stringent: Compliant Water and Energy Use**

<b>Application</b>	<b>Water per Device (gal/yr.)</b>	<b>Water per Location (gal/yr.)</b>	<b>Statewide Water Use (Mgal/yr.)</b>	<b>Embedded Electricity (GWh/yr.)</b>
<u>Residential – Single-Family</u>	2,420	87,120	507,818	1,810
<u>Residential - Multifamily</u>	<u>2,420</u>	<u>10,380</u>	<u>55,308</u>	<u>197</u>
<u>Commercial Excluding Schools</u>	2,420	N/A	153,037	546
Government	2,420	N/A	22,956	82
Total	N/A	N/A	<u>739,119</u>	<u>2,635</u>

Source: California Energy Commission

**Table 2-9: Less Stringent: Alternative 2 Compliant Water and Energy Use**

<b>Application</b>	<b>Water per Device (gal/yr.)</b>	<b>Water per Location (gal/yr.)</b>	<b>Statewide Water Use (Mgal/yr.)</b>	<b>Embedded Electricity (GWh/yr.)</b>
<u>Residential – Single-Family</u>	2,919	105,084	612,428	2,183
<u>Residential - Multifamily</u>	<u>2,919</u>	<u>12,533</u>	<u>66,702</u>	<u>241</u>
<u>Commercial Excluding Schools</u>	2,919	N/A	184,563	658
Government	2,919	N/A	27,684	99
Total	N/A	N/A	<u>891,377</u>	<u>3,181</u>

Source: California Energy Commission

Table 2-6 lists the baseline annual water and energy use for the first year the proposed standards become effective.

### Cost and Savings

Staff estimated and tabulated statewide savings in Tables 2-10, 2-11, and 2-12 using the results listed in Tables 2-6, 2-7, 2-8 and 2-9.

**Table 2-10: Proposed Water Savings and Energy Savings**

<b>Application</b>	<b>Water Savings per Device (gal/yr.)</b>	<b>Water Savings per Location (gal/yr.)</b>	<b>Statewide (Mgal/yr.)</b>	<b>Embedded Electricity (GWh/yr.)</b>
<u>Residential – Single-Family</u>	554	19,951	<u>104,646</u>	373
<u>Residential - Multifamily</u>	<u>554</u>	<u>2,377</u>	<u>11,397</u>	<u>41</u>
<u>Commercial Excluding Schools</u>	554	N/A	<u>31,515</u>	112
Government	554	N/A	<u>4,727</u>	17
Total	N/A	N/A	<u>152,286</u>	<u>543</u>

Source: California Energy Commission

**Table 2-11: Alternative 1 More Stringent: Water Savings and Energy Savings**

<b>Application</b>	<b>Water Savings per Device (gal/yr.)</b>	<b>Water Savings per Location (gal/yr.)</b>	<b>Statewide (Mgal/yr.)</b>	<b>Embedded Electricity (GWh/yr.)</b>
<u>Residential – Single-Family</u>	594	21,384	112,163	400
<u>Residential - Multifamily</u>	<u>594</u>	<u>2,548</u>	<u>12,216</u>	<u>44</u>
<u>Commercial Excluding Schools</u>	594	N/A	33,802	121
Government	594	N/A	5,070	18
Total	N/A	N/A	<u>163,251</u>	<u>583</u>

Source: California Energy Commission

**Table 2-12: Alternative 2 Less Stringent: Water Savings and Energy Savings**

<b>Application</b>	<b>Water Savings per Device (gal/yr.)</b>	<b>Water Savings per Location (gal/yr.)</b>	<b>Statewide (Mgal/yr.)</b>	<b>Embedded Electricity (GWh/yr.)</b>
<u>Residential – Single-Family</u>	40	1,440	7,553	27
<u>Residential - Multifamily</u>	<u>40</u>	<u>172</u>	<u>823</u>	<u>3</u>
<u>Commercial Excluding Schools</u>	40	N/A	2,276	8
Government	40	N/A	341	1
Total	N/A	N/A	<u>10,993</u>	<u>39</u>

Source: California Energy Commission

**Table 2-13** provides statewide monetary savings based upon the California Department of Water Resources (CA DWR) data, which provided costs of residential water as \$5.76 per 1,000 gallons. The CASE Report provided the embedded electricity costs. Although the CASE team projects a yearly water delivery rate increase, staff chose to keep the water delivery rate flat for simplicity and because an increasing water delivery rate will merely result in more monetary savings.



