Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard

WUES-DWR-2021-03

A Report to the State Water Resources Control Board Prepared Pursuant to California Water Code Section 10609.8(a)

September 2022

California Department of Water Resources
Water Use Efficiency Branch

Note: This report is part of the package of reports developed by the California Department of Water Resources to meet the requirements of Senate Bill 606 and Assembly Bill 1668 of 2018 for urban water use efficiency.

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California Natural Resources Agency
Wade Crowfoot, Secretary for Natural Resources
Saul Gomez, Undersecretary
Andrea Ambriz, Deputy Secretary for External Affairs

California Department of Water Resources
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Climate Resilience
John Andrew

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Integrated Watershed Management
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Anecita Agustinez

Internal Audit Office
David Whitsell

Office of Workforce Equality
Tiffany Vital

Division of Regional Assistance
Arthur Hinojosa, Manager

Water Use Efficiency Branch
Ryan Bailey, Manager
Peter Brostrom (in memoriam)[1]

Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard Project Team

California Department of Water Resources

Water Use Efficiency Branch
Sabrina Cook
Shem Stygar
Bekele Temesgen
Julie Saare-Edmonds

Division of Planning
Manucher Alemi, Policy Advisor

Division of Regional Assistance
Matthew Bates, Assistant Manager
Diana S. Brooks, Policy Advisor

Integrated Watershed Management
Teji Sandhu, Policy Advisor to the Deputy Director
Andria Avila, Executive Assistant to the Deputy Director

Special Restoration Initiatives Branch
James Campagna, Office Technician

[1] Peter Brostrom served as the California Department of Water Resources Water Use Efficiency Branch Manager through October 29, 2020, and he was instrumental in assembling the stakeholder working groups and study design.

Water Use Studies Working Group Members

Arcadis
Greg Imamura

Association of California Water Agencies
Dave Bolland

California American Water
Patrick Pilz

Camrosa Water District
Charlotte Lopez

City of Sacramento
William Granger

Coachella Valley Water District
Jason Lucas

County of Napa
Christopher M. Silke

Eastern Municipal Water District
Sara Quintero

Ecolab
Mark Muellner

Irvine Ranch Water District
Amy McNulty

Kennedy Jenks Consultants
Meredith Clement

Long Beach Water Department
Dean Wang

Los Angeles Department of Water and Power
Terrence McCarthy

Moulton Niguel Water District
Justin Finch

Municipal Water District of Orange County
Rachel Waite

Natural Resources Defense Council
Tracy Quinn

Niemela Pappas & Associates
Tiffany Phan

Pacific Institute
Heather Cooley

Plumbing Manufacturers International
Cambria McLeod

Rancho California Water District
Jason Martin

Private Citizen
Martha Davis

Sacramento Suburban Water District
Greg Bundesen

San Francisco Public Utilities Commission
Julie Ortiz

San Jose Water
Courtney Rubin

Santa Clarita Valley Water Agency
Matthew S. Dickens

Sonoma-Marin Saving Water Partnership
Chelsea Thompson

South Tahoe Public Utility District
Shelly Thomsen

Stanford University
Newsha Ajami

Valley County Water District
Tara Robinson

Valley Water
Metra Richert

Walnut Valley Water District
Donna DiLaura

WateReuse CA
Charles LaSalle

Western Municipal Water District
Jason Pivovaroff

WaterNow Alliance
Caroline Koch

West Yost Associates
Elizabeth Drayer

Standards, Methodologies, and Performance Measures Working Group Members

Alameda County Water District
Stephanie Nevins

Association of California Water Agencies
Dave Bolland

Bay Area Water Supply and Conservation Agency
Andree Johnson

California Water Service
Ken Jenkins

City of Glendale
Michael De Ghetto

City of Lakewood
Toyasha Sebbag

City of Petaluma
Chelsea Thompson

City of Pleasanton
Rita Di Candia

City of Sacramento
Roshini Das

City of Santa Monica
Russell Ackerman

Coachella Valley Water District
Katie Evans

Contra Costa Water District
Bob Eagle

Delta Stewardship Council
Cory Copeland

East Bay Municipal Utility District
Alice Towey

Ecolab
Mark Muellner

EKI Environment & Water, Inc.
Kat Wuelfing

Gardenworks Inc.
Peter Estournes

Irvine Ranch Water District
Fiona Sanchez

Los Angeles Department of Water and Power
Sofia Marcus

Metropolitan Water District
Krista Guerrero

Mission Springs Water District
John M. Soulliere

Natural Resources Defense Council
Tracy Quinn

Olivenhain Municipal Water District
Brian Sodeman

Pacific Institute
Heather Cooley

Plumbing Manufacturers International
Cambria McLeod

Rancho California Water District
Tyson Heine

Regional Water Authority
Amy Talbot

San Diego County Water Authority
Elizabeth Lovsted

San Jose Water
Kurt Elvert

Santa Clara Valley Water District, Pajaro River Watershed
Samantha Greene

Stanford University
Newsha Ajami

Water Systems Optimization
Kate Gasner

WateReuse CA
Charles LaSalle

WaterNow Alliance
Caroline Koch

Western Municipal Water District
Karly Gaynor

Technical Consultants

Stantec Consulting Services Inc.
Yung-Hsin Sun

Western Policy Research
Anil Bamezai

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Abbreviations and Acronyms

2018 Legislation	2018 Legislation on Water Conservation and Drought Planning (Senate Bill 606 [Hertzberg] and Assembly Bill 1668 [Friedman], as amended)
BAWSCA	Bay Area Water Supply and Conservation Agency
Cal-SIMETAW	California Simulation of Evapotranspiration of Applied Water
CalWEP	California Water Efficiency Partnership
CCR	California Code of Regulations
CII	commercial, industrial, and institutional
CII-DIM	commercial, industrial, and institutional dedicated irrigation meter
CII-DIMWUS	Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard
CIILA_new	commercial, industrial, and institutional landscape area for new landscapes, post-January 1, 2020
CIILA_r	commercial, industrial, and institutional landscape area for regular landscapes, pre-January 1, 2020
CIMIS	California Irrigation Management Information System
DIM	dedicated irrigation meter
DWR	California Department of Water Resources
eAR	electronic annual report
EORWU	efficient outdoor residential water use
ETAF	evapotranspiration factor in Model Water Efficient Landscape Ordinance design standard (on parcel level)
ETF	evapotranspiration factor (on urban retail water supplier level)
ETo	reference evapotranspiration
GC	Government Code
GIS	geographic information system
HOA	homeowners association

IE	irrigation efficiency
II	irrigable-irrigated
INI	irrigable-not irrigated
IRWUS	Indoor Residential Water Use Efficiency Standard
K_L	landscape coefficient
LA	landscape area
MAWA	maximum applied water allowance
MWELO	Model Water Efficient Landscape Ordinance
NI	not irrigated
ORWUS	Outdoor Residential Water Use Efficiency Standard
Peff	effective precipitation
PF	plant factor
PRISM	Parameter-elevation Relationships on Independent Slopes Model
Recommendation Package	Urban Water Use Efficiency Recommendation Package
SB	Senate Bill
SLA	Special Landscape Area
State	State of California
State Water Board	State Water Resources Control Board
TDS	total dissolved solids
UCANR	University of California Agriculture and Natural Resources
UCD	University of California, Davis
UWUO	urban water use objective
WC	California Water Code
WELO	Water Efficient Landscape Ordinance
WLS	Water Loss Standard

Executive Summary

The California State Legislature passed the 2018 Legislation on Water Conservation and Drought Planning (Senate Bill 606 [Hertzberg] and Assembly Bill 1668 [Friedman], as amended; hereinafter referred to as the "2018 Legislation"), which included provisions for advancing urban water use efficiency through developing and implementing various water use efficiency standards, variances, and performance measures. This report is submitted pursuant to California Water Code (WC) Section 10609.8, which directs the California Department of Water Resources (DWR), in coordination with the State Water Resources Control Board (State Water Board), to conduct necessary studies and investigations and recommend standards for outdoor irrigation of landscape areas with dedicated irrigation meters (DIM) or other means of calculating outdoor irrigation use in connection with commercial, industrial, and institutional (CII) water use for adoption by the State Water Board.

DWR developed the recommendations for the Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard (CII-DIMWUS) based on the legislative directive. In particular, the WC requires CII-DIMWUS to incorporate the principles of the Model Water Efficient Landscape Ordinance adopted by DWR (California Code of Regulations, Chapter 2.7, Section 490, et seq.).

Consistent with the legislative directive, DWR used a public process involving a diverse group of stakeholders in the review and development of the recommended CII-DIMWUS. The Water Use Studies Working Group and the Standards, Methods, and Performance Measures Working Group that DWR established to assist in implementing the 2018 Legislation were the primary stakeholders involved in the standard development process. Additional stakeholders included State of California agencies, cities, counties, urban retail water suppliers, environmental organizations, and other interested parties. Working group members and stakeholders were provided with many opportunities to comment on and inform the appropriateness of recommending a classification system for CII water use. Stakeholders were able to comment on, and inform the development and refinements for, the applicable scope, specifications, guidelines, and methodologies for the recommended standard. DWR also engaged individual urban retail water suppliers, university horticulture experts, and landscape management professionals to inform development of the standard.

The recommendation, which was presented to stakeholders, included implementation considerations and potential impacts on urban retail water suppliers as well as consideration of a wide range of financial and organizational capacities. Based on the evaluation of available data, DWR recommends a CII-DIMWUS that is consistent with the recommended Outdoor Residential Water Use Efficiency Standard, with modifications for Special Landscape Areas and new landscapes (post-January 1, 2020).

The recommended standard would require urban retail water suppliers to identify DIMs (or equivalent technologies) and measure the associated irrigated CII landscapes within five years after the State Water Board adopts the regulation. Stakeholders found that implementation of CII-DIMWUS would require additional urban retail water supplier resources and DWR to provide additional technical assistance.

The recommendations for CII-DIMWUS are included in this report, *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* (WUES-DWR-2021-03), along with other recommendations on guidelines and methodologies for calculating efficient water use, which DWR prepared per the requirements of the 2018 Legislation that are to be transmitted to the State Water Board for adoption. The recommendations and reporting requirements are also part of the report, *Recommendations for Urban Water Use Efficiency Standards, Variances, Performance Measures, and Annual Water Use Reporting* (WUES-DWR-2021-01A). The recommended CII-DIMWUS is related to the recommendations in the *Recommendations for Dedicated Irrigation Meter Conversion Threshold for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* (WUES-DWR-2021-18) and *Recommendations for Outdoor Residential Water Use Efficiency Standard* (WUES-DWR-2021-02).

1.0 Introduction

Senate Bill (SB) 606 (Hertzberg) and Assembly Bill 1668 (Friedman) of 2018, as amended (hereinafter referred to as the "2018 Legislation"), established a new foundation for long-term improvements in water conservation and drought planning to adapt to climate change and the resulting longer and more intense droughts in the State of California (State). These two bills provide expanded and new authorities and requirements to enable permanent changes and actions for those purposes, thereby improving the State's water future for generations to come. Details of these provisions are summarized in *Making Water Conservation a California Way of Life: Primer of 2018 Legislation on Water Conservation and Drought Planning, Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman)* (DWR and State Water Board, 2018).

1.1 New Approach to Urban Water Use Efficiency

Among other things, the 2018 Legislation contains provisions for advancing urban water use efficiency through developing and implementing various water use efficiency standards, variances, and performance measures per California Water Code (WC) Section 10609. The new water conservation framework is different than SB X7-7, which was established in 2009. The focus of SB X7-7 was to reduce statewide urban water use by 20 percent in 2020 compared to baseline calculated in 2010. The 2018 Legislation requires a bottom-up estimate from urban retail water suppliers of the urban water use objective (UWUO) based on the aggregated efficient water use volume by considering four urban water use efficiency standards and appropriate variances. The four standards are:

- Indoor Residential Water Use Efficiency Standard (IRWUS).
- Outdoor Residential Water Use Efficiency Standard (ORWUS).
- Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard (CII-DIMWUS).
- Water Loss Standard (WLS).

Commercial, industrial, and institutional (CII) water use not associated with dedicated irrigation meters (DIM) (or equivalent technology) for outdoor irrigation of landscape areas is excluded from the UWUO.

Each of the procedural requirements to formalize these four standards for implementation is different. The 2018 Legislation includes a default progressively reduced IRWUS (WC Section 10609.4(a)). In November 2021, in collaboration with the

State Water Resources Control Board (State Water Board), the California Department of Water Resources (DWR) submitted the joint recommendations for IRWUS to the California State Legislature for further consideration per WC Section 10609.4(b). Separately, the State Water Board is currently conducting a rulemaking process to adopt the proposed WLS, which was originally authorized by SB 555 of 2015. For ORWUS and CII-DIMWUS, the 2018 Legislation requires DWR, in coordination with the State Water Board, to conduct necessary studies and investigations and develop recommendations to the State Water Board by October 1, 2021 (WC Sections 10609.6 and 10609.8).

Another major difference between the SB X7-7 requirements and those of the 2018 Legislation is that the anticipated outcome was measured on a statewide level per SB X7-7 and on an individual urban retail water supplier level per the 2018 Legislation. Recognizing the diversity of water use to support local economic, social, and environmental needs and varying climate conditions in California, the 2018 Legislation requires DWR, in coordination with the State Water Board, to conduct necessary studies and investigations. It also requires DWR to develop recommendations for adoption by the State Water Board by October 1, 2021, for appropriate variances for unique uses that can have a material effect on an urban retail water supplier's UWUO and the corresponding thresholds of significance (WC Section 10609.14). In this context, DWR interpreted that a material effect means that this unique water use, although used in an efficient manner, could unfairly jeopardize an urban retail water supplier's ability to meet the UWUO when not explicitly addressed and calculated separately from the volume based on the four water use efficiency standards.

As a supporting recommendation, the 2018 Legislation requires DWR to develop accompanying guidelines and methodologies for calculating the UWUO (WC Section 10609.16) and provide the recommendation to the State Water Board for adoption, along with DWR's recommendations on ORWUS, CII-DIMWUS, and appropriate variances by June 30, 2022 (WC Section 10609.2). The 2018 Legislation further requires DWR and the State Water Board to solicit broad public participation throughout the development and adoption processes (WC Section 10609(b)(3)).

1.2 Purpose of the Report

This report describes the studies and investigations on CII landscape irrigation with DIMs (or equivalent technologies) and provides the recommendation on CII-DIMWUS, including the guidelines, methodologies, and data accuracy requirements, for adoption by the State Water Board.

Use of the Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard

The recommended CII-DIMWUS would be used to calculate the volume of efficient commercial, industrial, institutional dedicated irrigation meter (CII-DIM) water use delivered to large landscapes. The standard, guidelines, and performance measures are subject to adoption by the State Water Board. When adopted, CII-DIMWUS would be included in an urban retail water supplier's UWUO.

Relationship to California Department of Water Resources's Other Recommendations

CII Water Use Performance Measures

Related to CII-DIMWUS are two CII water use performance measures (defined in WC Secton 10609.10) that DWR has been directed to study and investigate and make recommendations on to the State Water Board. The first CII water use performance measure is a recommendation for the minimum size threshold for converting urban retail water suppliers' mixed-use CII meters to a DIM (or equivalent technology) pursuant to WC Section 10609.10(a)(2) (refer to *Recommendations for Dedicated Irrigation Meter Conversion Threshold for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* [WUES-DWR-2021-18]). Mixed-use CII meters that are converted to DIMs (or equivalent technologies) would be subject to CII-DIMWUS that applies to all CII-DIMs. The second CII water use performance measure is the recommended CII water use classification system that includes classifications specifically for CII-DIMs (or equivalent technologies) (refer to *Recommendations for Commercial, Industrial, and Institutional Water Use Classification System Performance Measure* [WUES-DWR-2021-17]).

