

**Recommendations for Dedicated Irrigation Meter Conversion
Threshold for Commercial, Industrial, and Institutional Outdoor
Irrigation Water Use Performance Measure**

WUES-DWR-2021-18

**A Report to the State Water Resources Control Board
Prepared Pursuant to California Water Code
Section 10609.10**

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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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Abbreviations and Acronyms

2013 CII Task Force Report	2013 Commercial, Industrial, and Institutional Task Force Water Use Best Management Practices Report to the Legislature
2018 Legislation	2018 Legislation on Water Conservation and Drought Planning (Senate Bill 606 [Hertzberg] and Assembly Bill 1668 [Friedman], as amended)
AB	Assembly Bill
ACWA	Association of California Water Agencies
APN	assessor's parcel number
AWWA	American Water Works Association
BMP	best management practice
CaWEP	California Water Efficiency Partnership
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CII	commercial, industrial, and institutional
CII-BMP	commercial, industrial, and institutional water use best management practice
CII-BMPs Performance Measure	Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure
CII Classification System PM	Commercial, Industrial, and Institutional Water Use Classification System Performance Measure
CII-DIMWUS	Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard
Conversion Threshold PM	Conversion Threshold Performance Measure
CPUC	California Public Utilities Commission
CUWA	California Urban Water Agencies
CUWCC	California Urban Water Conservation Council (now the California Water Efficiency Partnership)
CWA	California Water Association
DIM	dedicated irrigation meter

DWR	California Department of Water Resources
ET _o	reference evapotranspiration
gpcd	gallons per capita per day
gpy	gallons per year
HOA	homeowners association
In-Lieu Technologies	in-lieu technologies recommended under the In-Lieu Technologies Performance Measure
In-Lieu Technologies PM	In-Lieu Technologies Performance Measure
IRWUS	Indoor Residential Water Use Efficiency Standard
Legislature	California State Legislature
MAWA	maximum applied water allowance
MWELO	Model Water Efficient Landscape Ordinance
NAICS	North American Industry Classification System
ORWUS	Outdoor Residential Water Use Efficiency Standard
Recommendation Package	Urban Water Use Efficiency Recommendation Package
ROI	return on investment
SB	Senate Bill
SLA	Special Landscape Area
State	State of California
State Water Board	State Water Resources Control Board
UWUO	urban water use objective
WC	California Water Code
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 10609.10, 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 performance measures for commercial, industrial, and institutional (CII) water use for the State Water Board’s adoption. Among other things, these performance measures include a Conversion Threshold Performance Measure (Conversion Threshold PM) that sets minimum size thresholds for converting mixed-use CII meters to dedicated irrigation meters (WC Section 10609.10).

DWR developed the recommendations for the Conversion Threshold PM based on the legislative directive. In particular, the WC also requires the recommended CII water use performance measures to be consistent with *Commercial, Industrial, and Institutional Task Force Water Use Best Management Practices Report to the Legislature* (DWR, 2013a and 2013b). The technical and financial feasibility recommendations provided in that report are aimed at supporting the economic productivity of the State of California’s (State) CII sectors (WC Section 10609.10(c)). The documentation of the implementation of the CII water use performance measures, including the Conversion Threshold PM, is required in the urban retail water supplier’s Annual Water Use Report filing (WC Section 10609.24(a)(3)). However, quantification of water use per category is not required as the associated CII water use is excluded in the quantification reporting per provisions related to the urban water use objective.

Consistent with the legislative directive, DWR used a public process involving a diverse group of stakeholders in the review and development of the Conversion Threshold PM. 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 development process for the CII water use performance measures. Additional stakeholders included State 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 suitability and practical application of the recommended Conversion Threshold PM. Their input informed development and refinements for the applicable scope, specific thresholds for determining “large CII landscapes,” and performance measures for implementation by urban retail water suppliers. Technical feasibility, financial considerations, and associated economic

effects on CII sectors were also considered during the development process. In responding to stakeholder input, DWR incorporated the consideration of the limited authority urban retail water suppliers may have to unilaterally implement certain actions without explicit cooperation from CII water users in formulating performance measures. DWR, through extensive review of literature, survey information, and stakeholder engagement, explored implementation considerations and potential effects on urban retail water suppliers to inform the technical and financial feasibility of implementing the Conversion Threshold PM.

Based on the research, technical studies, and stakeholder feedback, DWR recommends a Conversion Threshold PM that is based on a measurement of the irrigated landscape area associated with the mixed-use meter, measured on a per parcel basis. For efficiency in streamlining the implementation, DWR also recommends that the schedule for implementing the Conversion Threshold PM be coordinated with implementing the Commercial, Industrial, and Institutional Water Use Classification System Performance Measure; Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure; and Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard, and that implementation be completed within five years after the State Water Board adopts the regulation.

DWR's recommendations for the Conversion Threshold PM are included in the report, *Summary of Recommendations for Performance Measures for Commercial, Industrial, and Institutional Water Use* (WUES-DWR-2021-15), along with other recommendations on CII water use performance measures for coordinated implementation, which DWR prepared per the requirements of the 2018 Legislation and that are to be transmitted to the State Water Board for adoption. DWR's recommendations for the Conversation Threshold PM and associated annual reporting requirements are also included in the report, *Recommendations for Urban Water Use Efficiency Standards, Variances, Performance Measures, and Annual Water Use Reporting* (WUES-DWR-2021-01A), which provides the complete context of the Urban Water Use Efficiency Recommendation Package and its implementation.

1.0 Introduction

Senate Bill (SB) 606 (Hertzberg) and Assembly Bill (AB) 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. This 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 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 technologies) 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 (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 the State, 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, when not excluded from an urban retail water supplier's UWUO, could unfairly jeopardize the ability of an urban retail water supplier to comply with the UWUO calculated using the standards adopted per the 2018 Legislation.

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)).

Not all urban water uses are included in the UWUO. The 2018 Legislation includes considerations to manage CII water use separately, because CII water use can be complex and diverse and have direct connections to economic productivity. Additionally, there is currently insufficient information available to properly set standards or variances for CII water use, if even feasible, as there is for other categories of urban water use (e.g., indoor residential and outdoor residential). However, progress should still be made to improve CII water use efficiency. Therefore, the 2018 Legislation requires that DWR develop recommendations on performance measures for CII water use other than water use for CII outdoor irrigation of landscape areas with DIMs (already included as one of the standards) and process water (excluded from both the UWUO and CII water use performance measures). More detailed discussion is provided in Section 1.2.

This performance measure approach for CII water use in the 2018 Legislation is different from the previous SB X7-7 requirements. The SB X7-7 water conservation framework required urban retail water suppliers to set conservation targets in gallons per capita per day (gpcd) and accounted for CII water use in a lumped reduction format with process water excluded. However, reporting CII water use in gpcd could be misleading, because CII water use may not have a direct correlation to the number of permanent residents in the service area. Reporting CII water use in gpcd or other metrics without the context of associated economic activities is not effective for showing progress in increased CII water use efficiency; efficient water uses of different CII-related economic activities can vary significantly in volume depending on a number of factors. Therefore, urban retail water suppliers are often required to provide additional justifications or description for CII water use efficiency that cannot be demonstrated by using gpcd statistics or other metrics, including factors that may hinder the anticipated progress, such as lack of authority to unilaterally implement improvements or best management practices (BMP) without explicit cooperation of CII water users.

Under the 2018 Legislation, urban retail water suppliers are not required to report the volume of CII water use, except for the outdoor irrigation water use under CII-DIMWUS. However, urban retail water suppliers are required to report the performance measures in their Annual Water Use Report, including the actions they take to improve CII water use efficiency and associated outcomes. This more granular approach to improving CII water use efficiency is consistent with the approach to the volumetric reporting requirements under the UWUO and provides an opportunity for understanding the causations between performance measure actions and resulting water use efficiency improvements.

1.2 Commercial, Industrial, and Institutional Water Use Performance Measures

Following the 2012 to 2016 drought, the State reevaluated its water use practices and resolved to prioritize long-term water conservation and drought planning. In a broader sense, the 2018 Legislation calls for increased water conservation and more efficient use of water. In particular, WC Section 10608(e) states, “The success of [S]tate and local water conservation programs to increase efficiency of water use is best determined on the basis of measurable outcomes related to water use or efficiency.” Providing measurable outcomes of increased water use efficiency requires evaluation of baseline water use for comparative purposes. However, recognizing that the diverse conditions preclude determination of baseline water use for varying water use in CII sectors in the State, the 2018 Legislation requires DWR to make recommendations on CII water use performance measures for CII water uses other than outdoor irrigation for landscapes with DIMs (or equivalent technologies).

In the context of CII water use, recommendations on sustainable water use and demand reduction performance measures must “[s]upport the economic productivity of California’s agricultural, commercial, and industrial sectors” (WC Section 10608.4(j)), but that “...does not require a reduction in the total water used in the agricultural or urban sectors, because other factors, including, but not limited to, changes in agricultural economics or population growth may have greater effects on water use. This part does not limit the economic productivity of California’s agricultural, commercial, or industrial sectors” (WC Section 10608.8(c)).

DWR was required to conduct necessary studies and investigations and make recommendations on performance measures for CII water use to the State Water Board for its adoption by no later than October 1, 2021, as specified in AB 1668 and codified in WC Section 10609.10. In this context, “CII water use” means water used by commercial water users, industrial water users, institutional water users, and large landscape water users (WC Section 10608.12(d)), with the following supporting definitions.