**Table 2-13: Proposed Statewide Monetary Savings**

Application	First Year			Stock Savings		
	Water Delivery (M\$/yr.)	Embedded Electricity (M\$/yr.)	Total (M\$/yr.)	Water Delivery (M\$/yr.)	Embedded Electricity (M\$/yr.)	Total (M\$/yr.)
<u>Residential – Single-Family</u>	\$60.3	\$5.3	\$65.6	\$602.8	\$53.4	\$656.1
<u>Residential - Multifamily</u>	\$6.6	\$0.6	\$7.1	\$65.6	\$5.8	\$71.5
<u>Commercial Excluding Schools</u>	\$18.2	\$1.6	\$19.8	\$181.6	\$16.1	\$197.7
Government	\$2.7	\$0.2	\$2.9	\$27.2	\$2.4	\$29.6
Total	<u>\$87.6</u>	<u>\$7.8</u>	<u>\$95.3</u>	<u>\$877.2</u>	<u>\$77.7</u>	<u>\$954.9</u>

Source: California Energy Commission

**Table 2-14: Alternative 1 More Stringent: Statewide Monetary Savings**

Application	First Year			Stock Savings		
	Water Delivery (M\$/yr.)	Embedded Electricity (M\$/yr.)	Total (M\$/yr.)	Water Delivery (M\$/yr.)	Embedded Electricity (M\$/yr.)	Total (M\$/yr.)
<u>Residential – Single-Family</u>	\$64.6	\$5.7	\$70.3	\$646.1	\$57.2	\$703.3
<u>Residential - Multifamily</u>	<u>\$7.0</u>	<u>\$0.6</u>	<u>\$7.6</u>	<u>\$70.3</u>	<u>\$6.2</u>	<u>\$76.6</u>
<u>Commercial Excluding Schools</u>	\$19.5	\$1.7	\$21.2	\$194.7	\$17.2	\$211.9
Government	\$2.9	\$0.3	\$3.2	\$29.2	\$2.6	\$31.8
Total	<u>\$94.0</u>	<u>\$8.3</u>	<u>\$102.3</u>	<u>\$940.3</u>	<u>\$83.2</u>	<u>\$1,023.6</u>

Source: California Energy Commission

**Table 2-15: Alternative 2 Less Stringent: Statewide Monetary Savings**

Application	First Year			Stock Savings		
	Water Delivery (M\$/yr.)	Embedded Electricity (M\$/yr.)	Total (M\$/yr.)	Water Delivery (M\$/yr.)	Embedded Electricity (M\$/yr.)	Total (M\$/yr.)
<u>Residential – Single-Family</u>	\$4.4	\$0.4	\$4.8	\$43.5	\$3.9	\$47.4
<u>Residential - Multifamily</u>	<u>\$0.5</u>	<u>\$0.0</u>	<u>\$0.5</u>	<u>\$4.7</u>	<u>\$0.4</u>	<u>\$5.2</u>
<u>Commercial Excluding Schools</u>	\$1.3	\$0.1	\$1.4	\$13.1	\$1.2	\$14.3
Government	\$0.2	\$0.0	\$0.2	\$2.0	\$0.2	\$2.2
Total	<u>\$6.4</u>	<u>\$0.5</u>	<u>\$6.9</u>	<u>\$63.3</u>	<u>\$5.7</u>	<u>\$69.1</u>

Source: California Energy Commission

Staff surveyed manufacturer and retailer websites to determine the average retail price of sprinkler heads with and without pressure regulation. **Table 2-16** presents the results.

**Table 2-16: Average Sprinkler Head Price**

Stem (Pop-up height in inches)	Baseline	Proposed	Alternative 1: More Stringent	Alternative 2: Less Stringent
Gravity 2"	\$3.92	N/A	N/A	N/A
2"	\$2.03	N/A	N/A	N/A
4"	\$1.76	\$5.06	\$6.33	\$4.29
6"	\$6.10	\$10.78	\$11.52	\$8.03
12"	\$10.23	\$13.26	\$15.96	\$11.01

Source: California Energy Commission

**Table 2-17** presents the incremental cost between a noncompliant and compliant product. Since staff could not find a compliant 2" gravity or 2" pop-up, the incremental costs for this product represent a compliant 4" pop-up installed with a flexible pipe adapter called a "funny pipe."

**Table 2-17: Sprinkler Head Incremental Costs**

Stem (Pop-up height in inches)	Proposed	Alternative 1: More Stringent	Alternative 2: Less Stringent
2"	\$2.22	\$3.16	\$1.02
4"	\$3.30	\$4.57	\$2.53
6"	\$4.68	\$5.42	\$1.93
12"	\$3.03	\$5.73	\$0.78

Source: California Energy Commission

**Table 2-18** lists the annual water and energy savings for spray sprinkler bodies once the proposed standard becomes effective. It also lists the design life, annual monetary savings, incremental cost, and life-cycle benefit of spray sprinkler bodies. Because water delivered to customers typically carries a fixed price, savings resulting from embedded electrical energy are not factored into staff calculations for monetary savings per unit. Staff chose the highest incremental cost of \$4.68 for the 6" pop-up stem for the life-cycle benefit calculation. Since other types of spray sprinkler bodies have lower incremental costs, the life-cycle benefit calculation is conservative. Energy Commission staff assumes that manufacturing improvements will be passed on to distributors, retailers, and consumers with no costs to spray sprinkler bodies manufacturers. Staff assumed a 3 percent discount rate to calculate the net

present worth of the water savings. The incremental cost is subtracted from the net present worth of the savings to determine the life-cycle benefit.