Variances

CII-DIMWUS is also related to three recommended variances for outdoor water use:

- Significant landscaped areas irrigated with recycled water having high levels of total dissolved solids (WC Section 1069.12(b)(4)) described in *Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-09).

- Significant use of water for soil compaction and dust control (WC Section 1069.12(b)(5)) as described in *Recommendations for Variance for Significant Use of Water for Dust Control for Horse Corrals and Animal Exercising Arenas, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-10).

- Significant use of water to supplement ponds and lakes to sustain wildlife (WC Section 1069.12(b)(6)) described in *Recommendations for Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-11).

Relationship to California Department of Water Resources' Urban Water Use Efficiency Recommendation Package

DWR has completed a significant body of work to meet the requirements of the 2018 Legislation and provide recommendations on different topics to the State Water Board for adoption. To streamline document development and recognize the inherent interrelationship among different topics and the need for overall consistency, DWR organized the various reports in an Urban Water Use Efficiency Recommendation Package (Recommendation Package) that allows mutual referencing and incorporates content by reference. All reports in this Recommendation Package are given a serial number in the form of "WUES-DWR-2021-xx." For each report, Appendix A includes the list of documents within the Recommendation Package that are incorporated by reference.

Specifically, this report, *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* (WUES-DWR-2021-03), provides the detailed documentation for the recommended CII-DIMWUS; the corresponding guidelines and methodologies for calculating efficient water use for this standard were summarized in *Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective* (WUES-DWR-2021-01B). The additional context, development process and approach, and stakeholder input included in this document are incorporated by reference. Key terms and their definitions used in this report, along with abbreviations and acronyms, are included in *Urban Water Use Efficiency Recommendation Package: Glossary and Abbreviations and Acronyms* (WUES-DWR-2021-21).

Effects on Existing Law and Regulations

DWR developed the recommendations on CII-DIMWUS per legislative directive. The resulting CII-DIMWUS, when adopted, does not set, rescind, or modify existing requirements for managing CII water use.

1.3 Legislative Requirements

The 2018 Legislation directed DWR, in coordination with the State Water Board, to study and make recommendations on the efficient water use standard for CII large landscapes irrigated by DIMs (or equivalent technologies) for adoption by the State Water Board. Similar to ORWUS, this CII-DIMWUS incorporates the principles of the Model Water Efficient Landscape Ordinance (MWELO) (California Code of Regulations

[CCR] Chapter 2.7) and must exclude water used for commercial agriculture from the standard. Per WC Section 10609.8:

> *(a) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, standards for outdoor irrigation of landscape areas with dedicated irrigation meters or other means of calculating outdoor irrigation use in connection with CII water use for adoption by the board in accordance with this chapter*.
>
> *(b) The standards shall incorporate the principles of the model water efficient landscape ordinance adopted by the department pursuant to the Water Conservation in Landscaping Act (Article 10.8 (commencing with Section 65591) of Chapter 3 of Division 1 of Title 7 of the Government Code).*
>
> *(c) The standards shall include an exclusion for water for commercial agricultural use meeting the definition of subdivision (b) of Section 51201 of the Government Code.*

CII water use is defined by WC Section 10608.12(d) and large landscapes associated with CII water use are defined in WC Section 10608.12(l):

> *"CII water use" means water used by commercial water users, industrial water users, institutional water users, and large landscape water users.*
>
> *"Large landscape" means a nonresidential landscape as described in the performance measures for CII water use adopted pursuant to Section 10609.10.*

Per WC Section 10609(b)(3), DWR was directed to solicit broad stakeholder and public participation in development of this standard:

> *This chapter requires the department and the board to solicit broad public participation from stakeholders and other interested persons in the development of the standards and the adoption of regulations pursuant to this chapter.*

CII-DIMWUS is used by an urban retail water supplier to estimate the aggregate efficient outdoor irrigation of CII landscapes irrigated with a DIM (or equivalent technology), which is part of the urban retail water supplier's UWUO as defined in WC Section 10609.20(c)(3):

> *Aggregate estimated efficient outdoor irrigation of landscape areas with dedicated irrigation meters or equivalent technology in connection with CII water use.*

1.4 Senate Bill X7-7 Legislative Test

The 2018 Legislation requires that long-term efficiency standards be set in a way such that water conservation in the future exceeds what would have occurred under the SB X7-7 approach.

Even though final standards that DWR is recommending in response to the 2018 Legislation have yet to undergo the State Water Board's rulemaking process, and the IRWUS currently in the WC may be revised downward by the California State Legislature based on the new indoor water use standard recommended by DWR and the State Water Board, it is necessary to assess whether DWR's recommended standards are likely to be on track to meet the SB X7-7 legislative test. The test requirement is stated as follows (WC Section 10609.2(d):

> *The long-term standards shall be set at a level designed so that the water use objectives, together with other demands excluded from the long-term standards such as CII indoor water use and CII outdoor water use not connected to a dedicated landscape meter, would exceed the statewide conservation targets required pursuant to Chapter 3 (commencing with Section 10608.16).*

To conduct the test in the absence of CII-DIM irrigated landscape area data, DWR assumed that all CII-DIM reported water use met the standard. Therefore, the test will result in an artifically higher overall standards-based UWUO than what is expected to be the true case, because at least some of CII-DIM reported water use will likely be above the standard. Refer to the *Recommendations for Outdoor Residential Water Use Efficiency Standard* (WUES-DWR-2021-02) for details on this test.

2.0 Scope Definition

The WC directive for DWR in developing CII-DIMWUS provides the general direction for the scope of DWR's studies and investigations. DWR's studies and investigations included conducting a literature search, reviewing available data on the efficient use of water on CII landscapes, engaging with water management experts, and developing a recommended CII-DIMWUS for the purpose of calculating the UWUO. Consistent with the WC, extensive stakeholder outreach was conducted on the proposed CII-DIMWUS, with incorporation of feedback and experience provided by urban retail water suppliers and stakeholders. Implementation challenges were also identified.

2.1 Existing Statutory Requirements

The WC directs urban retail water suppliers to require a DIM for irrigated landscapes exceeding 5,000 square feet as a condition of new retail water service (WC Section 535). Other local codes and ordinances may also be applicable that may be more stringent.

The WC requires that the recommended CII-DIMWUS include an exclusion for commercial agriculture meeting the definition of Government Code (GC) Section 51201(b) (WC Section 10609.8(c)).

2.2 Equivalent Technology

WC Section 10609.22 requires urban retail water suppliers to calculate their actual water use, which includes the aggregate outdoor irrigation of landscape areas with DIMs in connection with CII water use (WC Section 10609.22(c)(2)). WC Section 10609.20(c)(3) requires, as part of the UWUO, that landscape areas with equivalent technology be included in the aggregate estimate of water use in connection with CII water use. DWR's understanding is that equivalent technology in this context refers to technology that is ***functionally equivalent*** to a DIM, or it cannot be used for calculating actual water use.

Functionally equivalent technologies must report directly to the urban retail water supplier on the same time interval (e.g., monthly), and – at a minimum – measure the volume of water delivered with an equivalent accuracy such that it could be used for billing purposes should an urban retail water supplier choose to do so. Equivalent technologies may be different from a DIM in some respects or provide greater functionality, but greater functionality is not a requirement. Equivalent technologies could include devices such as in-line flow meters or submeters with the capability and permission to report water volumes directly to the urban retail water supplier. Use of Advanced Meter Infrastructure high-frequency meter reads for which the urban retail water supplier has a means to disaggregate the indoor from the outdoor water use with

sufficient accuracy may also be considered an equivalent technology. Having the detailed information necessary for an equivalency assessment, urban retail water suppliers are best positioned to assess their technologies and identify whether a particular technology should be considered an equivalent technology.

All CII landscapes with irrigation water served by any technology, regardless of when it was installed, and meeting the minimum criteria of an equivalent technology for measuring water use on CII landscapes is required to be included in CII-DIMWUS and calculation of an urban retail water supplier's UWUO with the associated water use reported in the actual water use calculations (see *Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective* [WUES-DWR-2021-01B] for calculating the UWUO and actual water use).

2.3 Conversion Threshold Performance Measures

WC Section 10609.10(b)(2) requires DWR to make recommendations relative to the following as part of the CII performance measure:

> *[…] Recommendations for setting minimum size thresholds for converting mixed CII meters to dedicated irrigation meters, and evaluation of, and recommendations for, technologies that could be used in lieu of requiring dedicated irrigation meters.*

This means that:

- If a landscape area served by a mixed-use CII meter for irrigation is greater than the recommended conversion threshold as described in *Recommendations for Dedicated Irrigation Meter Conversion Threshold for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* (WUES-DWR-2021-18) and converted to a DIM (or equivalent technology), the irrigated landscape area and associated water use would become subject to CII-DIMWUS and would be reported as part of the UWUO and actual water use.
- The existing WC does not require the quantification or reporting of efficient water use volumes in the UWUO for CII landscapes implementing in-lieu technologies.

All accounts for landscape irrigation served by CII-DIMs (or equivalent technologies) should be classified in accordance with the CII water use classification system performance measure discussed in *Summary of Recommendations for Performance Measures for Commercial, Industrial, and Institutional Water Use* (WUES-DWR-2021-15).

2.4 Relationship to the Model Water Efficient Landscape Ordinance

WC requires that CII-DIMWUS incorporate the principles of the MWELO (WC Section 10609.8(b)). The MWELO includes several requirements for new and rehabilitated landscapes that are applicable for consideration in CII-DIMWUS. The MWELO may be updated in the future. CII-DIMWUS should recognize the potential for modifications and consider consistency with future updates of MWELO.

Special Landscape Areas

Special Landscape Areas (SLA) in the MWELO are provided a higher efficient water use allowance to accommodate the beneficial use of certain landscape functions. SLAs, as defined in the MWELO (CCR Section 491), include the following landscape types:

- Dedicated solely to edible plants (e.g., community gardens).
- Active and passive recreational areas (e.g., outdoor event spaces and sports fields).
- Areas irrigated with recycled water.
- Water features using recycled water.

SLAs are more often associated with CII landscapes and, in specific instances, residential landscapes irrigated with a DIM (or equivalent technology) may qualify as SLAs. In the 2015 MWELO, all SLAs, regardless of when established or whether they are considered CII or residential, receive an additional water allowance through a higher evapotranspiration factor of 1.0.

Exempt Water Uses

Exempt water uses applies to the following exempt landscapes in the 2015 MWELO (CCR Section 490.1(e)). These exempt landscapes are not subject to the maximum applied water allowance (MAWA) requirement of MWELO because of the temporary irrigation of certain projects or important beneficial uses associated with specific landscapes:

- Registered local, State, or federal historical sites.
- Ecological projects that do not require a permanent irrigation system.
- Mined-land reclamation projects that do not require a permanent irrigation system.

- Existing (pre-2015) plant collections, botanical gardens and arboretums open to the public.
- Water use for cemeteries built before 2015 (per GC 65598):
  - Cemeteries built before 2015 are limited to CCR Sections 493, 493.1, and 493.2 (Title 23, Chapter 2.7, MWELO) for existing cemeteries.
  - Cemeteries built after 2015 are limited to CCR Sections 492.4, 492.11, and 492.12 (Title 23, Chapter 2.7, MWELO) for new and rehabilitated cemeteries.

Model Water Efficient Landscape Ordinance Implementation Requirements

MWELO requirements address conditions under which MWELO applies, including metering and reporting requirements pertinent to new and rehabilitated CII landscapes, such as the following:

- MAWA applies to new landscapes of 500 square feet or greater; new and rehabilitated landscapes of 2,500 square feet or greater; and buildings or landscapes that require a landscape permit, plan check, or design review by the corresponding land use authority.
- A dedicated meter or submeter is required for new and rehabilitated nonresidential landscapes of 1,000 to 5,000 square feet.
- CCR Section 492.1 Compliance with Landscape Documentation Package includes requirements for providing the urban retail water suppliers with the Water Efficient Landscape Worksheet at two stages of landscape development and includes documentation of MAWA calculation and associated landscape areas.
  - Upon approval of Landscape Documentation Package (CCR Section 492.1(a)(5).
  - Prior to construction activities (CCR Section 492.1(b)(3)).

Relationship to Water Code Section 535

When new water service is provided to properties with more than 5,000 square feet of irrigated landscape, WC Section 535 requires a DIM to serve the irrigated landscape:

> *(a) A water purveyor shall require as a condition of new retail water service on and after January 1, 2008, the installation of separate water meters to measure the volume of water used exclusively for landscape purposes.*

(b) Subdivision (a) does not apply to either of the following: (1) Single-family residential connections. (2) Connections used to supply water for the commercial production of agricultural crops or livestock.

(c) Subdivision (a) applies only to a service connection for which both of the following apply: (1) The connection serves property with more than 5,000 square feet of irrigated landscape. (2) The connection is supplied by a water purveyor that serves 15 or more service connections.

(d) For the purposes of this section, "new retail water service" means the installation of a new water meter where water service has not been previously provided, and does not include applications for new water service submitted before January 1, 2007.

2.5 Relationship to Outdoor Residential Water Use Efficiency Standard

Existing DIMs (or equivalent technologies) may be classified by an urban retail water supplier as either residential, uncategorized, commercial meters, or as CII-DIMs. Commonly irrigated landscapes in multifamily and homeowners associations (HOA) served by a residential DIM (or equivalent technology) are operated and maintained similar to CII landscapes. Urban retail water suppliers should be allowed to report all meters that function similar to DIMs as being equivalent to CII-DIMs for the purposes of the UWUO and Annual Water Use Report. If residential DIM (or equivalent technology) landscape area is reported as part of CII-DIMWUS, it must be excluded from the residential landscape area; and the associated water use is to be reported under CII-DIMWUS.

ORWUS classifies residential landscape areas as irrigable-irrigated (II), irrigable-not irrigated (INI), and not irrigated (NI) and includes both II and INI residential landscape areas in the recommendation for calculating outdoor residential efficient water use. Unlike the residential landscape area measurements, CII-DIM (or equivalent technology) irrigable landscape area measurements have not been provided by DWR; and the DIMs serve a specific irrigated landscape area. Therefore, actual DIM (or equivalent technology)-irrigated landscape area must be measured, and there would be no need for an INI component associated with landscapes reported under CII-DIMWUS.

2.6 Relationship to Variances

Two variances were identified as being related to CII-DIMWUS, and other variances may be associated with CII-DIMWUS in the future. An urban retail water supplier must request and receive approval by the State Water Board prior to using any variance in

their UWUO calculation as described in the *Summary of Recommendations for Variances* (WUES-DWR-2021-04) and in the individual variance reports.

Variance for Significant Landscape Area Irrigated with Recycled Water Having High Levels of Total Dissolved Solids

The variance for significant landscaped areas irrigated with recycled water having high levels of total dissolved solids (TDS) was identified as being associated with CII-DIMWUS. Additional water allowance is needed to protect plant health and prevent salt build up in soils when recycled water with high TDS is used on irrigated landscapes.

Refer to *Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-09) for details on this variance.

Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife

The second variance identified as being associated with CII-DIMWUS is for the significant use of water to supplement ponds and lakes to sustain wildlife. DIM (or equivalent technology) water use that does not have a regulatory requirement to maintain water levels is excluded from the variance.

If there is a regulatory requirement to maintain water levels, an urban retail water supplier can apply for a variance against CII-DIMWUS to meet this need. Refer to the *Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective* (WUES-DWR-2021-01B) and *Recommendations for Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-11) for details on this variance.