- *“Commercial water user” means a water user that provides or distributes a product or service (WC 10608.12(e)).*
- *“Industrial water user” means 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 (WC 10608.12(i)).*
- *“Institutional water user” means 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 (WC 10608.12(j)).*
- *“Large landscape” means a nonresidential landscape as described in the performance measures for CII water use adopted pursuant to Section 10609.10 (WC 10608.12(l)).*

In addition, per WC Section 10608.12(n), “performance measures” are:

...actions to be taken by urban retail water suppliers that will result in increased water use efficiency by CII water users. Performance measures may include, but are not limited to, educating CII water users on best management practices, conducting water use audits, and preparing water management plans. Performance measures do not include process water.

Furthermore, per WC Section 10608.12(p), “process water” means:

...water used by industrial water users for producing a product or product content or water used for research and development. Process water

includes, but is not limited to, continuous manufacturing processes, and water used for testing, cleaning, and maintaining equipment. Water used to cool machinery or buildings used in the manufacturing process or necessary to maintain product quality or chemical characteristics for product manufacturing or control rooms, data centers, laboratories, clean rooms, and other industrial facility units that are integral to the manufacturing or research and development process is process water. Water used in the manufacturing process that is necessary for complying with local, [S]tate, and federal health and safety laws, and is not incidental water, is process water. Process water does not mean incidental water uses.

As previously mentioned, except for landscape irrigation with DIMs (or equivalent technologies) in connection with CII water use, CII water use is not part of the UWUO that urban retail water suppliers need to report quantitatively in their respective Annual Water Use Reports. Water use efficiency in CII sectors is instead addressed through implementation of CII water use performance measures. The 2018 Legislation directs DWR to develop and recommend CII water use performance measures that include the following:

- CII water use classification system to address significant uses of water.
- Minimum size threshold for converting mixed-use CII meters to DIMs or in-lieu technologies.
- BMPs, which may include, but are not limited to, water audits and water management plans for CII customers above a certain size, volume of use, or other thresholds.

The 2018 Legislation further requires that DWR's recommended CII water use performance measures be consistent with *Commercial, Industrial, and Institutional Task Force Water Use Best Management Practices Report to the Legislature* (DWR, 2013a and 2013b) (WC Section 10609.10(c)), hereinafter referred to as the "2013 CII Task Force Report." The Task Force consisted of stakeholders and experts convened by DWR and the California Urban Water Conservation Council, which is now the California Water Efficiency Partnership (CUWCC, now CalWEP), to develop BMPs for CII water users, as directed by WC Section 10608. The following recommendations by the Task Force (DWR, 2013a) are particularly relevant to the development of CII water use performance measures:

Recommendation 5-7: DWR should work with the Association of California Water Agencies (ACWA), CUWCC [now CalWEP], California Urban Water Agencies (CUWA), California Public Utilities Commission (CPUC), California Water Association (CWA), and American Water Works

Association (AWWA) to develop a full-spectrum, water-centric standardized classification system of customer categories. This classification system should include consistent use of North American Industry Classification System (NAICS) codes and assessors' parcel numbers (APNs).

Recommendation 5-8: *DWR, in consultation with a stakeholder advisory committee and through a public process, should develop a system and implementation plan for water production, delivery, and use data collection for classification and for reporting and tracking at the user, water service provider, [S]tate, and federal levels. One or more of the following options should be considered.*

- **Option 5-8.1:** *DWR should develop a water-centric water use and user classification system.*
- **Option 5-8.2:** *Water service providers should classify water users using a common classification system and transition their customer databases to incorporate this system.*
- **Option 5-8.3:** *Water service providers should consider recording and maintaining key data fields, such as assessor's [sic] parcel numbers for customers. This would enable the linking of water usage data with information from other sources for purposes of metrics, water demand analysis, and demand projections.*
- **Option 5-8.4:** *Water service providers and self-supplied water users meeting defined criteria should be required to report water use to the [S]tate.*
- **Option 5-8.5:** *Water service providers, CUWCC [now CalWEP], and water users should expand on landscape irrigation water use categorizations that recognize and promote BMPs for separate metering, especially for larger and mixed use sites.*

Recommendation 6-3: *Water and energy service providers should incorporate water audits into their efficiency programs, consider financial incentives for BMP implementation, and provide other technical assistance as appropriate.*

Recommendation 6-4: *Organizations representing businesses and industry, water service providers, the CUWCC [now CalWEP], other interested parties, and DWR should educate CII water users or entities on the BMPs and approaches to doing audits and performing a cost-effectiveness analysis.*

The "Recommendations" section (Section 5.2) of the 2013 CII Task Force Report states:

This section does not currently recommend any single metric for use in all CII sectors.

Furthermore, the CII Task Force cautions against setting regulatory minimum standards for water use efficiency metrics that would be applicable to specific CII establishments, sectors, or subsectors. Even within subsectors, it would be difficult to set uniform standards across CII establishments (defined as individual CII water user sites) because of the variability in the types of products made or services provided and the many confounding factors in how water is used.

The 2013 CII Task Force Report presents the following option for further study or action to improve data collection and reporting. This option is specifically related to the development of a water use and user classification system (DWR, 2013b):

Option 1: *DWR should develop a water use and user classification system. The system should comprehensively address all sectors of water use, not just CII water users. The system should be designed for all water use establishments to be classified using a full-spectrum water-centric coding system integrated with national, [S]tate, regional, and local goals and objectives for water resources planning and management. The classification system should include common definitions for water use sectors for consistent aggregation of data. Consideration should be given to using a commonly accepted coding system, such as NAICS, as a basis for definitions.*

Section 7.3.5 of Volumes I and II of the 2013 CII Task Force Report provides recommendations for large landscape BMPs (DWR, 2013a and 2013b).

Per WC Section 10609.10(d)(1), the State Water Board, in coordination with DWR, must adopt the performance measures on or before June 30, 2022. Documentation of the implementation of CII water use performance measures, including progress and implementation of a performance measure for setting a minimum size threshold for converting mixed-use CII meters to DIMs (or equivalent technologies), is required in the urban retail water supplier's Annual Water Use Report filing (WC Section 10609.24(a)(3)).

1.3 Purpose of the Report

Per legislative requirements and with stakeholder engagement, DWR conducted studies and investigations to develop and recommend CII water use performance measures for adoption by the State Water Board. This report focuses on the Conversion Threshold Performance Measure (Conversion Threshold PM) that sets minimum size thresholds for converting mixed-use CII meters to DIMs (or equivalent technologies) or to

acceptable in-lieu technologies, and is one of three performance measure-specific reports produced by DWR per requirements of the 2018 Legislation. Refer to the report, *Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* (WUES-DWR-2012-19), for a comprehensive definition and discussion of acceptable in-lieu technologies.

Commercial, Industrial, and Institutional Water Use for Landscape Irrigation

Large landscape irrigation may be served by one or more DIMs, one or more mixed-use meters (whereby both CII indoor water use and irrigation water use are measured by one meter), or a combination of the two. Water use on large landscapes can be significant, and there are opportunities to increase water use efficiency for large, irrigated landscapes served by mixed-use meters.

While this report provides DWR's recommendations for the development of the Conversion Threshold PM for large landscape areas, it does not define the term "large landscape." Rather, the Conversion Threshold PM ultimately adopted by the State Water Board will need to define this term, per WC 10608.12(I). Recommendations from the 2013 CII Task Force Report relevant to the Conversion Threshold PM are included in Section 3.3 of this report.

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 Dedicated Irrigation Meter Conversion Threshold for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* (WUES-DWR-2021-18), provides the detailed documentation for the review and subsequent development of specifications, guidelines, and methodologies for the Conversion Threshold PM. The recommendations for the Conversion Threshold PM were summarized in the report, *Summary of Recommendations for Performance Measures for Commercial, Industrial, and Institutional Water Use* (WUES-DWR-2021-15), along with other performance measures for coordinated implementation. The additional context, performance measure

development process and approach, evaluation of options, and stakeholder input included in this document are incorporated by reference. The recommendations for the Conversion Threshold PM and associated annual reporting requirements are also included in the report, *Recommendations for Urban Water Use Efficiency Standards, Variances, Performance Measures, and Annual Water Use Reporting* (WUES-DWR-2021-01A), which provides the complete context of the Recommendation Package and its implementation. 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 Laws and Regulations

DWR developed the recommendations on the Conversion Threshold PM pursuant to legislative directive. The recommended Conversion Threshold PM does not rescind or modify existing or future requirements or authorities for implementing DIMs for CII landscape irrigation.

1.4 Report Organization

This report is organized into six sections:

- **Section 1 – Introduction** provides the background and purpose of this document.
- **Section 2 – Scope Definition** provides the process and rationales used in defining the scope for this performance measure that reflects alternative compliance pathways.
- **Section 3 – Approach** describes the technical approach and stakeholder engagement that DWR conducted to support performance measure development, and those specifically applied to the Conversion Threshold PM.
- **Section 4 – Recommendations for Conversion Threshold Performance Measure** provides DWR’s recommendations for the specifications, guidelines, and methodologies for this performance measure.
- **Section 5 – Glossary** provides a list of key terms and their definitions used in this document.
- **Section 6 – References** provides a list of references used in this document.

This report includes one appendix:

- **Appendix A** provides the list of documents in DWR's Recommendation Package that are incorporated by reference.