**Table 2-18: Annual Water, Energy, and Monetary Savings**

<b>Design Life (years)</b>	<b>Water Savings (gal/yr.)</b>	<b>Embedded Electricity Savings (kWh/yr.)</b>	<b>Incremental Costs (\$)</b>	<b>Average Annual Savings (\$/yr.)</b>	<b>Life-Cycle Benefit (\$)</b>
10	554	2.0	\$4.68	\$3.19	\$22.55

Source: California Energy Commission

# CHAPTER 3:

## Changes in California Jobs

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California Energy Commission staff reviewed and evaluated analysis performed by Evergreen Economics on the effect on jobs from implementation of proposed and alternate spray sprinkler body efficiency standards between 2020 and 2029.<sup>42</sup> The number of jobs created in 2029 indicates the steady-state or long-term job change in the California economy from the proposed regulations. The 2020-to-2029 effect to employment over 10 years following adoption of proposed efficiency regulations is summarized in **Table 3-1**.

**Table 3-1: Estimated Effect of California Employment from Spray Sprinkler Body Proposal and Alternatives**

	<b>Less Stringent</b>	<b>Proposed</b>	<b>More Stringent</b>
<b>Job-Years in 2029</b>	<u>182</u>	<u>5,041</u>	<u>5,359</u>

Source: Evergreen Economics

Results from the macroeconomic modeling show that higher spray sprinkler body efficiency standards lead to greater levels of job creation. This job creation makes sense given the amount of savings that consumers receive on their water utility bills as a result of the efficiency standards. These savings are reallocated from consumer spending on water delivery to spending on other goods and services within the California economy, which translates into jobs. Utility-sector jobs are not expected to decrease due to lower water retail sales.

The increased incremental cost of spray sprinkler bodies leads to job growth for California spray sprinkler body manufacturers. The economic analysis assumes one-third of the spray sprinkler bodies will be manufactured by California companies. The increased revenues of \$43.0 million from the incremental cost of compliant spray sprinkler bodies will lead to 283 additional jobs for California spray sprinkler body manufacturers.<sup>43</sup>

In terms of the California economy, the effect on jobs of the proposed and alternative standards is minor. The changes in jobs shown in **Table 3-1** represent just a 0.03 percent change from baseline employment levels, assuming 18.5 million jobs statewide. The proposed standard leads to job gains throughout the evaluation period. The less stringent and more stringent alternatives have job losses at the beginning before water savings build over time to counter the increased incremental cost.

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<sup>42</sup> Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 31, Table 20.

<sup>43</sup> Ibid., pg. 24, Table 15.

# CHAPTER 4:

## Changes to California Businesses

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The proposed regulations will not lead to the specific creation or elimination of any California business. The proposed regulations require a minimum performance and may require manufacturers to shift product lines to accommodate increased demand for compliant products. However, the proposed regulations do not create the need for a new, nonexistent good or service. Instead, it requires the improvement of existing goods in the market. Therefore, no specific business is estimated to be created directly by the regulation, although secondary businesses may be created from expanded jobs and disposable income within the state.

The overall effect to California businesses will be positive: reduced water delivery costs and increased revenues through the manufacture of compliant spray sprinkler bodies.

### Effects to Spray Sprinkler Body Manufacturers

The economic analysis showed that about one-third of spray sprinkler body manufacturing is within California.<sup>44</sup> **Table 4-1** lists spray sprinkler body manufacturers identified by Commission staff with the headquarters locations and whether they perform sprinkler design or manufacturing in California.

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<sup>44</sup> Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 23.

**Table 4-1: Spray Sprinkler Body Manufacturers**

<b>Manufacturer</b>	<b>Headquarters</b>	<b>Manufacturing in California</b>	<b>Design Sprinklers in California</b>
The Toro Company	Riverside, CA	Yes	Yes
Rainbird	Azusa, CA	No	No
Hunter	San Marcos, CA	Yes	Yes
Irritol	Riverside, CA	No	No
Champion-Arrowhead Brass	Los Angeles, CA	No	No
Signature-Nelson	Irvine, CA	No	No
Aqualine	Los Angeles, CA	No	No
Krain	West Palm Beach, FL	No	No
Orbit	Bountiful, UT	No	No
Weathermatic	Garland, TX	No	No
Hydro-Rain	North Salt Lake, UT	No	No
Buckner/Superior	Torrance, CA	No	No
HIT Products Corporation	Lindsay, CA	No	No

Source: California Energy Commission staff

Staff expects manufacturers will need to change product lines from noncompliant to compliant spray sprinkler bodies. Effects could include designing and procuring new tooling to add pressure-regulating devices to meet the proposed regulations.

Staff evaluated results provided by Evergreen Economics regarding the effect of the regulations upon in-state spray sprinkler body manufacturers. The effects will be positive as the incremental costs consumers and businesses pay to replace failed sprinklers will represent additional revenue for spray sprinkler body manufacturers.<sup>45</sup> Evergreen Economics estimates the additional revenue due to the incremental cost as \$43.0 million dollars per year. **Table 4-2** presents the Evergreen Economics findings.