3.0 Approach to Standard Design

DWR considered performing a study for CII landscape water use similar to the ORWUS study. However, CII landscapes are diverse; and a selected sample of urban retail water suppliers would have significant challenges with representing the diversity of CII landscape areas, climate conditions, local landscape ordinances that affect landscape development and management, age distribution of landscapes developed prior to various water conservation regulations, cultural effects, and other factors that affect both the irrigated landscape area and landscape water requirements. Additionally, landscape irrigation data reported in the electronic annual report (eAR) submitted by urban retail water suppliers to the State Water Board may not capture all DIM (or equivalent technology) landscape water use, may include residential DIM (or equivalent technology) water use, and may include CII landscape areas served by both mixed-use meters and DIMs (or equivalent technologies). Furthermore, the eAR DIM water use cannot be associated with specific landscapes areas to generate the type of analysis developed in the ORWUS study. Given the extreme diversity of CII landscapes and lack of sufficient quantified irrigation and associated landscape area data, a study of this type was not conducted.

The recommended CII-DIMWUS recognizes that plant water requirements in CII landscapes adhere to the same horticultural science used to develop ORWUS, which is described in detail in *Recommendations for Outdoor Residential Water Use Efficiency Standard* (WUES-DWR-2021-02) and *Landscape Area Measurements Final Project, Report EA-133C-16-CQ-0044* (WUES-DWR-2021-02.T1). CII-DIMWUS is required by the 2018 Legislation to incorporate the same principles of MWELO used in ORWUS. However, DWR recognized that there are significant differences in landscape management between residential and CII landscapes. DWR conducted a literature review and engaged with urban retail water suppliers and CII landscape management experts to evaluate efficient CII landscape water use as the basis for the CII-DIMWUS approach.

DWR received informative CII landscape and water use data from a handful of urban retail water suppliers representing the San Francisco Bay Area, North Central Valley, and the South Coast regions. This stakeholder-provided dataset was a non-random limited sample, did not include all CII water user landscapes within the urban retail water suppliers' service areas, and does not adequately represent the diversity of CII landscapes and water use in the State. However, data from this limited sample of CII water use and landscape areas were used to inform what efficient CII landscape water use should be when landscapes are professionally managed and when there is good communication between the urban retail water supplier and CII water user.

3.1 Stakeholder Process

Consistent with the legislative directive, DWR used a public process involving diverse stakeholders in the review and development of recommendations for CII-DIMWUS and data needs. The stakeholder process was part of the larger engagement process to implement the provisions of urban water use efficiency in the 2018 Legislation (see *Stakeholder Outreach Summary for Developing Urban Water Use Efficiency Standards, Variances, and Performance Measures* [WUES-DWR-2021-20]). More focused stakeholder engagements specifically for variances started in November 2020, with periodic meetings and workshops held through early 2022.

DWR established two working groups to assist in implementing the 2018 Legislation, and these groups formed the base of the stakeholder involvement process that included State agencies, cities, counties, urban retail water suppliers, environmental organizations, professionals, and other stakeholders and interested parties. The Water Use Studies Working Group was established in July 2019 to inform DWR in developing water use studies for setting up standards, variances, and performance measures. Concurrently, the Standards, Methods, and Performance Measures Working Group was also established to provide input to DWR on developing the structure and specifications of water use efficiency standards, variances, methodologies, and performance measures. However, due to the close relationship between research on different CII water use performance measures and the implementation of urban water use efficiency standards and variances, members of both working groups were invited to participate in the same stakeholder meetings and workshops. DWR opened working group meetings and workshops to the public to allow for broader participation in and input from other stakeholders, interested parties, and individuals.

Working group members and other participants had ample opportunities to learn about the review of various CII-DIM water use standards and options considered for recommendation as well as provide feedback on these topics. They also gave input on implementation such as resource needs (staff), and other implementation considerations.

DWR also conducted and responded to requests for additional meetings and public outreach and engagement activities with individuals and groups of stakeholders to learn from their experiences, understand their specific concerns, and receive other feedback.

3.2 Design Criteria

In developing the recommended CII-DIMWUS, DWR considered the specific design criteria included in WC and stakeholder input, along with factors associated with landscape irrigation water use efficiency used in development of the related ORWUS and variances.

The 2018 Legislation requires the recommended CII-DIMWUS to incorporate the principles of the MWELO (WC Section 10609.8(b)), contain a provision for exclusion of commercial agriculture (WC Section 10609.8(d)), and to solicit broad stakeholder and other interested persons' participation in the development of the standard (WC Section 10609(b)(3)). Additionally, CII-DIMWUS will be used to calculate the aggregate estimated efficient CII-DIM water use (WC Section 10609.20(c)(1)). Similar to ORWUS, CII-DIMWUS does not apply to the individual parcel-level calculation, but parcel-level efficient water use information can be used to inform the standard.

CII-DIMWUS should be developed for irrigated CII landscape situations that are generally applicable to all urban retail water suppliers. Unique water use conditions would be considered as part of the variance process such that all pertinent DIM (or equivalent technology) water use is accounted for in either CII-DIMWUS or the variances.

Principles of Model Water Efiicient Landscape Ordinance

WC Section 10609.9 defines the principles of the MWELO to mean the provisions applicable to the establishment or determination of the amount of water necessary to efficiently irrigate both new and existing landscapes. While MWELO applies at the individual parcel level, its conceptual framework can be usefully extended to the urban retail water supplier level to assess and quantify an outdoor water use efficiency standard. Per WC Section 10609.9:

> *… "principles of the model water efficient landscape ordinance" means those provisions of the model water efficient landscape ordinance applicable to the establishment or determination of the amount of water necessary to efficiently irrigate both new and existing landscapes. The provisions include, but are not limited to, all of the following:*
>
> *(a) Evapotranspiration factors, as applicable.*
>
> *(b) Landscape area.*
>
> *(c) Maximum applied water allowance.*
>
> *(d) Reference evapotranspiration.*
>
> *(e) Special landscape areas, including provisions governing evapotranspiration factors for different types of water used for irrigating the landscape.*

Parcel-level evapotranspiration is influenced by the many components of weather, plants, and landscape management. To accommodate these differences, a local reference evapotranspiration (*ETo*) is measured and adjusted by an evapotranspiration

factor (*ETAF*) to account for different plant requirements and irrigation efficiencies (*IE*). *ETo* is a measure of evaporation plus transpiration from a standardized grass surface. The plant water requirements for the landscape area is represented by a landscape coefficient (K_L) used to modify *ETo*. K_L can also be represented by a plant factor (*PF*). To provide the necessary water to irrigate the landscape, the *IE* of the landscape irrigation system is also needed and can be estimated based on irrigation system design or performance. The *ETAF* is then the K_L or *PF* divided by the *IE.*

MWELO provides a higher water allowance for SLAs, recognizing that maintaining their beneficial uses may require additional irrigation water. Most SLAs are associated with landscapes having a CII classification. CII-DIMWUS should include a higher allowable water use for SLAs to preserve these beneficial uses.

General Maximum Applied Water Allowance

An individual parcel's theoretical efficient irrigation water use allowance must remain below the MAWA, defined as:

MAWA (Annual Gallons Allowed) = *ETo* x 0.62 x {[*ETAF* x *LA*] + [(1-*ETAF)* x *SLA*]}

where,

- MAWA is the maximum applied water allowance in gallons.
- *LA* is the parcel landscape area in square feet.
- *SLA* is the Special Landscape Area in square feet.
- *ETo* is the reference evapotranspiration in inches.
- *ETAF* is the evapotranspiration factor (unitless).
- 0.62 is a unit conversion factor.

and,

ETAF = PF / IE

Parcel-level *ETAF* is codified in the MWELO and has undergone several iterations over time. In the 2015 MWELO update, the *ETAF* for new and rehabilitated, nonresidential landscapes is set at 0.45, or 0.1 less than the residential landscape standard, along with an *ETAF* of 1.0 for SLAs (CCR Section 491(s)). There is no difference between residential and nonresidential *ETAF* for existing landscapes, which is 0.8 for landscapes greater than 1 acre (CCR Section 493.1(a)).

Factoring in Effective Precipitation

MWELO allows for consideration of effective precipitation (*Peff*) in the MAWA equation to account for precipitation available for plant growth, up to a maximum of 25 percent of annual precipitation, at the local agency's discretion (CCR Section 494). In the 2015 MWELO, if there is an SLA, that landscape is included in both the landscape area (*LA)* and *SLA* components of the equation, below, with the evapotranspiration coefficient for *SLA*s adjusted to reflect an *ETAF* of 1.0 while not "double-counting" the SLA.

When *Peff* and SLAs are included, the above equation would then be:

MAWA (Annual Gallons Allowed) = (*ETo - Peff)* x 0.62 x {[*ETAF* x *LA*] + [(1 - *ETAF*) x *SLA*]}

Landscape Scale

The MAWA equation for calculating efficient landscape water use requirements can be applied at various scales. For CII-DIMWUS, efficient landscape water use requirements apply to the aggregate measurement of irrigated CII landscapes within an urban retail water supplier service area. At the landscape scale, individual *PF*s and *IE*s would not be applicable, and an overall aggregate evapotranspiration factor (*ETF*) on an urban retail water supplier level can be used to represent the *ETAF* in the MWELO equation.

Stakeholder-Informed

The WC directs DWR to solicit broad public participation from stakeholders and other interested persons on the CII-DIMWUS recommendation (WC Section 10609(b)(3)). Development of CII-DIMWUS considered data and suggestions made by stakeholders and incorporated comments and suggestions, when appropriate and beneficial.

Recommended Outdoor Residential Water Use Efficiency Standard

During the ORWUS development process, it was decided that the recommended ORWUS would not include SLAs because the study was not able to distinguish SLAs from regular residential landscape areas with the available data. However, under the recommended ORWUS, urban retail water suppliers with residential DIMs (or equivalent technologies) that wish to incorporate the consideration of SLAs were directed to report this water use under CII-DIMWUS, at the discretion of the urban retail water supplier.

Variances

The variance development process determined that certain landscapes served by a DIM (or equivalent technology) were more appropriately addressed under CII-DIMWUS as SLAs because of their beneficial uses to the public. These included:

- Irrigation necessary for stabilization of bioengineered slopes, which is a public safety consideration.

- Non-regulatory supplemental water for ponds or lakes including, but not limited to, sustaining wildlife, recreation, or other public benefit. This does not apply to water used for regulatory lakes and ponds, which remained under the variance considerations.

3.3 Literature Review

DWR reviewed three key studies on CII landscape irrigation efficiency and CII landscape water use as described below.

University of California Agriculture and Natural Resources Study, 2014 to 2016

The University of California Agriculture and Natural Resources (UCANR) at Davis performed a two-year *ETAF* study from 2014 to 2016 in coordination with DWR examining the potential to reduce applied water to landscapes and continue to maintain a healthy and attractive landscape with a 0.7 *ETAF*. The study followed 31 large landscapes monthly (e.g., parks, school grounds, private grounds, business parks, golf courses) with wide varieties of species, microclimates, densities, irrigation schedules and technologies. The landscapes were located in six climatic zones throughout the State, including Central Valley, Central Coast, South Coast, Los Angeles Basin, Inland Empire, and Desert. Sites were split into turf and shrub components, with the turf and shrub landscape area measurements ranging from less than 1,000 square feet to greater than 1 million square feet and 500 square feet to almost 30,000 square feet, respectively. Each site was given a MAWA using historical ETo data from a nearby California Irrigation Management Information System (CIMIS) weather station.

Quarterly landscape inspections included an irrigation maintenance inspection to confirm proper operation and documentation of actions implemented, including system pressure checks and adjustments, distribution uniformity tests, and repairs of malfunctioning or broken irrigation system components. Plant health for each site was evaluated quarterly with water usage recorded and compared to the 0.7 *ETAF* monthly water budget.

Results from the two-year study showed that to meet a 0.7 *ETAF*, low-water-use shrubs needed to be more predominantly used in landscapes. Turfgrass in both years was not able to meet the *ETAF* of 0.7; and while *ETAF* was not met, significant reductions in landscape water use were achieved due to State drought water restrictions. “As a group the shrub sites watering at a 0.58 ETAF did not experience any adverse effects to the plant material. Nine of the sites had drip irrigation, and in 2014 they watered at a 0.35 ETAF. In 2015/2016 the irrigation was further reduced as water applications were lowered to a 0.29 ETAF” (Fujino, 2017). The study recommendations noted that the distribution uniformity at sites could be increased without major redesign by switching from spray to rotary sprinkler heads, which would result in lower water use. Performing quarterly maintenance inspections and water audits could significantly increase water

savings and should be performed at least every six months and integrated with the site's irrigation maintenance plan (Fujino, 2017; Hartin, 2019; Reid et. al., 2017). The study recommended that for existing landscapes to achieve a lower *ETAF,* predominantly turf CII landscapes would require rehabilitation with plant palettes that have a greater number of low-water-use shrubs and irrigation system inspections and maintenance at least every six months.

Bay Area Water Supply and Conservation Agency, 2020 Annual Report – Large Landscape Program

Waterfluence partners with urban retail water suppliers through a CII landscape management program to improve *IE* at large CII landscapes by comparing actual water use with a water budget benchmark based on site-specific characteristics and real-time weather. Waterfluence provided DWR the 2020 Annual Report for Bay Area Water Supply and Conservation Agency (BAWSCA) on Large Landscapes with the approval of the member urban retail water suppliers.

Among the 20 Bay Area urban retail water suppliers, 4,767 sites irrigating a total of 8,395 acres were monitored. The BAWSCA 2020 annual report identified opportunities to make significant reductions in overwatering with commercial sites, especially those with less than 1 acre of landscaping and planted with shrubs. For all irrigated landscapes monitored, overwatering averaged 10.8 inches in depth but was greater than 48 inches at 26 percent of the sites. This amounts to about 6.7 to 30 gallons of over irrigation per square foot of landscape area.

Trends observed indicated that, "Overwatering at both commercial and public sites has dropped over 50 percent since 2002, reaching a low in 2015 during a statewide drought. Overwatering rebounded after the drought, but in 2020 is still significantly below 2013 levels" (BAWSCA, 2020).

In 2020, shrub-dominant sites received less water, but their depth of overwatering was higher. Shrubs have different irrigation systems and scheduling considerations, and the data suggest both shrub and turf still have significant potential for efficiency improvements. Figure 3-1 summarizes BAWSCA's water use by type of site.

Description	Commercial	Public	Total
Number of Sites	1,142	293	1,435
< 1 Acre	57%	44%	55%
1-3 Acres	30%	31%	30%
>3 Acres	13%	24%	16%
Irrigated Acres	1,835	668	2,503
Average Acres per Site	1.6	2.3	1.7
Turf %	39%	73%	48%
Shrub %	61%	27%	52%
2020 Water Use CCF	2,773,976	637,636	3,411,612
2020 Water Use Acre Feet	6,368	1,464	7,831
2020 Water Use %	81%	19%	100%
2020 Depth Applied Feet	3.5	2.2	3.1

Figure 3-1 2020 Bay Area Water Supply and Conservation Agency Large Landscapes - Annual Report - Site Characteristics

Dedicated Irrigation Meter Management for Commercial, Industrial, and Institutional Accounts – California Water Efficiency Partnership (December 2019)

The California Water Efficiency Partnership (CalWEP) analyzed survey data on CII-DIM management submitted by urban retail water suppliers that were part of the California Urban Water Conservation Council Memorandum of Understanding. This analysis indicated that DIM management programs are effective at promoting efficient water use. However, the majority of urban retail water supplier CII irrigation water is generally not separately metered, and existing DIM accounts do not have associated water budgets. For those urban retail water suppliers with DIM water budgets, few flag accounts that use water over their water budget allocation; and most urban retail water suppliers must manually query the billing system to determine which DIMs are noncompliant. Additionally, with many parties involved in managing CII landscapes, it takes the collaboration of all parties working together to be successful (CalWEP, 2019).