2.0 Scope Definition

Per WC Section 10609.10, DWR conducted studies and investigations, solicited stakeholder participation, and ensured consistency with the 2013 CII Task Force Report in developing the information necessary to make a recommendation on the Conversion Threshold PM to the State Water Board:

(a) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, performance measures for CII water use for adoption by the board in accordance with this chapter.

(b) Prior to recommending performance measures for CII water use, the department shall solicit broad public participation from stakeholders and other interested persons relating to all of the following: [...]

(2) 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. [...]

(c) Recommendations of appropriate performance measures for CII water use shall be consistent with the October 21, 2013, report to the Legislature by the Commercial, Industrial, and Institutional Task Force entitled “Water Use Best Management Practices,” including the technical and financial feasibility recommendations provided in that report, and shall support the economic productivity of California’s commercial, industrial, and institutional sectors.

DWR’s studies and investigations included a literature review and data analysis, stakeholder engagement and identifying a performance measure for implementation of a conversion threshold for converting mixed-use meters to DIMs (or equivalent technologies) or in-lieu technologies.

Consistent with the WC, extensive stakeholder outreach was conducted for developing the recommendations on the Conversion Threshold PM, with incorporation of feedback and experience provided by urban retail water suppliers and stakeholders. Implementation challenges were also identified.

DWR’s goals in conforming to WC Section 10609.10 were to:

- Inform the recommendation for a minimum size threshold for converting mixed-use meters to DIMs (or equivalent technologies).

- Provide the basis for alternative compliance pathways (i.e., implementing in-lieu technologies).

2.1 Roles in Implementation of Commercial, Industrial, and Institutional Water Use Landscape Irrigation Meter Conversion

The conversion of mixed-use meters to DIMs (or equivalent technologies) or in-lieu technologies is to be implemented by CII water users in coordination with the urban retail water supplier. The 2013 CII Task Force Report recognized that implementation of specific CII-BMPs, such as DIMs (or equivalent technologies) or in-lieu technologies, are subject to particular considerations that include the following (DWR, 2013b):

*1. **One size does not fit all** – For any given CII sector, subsector, or entity, there may be a dozen potential BMPs. Not all will be applicable. In many cases establishing one BMP could mean that another will not be applicable because they will “be saving the same water.”*

*2. **Every facility is unique** – Analysis of potential payback is unique to each facility and situation. Facilities, even in the same CII sector, vary in their process, equipment selection, and design. This means that what may work at one vegetable processing plant may not be applicable at another; what works in one research laboratory or hotel may not be applicable in another.*

*3. **The BMPs in this document should be used only as a guide** – The intent of this report is to provide a compendium of BMPs that are possible measures that CII entities can adopt for their specific situation.*

CII water users often consider the business case for implementing specific CII-BMPs, such as DIMs (or equivalent technologies) or in-lieu technologies. A frequent consideration is the payback period – how long it takes for cost savings (e.g., reduction in water and wastewater charges) to exceed the initial up-front costs. An additional consideration may be the available staffing resources for implementation or maintenance, even for certain CII-BMPs with a favorable return on investment (ROI). In addition, sometimes, property owners may restrict certain changes for different reasons. However, there may also be conditions where CII water users or property owners may implement certain CII-BMPs in exchange for other benefits that may not be related to direct revenues or profits. A number of CII-BMPs that can be implemented by water users, along with associated implementation challenges, are included in the technical report, *Best Management Practices for Improving Efficiency in Commercial, Industrial,*

and Institutional Water Use: Key Successes and Challenges in California (WUES-DWR-2021-16.T1).

Commercial, Industrial, and Institutional Water Users

CII water users and property owners have a role in managing their landscape water use efficiently. DIMs (or equivalent technologies) or in-lieu technologies can help the CII water user or property owner improve landscape water use efficiency. However, a DIM, in the context of this performance measure, cannot be unilaterally implemented by the CII water user or property owner; approval by and cooperation with the urban retail water supplier is necessary, because a DIM is tied directly into the urban retail water supplier's distribution and reporting system and, as such, is subject to the urban retail water supplier's approval.

There is often an associated cost to the CII water user or property owner with implementing a DIM (or equivalent technology) or in-lieu technologies, such as the initial construction costs, water bill meter fee (for a DIM), long-term maintenance costs (for in-lieu technologies), and, potentially, other costs. Therefore, implementation of a DIM (or equivalent technology) or in-lieu technologies requires approval by and cooperation with the CII water user or property owner. As noted above, the CII water user or property owner will consider the business case for implementation, including ROI and the cost of implementing the meter conversion or implementing in-lieu technologies.

Urban Retail Water Suppliers

Urban retail water suppliers have a role to assist and incentivize implementation of CII landscape water use BMPs such as DIMs (or equivalent technologies) or in-lieu technologies. However, they often lack proper authority to implement DIMs (or equivalent technologies) or in-lieu technologies without explicit cooperation from CII water users or property owners; CII water users or CII property owners retain the right to decide on actions taken on their properties, subject to specific regulatory requirements, and they are responsible for all or a portion of the associated cost.

The mixed-use meter conversion must be implemented in coordination with and approval by the CII water users or property owners. However, the 2018 Legislation does not directly impose standards and requirements on individual residents or CII water users; rather, the legislative directive requires DWR to develop performance measures that identify "actions to be taken by urban retail water suppliers that will result in increased water use efficiency by CII water users" (WC Section 10608.12(n), as discussed further below. In this context, actions taken by urban retail water suppliers to: (1) identify large landscape areas exceeding the conversion threshold irrigated with mixed-use meters, and (2) incentivize, encourage, or assist CII water users or property owners in implementing the meter conversion could be considered for performance measures.

It should be noted that it is possible that an equivalent technology could be unilaterally implemented by an urban retail water supplier. Equivalent technology, as defined in *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* (WUES-DWR-2021-03), means it is functionally equivalent to a DIM. While DWR is not aware at this time of an equivalent technology substantially similar to a DIM, DWR is not precluding that such a technology could exist in the future (e.g., a technology that could be used on a time scale and with an accuracy similar to a DIM, whereby water use could be measured for billing purposes). Therefore, DWR acknowledges that should a technology equivalent to a DIM become available, an urban retailer water supplier could unilaterally implement it.

2.2 Threshold Considerations

WC Section 10609.10 requires DWR to recommend setting a minimum size threshold for converting mixed-use meters to DIMs (or equivalent technologies) or implementing in-lieu technologies. However, the WC does not specifically define what is meant by “size” in this context. Therefore, DWR considered a threshold based on the amount of water used, pipe size, and irrigated landscape area. The following provides a summary of the thresholds DWR considered and the rationales supporting the use of a threshold based on the size of the irrigated landscape area.

Volumetric Threshold

A conversion threshold based on a specific volume of water use, above which conversion would be required, could provide a means to target those landscapes with high water use for either conversion to a DIM (or equivalent technology) or for implementation of in-lieu technologies to achieve landscape water use efficiency. While it may be attractive to target high water use landscapes, there are several challenges with this approach:

1. High water use does not necessarily mean inefficient water use.
2. A volumetric threshold would require urban retail water suppliers to estimate the amount of water used for each CII landscape in their service area that is irrigated with mixed-use meters.
 - This would be an onerous burden on urban retail water suppliers, because they would have to calculate water use volumes for each CII landscape. To calculate the estimated volume of irrigation water use and, thus, determine if a conversion is required, urban retail water suppliers would need to have a specific understanding of the conditions that affect the volume of water use for each CII landscape, including local climate conditions, the diversity and

- quantity of plant types within existing CII landscapes, and irrigation system efficiencies, as well as information about the CII indoor water use.
- If urban retail water suppliers could estimate these water use volumes with acceptable accuracy, they could also report outdoor water use and its efficiency, even without a DIM, thereby making the conversion of the mixed-use meter unnecessary.
3. A statewide volumetric conversion threshold would result in disproportionate conversion requirements, depending on local climate conditions. Under the principles of the Model Water Efficient Landscape Ordinance (MWELO) design standard (California Code of Regulations [CCR], Title 23, Sections 490 through 495), calculated efficient landscape irrigation volume varies depending on the location, even when all other factors remain the same. The MWELO design standard maximum applied water allowance (MAWA) (CCR, Section 491(tt)) can be used to compare efficient landscape irrigation requirements for landscape in different climate zones statewide, with all other factors remaining the same. MAWA is the upper limit of annual allowable applied water for a water efficient established landscape and is based on the landscape area, reference evapotranspiration (*ET_o*), and evapotranspiration factor in MWELO design standard on the parcel level. For example, MAWA calculated for a representative 20,000-square-foot landscape area with the same plant types, but in different climate zones, shows the range of annual applied water for the established landscape area, as specified in MWELO Section 492.4, for efficient water use:
- Eureka, CA: MAWA = 153,450 gallons per year (gpy), where *ET_o* is 27.50 inches.
 - Roseville, CA: MAWA = 291,240 gpy, where *ET_o* is 52.20 inches.
 - El Centro, CA: MAWA = 455,850 gpy, where *ET_o* is 81.70 inches.

This example indicates that a volume threshold would be unequally applied across the State simply because of local climate conditions; an average volume threshold could result in inefficient water use in Eureka and would not be sufficient to support an efficient landscape in El Centro.

4. A volumetric threshold is inconsistent with the WC, which specifically requires a size threshold. The subsequent WC section (WC Section 10609.10(b)(3)) differentiates between a size, volume, or other threshold, indicating that volume is not considered a 'size' threshold. Therefore, a volumetric threshold is not considered further in DWR's recommendations for this performance measure.