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<sup>45</sup> Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 24, Table 15.

**Table 4-2: Annual Estimated Economic Impacts in California from Increased Spending on Compliant Spray Sprinkler Bodies**

<b>Incremental Revenue Received by California Spray Sprinkler Body Manufacturers (\$M)</b>	<b>Change in Employment (Jobs)</b>	<b>Change in Economic Output (\$M)</b>
<u>\$43.0</u>	<u>283</u>	<u>\$74.3</u>

Source: Evergreen Economics

## **Impacts to Distributors and Retailers**

Under the Appliance Efficiency Regulations (Sections 1608 and 1609), distributors and retailers are responsible for ensuring that the products they sell have been certified by the product manufacturer and appear in the Energy Commission’s Modernized Appliance Efficiency Database System (MAEDbS). Because spray sprinkler bodies are a newly covered product, Energy Commission staff assumes that retailers will experience some additional costs associated with verification, although this cost will be insignificant in comparison to their overall expenditure.

Some retailers may choose to incur additional costs if they rebrand an appliance that is not certified to Energy Commission and wish to sell it in California. These retailers are required to certify the appliances to California.

## **Effects to Commercial Building Owners**

Commission staff estimates commercial building owners, including office buildings, retail outlets, and restaurants, that irrigate landscapes with spray sprinkler bodies will accrue similar savings as California residents. Evergreen Economics estimated that 63 million spray sprinkler bodies are used in these locations. Staff estimates the net savings growing over time and ultimately totaling \$155 million in 2029.<sup>46</sup>

## **Effects to Multifamily Building Owners**

Commission staff estimates savings for multifamily building owners, including single-family attached homes and multifamily buildings with two or more units that irrigate landscapes with spray sprinkler bodies. Commission staff estimates that savings will accrue at a rate similar to the rate of savings for residential single-family homes. Staff estimated that 23 million spray sprinkler bodies are used in these locations. Staff estimates the net savings growing over time and ultimately totaling \$56 million in 2029.<sup>47</sup>

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<sup>46</sup> Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 21, Table 12.

<sup>47</sup> *Ibid.*, pg. 21, Table 12.

## Effects to Government Buildings

Evergreen Economics estimated a stock of 9.5 million spray sprinkler bodies around government buildings. Using the same assumptions as for residential and commercial buildings, savings were estimated as accruing to \$23 million by 2029.<sup>48</sup>

## Effects to California Urban Water Suppliers

Urban water suppliers, both retail and wholesale, will have reduced sales of water due to increased efficient use under the proposed standard. The reduction is in line with the Governor's Executive Order B-37-16 that directs the Department of Water Resources and California State Water Resources Control Board to help water suppliers increase conservation through using water more wisely.<sup>49</sup> Reducing the demand for water may also benefit water suppliers by decreasing the need for investments in costly, large-scale infrastructure projects such as dams, canals, and reservoirs. Commission staff cannot identify any specific projects that would be cancelled or modified as a result of the water savings. Evergreen Economics notes that the complexity of the state's water policies when combined with the impacts of the proposed regulation are beyond the scope of the IMPLAN model.<sup>50</sup>

## Effects on California Electricity Generators

Sellers of electric power, both retail and wholesale, may experience slightly reduced sales of electricity due to the proposed standard as less energy is needed to extract water from the source; to treat, distribute, and use it; and to collect and treat wastewater for release back into the environment. Because California's investor-owned energy utilities' earnings are decoupled from energy sales, these utilities will see minimal effects from the proposed regulations.<sup>51</sup>

## Impacts to California Landscape Professionals

Energy Commission staff assumes that there will be no change in business consumer behavior. Landscape professionals will pass incremental costs on to end users, and building owners will absorb the incremental costs as a typical business expense.<sup>52</sup>

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48 Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 22, Table 13.

49 California Department of Water Resources, State Water Resources Control Board, California Public Utilities Commission, California Department of Food and Agriculture, and California Energy Commission, April 2017. *Making Water Conservation a California Way of Life*, pg. ii, available at <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Water-Basics/Conservation-Tips/Files/Publications/Making-Water-Conservation-a-California-Way-of-Life.pdf>.

50 Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg.24.

51 California Public Utilities Commission, *California's Decoupling Policy*, available at [https://fishnick.com/pge/Decoupling\\_Explained.pdf](https://fishnick.com/pge/Decoupling_Explained.pdf).

52 Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 24.



## CHAPTER 5: Competitive Advantage or Disadvantage

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The proposed regulation would apply to all businesses manufacturing the regulated products inside and outside the state and selling spray sprinkler bodies to California customers. It is, therefore, not anticipated that the regulation will have an adverse effect on the competitiveness of California businesses compared with businesses outside the state. Staff concluded the alternatives considered would apply to businesses in a similar manner to the proposed regulations.