3.4 Stakeholder Provided Data

Waterfluence also provided valuable data on CII landscape irrigation for CII landscape sites from BAWSCA members, Santa Clara County, and Contra Costa County. However, the existing CII large landscapes managed as part of Waterfluence's program are not representative of the statewide diversity of CII landscapes and water use. The data are from 2020 for sites primarily served by one or more DIMs and represent 1,435 BAWSCA sites plus a combined 3,332 sites for Santa Clara and Contra Costa Counties. Data also noted irrigation water as potable or recycled water. DWR did not perform a quality assurance check on the data to screen and remove outliers or investigate if very low *ETAF*s were accurate. For example, the very low site *ETAF*s may or may not represent efficient landscape water use; low *ETAF* values may be representative of

actual landscape water use, an incorrect meter reading, landscape irrigation being turned off, or another undetermined reason. East Bay Municipal Utilities District and Waterfluence noted traffic easement irrigation may be essentially abandoned after initial establishment; and high *ETAF* values could represent actual landscape water use, a broken meter, or leaks.

The CII landscape area and DIM water use measurements are valuable in showing what existing water use is for a diverse representation of CII landscape types and sizes. As stated above, Waterfluence's programs are not representative of the statewide diversity of CII landscape water use. Waterfluence, with the approval of urban retail water suppliers, provided data for CII landscapes classified by CII water user type (i.e., commercial, public, or residential), different landscape sizes (i.e., less than 1 acre, 1 to 3 acres, and greater than 3 acres), and if they were irrigated with recycled water. The data support grouping landscapes into three different size classes with the following explanation. Water bills associated with landscapes less than 1 acre are inconsequential and are typically where smaller landscape contractors operate. Water bills become more consequential with landscapes between 1 to 3 acres which are generally managed by larger landscape contractors. Landscapes greater than 3 acres use a lot of water as they are generally institutional landscapes with professional staff assigned to landscape maintenance.

With the data provided by Waterfluence, DWR averaged *ETAF* by customer type and landscape size to evaluate if there were any trends. These averaged *ETAFs* are shown in Figure 3-2 through Figure 3-6, by county, and demonstrate what has been achieved with professional landscape management and water audits, in coordination with urban retail water suppliers, landscape contractors, and property managers. The *ETAFs* on these landscapes vary widely by type and size. Some general observations were:

- Smaller sites are generally near or slightly above an *ETAF* of 1.0 (i.e., water use is equal to or higher than evapotranspiration from a reference grass surface). Larger sites are generally under an *ETAF* of 1.0 (i.e., water use is less than evapotranspiration from a reference grass surface).

- *ETAF* for sites using recycled water are generally near or slightly above the *ETAF* budget of similar sites using potable water.

- Opportunities remain to improve water use efficiency on outdoor residential landscapes; and a significant amount of landscaped area is associated with commercial and HOA landscapes.

- Apartments with less than 1 acre of landscape have opportunities to increase landscape water use efficiency.

While the data provide general information about site performance, the data demonstrate that each CII site is unique; and there are many factors that determine a site's water use. Achieving greater water use efficiency on CII landscapes requires the close collaboration of urban retail water suppliers, landscape contractors, property managers, and building owners.

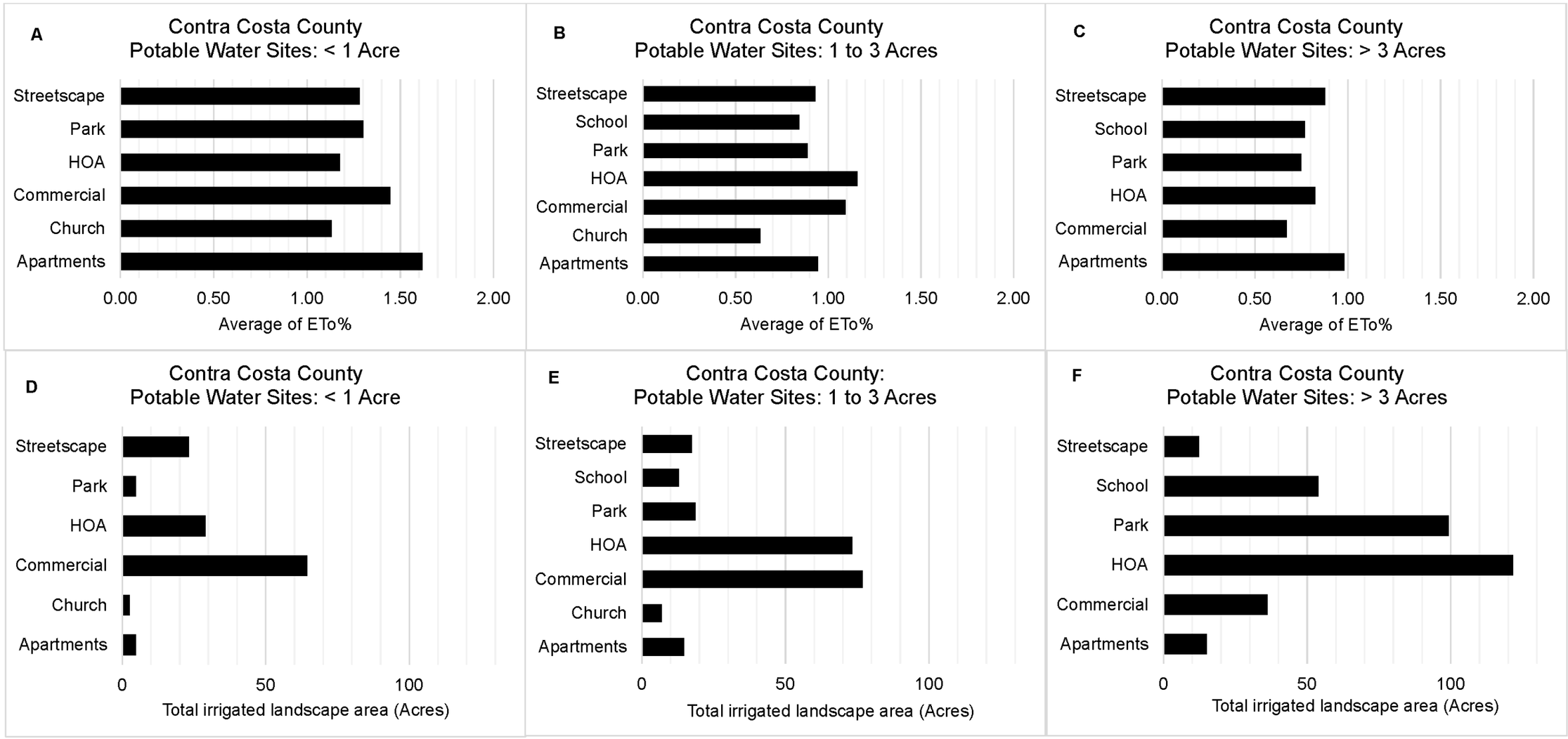

Figure 3-2 Contra Costa County – Average Percent of Evapotranspiration and Total Irrigated Landscape Area for Potable Water Sites and Recycled Water Sites Organized by Size (Acres)

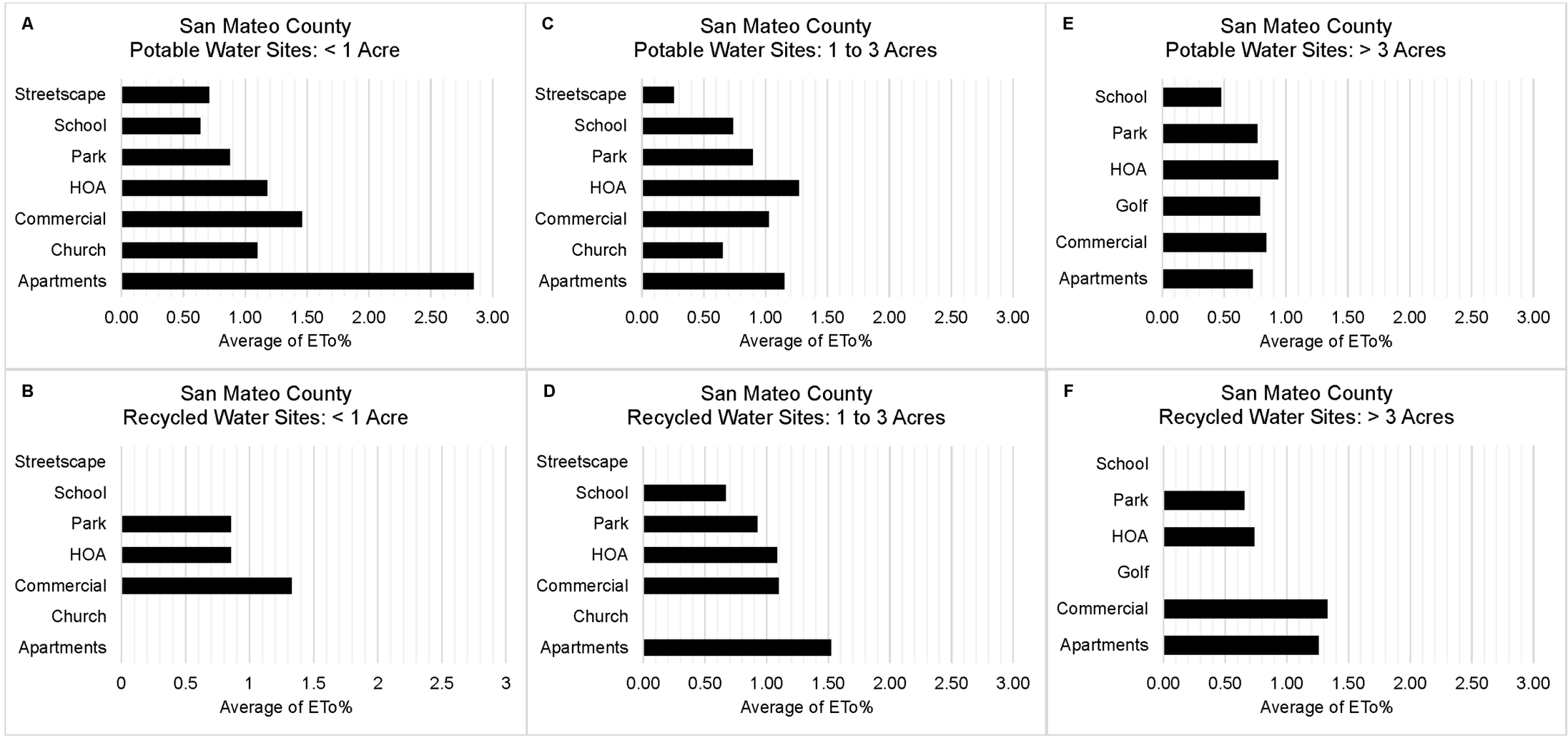

Figure 3-3 San Mateo County – Average Percent of Evapotranspiration for Potable Water Sites and Recycled Water Sites Organized by Size (Acres)

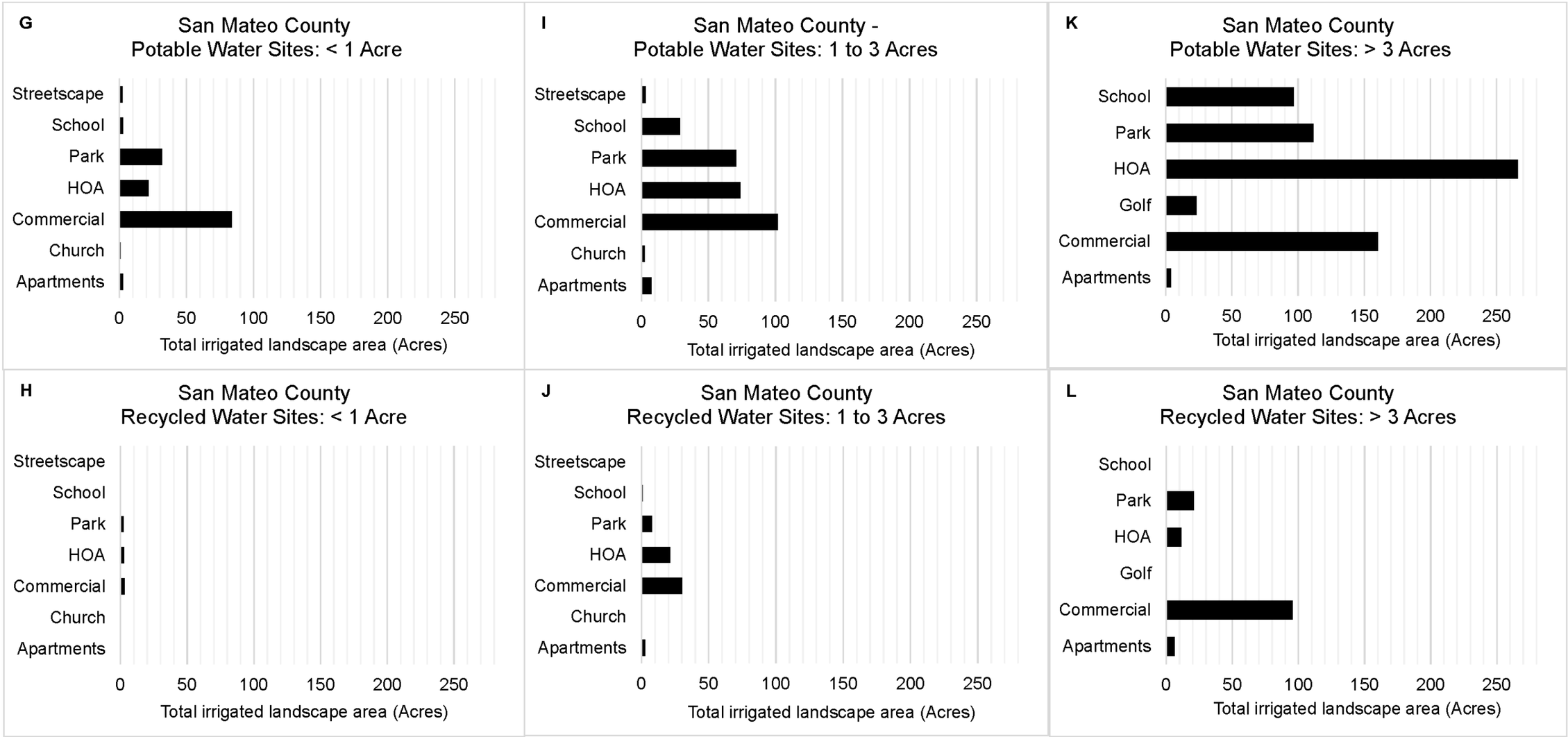

Figure 3-4 San Mateo County – Total Irrigated Landscape Area for Potable Water Sites and Recycled Water Sites Organized by Size (Acres)