Pipe Size Threshold

A conversion threshold based on pipe size was considered, because pipe size and pressure are directly related to the maximum volume of water that can be delivered to customers. In theory, larger, mixed-use pipe sizes could provide more water to irrigated landscapes. However, using mixed-use pipe size as the conversion threshold has some significant drawbacks:

1. Water use measured at the mixed-use meter includes both indoor water use and landscape irrigation, and larger pipe sizes may be needed for indoor use, not landscape use.
2. Pipe size and the maximum volume of water the pipe can deliver has little correlation to CII landscape water use efficiency, even if the majority of water is delivered to the landscape.
3. Pipe size can have little correlation to actual water use (indoor or outdoor), because pipes can be sized for many other purposes, such as pressure regulation, fire flow requirements, other codes and ordinances (e.g., health and safety requirements), and other requirements specific to the CII business practice(s).

Because a minimum pipe size conversion threshold for mixed-use CII meters cannot properly account for the range of diverse CII business practices associated with mixed-use meters and has a low correlation to landscape water use, a pipe size threshold is not considered further in DWR's recommendations for the performance measure.

Landscape Area Size Threshold

A mixed-use meter conversion threshold based on the size of irrigated landscape area is the most feasible approach for urban retail water suppliers to implement and is consistent with WC Section 10609.10. Additionally, as noted in Section 1.2, WC Section 10608.12(l) defines a "large landscape" as non-residential landscape as described in relationship to the performance measures for CII water use adopted pursuant to WC Section 10609.10.

A landscape area size threshold can be universally applied statewide and does not require complicated data collection or water use calculations. However, this threshold does require measurement of each individual CII irrigated landscape area in order to identify those landscapes that are above the conversion threshold.

There are some relevant landscape size threshold references in State legislation that DWR considered in its development of the conversion threshold. Some established criteria for implementing DIM requirements are based on landscape size:

- MWELO includes requirements for efficient water use on existing landscapes that exceed 1 acre.
- MWELO requires that new water service for CII customers with greater than 1,000 square feet of irrigated landscape area install a DIM or private submeter for landscape irrigation. CCR, Title 23, Section 492.7(a)(1)(A) requires the following:

Landscape water meters, defined as either a dedicated water service meter or private submeter, shall be installed for all non-residential irrigated landscapes of 1,000 [square feet] but not more than 5,000 [square feet] (the level at which Water Code 535 applies) and residential irrigated landscapes of 5,000 [square feet] or greater. A landscape water meter may be either: (1) a customer service meter dedicated to landscape use provided by the local water purveyor; or (2) a privately owned meter or submeter.

- WC Section 535 requires a DIM for a new service connection request when landscapes exceed 5,000 square feet:

(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.

2.3 Clarified Scope for Performance Measure Development

Based on the above discussion and legislative directive, DWR considers that the Conversion Threshold PM should be based on the size of irrigated CII landscape area

served by a mixed-use meter. Except for outdoor irrigation of landscape areas with DIMs in connection with CII water use, CII water use is not part of the quantitative reporting requirements for the UWUO. However, an urban retail water supplier's progress towards implementing CII water use performance measures, including the Conversion Threshold PM, is part of the annual reporting requirements for the Annual Water Use Report.

2.4 Relationships to Other Commercial, Industrial, and Institutional Water Use Standards and Performance Measures

DWR developed the CII water use standard and performance measures to be mutually supportive and for integrated implementation, as discussed in *Summary of Recommendations for Commercial, Industrial, and Institutional Water Use Performance Measures* (WUES-DWR-2021-15). The following describes the key connections among the Conversion Threshold PM, CII-DIMWUS, and the In-Lieu Technologies PM.

The Conversion Threshold PM is related to the other CII water use performance measures in that the conversion of mixed-use meters for landscape irrigation to DIMs (or equivalent technologies) will eventually change the way some CII water users account for their landscape water use. DWR also anticipates that the implementation of in-lieu technologies for landscapes served by mixed-use meters that exceed the conversion threshold but do not convert to a DIM (or equivalent technology) will achieve improved water use efficiency through implementation of the In-Lieu Technologies Performance Measure (In-Lieu Technologies PM), discussed in further detail below.

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

The CII-DIMWUS applies to an urban retail water supplier's aggregate estimated efficient outdoor irrigation of CII landscape areas irrigated with a DIM (or equivalent technology). Under the Conversion Threshold, urban water suppliers must: (1) convert large landscapes served by mixed-use meters exceeding the certain conversion thresholds to a DIM (or equivalent technology), or (2) implement the In-Lieu Technologies PM. If an urban retail water supplier converts a mixed-use meter to a DIM (or equivalent technology), the water use is then subject to CII-DIMWUS. As such, per CII-DIMWUS, CII landscapes served by mixed-use meters that are converted to DIMs (or equivalent technologies) will become part of the urban retail water supplier's UWUO, as defined in WC Section 10609.20(c):

Each urban water supplier's urban water use objective shall be composed of the sum of the following:

- (1) *Aggregate estimated efficient indoor residential water use.*
- (2) *Aggregate estimated efficient outdoor residential water use.*
- (3) *Aggregate estimated efficient outdoor irrigation of landscape areas with dedicated irrigation meters or equivalent technology in connection with CII water use.*
- (4) *Aggregate estimated efficient water losses.*
- (5) *Aggregate estimated water use in accordance with variances, as appropriate.*

In-Lieu Technologies Performance Measure

If an individual CII irrigated landscape area served by a mixed-use meter is at or greater than the recommended size threshold for conversion, an urban retail water supplier may choose to implement the In-Lieu Technologies PM, instead of converting the mixed-use meter to a DIM (or equivalent technology), as described in *Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure (WUES-DWR-2021-19)*. It is important to recognize that DIM-equivalent technologies and in-lieu technologies are mutually exclusive:

- DIM-equivalent technologies for CII landscape water use are functionally equivalent to a DIM for measuring the volume of water delivered. The resulting water use is included in the calculation of an urban retail water supplier's Actual Water Use and UWUO through CII-DIMWUS.
- The In-Lieu Technologies PM addresses water use efficiency by other means and without the direct measurement of water use. Water use volumes are not included in the calculation of an urban retail water supplier's Actual Water Use or UWUO. However, water use estimates (if determined) and implementation of the In-Lieu Technologies PM need to be reported as part of the Annual Water Use Report.

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3.0 Approach

DWR's approach to developing the recommendations for this performance measure was an iterative process in collaboration with stakeholders and the State Water Board to assist DWR in formulating design criteria, conducting literature reviews, and refining options and associated implementation considerations.

3.1 Stakeholder Process

Consistent with the legislative directive, DWR used a public process involving diverse stakeholders in the review and development of the Conversion Threshold PM. 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 engagement specifically for CII performance measures began in March 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 basis 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.

During the working group meetings, presentations and discussions covered the legislative background, DWR research into existing classification systems, and the proposed approaches to the performance measure. Stakeholder presentations were designed to provide information to a large number of participants.

Working group members and other participants had ample opportunities to learn about the approach to the Conversion Threshold PM and to provide feedback on the development of the performance measure. In addition, they provided 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 both individual entity and groups of stakeholders to learn from their experiences, understand their specific concerns, and receive other feedback.

3.2 Principles

DWR developed the following design criteria to evaluate the Conversion Threshold PM while considering legislative requirements, stakeholder input, literature reviews, and practitioner experience. DWR recognizes the following principles in developing the Conversion Threshold PM, consistent with the legislative guidance:

- Recommended CII water use performance measures, including the Conversion Threshold PM, must be consistent with the 2013 CII Task Force Report (WC Section 10609.10(c)).
- DWR's main considerations for designing a Conversion Threshold PM should be to select an appropriate conversion threshold that promotes water use efficiency in CII landscape irrigation and defines 'large landscape' with respect to the potential resource needs and challenges for implementation.
- The recommended Conversion Threshold PM should allow flexibility and customization for local conditions.
- This performance measure cannot stand alone, but needs to work in conjunction with other performance measures, water use efficiency standards, and variances; the resulting performance measure would be implemented in conjunction and in coordination with CII-DIMWUS, the In-Lieu Technologies PM, and the Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure (CII-BMPs Performance Measure).

Need for a Local Data-Driven Approach

DWR considered a study to collect CII landscape area measurements for a representative statewide set of urban retail water suppliers with sufficient diversity in established landscapes and associated DIM water use for a subset of these landscape areas. Actual and estimated efficient water use on the landscapes could be assessed to provide an indication of potential landscape sizes associated with significant water use. Through the discussion with stakeholders, this study concept, although promising, was likely to be compromised for many practical reasons that the Conversion Threshold PM should consider.

Even when aerial surveys and remote sensing are used to estimate the irrigated CII landscape area, field verification is necessary to map the actual irrigated area served by DIMs and mixed-use meters, even when meters are geolocated, because CII landscapes can be served by: one or many DIMs; a combination of DIM(s) and one or many mixed-use meters; and natural or private water sources. For example, a large, irrigated parkland with a very small portion served by a mixed-use meter may be considered above the conversion threshold based on the apparent mixed-use meter irrigated landscape area (green area), which may instead be receiving most of its irrigation from DIMs, natural sources, or local sources. Using remote sensing techniques to measure an irrigated landscape area, such as those used for ORWUS, requires correlation with DIM locations and significant on-the-ground surveys to identify the specific area(s) being served by the mixed-used meter and DIMs, separately. Additionally, some meters that serve a common landscape area cross multiple parcel boundaries involving multiple parties. CalWEP (2019) also reported that misalignment of parcel boundaries with irrigated areas can be critical when using remote-sensing (aerial imagery) to measure landscape areas, because in many instances, parcel boundaries do not align with the coverage areas of DIMs or mixed-use meters. Therefore, identification and measurement of qualified CII landscape areas using a mixed-use meter that would be subject to the Conversion Threshold PM have to be developed by urban retail water suppliers. For these reasons, it is reasonable that the 2018 Legislation did not direct DWR to collect CII landscape area measurements for CII-DIMWUS and performance measure development.