The proposed regulations will, by design, give an advantage to manufacturers of more efficient products. The proposed performance standards are not based on any particular patent or technology and, therefore, give a broad advantage rather than a specific advantage. Compliant products are offered by many manufacturers.<sup>53</sup> Assembly of spray sprinkler bodies does not occur in significant volume within the state – most are assembled in China. However, there are California-based SSB corporations, as shown in **Table 4-1**.

The decrease in overall water use estimated by the proposed regulation would create a slight competitive advantage for California businesses through lower operating expenses to maintain their landscapes.

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<sup>53</sup> Steffensen, Sean. 2019. *Final Staff Analysis of Water Efficiency Standards for Spray Sprinkler Bodies*. California Energy Commission, CEC-400-2018-005, pp. 40-43.

## CHAPTER 6: Changes in State Investment

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The result of conserving water with the proposed spray sprinkler body efficiency standards is an increase in gross state product (GSP). This modeled increase in GSP is the result of lower annual water bills and reallocation of spending by businesses and homes on other goods and services within the California economy, and they lead to an increase in California business proprietor income. Evergreen Economics estimated the change in proprietor income through the IMPLAN analysis. Because of uncertainty as to when the investment will occur and to present a concise number as to the effect, Evergreen Economics discounted the total value of the increases to proprietor income to the first year of implementation, 2021. The total change in income over the period analyzed discounted to 2021 is \$153 million.<sup>54</sup>

Based upon a review of national data, Evergreen Economics estimates that 29.3 percent of the proprietor income will be reinvested as measured by net private domestic investment (NPDI).<sup>55</sup> This assumption leads to a change in NPDI of \$44.9 million. The level of increased NPDI is very small compared to the whole California economy and represents up to a 0.0016 percent change compared to the GSP. Staff finds the overall effect of the regulations on investment in California to be small compared to benefits of reduced water consumption, increased jobs, increased personal income, improved air quality, and reduced greenhouse gas emissions.

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54 Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 17, Table 8.

55 Ibid., pg. 17, Table 8.

# CHAPTER 7:

## Changes in Incentives for Innovation

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The technologies necessary to meet the proposed and alternative standards are widely available as a result of past and ongoing investments in research and development. There are many product models across multiple manufacturers that comply with the proposed standards and the alternatives considered. The proposed standards will cause the spread of existing, efficient technologies into products that may not currently contain them, thereby increasing the number of products that would comply with the proposed and alternative standards.

Future innovations in the products proposed to be regulated can be organized into three types: innovations that would decrease water use, innovations that are neutral to water use, and innovations that would increase water use.

The proposed standards clearly provide incentives for technologies and innovations that can reduce the water use of spray sprinkler bodies. The proposed regulations put pressure on manufacturers of existing products to adjust from status quo designs that would have difficulty meeting the efficiency standards. These changes lead to increased industry investment in technology and form the core of innovation. This investment also generates expertise and fuels secondary innovation. In addition, the regulations would add reporting and marking requirements that would make spray sprinkler bodies performance more transparent, thereby encouraging competition and innovation.

In some cases, innovation does not come with any change in water use. For example, changing the shape of a spray sprinkler body by adding or eliminating a flange may not change the efficiency but may lead to easier installation or greater durability. Generally, these types of innovations are neither promoted nor hindered by water performance standards.

The proposed regulation will impose limits on the outlet pressure of the spray sprinkler bodies. By providing tighter control over the outlet pressure, spray sprinkler body designers may be able to optimize other parts of the design for cost savings or performance improvements.

Some innovations incorporate features that might require additional water consumption in regulated products. The regulations mandate lower water consumption, resulting in an upper limit for innovations that would otherwise increase the consumption of water. The result of the innovation can be positive, neutral, or negative with regard to water consumption. The proposed regulations would have a neutral effect on innovations that would increase consumption, but not in excess of the performance standard. The proposed regulations would have a negative effect on innovations that would cause water consumption to exceed the standard. This means that manufacturers will have to either modify the innovation to conform to the standard or forgo the innovation. The regulations would have a positive effect on innovation where the water-consuming innovation drives the demand for water-saving innovations to comply with the proposed standards.

The economic analysis of the proposed regulations shows an increase in personal disposable income. This income can be used to buy innovative products that are beyond what consumers consider baseline. Further, the utility bills of California businesses would decrease from the proposed cost-effective regulations. Reduced spending on utilities frees up capital for businesses to invest in research and development in other areas of innovation.

# CHAPTER 8:

## Benefits and Costs to Californians

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The proposal and alternatives provide benefits to California households and businesses. The benefits that were quantified for this assessment include water and electricity conservation, utility bill savings, more jobs, changes in household spending, reduced air pollution, and reduced greenhouse gas emissions. Estimates were made for the incremental costs to residential and commercial consumers of spray sprinkler bodies.

### Water Savings

Water is conserved directly as the spray sprinkler bodies are made more efficient by adding a pressure regulator or, in the case of the alternatives, a drain check valve. The proposed spray sprinkler body efficiency standards yield total annual water savings estimated at 15 billion gallons in 2020 and 152 billion gallons in 2029. Total cumulative water savings over the 10-year period of analysis is 836 billion gallons or about 2.6 million acre-feet. These cumulative water savings are equivalent to the storage capacity of Trinity Lake.<sup>56</sup> More stringent standards would have more savings; less stringent standards would have less savings, directly correlating to savings on water bills. These savings are summarized in **Table 8-1**.