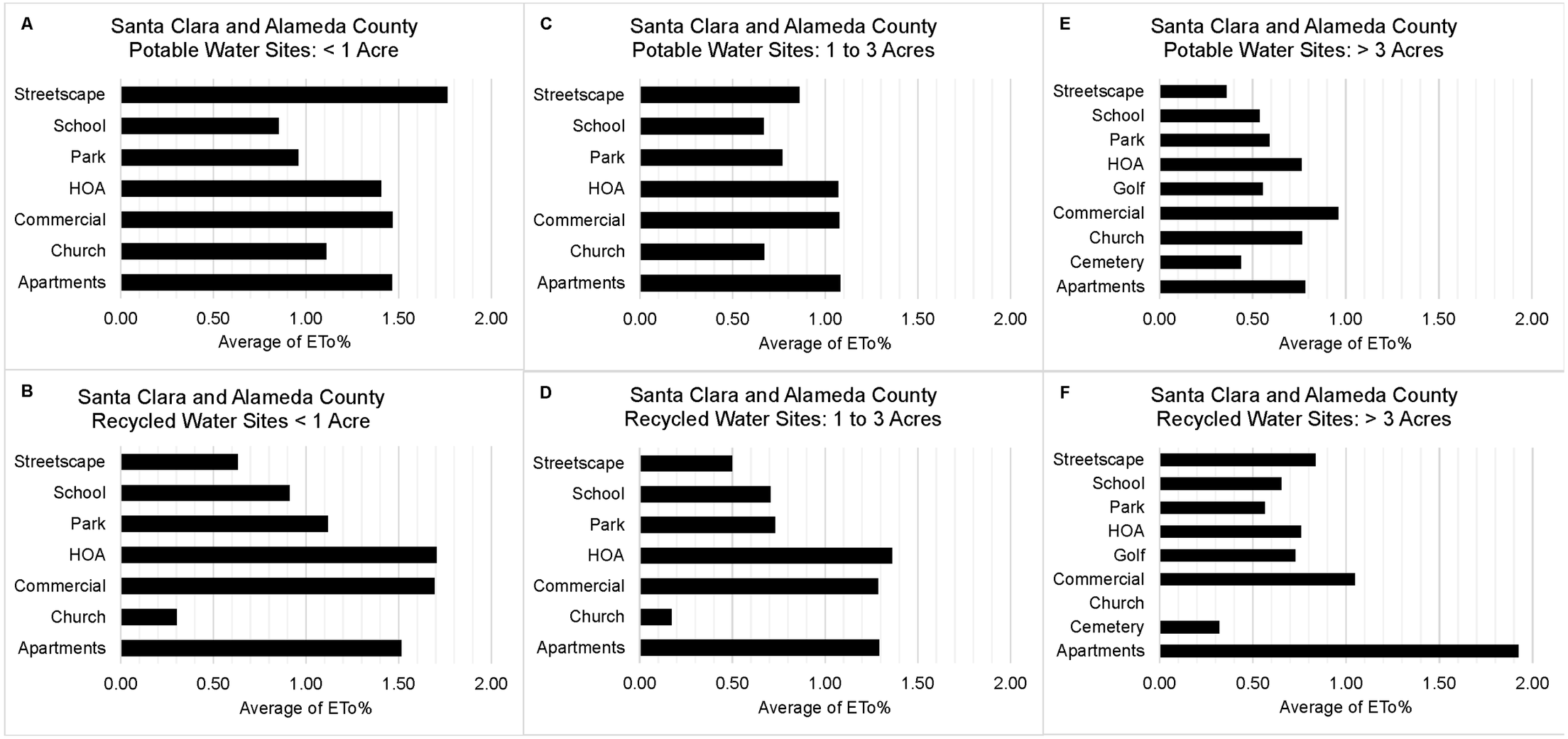

Figure 3-5 Santa Clara and Alameda County – Average Percent of Evapotranspiration for Potable Water Sites and Recycled Water Sites Organized by Size (Acres)

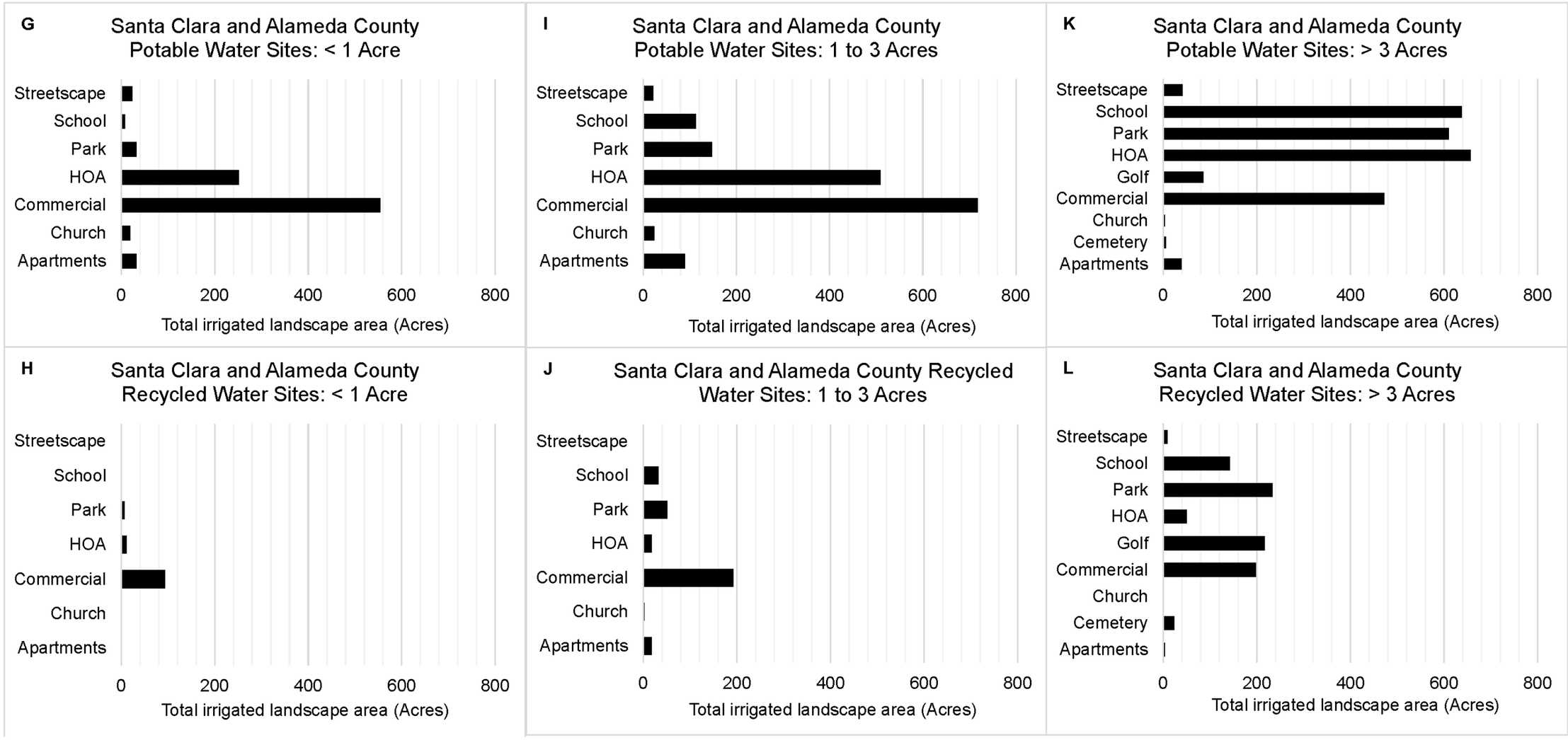

Figure 3-6 Santa Clara and Alameda County – Total Irrigated Landscape Area for Potable Water Sites and Recycled Water Sites Organized by Size (Acres)

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3.5 Basis for the Recommendation

Information pertaining to the landscape areas, plant types, and irrigation water used on all landscapes was not available for CII landscapes. However, water requirements for plants used in CII landscapes must adhere to the same principles of MWELO as the recommended ORWUS and water requirements for plants used in CII landscapes; and they must adhere to the same horticultural science used to develop the recommended ORWUS, which is described in detail in *Recommendations for Outdoor Residential Water Use Efficiency Standard* (WUES-DWR-2021-02) and supporting documents *Landscape Area Measurements Final Project, Report EA-133C-16-CQ-0044* (WUES-DWR-2021-02.T1). CII landscapes, like residential landscapes, have the same local climate, plant water needs, and *ETo*. This means that CII-DIMWUS can be informed by the results of the ORWUS study and in combination with the data and experiences shared by urban retail water suppliers, CII landscape managers, and the principles of MWELO. All CII-irrigated landscape areas served by a DIM (or equivalent technology) will have to be individually measured. However, CII landscapes are either irrigated or not irrigated; there is no INI component as in the recommended ORWUS.

Model Water Efficient Landscape Ordinance Principles

The principles of MWELO include a higher water allowance for SLAs, an exclusion of water use for exempt landscapes, an *ETAF* of 0.8 for existing landscapes that are more than 1 acre in size, and an *ETAF* of 0.45 for new and rehabilitated CII landscapes, which is 0.1 less than the *ETAF* for new and rehabilitated residential landscapes.

Recommended Outdoor Residential Water Use Efficiency Standard

In the recommended ORWUS, efficient outdoor residential water use (EORWU) is calculated based on the MAWA equation as follows:

EORWU (urban retail water supplier level) = (*ETo* - *Peff*) x 0.62 x *ORWUS* x [*II* + (0.2 x *INI*)]

where,

- EORWU is the efficient outdoor residential water use in gallons.
- *ETo* is the reference evapotranspiration in inches.
- *Peff* is the modeled-effective precipitation in inches and is capped at 25 percent of total precipitation.
- 0.62 is a unit conversion factor.
- *ORWUS* is the Outdoor Residential Water Use Efficiency Standard. For existing residential landscapes, ORWUS is an *ETF* of 0.8 in 2023 and transitions to an *ETF* of 0.63 in 2030 and beyond. ORWUS equals an *ETF* of 0.55 for new and

rehabilitated residential landscapes. *ETF* is the aggregate service area expression of *ETAF*, the evapotranspiration factor used to adjust *ETo* and *Peff* in determining the water allowance.

- *II* is the service area aggregate 'irrigable-irrigated' landscape area in square feet.
- *INI* is the service area aggregate 'irrigable-not irrigated' landscape area in square feet.
- *II + 0.2* x *INI* is the adjusted II residential landscape area for an urban retail water supplier in square feet.

Refer to *Recommendations for Outdoor Residential Water Use Efficiency Standard* (WUES-DWR-2021-02) for details.

Landscape Area Measurement for Commercial, Industrial, and Institutional Dedicated Irrigation Meters

Determining efficient water use on CII landscapes requires measurement of the irrigated landscape area and how much water was applied (CalWEP, 2019). This data was not available in sufficient quantity and locations to capture the diversity of CII landscapes across urban retail water suppliers in the State.

Measurement of the irrigated area served by DIM (or equivalent technology) must be conducted on a local level. Aerial surveys and remote sensing can be used to estimate the irrigated CII landscapes, but it requires field verification by the urban retail water supplier to map the actual area irrigated by the DIM(s) because CII landscapes can be served by one or many DIMs (or equivalent technologies), can irrigate a common landscape area crossing multiple parcel boundaries, and can be used in combination with mixed-use meters. Additionally, different from residential landscapes, CII landscapes are more likely to qualify as SLAs, as defined by MWELO, which are allowed a higher water use allowance than normal CII landscapes. Because of these complexities, the measurement of the associated CII landscape area served by DIMs (or equivalent technologies) can only be performed at individual DIM (or equivalent technology) level.

Through stakeholder engagement and available studies (CalWEP, 2019), it is evident that many urban retail water suppliers in the State do not know the number or the exact location of their DIMs (or equivalent technologies) and the irrigated landscapes served by them. It will take time and resources for many urban retail water suppliers to measure their DIM-irrigated landscapes in order to calculate their efficient CII-DIM water use volume.

Commercial, Industrial, and Institutional Landscape Water Use Efficiency

CII landscapes often differ from residential landscapes in the diversity of plant palettes, landscape size, type of water use (i.e., potable and recycled water), and type of

landscape (i.e., regular, special, and exempt landscapes). Aggregate *ETAF* estimates for existing CII landscapes from a few urban retail water suppliers considered to be efficient water managers and information from UCANR are included in Table 3-1. Efficient average *ETAF*s ranged from 0.7 to 1.1 per the information are shown in Table 3-1.

Table 3-1 Efficient ETAFs on Existing CII Landscapes

Location or Source of Information	Efficient *ETAF*[1]
Bay Area (primarily) and North Central Valley Urban Retail Water Suppliers[2]	0.9
Southern California Urban Retail Water Supplier	0.8
Southern California Urban Retail Water Supplier[3]	0.93
North Central Valley Urban Retail Water Supplier	0.7
University of California, Davis – Agriculture and Natural Resources	1.1[4]

Notes:
[1] Does not include effective precipitation
[2] Data provided by Waterfluence for 4,767 CII landscapes in 20 urban retail water supplier service areas across 4 Bay Area counties.
[3] 0.8 for potable water and 1.0 for recycled water
[4] With improvements may get to 0.9 to 0.75 (additional data is needed for validation)
Key:
CII = commercial, industrial, and institutional
ETAF = evapotranspiration factor in MWELO design standard (on parcel level)

The data show that an aggregate CII landscape *ETAF* of less than 0.7, calculated excluding *Peff,* will likely be difficult to achieve and will require significant changes in existing CII landscape management and, likely, plant pallets. When *Peff* is included in the calculation, the effective efficient *ETAFs* in Table 3-1 will be higher, making achieving an *ETAF* of less than 0.7 even more difficult.

Operations and Management Practices

Even with the implementation of the best water conservation technology by the CII water user, successfully achieving water efficiency on existing landscapes depends on coordination among landscape contractors, property owners, property managers, and – ideally – the urban retail water supplier. Urban retail water suppliers cannot unilaterally control these conditions. Additionally, properly designing and implementing an efficient water use CII landscape depends on the coordination of architects and designers, landscape contractors, irrigation system inspections, and adherence to the landscape design, all of which are under the authority of the local land use authority or department responsible for implementing MWELO.

CII landscapes differ in operations and management from residential landscapes.

- To achieve acceptable CII landscape appearance and efficient water use, the close coordination of the landscape manager, property manager, and owner is required.
- Each CII water user's irrigation requirements are affected by landscape management and maintenance, as well as the local microclimate, soils, and plant-types grown.
- Many DIMs (or equivalent technologies) were installed without urban retail water suppliers recording their latitude/longitude, the irrigated landscape area, or if it was serving an SLA or exempt landscape.
- A landscape manager's goal is to provide an acceptable landscape appearance in the least amount of time involved. This means that CII landscapes are often managed to provide an acceptable appearance to the worst performing part of the landscape (e.g., if a brown spot appears on a turf landscape, providing an acceptable appearance to that part of the landscape controls how the rest of the landscape is irrigated); and efficiently using water is often not considered.
- The cost of wasted water is often minor in comparison to other CII operational costs.

Landscape Age

Many existing CII irrigation systems are older, heterogeneous, and built according to the design standards and technology available at the time of installation. MWELO is a design standard to provide existing, new, and rehabilitated landscapes help with achieving a certain level of water use efficiency. Efficient water use is based on a MAWA that is a function of the local climate conditions, plant types, and irrigation system efficiency. MWELO was not included in building codes until 2011, and annual reporting of MWELO was first required in 2015. Knowing when landscapes were constructed can inform why some landscapes may be more efficient. However, many existing CII landscapes were developed without following MWELO; were implemented under an older MWELO with different design standards; and in many cases, were designed with less thought towards water conservation. Additionally, MWELO is enforced through the land use authority, and annual reporting on MWELO was not required until 2015.

Variances

Water Use for Bioengineered Slopes – Deferred to CII-DIMWUS

Water use for soil stabilization of bioengineered slopes was deferred from the variance process to be covered under CII-DIMWUS as an SLA. Healthy vegetation on bioengineered slopes contributes to soil stabilization. Bioengineered slopes are a common landscape in many urban retail water suppliers' service areas; therefore, they

are not suitable for a variance that must be for unique uses. As a safety concern, sufficient water must be applied to support the existing vegetation. Additionally, although many bioengineered slopes are vegetated with low-water-use plants, more water may be necessary to adequately support the vegetation because of the slopes.

Water Use to Support Non-Regulatory Ponds and Lakes – Deferred to CII-DIMWUS

Water used to support ponds and lakes for non-regulatory public or wildlife benefit purposes were deferred from the variance process to be covered under CII-DIMWUS as an SLA. These features are common in many urban retail water suppliers' service areas and are not suitable for a variance that must be for unique uses. As a feature supporting public or wildlife benefits, it is important to maintain beneficial use functions.