Actions Recommended in the 2013 CII Task Force Report

The 2013 CII Task Force Report recognized that certain actions are necessary to establish and sustain landscape water use efficiencies in the Task Force recommendations and in Section 7.3.5 of Volumes I and II, respectively (DWR 2013a and 2013b).

Recommendation 5-1: *CII establishments should use metrics to improve and track their water use efficiency over time. Where norms or ranges are available, establishments should compare their metrics to those norms.*

Recommendation 5-2: *CII associations, water service providers, and the CUWCC [now CalWEP], among others, should provide tools, guidance, and training to their constituents and customers on BMPs and the establishment and use of metrics-based benchmarking to demonstrate improved water use efficiency over time.*

The 2013 CII Task Force Report further presents the following option for further study or action to improve data collection and reporting. This option is specifically related to the development of a recommended conversion threshold for mixed-use meters (DWR, 2013b):

Option 5: Water service providers should separately meter large landscape irrigation sites, even where this is not currently required by law. The CUWCC [now CalWEP] should be encouraged to make this a foundational best management practice for its signatories. CII water users should be encouraged to install submeters at any location with significant on-site irrigation when significant other end-uses of water are also occurring at establishment sites. Large landscape irrigation uses should be subclassified according to the use context, namely residential, commercial, institutional, or industrial, for improved ability to analyze water use data.

Below are additional 2013 CII Task Force Report recommendations specific to the Conversion Threshold PM:

The importance of appropriate landscape design cannot be overstated since a well-designed landscape can save water and minimize long-term maintenance costs. For large California urban water providers, turf can account for approximately 50 percent of outdoor plant material and is responsible for approximately 70 percent of outdoor water use. Limiting turf to larger functional areas, and eliminating turf from narrow and other difficult to irrigate areas during landscape design, would substantially reduce outdoor water use. Landscape design BMPs are found in MWELO , Section 492.61. BMP landscape elements not addressed in MWELO include the use of synthetic turf, alternative turf choices, and subsurface irrigation. (DWR, 2013b)

Landscape water use needs to be metered or submetered in order to determine water use efficiency for site water management. The MWELO document requires the installation of a dedicated water meter for new and rehabilitated landscapes 5,000 square feet or greater, and recommends dedicated irrigation meters for landscapes less than 5,000 square feet. Although not required by MWELO, existing landscapes should also be submetered with monthly reading of a submeter to help save water. (DWR, 2013b)

3.3 Data Evaluation

The following provides a summary of available information and associated stakeholder input on CII landscape size and distribution, and technical and financial feasibility of a mixed-use meter conversion. DWR recognizes that necessary data and information on CII irrigated landscapes are limited.

Landscape Size and Distribution

Limited information is available on the statewide distribution of CII landscape sizes and how landscape size may be associated with significant water use. While it may be reasonable to assume that the larger the landscape, the more irrigation water is used, this is not always the case. For example, large parklands may have significant amounts of non-irrigated landscape areas, other very large landscapes may be vegetated with low water using plants, and many mid-size or small landscapes may be inefficiently managed and have high water use. Additionally, across the State, CII landscapes have diverse plant palettes, functions, management practices, and climate conditions. CalWEP (2019) identified that the most accurate method of CII irrigated landscape area measurement was found to be on-the-ground field measurements; yet they are the most time consuming and costly. They noted that the preferred approach to measuring irrigated CII landscape areas is for urban retail water suppliers to combine aerial imagery with subsequent field measurements. Customer-supplied measurement data was deemed acceptable with verification of the measurements performed by the urban retail water supplier.

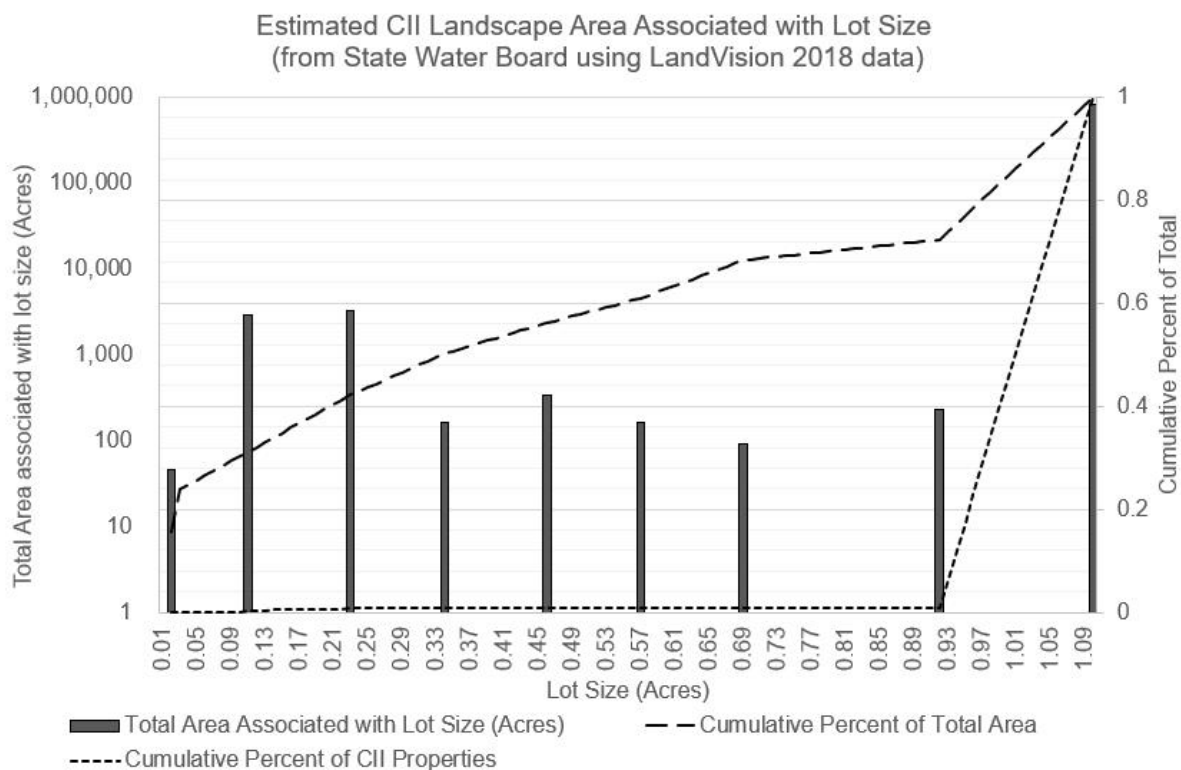
The 2013 CII Task Force Report identified that commercial landscapes use a significant amount of water in the CII sector ranging from 0 to 100 percent at individual CII sites (DWR, 2013a). Within the CII water use sector, on average, water use on large landscapes accounts for about 32 percent of total CII water use (based on data from 2011 to 2015 [DWR, 2019]). It should be noted that this value may be for only those irrigated landscapes served by a DIM and may not include landscapes with mixed-use meters; most of the urban retail water suppliers' responses to a CalWEP study, reported in *Lessons Learned: Dedicated Irrigation Meter Management for CII Accounts* (CalWEP, 2019), indicated that less than 50 percent of CII customers use DIMs for landscape irrigation. Therefore, a large amount CII landscapes may not be separately metered or may be served by both DIMs and CII mixed-use meters, or by CII mixed-use meters alone (CalWEP, 2019).

Through stakeholder engagement and CalWEP's study (CalWEP, 2019), it is very likely that many urban retail water suppliers in the State do not know: (1) how many DIMs are serving their landscapes; (2) the exact location of their DIMs and mixed-use meters, or (3) the measurements of the associated irrigated landscape served by them. Measuring the irrigated landscape areas associated with mixed-use meters must be performed by the individual urban retail water supplier.

DWR received information on CII landscape sizes from a handful of urban retail water suppliers representing the Bay Area and California Water Service Company service areas, in addition to a gross estimate provided by the State Water Board. A summary of these data is provided below. A common observation is that a few large CII landscapes, by size, comprise the majority of total CII landscape area.

State Water Board – Gross Estimates of Statewide CII Landscape Size

The State Water Board performed an analysis using 2018 LandVision data for gross estimates of CII landscape area based on ‘lot size’ or the total parcel area, less the building footprint. These gross estimates generally overestimate CII landscape areas, because they do not exclude hardscape areas (e.g., pavement, sidewalks, and others) that are typically present and unique to each CII account, nor did it exclude other non-irrigated areas (e.g., undeveloped land within the parcel, rainfed trees and riparian areas in parks, and others). The analysis also did not differentiate landscapes served by a DIM, a mixed-use meter, or combination of meters. Therefore, this data provides information on potential maximum landscape area sizes on CII parcels. As shown in Figure 3-1, approximately 99 percent of the total potential maximum CII landscape area statewide is associated with CII parcels with lot sizes greater than 1 acre (43,560 square feet) (note that the left vertical axis in Figure 3-1 is a logarithmic scale, so each line is 10 times the previous line).