**Figure 8-1: Cumulative Water Savings Equal to Trinity Lake, California**



Illustration Credit: U.S. Bureau of Reclamation

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<sup>56</sup> United States Geological Survey, Water-Year Summary for Trinity Lake, available at [https://waterdata.usgs.gov/nwis/wys\\_rpt/?site\\_no=11525400](https://waterdata.usgs.gov/nwis/wys_rpt/?site_no=11525400).

**Table 8-1: Comparison of Savings From Proposal and Alternatives**

	<b>Water Savings at Total Stock Turnover (Bgal/yr.)</b>
<b>Proposed</b>	<u>152</u>
<b>Alternative 1: More Stringent</b>	<u>163</u>
<b>Alternative 2: Less Stringent</b>	<u>11</u>

Source: California Energy Commission staff

The value of annual residential water bill savings under the proposed standards is estimated to be \$60.3 million in 2020 and up to \$603 million by 2029. Residential consumers will see cumulative water bill savings of \$3.3 billion over the analysis period. Businesses' water bill savings over the same period range from a low of \$18.2 million to a high of \$182 million. Businesses will see cumulative water bill savings of \$1.0 billion between 2020 and 2029. Government water bill savings over the same period range from a low of \$2.7 million to a high of \$27 million. Government will see cumulative water bill savings of \$150 million between 2020 and 2029. Water utilities will have lower sales of \$4.8 billion over the analysis period. **Tables 8-2 through 8-5** contain the annual undiscounted water bill savings for spray sprinkler bodies. These savings increase over time as more spray sprinkler bodies are replaced with higher-efficiency products.

**Table 8-2: Annual Residential Water Savings**

	<b>Proposed (Million \$2018)</b>	<b>Alternative 1: More Stringent (Million \$2018)</b>	<b>Alternative 2: Less Stringent (Million \$2018)</b>
<b>2020</b>	\$60.3	\$64.6	\$4.4
<b>2021</b>	\$120.5	\$129.2	\$8.7
<b>2022</b>	\$180.8	\$193.8	\$13.1
<b>2023</b>	\$241.0	\$258.4	\$17.4
<b>2024</b>	\$301.3	\$323.0	\$21.8
<b>2025</b>	\$361.5	\$387.6	\$26.1
<b>2026</b>	\$421.8	\$452.2	\$30.5
<b>2027</b>	\$482.0	\$516.8	\$34.8
<b>2028</b>	\$542.3	\$581.5	\$39.2
<b>2029</b>	\$602.6	\$646.1	\$43.5
<b>Cumulative</b>	\$3,314.0	\$3,553.3	\$239.3

Source: California Energy Commission staff

**Table 8-3: Annual Commercial Water Savings**

	<b>Proposed (Million \$2018)</b>	<b>Alternative 1: More Stringent (Million \$2018)</b>	<b>Alternative 2: Less Stringent (Million \$2018)</b>
<b>2020</b>	\$18.2	\$19.5	\$1.3
<b>2021</b>	\$36.3	\$38.9	\$2.6
<b>2022</b>	\$54.5	\$58.4	\$3.9
<b>2023</b>	\$72.6	\$77.9	\$5.2
<b>2024</b>	\$90.8	\$97.3	\$6.6
<b>2025</b>	\$109.0	\$116.8	\$7.9
<b>2026</b>	\$127.1	\$136.3	\$9.2
<b>2027</b>	\$145.3	\$155.8	\$10.5
<b>2028</b>	\$163.4	\$175.2	\$11.8
<b>2029</b>	\$181.6	\$194.7	\$13.1
<b>Cumulative</b>	\$998.7	\$1,070.8	\$72.1

Source: California Energy Commission staff

**Table 8-4: Annual Multifamily Water Savings**

	<b><u>Proposed (Million \$2018)</u></b>	<b><u>Alternative 1: More Stringent (Million \$2018)</u></b>	<b><u>Alternative 2: Less Stringent (Million \$2018)</u></b>
<b><u>2020</u></b>	<u>\$6.6</u>	<u>\$7.0</u>	<u>\$0.5</u>
<b><u>2021</u></b>	<u>\$13.1</u>	<u>\$14.1</u>	<u>\$0.9</u>
<b><u>2022</u></b>	<u>\$19.7</u>	<u>\$21.1</u>	<u>\$1.4</u>
<b><u>2023</u></b>	<u>\$26.3</u>	<u>\$28.1</u>	<u>\$1.9</u>
<b><u>2024</u></b>	<u>\$32.8</u>	<u>\$35.2</u>	<u>\$2.4</u>
<b><u>2025</u></b>	<u>\$39.4</u>	<u>\$42.2</u>	<u>\$2.8</u>
<b><u>2026</u></b>	<u>\$45.9</u>	<u>\$49.3</u>	<u>\$3.3</u>
<b><u>2027</u></b>	<u>\$52.5</u>	<u>\$56.3</u>	<u>\$3.8</u>
<b><u>2028</u></b>	<u>\$59.0</u>	<u>\$63.3</u>	<u>\$4.3</u>
<b><u>2029</u></b>	<u>\$65.6</u>	<u>\$70.4</u>	<u>\$4.7</u>
<b><u>Cumulative</u></b>	<u>\$360.9</u>	<u>\$387.0</u>	<u>\$26.0</u>