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4.0 Recommendation

The recommended CII-DIMWUS is based on ORWUS with modifications for SLAs, exempt landscapes, and includes the MWELO, as amended, design standard for new and rehabilitated landscapes constructed after January 1, 2020. There is a diversity of CII landscape ages, local conditions, and potentially significant costs associated with rehabilitating CII landscapes for urban retail water suppliers, especially for those with substantially more CII-DIMs (or equivalent technologies). Recognizing these challenges, combined with an examination of CII landscape water use data provided by efficient urban retail water suppliers for professionally managed landscapes, the MWELO design standard for regular CII landscapes with an *ETAF* factor of 0.1 less than residential landscapes was not supported for use in CII-DIMWUS. As amended, the MWELO design standard for new and rehabilitated CII landscapes was considered applicable only to those conditions as specified in the MWELO.

4.1 Recommended Standard

- DWR recommends a CII-DIMWUS that is consistent with the recommended ORWUS for existing landscapes with modifications:
  - The Efficient CII-DIM Water Use Volume is calculated for II landscape areas only.
  - For new and rehabilitated nonresidential landscapes (post January 1, 2020), the MWELO, as amended, MAWA is to be used to calculate the Efficient CII-DIM Water Use Volume.
  - For SLAs, the MWELO, as amended, MAWA is to be used to calculate Efficient CII-DIM Water Use Volume. For SLAs built prior to 2015, the 2015 MWELO MAWA is to be used.
  - Landscapes exempt from the MWELO, as amended, MAWA requirement are excluded from the UWUO and actual water use calculations. However, DWR recommends that actual water use for these landscapes be reported in the Annual Water Use Report.
- Commercial agricultural water use meeting the definition of subdivision (b) of Section 51201 of the GC is categorically excluded from the recommended CII-DIMWUS per WC Section 10609.8(c).
- **Equivalent technology** is defined as any other device or process that is not a DIM; yet the device measures the volume of water delivered to the landscape, reports that measurement directly to the urban retail water supplier on the same

time interval and with the same accuracy as service area DIMs and can be used for billing purposes if an urban retail water suppliers chooses to do so.

- The recommended CII-DIMWUS is subject to approval and adoption by the State Water Board.
- CII-DIMWUS applies to CII landscapes irrigated with a DIM (or equivalent technology) regardless of when that DIM (or equivalent technology) was installed.

The standard and applicable requirements are the basis for calculating the Efficient CII-DIM Water Use Volume, as described below.

Efficient Commercial, Industrial, and Institutional Dedicated Irrigation Meter Water Use Volume

DWR recommends that measurement of landscape areas to be included in the Efficient CII-DIM Water Use Volume shall be implemented over five years after adoption by the State Water Board for urban retail water suppliers that do not have measurements of all CII landscape areas associated with DIMs (or equivalent technologies).

The equation for Efficient CII-DIM Water Use Volume is based on the MWELO MAWA equation and EORWU equation.

From Adoption Through Year 4 After Adoption of CII-DIMWUS (estimated 2023 through 2027)

$$\text{Efficient CII-DIM Water Use Volume} = 0.62 * [(ETo - Peff) * ETF * CIILA\_r] + (MAWA\_SLA + MAWA\_CII\_new) + \textit{CII-DIM Delivered Water Use Volume for Unmeasured Landscape Areas}$$

For Year 5 After Adoption of CII-DIMWUS and Onward (estimated 2028 and Onward)

$$\text{Efficient CII-DIM Water Use Volume} = 0.62 * [(ETo - Peff) * ETF * CIILA\_r] + (MAWA\_SLA + MAWA\_CII\_new)$$

where,

- *CIILA_r* (commercial, industrial, institutional landscape area for regular landscapes, pre-January 1, 2020) is the service area aggregated CII regular landscape area in square feet.
- *Peff* is in inches and is capped at 25 percent of modeled effective precipitation.

- *ETo* is reference evapotranspiration in inches.
- 0.62 is a unit conversion factor, when landscape area is measured in square feet.
- *ETF* is the aggregate service area expression of *ETAF,* the evapotranspiration factor used to adjust *ETo* and *Peff* in determining the water allowance.
- *CII-DIM Delivered Water Volume for Unmeasured Landscape Areas* is the aggregate CII-DIM (or equivalent technology) volume of water delivered to unmeasured landscape areas.
- *ETF, MAWA_SLA, and MAWA_new* are as defined in Table 4-1.

Table 4-1 CII-DIMWUS Components

Name	Value
ETF	• 0.80 until December 31, 2029 • 0.63 beginning January 1, 2030
MAWA_SLA	• MAWA for SLAs calculated using the MWELO, as amended, MAWA equation and *ETAF* for SLAs at the time the landscape was developed, applied to the service area aggregate SLA landscape area or in accordance with the local WELO at the time the landscape is developed. • For pre-2015 SLAs, the 2015 MWELO shall apply. (Note: 2015 MWELO *ETAF* = 1.0 and *Peff* is optional)
MAWA_CII_new	• MAWA and *ETAF* for new or rehabilitated CII landscapes (post-January 1, 2020) calculated using the MWELO, as amended, MAWA equation and *ETAF* for new and rehabilitated landscapes at the time the landscape water developed, applied to the service area aggregate new and rehabilitated landscape area or in accordance with the local WELO at the time the landscape is developed. (Note: 2015 MWELO *ETAF* = 0.45 and *Peff* is optional)

Key:
CII = commercial, industrial, and institutional
CII-DIMWUS = Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard
ETAF = evapotranspiration factor in MWELO design standard (on parcel scale), applied to service area aggregate SLA or new and rehabilitated CII landscapes
ETF = evapotranspiration factor (on urban retail water supplier level)
MAWA_CII_new = aggregate maximum applied water allowance for new and rehabilitated CII landscapes, January 1, 2020, and onward
MAWA_SLA = aggregate maximum applied water allowance for special landscape areas
MWELO = Model Water Efficient Landscape Ordinance
Peff = effective precipitation
WELO = Water Efficient Landscape Ordinance

Special Landscape Areas

In addition to the above, the recommended CII-DIMWUS includes the SLAs in the MWELO, as amended, plus three additional recommended SLAs (below).

***SLAs in the 2015 MWELO include**:*

- Areas dedicated solely to edible plants (e.g., community gardens).
- Active and passive recreational areas (e.g., outdoor event spaces and sports fields).
- Recycled water irrigated areas.
- Areas with water features using recycled water.

***Additional Recommended SLAs**:*

- Bioengineered slopes.
- Public swimming pools.
- Supplemental water for ponds or lakes including, but not limited to, sustaining wildlife, recreation, or other public benefit. Note that urban retail water suppliers who provide supplemental water to ponds and lakes for sustaining wildlife under specific regulatory requirements should apply for the variance for this purpose (see *Recommendations for Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife, Methods of Calculation, and Supporting Data Requirements* [WUES-DWR-2021-11]).

Exempt Landscapes

DWR recommends that 2015 MWELO exempt landscapes be excluded from the UWUO, consistent with the MWELO MAWA requirements. These include:

- Registered local, State, or federal historical sites.
- Ecological projects that do not require a permanent irrigation system.
- Mined-land reclamation projects that do not require a permanent irrigation system (pre-2015).
- Existing plant collections, botanical gardens and arboretums open to the public (pre-2015).
- Cemeteries built before 2015 (per GC 65598).

Data Needed for Calculation

- Aggregated SLA (if applicable), in square feet, used to calculate MAWA_SLA.
- Aggregated New Landscape area (e.g., CII landscape area for new landscapes, post-January 1, 2020 [*CIILA_new*]), in square feet, used to calculate *MAWA_CII_new* for new regular landscapes.
- Aggregated CII-DIM (or equivalent technology) irrigated regular landscape area (*CIILA_r*), in square feet.
- *Peff* capped at 25 percent of modeled effective precipitation, in inches.
- *ETo,* in inches.
- *CII-DIM Delivered Water Volume for Unmeasured Landscape Areas* (through Year 4 following adoption by the State Water Board).
- Aggregated exempt landscape CII-DIM (or equivalent technology) water use volume (for reporting purposes only), in gallons.

4.2 Challenges and Other Considerations

As partners of the State in water conservation, urban retail water suppliers will be challenged with providing data and implementing measures to achieve water use efficiency on service area CII landscapes with DIMs (or equivalent technologies).

Account and Landscape Area Measurement Data

Many urban retail water suppliers have not measured landscape areas associated with DIMs (or equivalent technologies). Some urban retail water suppliers do not have separate billing classifications for DIMs, making it difficult for them to identify which meters are DIMs (or equivalent technologies). Therefore, many urban retail water suppliers will have to identify DIMs (or equivalent technologies), geolocate them, and measure associated DIM-irrigated landscape areas.

According to the CalWEP survey (CalWEP, 2019):

- The alignment of parcel information with an irrigated area is critical for aerial measurements. In many instances, parcel boundaries do not align with the coverage areas of DIMs.
- The most accurate method of measurement is “on-the-ground” field measurements, yet they are the most time consuming and costly to perform.

- The preferred approach is combining aerial imagery with subsequent field measurement for delineating actual DIM-served landscape areas.
- Verified customer-supplied measurement data is also acceptable.

Measuring the irrigated CII landscape area requires coordination among property managers, the urban retail water supplier, and potentially landscapers and property owners.

Age of Existing Landscapes

Existing CII landscape were developed under different design standards and with technology at the time of implementation. Improving water use efficiency on these landscapes will be challenging.

Professional irrigation system repairs, retrofits, and management to maximize efficiency of 31 CII landscapes sites in the UCANR study (see Section 3.3) had a combined actual *ETAF* of 0.78 in 2014 (Fujino, 2017). *ETAF* was reduced to 0.58 in 2015/2016 because of mandatory drought restrictions, but this had a negative impact on the health and appearance of turfgrass in many cases. Additionally, there are currently insufficient qualified irrigation system professionals to service existing CII landscapes for maximum water use efficiency.

Incentive Programs Success

Stakeholders have identified that incentive programs, such as smart irrigation controllers and turf rebate programs, can assist in improving efficiencies on residential landscapes. However, these types of programs take time and money. It is unknown what the effectiveness is on CII properties because landscape management is typically not performed by the property owner, property manager, or CII water user.

For residential landscape programs, the Municipal Water District of Orange County's Smart Timer Rebate Program has achieved only a 3.9 percent participation by single-family homes since 2004 (MWDOC, 2021). Additionally, their Turf Removal Program has achieved only about 2.2 percent participation by single-family homes since 2010, a rate of about 0.2 percent per year with a cost of about $6.33 per square foot.

Furthermore, incentive programs often exclude disadvantaged communities who cannot afford the cost-share or up-front cost to wait for a rebate. Direct assistance to disadvantaged community businesses may be needed to improve efficiencies for these communities.

Commercial, Industrial, and Institutional Landscape Irrigation Management

Most CII landscapes are managed by a landscape contractor. Communication between the landscape contractor, property manager, and property owner, and potentially the CII water user, is needed for efficient CII landscape water management.

- The landscape manager's goal is to provide an acceptable landscape appearance in the least amount of time involved. This means that CII landscapes are often managed to provide an acceptable appearance to the worst-performing part of the landscape (e.g., if a brown spot appears on a turf landscape, providing an acceptable appearance to that part of the landscape controls how the rest of the landscape is irrigated); and efficiently using water is often not considered. Additionally, landscape irrigation management and maintenance require training and oversight.

- The property manager's goal may be to have an acceptable landscape that invites customers to the business or makes the business look successful while minimizing the costs of landscape maintenance.

- The property owner's goal may be to minimize property improvement costs, such as costly irrigation system repairs and repairs to damaged fences or foundations from overwatering.

- The CII water user who is not the property owner has no authority to make changes to the property without the property owner's permission.

- The cost of water waste is small in comparison to other costs and often not a critical concern to the CII water user.

Dedicated Irrigation Meters and Water Use Efficiency

Improved water use efficiency requires setting appropriate water budgets and cooperation of the CII water user. Urban retail water suppliers without water budget-based rate structures, budget exceedance tracking, and CII water user cooperation will be challenged with improving water use efficiency on CII-DIM irrigated landscapes. From the CalWEP survey (CalWEP, 2017):

- **Designing Water Budgets.** Almost half of the urban retail water suppliers responding to the survey did not have water budgets associated with their DIMs. Water budgets are generally not integrated with geographic information system (GIS) and billing systems; and all of the budgets used some combination of evapotranspiration, landscape area, and *PF* or *ETo* adjustment factor.

- **Using Water Budgets.** Very few urban retail water suppliers automatically flag accounts for using more than their water budget allocation; noncompliance with

water budgets has to be queried by staff and individually tracked. There is a wide variation in the use of customer alerts when a DIM water budget is exceeded.

- **DIM Management Programs.** DIM management programs were found to be effective in promoting efficient use of water for the CII water user's property. Having the ability to set rates and send a price signal to customers helps with efficient use. Some best practices suggested integrating billing and GIS as an effective way to compile a comprehensive customer and site profile or putting urban retail water suppliers' commonly stored data into a database keyed to a premise-specific DIM account number.

Other Considerations

- Many CII water users may not have the resources or staff to implement the suggested water use efficiency programs. For many, the lost productivity costs (e.g., time spent managing for efficiency, participating in water audits, receiving training) or additional landscaping costs exceeds the cost of wasted water.

- Outdoor water savings takes time to achieve given the implementation timing and establishment periods required for drought-tolerant landscaping to succeed (LADWP, 2021).

- The Los Angeles Department of Water and Power[2] has estimated that the maximum cost-effective potential savings for CII landscape irrigation is approximately 15 percent of the total sector water savings, assuming maximized customer participation in the Los Angeles Department of Water and Power's water conservation programs through 2035.

Stakeholder Recommendations and Suggestions

Stakeholders were generally supportive of keeping CII-DIMWUS consistent with ORWUS to facilitate management and reporting.

Several suggestions and general recommendations were proposed by stakeholders in the various working group and public meetings. These suggestions and general recommendations recognize that the successful implementation of the new water use efficiency standards and UWUOs requires complementary actions by the State to assist urban retail water suppliers as they implement the new framework. DWR heard repeatedly from stakeholders that technical and financial support for urban retail water suppliers is key for the successful implementation of the new framework.

[2] The November 24th, 2021, Comment Letter provided by Los Angeles Department of Water and Power.

DWR includes these suggestions and general recommendations to underscore their importance for future consideration because improving urban water use efficiency depends on the successful implementation of the final water use efficiency standards adopted by the State Water Board. Again, these ideas are not specific recommendations from DWR to the State Water Board. DWR may consider these suggestions raised by stakeholders when new standards are approved by the State Water Board. DWR recognizes that it will require time, effort, and funding to implement these suggestions; and the pace of implementation will depend upon the feasibility and availability of resources and competing priorities.

Stakeholder suggestions and recommendations included the following:

Technical Assistance

- The State should consider providing technical assistance to urban retail water suppliers, in particular, smaller urban retail water suppliers with limited resources for implementation and reporting of UWUOs, variances, actual water use, and other progress reports to DWR.

- The State should consider providing technical assistance and guidance to urban retail water suppliers on measuring landscapes associated with CII-DIMs.

- The State should consider providing technical assistance to urban retail water suppliers on how customers can improve outdoor water use efficiency while protecting existing landscapes. This includes landscapes with higher *PF*s, urban wildlife habitat, and urban shade trees.

Financial and Local Assistance

- The State should consider providing direct financial assistance programs, not rebates, for low-income communities to assist with mitigating potential water affordability and to support the human right to water.

- The State should consider providing financial assistance to urban retail water suppliers, wastewater, and recycled water utilities to mitigate the financial impact of new UWUOs and support the implementation of water use efficiency programs.

- The State should consider offering incentives to urban retail water suppliers to support customer water use efficiency via local assistance grants and loan programs.

Outreach and Messaging

- The State should augment efforts by Save Our Water to assist customers in understanding the need for water and wastewater rate changes.

- The State should support additional statewide messaging to incentivize customers to participate in water use efficiency programs and upgrades.

Data

- Stakeholders recommended that DWR provide aerial CII landscape area measurements and assistance for mapping CII-DIM (or equivalent technology) locations and ground-truthing associated irrigated areas.