Note:
Lot Size = Total parcel area, less the building footprint.

Figure 3-1 Estimated Cumulative Commercial, Industrial, and Institutional Potential Landscape Area Distribution per State Water Resources Control Board’s Study

Bay Area Water Supply and Conservation Agency, Contra Costa County, and Santa Clara County

Twenty urban retail water suppliers from the Bay Area Water Supply and Conservation Agency, Contra Costa County, and Santa Clara County permitted Waterfluence to provide DWR with irrigated CII landscape area measurements for 4,767 managed CII accounts. The Waterfluence dataset also included water use and other information considered in the development of the recommended CII-DIMWUS (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard [WUES-DWR-2021-03]*).

Waterfluence recorded water use information organized under commercial, public, and residential categories. Commercial sites included commercial facilities and churches. Public sites included cemeteries, golf courses, parks, schools, and streetscapes. Residential sites included apartments and homeowners associations (HOA). Limited by the accounts Waterfluence managed, the CII landscapes included in its dataset were predominantly associated with DIMs and may or may not represent CII landscapes served by mixed-use meters. Additionally, the Waterfluence dataset did not include all CII landscapes within the 20 urban retail water suppliers' service areas and, therefore, provided only a limited representation of CII landscape sizes and distributions. However, the dataset still provided a useful reference for discussion purposes.

Figure 3-2 shows the distribution of 4,767 irrigated CII landscape accounts sites by size, based on the information provided by Waterfluence. The managed CII landscape area, by account, ranges in size from 1,000 square feet (0.02 acre) to 3.7 million square feet (85 acres). Approximately 54 percent of these total landscape areas are associated with CII accounts with irrigated landscape areas greater than 1 acre. The CII accounts with landscapes greater than 1 acre are primarily composed of commercial landscapes (40 percent) and HOA landscapes (27 percent), and do not represent the landscape area per parcel; multiple parcels may be combined into one landscape area.

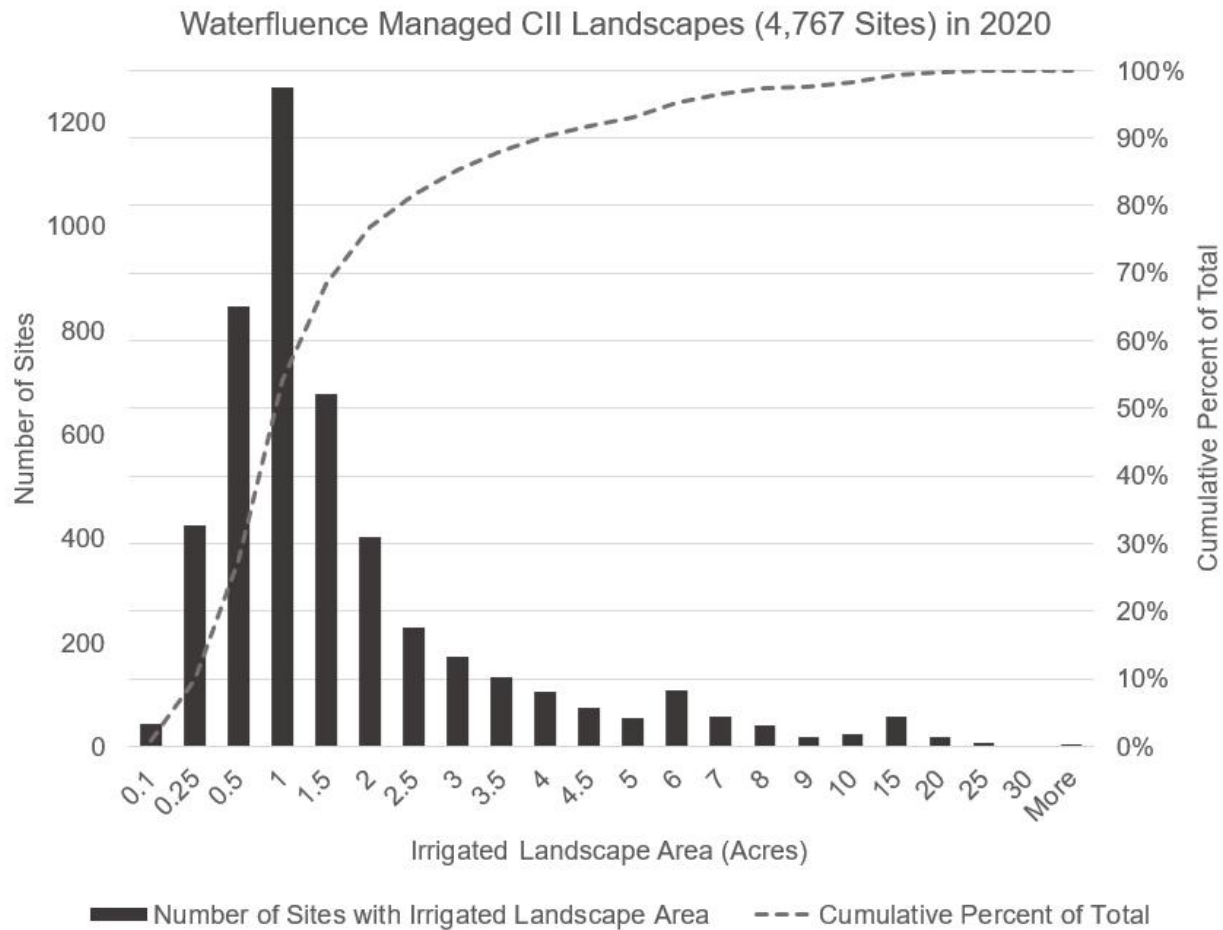


Figure 3-2 Cumulative Percent of Commercial, Industrial, and Institutional Landscape Area Distribution Based on Waterfluence Data

California Water Service Company

The California Water Service Company provided DWR with a report showing the distribution of CII landscape sizes per account within their 24 service areas (Mitchell and Chesnutt, 2017). The data provided by California Water Service Company was a broader representation of actual CII landscape sizes for all CII accounts distributed throughout the State. However, the information is specific only to the California Water Service Company and may or may not represent the true distribution of CII landscapes for other urban retail water suppliers across the State. The report did not identify if the CII landscapes were served by DIMs, mixed-use meters, or combination of both types of meters.

Figure 3-3 shows that approximately 10 percent of all CII accounts from the California Water Service Company do not have landscapes and about 25 percent have landscapes 500 acres or less. CII landscape areas with a size greater than 1 acre represent nearly 70 percent of the total landscape area from all 24 service areas and

are associated with 5 percent of all CII accounts. This independent finding is generally consistent with the gross estimates provided by the State Water Board in Figure 3-1.

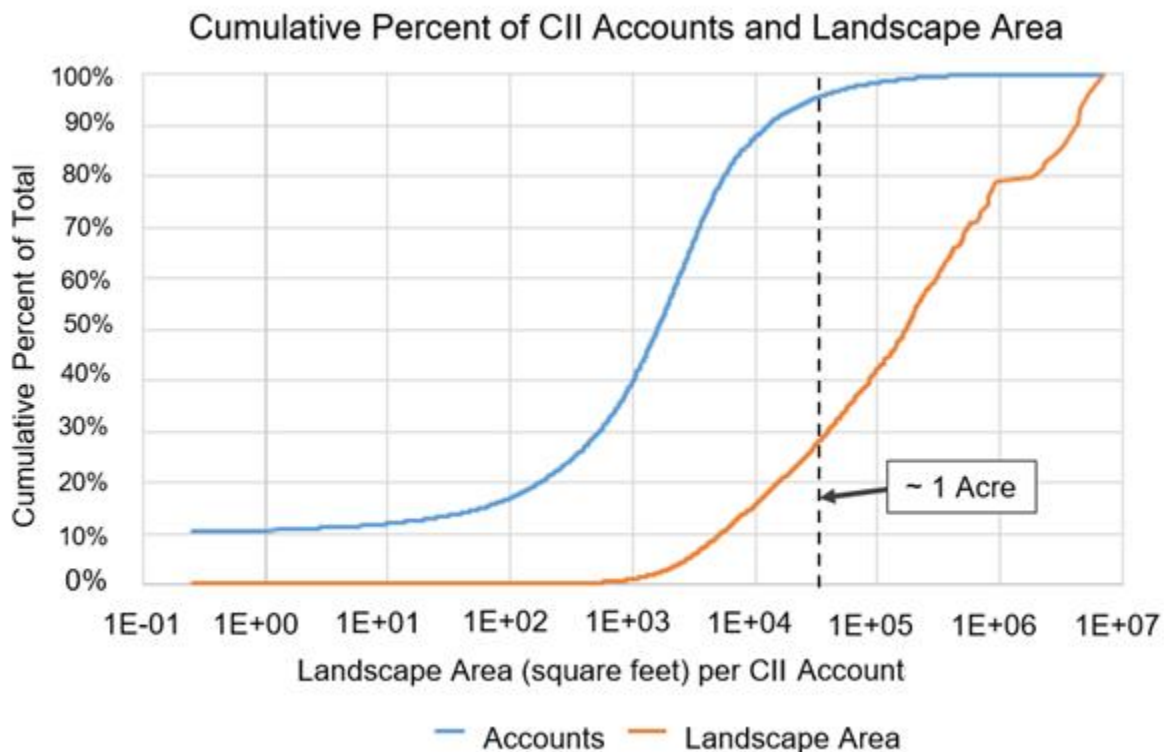


Figure 3-3 Cumulative Percent of Commercial, Industrial, and Institutional Landscape Area Distribution Based on Data from California Water Service Company

Technical and Financial Feasibility

DIMs (or equivalent technologies) may not be technically feasible to implement in some service areas or for some site locations, because urban retail water suppliers cannot unilaterally convert a mixed-use meter to a DIM (or equivalent technology). Discussions with several stakeholders indicated that CII customers are not typically willing to implement a DIM. Generally, stakeholders have indicated that:

- It is frequently not cost effective for CII customers to convert a mixed-use CII meter, even with incentive programs offered by urban retail water suppliers. Splitting a mixed-use meter does not guarantee water savings necessary to balance the cost of paying for the new service connection.
- The technical and financial feasibility of converting a mixed-use CII meter to a DIM is unique and site-specific.