Source: California Energy Commission staff

**Table 8-5: Annual Government Water Savings**

	<b>Proposed (Million \$2018)</b>	<b>Alternative 1: More Stringent (Million \$2018)</b>	<b>Alternative 2: Less Stringent (Million \$2018)</b>
<b>2020</b>	\$2.7	\$2.9	\$0.2
<b>2021</b>	\$5.4	\$5.8	\$0.4
<b>2022</b>	\$8.2	\$8.8	\$0.6
<b>2023</b>	\$10.9	\$11.7	\$0.8
<b>2024</b>	\$13.6	\$14.6	\$1.0
<b>2025</b>	\$16.3	\$17.5	\$1.2
<b>2026</b>	\$19.1	\$20.4	\$1.4
<b>2027</b>	\$21.8	\$23.4	\$1.6
<b>2028</b>	\$24.5	\$26.3	\$1.8
<b>2029</b>	\$27.2	\$29.2	\$2.0
<b>Cumulative</b>	\$149.8	\$160.6	\$10.8

Source: California Energy Commission staff

## Electricity Savings

Electricity is conserved indirectly as less water is pumped to irrigate landscapes. The proposed spray sprinkler body efficiency standards yield total annual electricity savings estimated at 54 gigawatt-hours (GWh) in 2020 and 543 GWh electricity savings by 2029. Total cumulative electricity savings over the 10-year period of analysis is 3.0 terawatt-hours (TWh). More stringent standards would have more savings; less stringent standards would have less energy savings. These savings are summarized in **Table 8-6**.

**Table 8-6: Comparison of Savings From Proposal and Alternatives**

	<b>Electrify Savings at Total Stock Turnover (GWh/yr.)</b>
<b>Proposed</b>	<u>543</u>
<b>Alternative 1: More Stringent</b>	<u>583</u>
<b>Alternative 2: Less Stringent</b>	<u>38</u>

Source: California Energy Commission staff

The value of annual electricity savings under the proposed standards is estimated to be \$7.8 million in 2018 and up to \$77.7 million by 2029 assuming a cost of \$0.143/kWh.<sup>57</sup> Water utilities will see the benefit through lower operating expenses. Electric utilities will have lower sales of \$427 million over the analysis period. **Table 8-7** contains the annual undiscounted

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57 Marshall, Lynn. "California Energy Demand 2018-2030 Revised Baseline Forecast - Mid Demand Case, Form 2.3." California Energy Commission Supply Analysis Office, available at [http://www.energy.ca.gov/2017\\_energy/policy/documents/2017-12-15\\_workshop/2017-12-15\\_middemandcase\\_forecast.php](http://www.energy.ca.gov/2017_energy/policy/documents/2017-12-15_workshop/2017-12-15_middemandcase_forecast.php).



electricity savings for spray sprinkler bodies. These savings increase over time as more spray sprinkler bodies are replaced with higher-efficiency products.

**Table 8-7: Annual Electricity Savings (Monetary)**

	<b>Proposed (Million \$2018)</b>	<b>Alternative 1: More Stringent (Million \$2018)</b>	<b>Alternative 2: Less Stringent (Million \$2018)</b>
<b>2020</b>	<u>\$7.8</u>	<u>\$8.3</u>	<u>\$0.6</u>
<b>2021</b>	<u>\$15.5</u>	<u>\$16.7</u>	<u>\$1.1</u>
<b>2022</b>	<u>\$23.3</u>	<u>\$25.0</u>	<u>\$1.7</u>
<b>2023</b>	<u>\$31.1</u>	<u>\$33.3</u>	<u>\$2.2</u>
<b>2024</b>	<u>\$38.8</u>	<u>\$41.6</u>	<u>\$2.8</u>
<b>2025</b>	<u>\$46.6</u>	<u>\$50.0</u>	<u>\$3.4</u>
<b>2026</b>	<u>\$54.4</u>	<u>\$58.3</u>	<u>\$3.9</u>
<b>2027</b>	<u>\$62.1</u>	<u>\$66.6</u>	<u>\$4.5</u>
<b>2028</b>	<u>\$69.9</u>	<u>\$75.0</u>	<u>\$5.1</u>
<b>2029</b>	<u>\$77.7</u>	<u>\$83.3</u>	<u>\$5.6</u>
<b>Cumulative</b>	<u>\$427.2</u>	<u>\$458.1</u>	<u>\$30.9</u>

Source: California Energy Commission staff

## Household Spending Increases

In addition to the electricity bill savings described above, the proposed standards will decrease real disposable personal income by \$28 million in 2020 and increase it by \$514 million in 2029.<sup>58</sup> The increase in personal income is certainly beneficial for the California economy and will amount to about \$88 per year per household. This increase in disposable income results from consumers saving money on utilities and spending it on other goods and services, leading to a gain in employment levels within the state. As with employment and electricity savings, personal disposable income rises with increased stringency of the standards. For comparison, the lowest stringency alternative yields an increase of \$7 million in disposable income, while the most stringent efficiency alternative yields an increase of \$544 million.