- The State should consider providing urban retail water suppliers updated landscape area measurement data every five years.

Other

- Stakeholders have recommended that the standards allow more time for urban retail water suppliers to perform outreach and coordination with their CII water users.

- The State should encourage local jurisdictions responsible for MWELO to improve MWELO implementation and enforcements.

4.3 Guidelines and Methodologies

It is incumbent upon the urban retail water supplier, when calculating Efficient CII-DIM Water Use Volume, to confirm that CII-DIMWUS and Guidelines and Methodologies adopted by the State Water Board are being used.

Efficient CII-DIM Water Use Volume is calculated using CII-DIMWUS, CII landscape areas irrigated with DIMs (or equivalent technologies), local *ETo* in inches, and local *Peff* in inches. CII landscapes areas irrigated with DIMs (or equivalent technologies) comprise the service area aggregate *SLAs*, aggregate new and rehabilitated CII landscape areas developed after January 1, 2020 (*CIILA_new*), and the aggregate regular (pre-January 1, 2020) CII landscape areas (*CIILA_r*).

Two variances were identified as being related to CII-DIMWUS, and additional variances related to this standard may be added in the future:

1. *Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-09).

2. *Recommendations for Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-11).

Water used for commercial agriculture is categorically excluded from CII-DIMWUS.

Efficient Commercial, Industrial, and Institutional Dedicated Irrigation Meter Water Use Volume

Efficient CII-DIM Water Use Volume is calculated using the following equations and the CII-DIMWUS values in Table 4-2. Dates shown are based on a five-year implementation process and are subject to change for consistency with the CII Classification System implementation schedule and State Water Board approval and adoption of the standard.

From Adoption Through Year 4 After Adoption (estimated 2023 through 2027)

$$\text{Efficient CII-DIM Water Use Volume} = 0.62 * [(ETo - Peff) * ETF * CIILA\_r] + (MAWA\_SLA + MAWA\_CII\_new) + \textit{CII-DIM Delivered Water Use Volume for Unmeasured Landscape Areas}$$

For Year 5 After Adoption and Onward (estimated 2028 and Onward)

$$\text{Efficient CII-DIM Water Use Volume} = 0.62 * [(ETo - Peff) * ETF * CIILA\_r] + (MAWA\_SLA + MAWA\_CII\_new)$$

where,

- *CIILA_r* (commercial, industrial, institutional landscape area for regular landscapes, pre-January 1, 2020) is the service area aggregated CII regular landscape area in square feet.
- *Peff* is in inches and is capped at 25 percent of modeled effective precipitation.
- *ETo* is the local reference evapotranspiration in inches.
- 0.62 is a unit conversion factor, when landscape area is measured in square feet.
- *ETF* is the aggregate service area expression of *ETAF,* the evapotranspiration factor used to adjust *ETo* and *Peff* in determining the water allowance.
- *CII-DIM Delivered Water Volume for Unmeasured Landscape Areas* is the aggregate CII-DIM (or equivalent technology) volume of water delivered to unmeasured landscape areas.
- *ETF, MAWA_SLA, and MAWA_CII_new* are as defined in Table 4-2.

Table 4-2 CII-DIMWUS Components

Name	Value
ETF	• 0.80 until December 31, 2029 • 0.63 beginning January 1, 2030
MAWA_SLA	• MAWA for SLAs calculated using the MWELO, as amended, MAWA equation and *ETAF* for SLAs at the time the landscape was developed, applied to the service area aggregate SLA landscape area or in accordance with the local WELO at the time the landscape is developed. • For pre-2015 SLAs, the 2015 MWELO shall apply. (Note: 2015 MWELO *ETAF* =1.0 and *Peff* is optional)
MAWA_CII_new	• MAWA and *ETAF* for new or rehabilitated CII landscapes (post-January 1, 2020) calculated using the MWELO, as amended, MAWA equation and *ETAF* for new and rehabilitated landscapes at the time the landscape water developed, applied to the service area aggregate new and rehabilitated landscape area or in accordance with the local WELO at the time the landscape is developed. (Note: 2015 MWELO *ETAF* = 0.45 and *Peff* is optional)

Key:
CII = commercial, industrial, and institutional
CII-DIMWUS = Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard
ETAF = evapotranspiration factor in MWELO design standard (on parcel level), applied to service area aggregate SLA for new and rehabilitated CII landscapes
ETF = evapotranspiration factor (on urban retail water supplier level)
MAWA_CII_new = aggregate maximum applied water allowance for new and rehabilitated CII landscapes, January 1, 2020, and onward
MAWA_SLA = aggregate maximum applied water allowance for special landscape areas
MWELO = Model Water Efficient Landscape Ordinance
Peff = effective precipitation
WELO = Water Efficient Landscape Ordinance

In addition to the above, the recommended CII-DIMWUS includes the SLAs in the MWELO, as amended, plus three additional recommended SLAs. Water used on exempt landscapes, in the MWELO, as amended, is reported but not included in CII-DIMWUS.

***SLAs in the 2015 MWELO include**:*

- Areas dedicated solely to edible plants (e.g., community gardens).
- Active and passive recreational areas (e.g., outdoor event spaces and sports fields).
- Recycled water irrigated areas.
- Areas with water features using recycled water.

Additional Recommended SLAs

- Bioengineered slopes.
- Public swimming pools.
- Supplemental water for ponds or lakes including, but not limited to, sustaining wildlife, recreation, or other public benefit. Note that urban retail water suppliers who provide supplemental water to ponds and lakes for sustaining wildlife under specific regulatory requirements should apply for the variance for this purpose (see *Recommendations for Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife, Methods of Calculation, and Supporting Data Requirements* [WUES-DWR-2021-11]).

Exempt Landscapes

DWR recommends that 2015 MWELO exempt landscapes be excluded from the UWUO, consistent with the MWELO MAWA requirements. These include:

- Registered local, State, or federal historical sites.
- Ecological projects that do not require a permanent irrigation system.
- Mined-land reclamation projects that do not require a permanent irrigation system (pre-2015).
- Existing plant collections, botanical gardens and arboretums open to the public (pre-2015).
- Cemeteries built before 2015.

Data Needed for Calculation

- Aggregated *SLA* (if applicable), in square feet, used to calculate *MAWA_SLA.*
- Aggregated new CII landscape area (e.g., *CIILA_new*), in square feet, used to calculate *MAWA_CII_new* for new regular landscapes.

- Aggregated CII-DIM (or equivalent technology) irrigated regular landscape area (*CIILA_r*), in square feet.
- *Peff* capped at 25 percent of modeled effective precipitation, in inches.
- *ETo,* in inches.
- *CII-DIM Delivered Water Volume for Unmeasured Landscape Areas*, in gallons (applicable through Year 4 following adoption by the State Water Board, if necessary).

Data Provided or Obtained by the Urban Retail Water Supplier

Urban retail water suppliers will be responsible for obtaining all of the following data associated with CII landscapes irrigated with DIMs (or equivalent technologies).

- Aggregated *SLA* (if applicable), in square feet. Note that for any specific landscape area, only one type of SLA condition can be used for volume calculation even if it may qualify for multiple criteria.
- Aggregated new CII landscape area (*CIILA_new*), in square feet.
- Aggregated CII-DIM (or equivalent technology) irrigated regular landscape area (*CIILA_r*), in square feet.
- Aggregated exempt landscape area CII-DIM (or equivalent technology) water use volume, in gallons.
- *CII-DIM Delivered Water Volume for Unmeasured Landscape Areas*, in gallons (applicable through Year 4 following adoption by the State Water Board, if necessary).

Measurement of Commercial, Industrial, and Institutional Landscape Areas Irrigated with Dedicated Irrigation Meters

Urban retail water suppliers must measure the landscape area associated with CII-DIMs (or equivalent technologies).

- Where an irrigated CII landscape is served by a combination of DIM(s) (or equivalent technology) and mixed-use meter(s), only the landscape area being irrigated by the DIM(s) (or equivalent technology) shall be included in CII-DIMWUS.

DWR recommends the CII landscape area measurements be conducted over a five-year implementation schedule as follows. This implementation schedule is subject to

change for consistency with the CII classification system implementation schedule and as adopted by the State Water Board:

- By 2023, all CII-DIMs (or equivalent technologies) must be identified.
  - DIMs (or equivalent technologies) serving HOAs, multifamily residential areas, or other residential areas may be identified as CII-DIMs for the purposes of the UWUO, if applicable, to make use of the SLA *ETAF* for calculating efficient water use on these landscapes.
  - Identification and classification of CII-DIMs (or equivalent technologies) does not require changing urban retail water supplier billing systems; information may be kept in a separate look-up table. However, urban retail water suppliers are encouraged to include the identification in their billing system or upon a billing system update.
- Starting in 2023 or upon adoption of CII-DIMWUS, urban retail water suppliers shall measure CII landscape areas served by a DIM (or equivalent technology) for a minimum of 20 percent of the CII-DIM accounts each year, with 100 percent of the CII-DIM (or equivalent technology) accounts' irrigated landscape areas measured by the end of 2027, or within five years after adoption of CII-DIMWUS.
- Urban retail water suppliers that encounter hardship with the identification of DIMs (or equivalent technologies) or measuring landscape areas can submit an action plan for approval by the State Water Board to meet compliance.

Geolocate or Map CII-DIMs

- Urban retail water suppliers should geolocate DIMs (or equivalent technologies) for assisting in measurement of associated landscape areas, identifying exempt landscapes or SLA DIMs (or equivalent technologies), and for future water management purposes.
  - Exempt landscapes can be partially identified by the North American Industry Classification System, but they should be verified by the urban retail water supplier.
- For urban retail water suppliers that do not have GIS, geolocation can be a record of latitude/longitude for later incorporation into a geospatial database.

CII-DIM Irrigated Landscape Area Measurement

Urban retail water suppliers must measure the landscape area irrigated with CII-DIMs (or equivalent technologies). This landscape area will include only the actual II area. Urban retail water suppliers can measure the irrigated landscape area associated with each CII-DIM (or equivalent technology) using any of the following methods:

- **California Urban Water Conservation Council BMP5 Handbook (CUWCC, 1999).** The principles described in this handbook for cost-effective measurement of an irrigated landscape area associated with a DIM remain applicable. The best method of measuring a CII-DIM landscape area depends on many interrelated factors and varies by urban retail water supplier.

- **Aerial Imagery or Remote Sensing**. Aerial imagery or remote sensing followed by a subsequent Direct Field Measurement can provide a good estimate of irrigated landscape area.

  - Subsequent field measurements of the irrigated area are required because landscape boundaries often do not align with DIM coverage areas.

  - Direct Field Measurements, as described below.

- **Direct Field Measurements.** Field measurements, coordinated with the property or landscape manager present to turn on irrigation systems, may be performed with an odometer wheel or drawn on a map.

- **Customer-Provided Measurements.** Customer-provided irrigated landscape area measurements are also acceptable provided the measurements are verified by the urban retail water supplier (CalWEP, 2019).

- **New CII-DIM Landscape Area.** For *CIILA_new* landscape areas, DWR recommends that the urban retail water supplier coordinate with the land use authority that approves MWELO plans and use those measurements in the CII-DIMWUS calculation. The MWELO Section 492.1 requires the local agency, upon approval of the Landscape Documentation Package and as described in MWELO Section 492.3, to submit to the local water purveyor the Water Efficient Landscape Worksheet.

- **Other Methods.** Other methods can be used provided they meet the Use of Alternative Data requirements specified below.

Groups or conglomerates of DIMs (or equivalent technologies), together irrigating one overall landscape area, can reported in aggregate with their overall landscape area. These must be identified in the look-up table or billing system per the adopted CII water use classification system (see *Recommendations for Commercial, Industrial, and Institutional Water Use Classification System Performance Measure* [WUES-DWR-2021-17]).

The following additional CII landscape area measurement data is recommended:

- Identify those measured landscape areas that qualify as SLAs, if applicable.

- If pursuing a variance for irrigation with high TDS recycled water, identify the amount of SLA area that is irrigated with high TDS recycled water (*SLA_htds*) (see *Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements* [WUES-DWR-2021-09]).

Data Accuracy Requirements

To help ensure data accuracy, DWR recommends that urban retail water suppliers provide a detailed description of the method(s) used to identify CII-DIMs (or equivalent technologies), locate CII-DIMs (or equivalent technologies), and obtain landscape area measurements in their Annual Water Use Report. DWR recommends that this description must include:

- Description of the process used to identify and verify CII-DIM (or equivalent technology) accounts.
- Description of the process used to geolocate or otherwise map and verify CII-DIMs (or equivalent technology) locations.
- Description of the CII-DIM (or equivalent technology) irrigated landscape area measurement and verification methods.
- Confirm, for each site, that the measured irrigated landscape area is not irrigated with a mixed-use meter.
  - In the cases where both DIM(s) (or equivalent technology) and mixed-use meter(s) are used for landscape irrigation, the urban retail water supplier will need to measure the portion of landscape that is only irrigated by the DIM (or equivalent technology).
- Description of methods or process used to identify SLAs and Exempt Landscape DIMs (or equivalent technologies). Include the basis for designating SLAs.
- Data collection and verification process or procedures, including, but not limited to documentation and records retention, update processes, and follow-up procedures (if necessary).
- Include credentials (e.g., licenses, certifications, education, training, or professional background of staff) for the entity/party that conducted the landscape area measurement and the entity/party that approved the data.
- Affidavit or certification of the landscape area measurement data by a qualified urban retail water supplier staff member responsible for data quality.

  - Certification of the landscape area measurement data by the entity/party that produced it if not produced by the urban retail water supplier's staff.

- Map(s), satellite image(s), or aerial image(s) showing the location of *CIILA_r,* and SLAs; documentation of methods and data supporting the CII-DIM (or equivalent technology) identification, location, landscape area measurement; and data verification should be available upon request and retained for the period the data is used plus three years.

Measurement Schedule for Consistency with CII Performance Measures

Urban retail water suppliers have up to five years after State Water Board adoption to complete mapping of accounts to the recommended CII water use classification system and DIM (or equivalent technology) landscape measurement.

- The minimum level of progress in account mapping per year is 20 percent of CII water user accounts. For the same 20 percent of CII accounts identified, provide measurements of the irrigated landscape area being served by a DIM (or equivalent technology).

- If an urban retail water supplier does not meet the annual 20 percent mapping requirement, the urban retail water supplier is to include in its annual report an explanation and its plan to meet the full mapping requirement by year five following adoption of CII-DIMWUS by the State Water Board.

- An urban retail water supplier experiencing a substantial hardship meeting the minimum level of progress by Year 3 will need to provide an implementation plan to meet the full mapping requirement subject to approval by the State Water Board.

Exempt Water Use Volume

Exempt Water Use Volume is the volume of water delivered to exempt landscape areas. DWR recommends that the exempt volume is not included in the calculation of the UWUO or actual water use but reported as part of the documentation in the Annual Water Use Report.

Data and Resources Provided by the California Department of Water Resources

- *ETo,* in inches.

- *Peff* capped at 25 percent of modeled effective precipitation, in inches.

DWR has existing, well established programs for estimating *ETo* at weather station sites that are managed by the CIMIS program and local *Peff* through the Cal-SIMETAW model.

Reference Evapotranspiration

DWR currently manages over 155 automated agro-climatic CIMIS stations throughout the State. To fill spatial data gaps, DWR, in cooperation with the University of California, Davis (UCD), developed Spatial CIMIS. Spatial CIMIS is a model that couples remotely sensed data from a geostationary operational environmental satellite with point measurements from CIMIS stations to estimate *ETo* at 2-kilometer grid. Urban retail water supplier boundaries were overlaid on the Spatial CIMIS grid, and a weighted average of each enclosed grid's *ETo* was derived to reflect an overall *ETo* at the urban retail water supplier level.