- When a mixed-use meter is converted to a DIM, CII water users will incur new monthly meter costs typically without associated benefits that offset the costs.
- Larger sites are easier to measure, and typically there is less percent error associated with the measurement of irrigated area relative to the size of the landscape area.

Input from Urban Retail Water Suppliers

The following provides a summary of the success rates for three existing, long-term meter conversion programs.

- **City of Santa Rosa Water Department.** A service meter split rebate program has been active since 2005 in the City of Santa Rosa, but only five customers have participated over the 17 years. The customers that did participate had simple systems and were small properties for which disconnecting the existing irrigation tie-in was easy. Multiple points of connection drive up the cost exponentially (ACWA Personal Communication, July 12, 2021).
- **Contra Costa Water District.** For the Contra Costa Water District (CCWD), splitting a mixed-use meter could have a very high new service line installation cost. Additionally, there are minimum meter size requirements for the building and landscape, which affects what the facility is charged. The cost to install a new dedicated meter generally ranges from \$10,000 to \$20,000, but typically there is also the new fixed cost associated with having an additional meter. Even with CCWD offering rebates that cover half the cost of a new dedicated meter, there is very low customer uptake. CCWD noted that regardless of DIM installation or not, water efficiency does not improve until the landscape is also managed properly. Additionally, if there is a drought, the new meter for the landscape is typically the one that gets turned off first (Chris Dunden, CCWD, Personal Communication, April 27, 2021).
- **Irvine Ranch Water District.** Over 15 years, three customers have asked about converting a mixed-use meter to a DIM, and only one customer wanted to implement the conversion. A feasibility study conducted for this customer found that it was not technically and financially sensible, and would require repaving over a six-lane highway (Irvine Ranch Water District, Personal Communication, June 9, 2021).

Estimated Financial Feasibility (California Water Efficiency Partnership and California Data Collaborative)

CalWEP and the California Data Collaborative evaluated cost-effectiveness scenarios for converting a mixed-use meter to a DIM for a 20,000- and 40,000-square-foot landscape using their DIM Feasibility Tool. This tool allows urban retail water suppliers

and individual CII water users to account for water and sewer cost savings, avoided costs from meter rebates, and average costs for implementation in determining the net present value of splitting a mixed-use meter and installing a DIM with a project lifetime of 15 to 20 years. This study suggested that when using generalized, average cost information, splitting a mixed-use meter was only cost-effective in limited situations.

- In the scenarios examined for CII landscapes of 20,000 square feet, splitting a mixed-use meter does not appear to be cost-effective at the parcel level from an avoided water-cost perspective.
- Meter splitting may be a cost-effective approach at larger sites (e.g., 40,000 square feet), with minimal construction costs on the CII water user side and where the DIM installation reduces irrigation water use. The modeled scenario that assumed a 20 percent water savings could be financially feasible when urban retail water suppliers reimburse customer costs so that the DIM installation would have a five-year payback period. However, this large reduction in water use is unlikely to occur just because the meter is split; achieving 20 percent water savings would only be achievable with additional substantial investment on top of the meter split, such as the implementation of water budget-based rates, water management plans, or other landscape water use BMPs that were not factored into the analysis.
 - Reduced wastewater costs were often the primary cost savings, with reduced retail cost of water also contributing to a portion of the potential cost savings to the CII water user.
 - Local cost-effectiveness will vary based on the individual urban retail water supplier service area costs and complexity of the project.

3.4 Findings

The exclusion of quantifying most CII water use from an urban retail water supplier's UWUO recognizes the diversity and complexity associated with CII water use. The legislative directive for the Conversion Threshold PM is to focus on actions taken by urban retail water suppliers to improve CII water use efficiency. Conversion of mixed-use meters to DIMs (or equivalent technologies) means that landscape areas are subject to CII-DIMWUS, thus achieving, on a service area aggregate, efficient water use under the UWUO. The recommended in-lieu technologies under the In-Lieu Technologies PM that are designed to achieve improved water use efficiency (hereinafter referred to as "In-Lieu Technologies") are discussed in detail in the report, *Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* [WUES-DWR-2021-19]).

In general, meter conversion cannot be implemented unilaterally by urban retail water suppliers without explicit cooperation from and consent by CII water users or property owners. However, the legislation provides an ‘either-or’ condition for compliance purposes. Therefore, urban retail water suppliers need to work with CII water users or property owners to determine the preferred pathway, resulting in improvement of CII water use efficiency.

Existing Regulations as a Basis for the Size Threshold

The existing regulatory framework is a strong basis to recognize an appropriate conversion threshold for existing mixed-use meter CII landscape conversion to DIMs (or equivalent technologies) or in-lieu technologies. The 2015 MWELO requires certain water management practices for existing landscapes greater than 1 acre. The purpose of the MWELO was to establish design standards for new landscapes and provisions for water management practices, and water waste prevention for existing landscapes (CCR, Section 490(b)(3)). These provisions apply to existing landscapes that are greater than 1 acre (CCR Section 493.1(a)), regardless of whether they are residential or CII landscapes.

Limitations on Landscape Size Distribution Conversion Threshold

Determining an appropriate size for the conversion threshold based on a distribution of existing CII landscape sizes requires measurement of the irrigated landscape area statewide. 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. As described above, DWR considered a study to collect CII landscape area measurements for a representative statewide set of urban retail water suppliers. This representative set would have sufficient diversity in established landscapes and associated commercial, industrial, and institutional dedicated irrigation meter water use of a subset of these landscape areas. Through the discussion with stakeholders, this study concept, although promising, was likely to be compromised for many practical reasons that could affect implementation of the Conversion Threshold PM:

- A conversion threshold based on an exceedance probability of a statewide distribution of CII landscape areas, in which mixed-use meter conversion would be required for all landscapes served by a mixed-use meter greater in size than the upper 25 percent of landscapes in the State, for example, may result in an uneven statewide implementation and overlook the diversity of factors that affect CII landscape sizes. These factors include climate conditions, age of communities, landscape functions, and other conditions.
- This type of threshold could result in a ‘moving target’ situation, since CII landscape distributions can change due to self-initiated actions or the conversion of mixed-use meters to DIMs.

Nonetheless, the conversion threshold ultimately recommended by DWR should be evaluated with respect to its relationship to estimates of landscape area size distribution based on the limited available data, which indicate that irrigated landscape areas of 1 acre or more typically represent the majority of service area total irrigated CII landscape area.

Adequate Consideration of Technical and Financial Feasibility

DWR's recommended size threshold for converting a mixed-use meter serving a CII landscape should consider the technical and financial feasibility of splitting a mixed-use meter. Only individual urban retail water suppliers can identify specific mixed-use meter conversion opportunities and determine the corresponding path of compliance.

- The feasibility of converting a mixed-use meter will vary depending on the unique characteristics of each CII customer and landscape, its existing connection infrastructure, and if the benefits of converting the mixed-use meter are greater than or equal to the costs to both the urban retail water supplier and the CII customer.
- The technical and financial feasibility of using a single conversion threshold can vary significantly among individual CII customers and urban retail water suppliers because of different demographic conditions, populations within the service areas, age of community development, and other various local conditions.

DWR's recommendation should take into account that many existing CII irrigation systems are older, heterogeneous, and built according to the design standards and technology available at the time of installation.

Efficiency in Focusing on Large Landscapes

In selecting the minimum landscape size as the conversion threshold for mixed-use CII meters, DWR should consider a reasonable size threshold that captures both major CII landscape water use and that is technically and financially feasible for implementation.

- Implementation of DIMs (or equivalent technologies) or In-Lieu Technologies as defined in the related In-Lieu Technologies PM for a mixed-use meter serving CII landscapes may not be warranted under the following conditions:
 - A mixed-use meter may serve only a minor amount of non-irrigation water use in some cases, such as drinking fountains and restrooms in a park. Splitting this meter may not be reasonable to accommodate the small fraction of non-irrigation water use.

- A CII landscape served by a mixed-use meter may already be highly efficient. Splitting the meter or implementing additional In-Lieu Technologies as defined in In-Lieu Technologies PM would provide no additional benefits.
- CII landscapes are more likely to qualify as a special landscape area (SLA), as defined in the recommended CII-DIMWUS. Converting mixed-use meter irrigated CII landscapes that include SLAs to a DIM would require separate measurement of the SLA portion of the landscape to make use of the higher water use allowance in the recommended CII-DIMWUS.
- Generally, a DIM is not financially feasible for landscapes with area less than 40,000 square feet (refer to Section 3.3), and even then, only under conditions where measurable water savings are achieved.