## Air Quality Improvements and Avoided Greenhouse Gas Emissions

Air quality and avoided greenhouse gas benefits of the proposed and alternative spray sprinkler body water efficiency regulations are significant as a result of avoided electricity generation but difficult to quantify given uncertainty in the mix of generation resources over the next 10 years. Evergreen Economics used the emissions factors and assumptions from the U.S. Environmental Protection Agency’s (U.S. EPA) Avoided Emissions and Generation Tool (ADVERT) to model

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<sup>58</sup> Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 19, Table 10.

criteria emissions reductions associated with electricity savings of the proposed SSB standards. Cumulative benefits from reduced emissions over the 10 years studied total \$115 million.<sup>59</sup>

## Environmental Benefits to California

For homes and workplaces, reducing water consumption would reduce the demand for available and shrinking water supplies, which will help decrease the need of investing in costly, large-scale infrastructure projects such as dams, canals, and reservoirs. It will also result in reduced operating costs for water utilities, as it takes a significant amount of energy to get water to the spray sprinkler bodies at a home or business. Energy is needed to extract water from the source; to treat, distribute, and use it; and to 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. The decrease in water consumption will result in increased availability of water to other users, decreased need for diversions, decreased associated environmental impacts to riparian and wetland habitats from those diversions, and decreased drought impacts on California. Evergreen Economics estimated the value of the water conserved as \$14.1 million per year, assuming a value of \$30.17 per acre-foot at full stock turnover.<sup>60</sup> The cumulative benefit would be \$70 million over the 10-year analysis period.

## Costs

Residential incremental costs of spray sprinkler bodies that meet the proposed standard are estimated to be \$88 million per year. Incremental costs of spray sprinkler bodies to California businesses are estimated to be \$27 million. The incremental cost per spray sprinkler body remains fixed throughout the analysis period, meaning staff assumes that it does not increase due to a shortage in the supply chain, and it does not decrease due to learning curves or economies of scale. **Table 8-8** provides the yearly incremental costs for purchase of compliant SSB.

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59 Helvoight, Ted. Evergreen Economics. January 15, 2019. *Economic Impact Analysis of the Water Efficiency Standards for Spray Sprinkler Bodies*, pg. 28, Table 17.

60 Ibid, pg. 26.

**Table 8-8: Incremental Costs**

	<b>Residential Single-Family Incremental Costs (\$M/yr.)</b>	<b>Residential Multifamily Incremental Costs (\$M/yr.)</b>	<b>Commercial Incremental Costs (\$M/yr.)</b>	<b>Government Incremental Costs (\$M/yr.)</b>
<b>Proposed</b>	88.4	<u>9.6</u>	26.6	4.0
<b>Alternative 1: More Stringent</b>	102.3	<u>11.1</u>	30.8	4.6
<b>Alternative 2: Less Stringent</b>	36.4	<u>4.0</u>	11.0	1.6

Source: California Energy Commission staff

## CHAPTER 9: Conclusion and Summary

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The magnitude of economic impact is greater than the \$50 million threshold for conducting a standardized regulatory impact assessment, with savings to consumers and businesses exceeding \$4 billion over 10 years. As a percentage of the California economy, the scale of impact is relatively minor. The proposed regulations and alternative scenarios provide economic benefits to California across all metrics considered. These benefits include increased employment, competitiveness, personal income, and investment in the state.

The proposed standards will have a cost to California consumers, businesses, and government in 2020 of \$40.9 million. This net cost in the first year of the regulations is due to combined spending on higher incremental costs of more efficient spray sprinkler bodies and the payback period being roughly 1.5 years. The proposed standards yield significant positive savings to consumers from 2021 through 2029 that exceed the initial costs.

The proposed standards provide greater net benefits to California than the less stringent scenario but slightly fewer net benefits than the more stringent scenario. The proposed standards are estimated to provide \$4,288 million more net benefits than the less stringent alternative. The increased net benefits from the more stringent scenario total \$188 million and suggest that additional economic benefit could be achieved. However, more stringent levels were developed by staff that do not have performance test data to verify technical feasibility and cost effectiveness. Pursuing the more stringent levels could lead to a significant delay in the implementation, as the Energy Commission would seek to vet the more stringent standards with stakeholders before proceeding to the formal rulemaking. This delay in itself would cause a loss of the economic benefit characterized for the proposed standards in the assessment. For these reasons, the Energy Commission is likely to support the proposed scenario and levels in lieu of an alternative analyzed in this standardized regulatory impact assessment.