Effective Precipitation

Similarly, daily total rainfall records are obtained from the Parameter-Elevation Relationships on Independent Slopes Model (PRISM) as an input to DWR's Cal-SIMETAW model to calculate *Peff*. PRISM is a climate mapping model developed by the PRISM Climate Group at Oregon State University, while Cal-SIMETAW is a soil water balance model that was developed by DWR and UCD.

Use of Alternative Data

If an urban retail water supplier chooses to use alternative data, they must receive approval from DWR and demonstrate that their data meets or exceeds the quality and accuracy of data and methodology provided by DWR prior to using it in the calculation of their UWUO and actual water use. Urban retail water suppliers requesting more than one type of alternative data may submit separate applications for each data type or a combined application for all data types so long as the required information is included in the combined package.

Alternative Reference Evapotranspiration Data

To demonstrate that alternative *ETo* (and/or total precipitation) data meet or exceed the quality and accuracy of the *ETo* (and/or total precipitation) data that DWR provides, an urban retail water supplier must submit a package containing the following:

1. Description of why the alternative data meet or exceed the quality and accuracy of the DWR data.

2. Description of the methodology used to estimate *ETo* (and/or precipitation).

3. Indication of the source of data used to estimate *ETo* (and/or precipitation); e.g., whether it is from a weather station or remote sensing.

4. If *ETo* (and/or precipitation) is calculated using station data:

    a. Description of the siting condition of the weather station.

b. List of all sensors used.

c. Description of maintenance procedures and schedules.

d. Description of the quality assurance/quality control procedures.

e. Detailed description of the equation used to estimate *ETo* and *Peff*.

5. If *ETo* is estimated using remote sensing data:

   a. The specific input data source (e.g., satellite, airborne) and image resolution.

   b. Detailed description of the methodology for deriving *ETo* from remotely sensed data.

   c. Description of how the method and data was validated and documentation of validation.

6. Description of why the alternative *ETo* (and/or precipitation) data quality and accuracy are equivalent to or better than that of DWR.

7. Certification of the alternative data by the entity that produced it.

8. A public process to provide the public an opportunity to review the alternative data and understand the purpose of the request to use alternative data.

9. Submit a request signed by the General Manager or Director of the urban retail water supplier to DWR.

Alternative Effective Precipitation Data

To request the use of alternative *Peff* data, the urban retail water supplier must demonstrate that the alternative *Peff* data meet or exceed the quality and accuracy of the *Peff* data that DWR provides by submitting a package containing the following:

1. Description of why the alternative *Peff* data meet or exceed the quality and accuracy of the DWR data.

2. Description of the source for the *Peff* data.

3. Description of the methodology used to estimate *Peff*.

4. Description of why the alternative *Peff* data meet or exceed the quality and accuracy of the DWR *Peff* data.

5. Certification of the alternative data by the entity that produced it.

6. A public process to provide the public an opportunity to review the alternative data and understand the purpose of the request to use alternative data.

7. Submit a request signed by the General Manager of the urban retail water supplier to DWR.

Interdependency of Reporting Under Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard and Certain Variances and Outdoor Residential Water Use Efficiency Standard

Relationship to ORWUS

Urban retail water suppliers are allowed to report water use from DIMs (or equivalent technologies) serving residential landscapes in the CII-DIMWUS for UWUO calculation and reporting purposes; however, the associated landscape areas and water use need to be removed from ORWUS calculation and reporting. The “Use of Alternative Data” process is not necessary for the simple subtraction of DIM (or equivalent technology) landscape area from DWR-provided residential landscape area measurement for allocation of landscape area to the CII-DIMWUS for the UWUO calculation and reporting. The “Use of Alternative Data” process is only necessary when not using the DWR residential landscape area measurement by performing the measurement independently or by modifying boundaries or data.

The potential benefits of reporting water use from DIMs (or equivalent technologies) serving residential landscapes under CII-DIMWUS are that:

- The allowable water volume calculation may be easier for the regular landscapes if the adopted *ETF* remains the same as in ORWUS.

- Where applicable, this allows for the use of SLA provisions for qualified landscapes specified in the recommended standard.

Relationship to Variances

Two variances were identified as being related to CII-DIMWUS. This does not exclude any future variances that may be identified as being associated with CII-DIMWUS. Before using a variance, an urban retail water supplier must obtain approval for use in their calculation of the UWUO from the State Water Board as described in the applicable variance reports. Urban retail water suppliers that are approved to use a variance will need to measure the associated area and remove it from the CII-DIMWUS calculation.

- **Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of TDS**. Additional water necessary to remove salt buildup from plants due to significant landscaped areas irrigated with recycled water

having high levels of TDS should be reported under the variance, if approved. Under the recommended variance, an incremental *ETF* of up to 0.26 is allowed for high TDS recycled water irrigation. The combined *ETF*, standard plus variance, is 1.26 *ETF*. If an urban retail water supplier does not qualify for the variance, recycled water use can be reported only under CII-DIMWUS as an SLA and use an *ETF* of 1.0 for those landscapes (see *Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements* [WUES-DWR-2021-09]).

- **Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife**. The second variance identified associated with CII-DIMWUS is for the significant use of water to supplement ponds and lakes including, but not limited to sustaining wildlife, recreation, or other public benefit as discussed in *Recommendations for Variance for Significant Use of Water to Supplement Ponds and Lakes to Sustain Wildlife, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-11). Water necessary to support regulatory ponds and lakes should be reported under the variance, if approved. If an urban retail water supplier does not qualify for the variance, water use can be reported under CII-DIMWUS as an SLA and use an *ETF* of 1.0 for those ponds and lakes.

Limitations

The recommended CII-DIMWUS does not set, rescind, or modify any existing laws and regulations on outdoor irrigation water use. For example, there are existing public health and safety laws for maintenance of public recreational areas such as pools.

CII-DIMWUS does not modify or change the MWELO or its implementation.

- MWELO is subject to future amendments.
- MWELO includes provisions for exempt landscapes.

5.0 Annual Reporting

Urban retail water suppliers must report all data used in or developed for calculating the UWUO and actual water use including, but not limited to:

- Aggregated *SLA* (if applicable), in square feet.
- Aggregated new CII landscape area (*CIILA_new*), in square feet.
- Aggregated CII-DIM (or equivalent technology) irrigated regular landscape area (*CIILA_r*), in square feet.
- *Peff* capped at 25 percent of modeled effective precipitation, in inches.
- *ETo,* in inches.
- *CII-DIM Delivered Water Volume for Unmeasured Landscape Areas,* in gallons (applicable through 2027, if necessary). Note: the 2027 date shown is based on a five-year implementation process and subject to being changed to be consistent with the CII classification system implementation schedule as approved by the State Water Board.

For those urban retail water suppliers choosing to use the Exempt Landscape provision of CII-DIMWUS, additional required data include:

- Aggregated exempt landscape area CII-DIM (or equivalent technology) water use volume, in gallons.

To ensure data accuracy, urban retail water suppliers must also provide a detailed description of the method(s) used to identify CII-DIMs (or equivalent technologies), locate CII-DIMs (or equivalent technologies), and obtain landscape area measurement data in their first Annual Water Use Report and subsequent reports if methods change. This description must include:

- Description of the process used to identify and verify CII-DIM (or equivalent technology) accounts.
- Description of the process used to geolocate or otherwise map and verify CII-DIMs (or equivalent technologies) locations.
- Description of the CII-DIM (or equivalent technology) irrigated landscape area measurement and verification methods.
- Confirm, for each site, that the irrigated landscape area is not irrigated with a mixed-use meter.

  - In cases where both DIM(s) (or equivalent technology) and mixed-use meter(s) are used for CII landscape irrigation, the urban retail water supplier will need to measure the portion of CII landscape irrigated by the DIM(s) (or equivalent technology).

- Description of methods or process used to identify SLAs and Exempt Landscape DIMs (or equivalent technologies). Include the basis for designating the CII landscape area as an SLA.

- Data collection and verification process or procedures, including, but not limited to: documentation and records retention; update process; and, follow-up procedures (if necessary).

Map(s), satellite image(s), or aerial image(s) showing the location of *CIILA_r,* SLA, and *CIILA_new;* documentation of methods and data supporting the CII-DIM (or equivalent technology) identification, location, landscape area measurement; and landscape area data verification do not have to be included in the report but should be available upon request and retained for the period the data is used plus three years.

Urban retail water suppliers have up to five years after State Water Board adoption to complete mapping of accounts to the recommended CII water use classification system and DIM (or equivalent technology) landscape measurement for annual reporting purposes.

- If an urban retail water supplier does not meet the annual 20 percent mapping requirement, the urban retail water supplier is to include in its Annual Water Use Report an explanation and its plan to meet the full mapping requirement by Year 5.

- Should an urban retail water supplier experience a substantial hardship meeting the minimum level of progress, by Year 3, the urban retail water supplier will provide an implementation plan to meet the full mapping requirement. That implementation plan will be subject to State Water Board approval.

- For any landscape area measurement processes that does not follow the initial process identified in the first Annual Water Use Report, DWR recommends that the subsequent Annual Water Use Report include a description of any changes or updates to data collection and verification processes.

6.0 Glossary

The following key terms are listed below for easy reference. Where applicable, existing definitions from statutes and regulations are provided.

bioengineered slope. A slope designed and constructed with live vegetation as an integral component of stability.

California Irrigation Management Information System. A network of automated weather stations that are owned and operated cooperatively between the California Department of Water Resources and local agencies. The stations are installed in most of the agricultural and urban areas in the State of California and provide farm and large landscape irrigation managers and researchers with “real time” weather data to estimate reference evapotranspiration use to estimate crop and landscape evapotranspiration rates and make irrigation management decisions.

commercial, industrial, and institutional water use. Water used by commercial water users, industrial water users, institutional water users, and large landscape water users, as defined in California Water Code Section 10608.12(d).

commercial water user. A water user that provides or distributes a product or service, as defined in California Water Code Section 10608.12(e).

dedicated irrigation meter. A meter used only for irrigation of outdoor landscape areas. However, a mixed-use meter with no more than five percent of total delivered water serving non-landscape irrigation purposes can also be considered a dedicated irrigation meter for the purpose of the urban water use objective and actual water use calculations and reporting.

equivalent technology. Any other device or process that is not a dedicated irrigation meter, which measures the volume of water delivered to the landscape and reports directly to the urban retail water supplier, on the same time interval as service area dedicated irrigation meters, and with the same accuracy as service area dedicated irrigation meters such that it can be used for billing purposes if an urban retail water supplier chooses to do so.

evapotranspiration. The amount of water transpired by plants, retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces.

evapotranspiration factor. An adjustment factor when applied to reference evapotranspiration that adjusts for plant factors and irrigation efficiency which are two major influences upon the amount of water that needs to be applied to the landscape.

high levels of total dissolved solids. For the purposes of variance development, high levels of total dissolved solids in recycled water were defined as between 900 and 1,600 milligrams per liter.

industrial water user. A water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development, as defined in California Water Code Section 10608.12(i).

institutional water user. A water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions, as defined in California Water Code Section 10608.12(j).

irrigable-irrigated land. A landscape area of healthy vegetation where the vegetation appears to be in growth, not senesced, and is foliated. The area is presumed to be maintained and managed through active irrigation.

irrigation efficiency. The efficiency of water application and use, calculated by dividing a portion of applied water that is beneficially used by the total applied water, expressed as a percentage. The two main beneficial uses are crop water use (evapotranspiration) and leaching to maintain a salt balance.

large landscape. A nonresidential landscape as described in the performance measures for commercial, industrial, and institutional water use adopted pursuant to California Water Code Section 10609.10, as defined in California Water Code Section 10808.12(l).

material effect. Having real importance or great consequences. In the context of California Department of Water Resources' recommendations regarding the urban water use objective and variances, a material effect is an effect on the urban water use objective that could influence the compliance status of an urban retail water supplier.

performance measures. Actions to be taken by urban retail water suppliers that will result in increased water use efficiency by commercial, industrial, and institutional water users. Performance measures may include, but are not limited to, educating commercial, industrial, and institutional water users on best management practices, conducting water use audits, and preparing water management plans. Performance measures do not apply to process water, as defined in California Water Code Section 10608.12(n).

recycled water. Water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource, as defined in California Water Code Section 13050(n), as defined in California Water Code Section 10608.12(q).

reference evapotranspiration. The evapotranspiration rate from an extended surface of 3- to 6-inch-tall (8- to 15-centimeter-tall) green grass cover of uniform height, actively growing, completely shading the ground, and not short on water (the reference evapotranspiration rate reported by the California Irrigation Management Information System).

Special Landscape Area. An area of the landscape dedicated solely to edible plants, areas irrigated with recycled water, water features using recycled water and areas dedicated to active play such as parks, sports fields, golf courses, and where turf provides a playing surface, as defined in California Code of Regulations, Title 23, Section 491(iii).

total dissolved solids. The inorganic salts, metals, and minerals present in water. This term is usually expressed in parts per million or milligrams per liter.

urban retail water supplier. A water supplier, either publicly or privately owned, that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually at retail for municipal purposes, as defined in California Water Code Section 10608.12(t).

urban water use efficiency standards. The standards effective through California Water Code Section 10609.4 (indoor residential use) or adopted by the State Water Resources Control Board (outdoor residential, water loss, and commercial, industrial, and institutional outdoor irrigation of landscape areas with dedicated meters) pursuant to California Water Code Section 10609.2.

urban water use objective. An estimate of aggregate efficient water use for the previous year based on adopted water use efficiency standards and local service area characteristics for that year, as described in California Water Code Section 10609.20, as defined in California Water Code Section 10608.12(u).

variances. Allowable volumes of water that can be added to the urban water use objective for efficient unique uses of water that could have a material effect on the urban water use objective.

water loss. The total of apparent loss and real loss (California Code of Regulations, Title 23, Section 638.1(a) and Section 638.1(k), respectively) in an urban retail water supplier's system. Apparent loss means loss due to unauthorized consumption and/or nonphysical (paper) loss attributed to inaccuracies associated with customer metering or systematic handling errors. Real loss means the physical water loss from the pressurized potable water system and the urban retail water supplier's potable water storage tanks, up to the point of customer consumption.

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Appendix A – Urban Water Use Efficiency Recommendation Package Reports Incorporated by Reference

DWR (California Department of Water Resources). September 2022. Recommendations for Urban Water Use Efficiency Standards, Variances, Performance Measures, and Annual Water Use Reporting. DWR Report Number: WUES-DWR-2021-01A.

DWR (California Department of Water Resources). September 2022. Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective. DWR Report Number: WUES-DWR-2021-01B.

DWR (California Department of Water Resources). September 2022. Recommendations for Outdoor Residential Water Use Efficiency Standard. DWR Report Number: WUES-DWR-2021-02.

DWR (California Department of Water Resources). September 2022. Landscape Area Measurements Final Project, Report EA-133C-16-CQ-0044. DWR Report Number: WUES-DWR-2021-02.T1.

DWR (California Department of Water Resources). September 2022. Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard. DWR Report Number: WUES-DWR-2021-03.

DWR (California Department of Water Resources). September 2022. Summary of Recommendations for Variances. DWR Report Number: WUES-DWR-2021-04.

DWR (California Department of Water Resources). September 2022. Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements. DWR Report Number: WUES-DWR-2021-09.

DWR (California Department of Water Resources). September 2022. Recommendations for Variance for Significant Use of Water for Dust Control for Horse Corrals and Animal Exercising Arenas, Methods of Calculation, and Supporting Data Requirements. DWR Report Number: WUES-DWR-2021-10.

DWR (California Department of Water Resources). September 2022. Recommendations for Variance for Significant Use of Water to Supplement

Ponds and Lakes to Sustain Wildlife, Methods of Calculation, and Supporting Data Requirements. DWR Report Number: WUES-DWR-2021-11.

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