Effectiveness of a Programmatic Approach

Performance measures are actions that improve water use efficiency. The review of various meter conversion successes suggests that rarely does a meter conversion, by itself, realize the anticipated outcomes for CII water use efficiency improvement. However, landscapes converted to a DIM (or equivalent technology) are subject to CII-DIMWUS and become a component of the urban retail water supplier's UWUO for efficient water use. In some cases, different actions, such as meter conversion, can be combined for a certain initiative, especially a short-term one. For instance, a meter conversion program can be combined with the CII-BMPs Performance Measure actions, such as outreach and education with incentive or training programs for landscape and irrigation system maintenance, in order to improve water use efficiency.

While a customized program formulation and implementation is allowed, it is important for urban retail water suppliers to demonstrate how the various components in the program can support each other and, collectively, achieve CII water use efficiency improvements. The overall coordinated design and administration could also reduce overall costs.

4.0 Recommendations for Conversion Threshold Performance Measure

This section provides DWR’s recommendations for the Conversion Threshold PM. These recommendations are to be implemented in conjunction with DWR’s other CII-related performance measures:

- In-Lieu Technologies PM (see *Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* [WUES-DWR-2021-19]).
- CII-BMPs Performance Measure (see *Recommendations for Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure* [WUES-DWR-2021-16]).
- Commercial, Industrial, and Institutional Water Use Classification System Performance Measure (CII Classification System PM) (see *Recommendations for Commercial, Industrial, and Institutional Water Use Classification System Performance Measure* [WUES-DWR-2021-17]).

As discussed previously, an adequate conversion threshold would need to be based on available, locally driven information; considerations of technical and financial feasibility; and consistency with existing laws and regulations. As such, DWR’s recommended Conversion Threshold PM was informed by the principles of MWELo, a general understanding of the CII landscape distribution, and feedback and experience shared by urban retail water suppliers and CII landscape managers.

For consistency with the recommended ORWUS and CII-DIMWUS, DWR recommends that the principles of MWELo be incorporated into the Conversion Threshold PM. These principles of MWELo are defined in WC Section 10609.9 as, “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.”

4.1 Recommended Conversion Threshold Performance Measure Specifications

Based on the analysis and stakeholder input, DWR recommends the following specifications for the Conversion Threshold PM, discussed below.

Conversion Threshold

DWR recommends using 1 acre (or 43,560 square feet), measured on a per-parcel basis, as the minimum conversion threshold required for converting mixed-use CII meters to a DIM (or equivalent technology) or to In-Lieu Technologies as defined in the In-Lieu Technologies PM.

Required Actions by Urban Retail Water Suppliers

DWR recommends that for all qualified landscapes (CII mixed-use meter irrigated landscapes that exceed the conversion threshold), urban retail water suppliers must implement one of the following and report accordingly in their Annual Water Use Report:

- Convert a mixed-use CII meter that exceeds the conversion threshold to a DIM (or equivalent technology) and report associated landscape area and water use under CII-DIMWUS (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* [WUES-DWR-2021-03]), following DWR's guidelines and methodologies for calculating the UWUO (see *Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective* [WUES-DWR-2021-01B]). For reporting purposes, the resulting DIM shall be classified as a "CII Dedicated Irrigation Meter" (see *Recommendations for Commercial, Industrial, and Institutional Water Use Classification System Performance Measure* [WUES-DWR-2021-17]).
- Implement the In-Lieu Technologies and adhere to the requirements per the In-Lieu Technologies PM (see *Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* [WUES-DWR-2021-19]).

Qualified Conditions and Exemptions

DWR recommends that all irrigated CII landscape areas served by a mixed-use meter with an irrigated area on a per-parcel basis that exceed the conversion threshold, including SLAs defined in CII-DIMWUS (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* [WUES-DWR-2021-03]), are subject to the mixed-use meter conversion requirements and implementation of the Conversion Threshold PM, except for the following:

- Exempt landscapes, as defined in CII-DIMWUS, are landscape areas exempted from the meter conversion requirements; however, they remain subject to the CII-BMPs Performance Measure (see *Recommendations for Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure*

[WUES-DWR-2021-16]). Exempt landscapes as defined in the MWEL0 and included in the recommended CII-DIMWUS include:

- Registered federal, State, or local 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, and botanical gardens and arboretums open to the public (pre-2015).
 - Water use for cemeteries built before 2015.
- A mixed-use CII meter with non-irrigation water use of no more than 5 percent of the total water use can be considered a DIM for CII landscape irrigation for the purposes of calculating the UWUO. Urban retail water suppliers shall report the associated landscape area and irrigation water use under CII-DIMWUS accordingly. Urban retail water suppliers also shall document that this landscape is exempt from the Conversion Threshold PM due to minor non-irrigation water use. For reporting purposes, this mixed-use meter shall be classified as a “CII Dedicated Irrigation Meter” (see *Recommendations for Commercial, Industrial, and Institutional Water Use Classification System Performance Measure* [WUES-DWR-2021-17]).
 - CII water users are considered to be implementing the In-Lieu Technologies PM when their CII landscapes are irrigated with a mixed-use meter, and when their estimated water use satisfies the requirements of the evapotranspiration factor on the urban retail water supplier level in 2030 CII-DIMWUS or MAWA for SLAs calculated using the MWEL0, as amended (*MAWA_SLA*) on a per-parcel basis (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* [WUES-DWR-2021-03]). The urban retail water supplier will need to document how the estimated water use was determined. Therefore, the mixed-use meter conversion requirements will not be applicable in this case. Urban retail water suppliers shall document each CII water user’s situation on aggregate with supporting information and adhere to the provisions of the In-Lieu Technology PM (see *Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* [WUES-DWR-2021-19]).

CII landscape areas irrigated with a mixed-use meter with an area on a per-parcel basis below the conversion threshold are subject to the CII-BMPs Performance Measure (see

Recommendations for Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure [WUES-DWR-2021-16]).

CII landscape areas irrigated with a DIM (or equivalent technology) are not subject to the Conversion Threshold PM. New CII landscape areas, as described in CII-DIMWUS, are not subject to the Conversion Threshold PM; however, a DIM is required for a landscape area greater than 5,000 square feet, per WC Section 535.

No Restrictions on Actions by Commercial, Industrial, and Institutional Water Users

DWR's recommendations on the conversion threshold and associated performance measure do not restrict CII water users from modifying their landscape areas, including reducing their total landscape area on a parcel basis, if so desired. Similarly, the recommendations do not restrict CII water users, in coordination with urban retail water suppliers, to convert a mixed-use meter into multiple DIMs or submeters for irrigating separate landscape areas on one parcel or using a DIM to cover the landscape irrigation needs of multiple parcels.

4.2 Implementation Schedule

DWR recommends the following implementation schedule. Urban retail water suppliers shall complete necessary landscape area measurements and implement necessary actions for mixed-use meter conversion within a five-year implementation schedule. The recommended schedule is to be implemented in conjunction with the CII Classification System PM (see *Recommendations for Commercial, Industrial, and Institutional Water Use Classification System Performance Measure [WUES-DWR-2021-17]*); CII-DIMWUS (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard [WUES-DWR-2021-03]*); and the CII-BMPs Performance Measure (see *Recommendations for Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure [WUES-DWR-2021-16]*). Refer to *Summary of Recommendations for Performance Measures for Commercial, Industrial, and Institutional Water Use (WUES-DWR-2021-15)* for a discussion of the potential integration schedule that can be implemented by urban retail water suppliers to streamline their compliance efforts for multiple CII water use performance measures.

Five-Year Implementation Schedule

The following requirements shall apply to the five-year implementation schedule for the Conversion Threshold PM:

- By 2023, DWR recommends that, at a minimum, urban retail water suppliers generally assess available data, existing processes, and generally describe the

status of existing mixed-use meters and CII landscapes that may be subject to the conversion threshold available to urban retail water suppliers.

- The minimum level of progress in geolocating mixed-use meters and mapping irrigated area measurements to identify qualified landscape areas where the Conversion Threshold PM applies is 20 percent of all CII water user accounts per year, starting in Year 1 after the State Water Board adoption of the Conversion Threshold PM.
 - When a CII mixed-use meter is subject to the Conversion Threshold PM, the compliance pathway shall be determined in the same year the landscape is measured, and implementation of CII-DIMWUS or the In-Lieu Technologies PM for the mixed-use meter shall occur in the following year.
 - Urban retail water suppliers have up to one year after qualified mixed-use meters are identified to implement necessary actions to convert the mixed-use meter to a DIM (or equivalent technology) or to implement the In-Lieu Technologies PM (see *Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure* [WUES-DWR-2021-19]).
 - When the In-Lieu Technologies PM compliance pathway is selected, it shall be implemented by the urban retail water supplier by the following year (starting in Year 2, after adoption of the CII performance measures by the State Water Board).
- Within five years, after adoption of the Conversion Threshold PM, urban retail water suppliers shall complete the geolocation and measurement of all qualified landscape areas with mixed-use meters exceeding the conversion threshold from all CII water user accounts. Within one additional year, urban retail water suppliers shall complete necessary actions to meet the compliance pathway requirements.

Urban retail water suppliers can accelerate implementation of the performance measure before Year 6 at their discretion and shall, at a minimum, meet annual performance measure requirements.

Hardship Reporting

DWR recommends additional provisions for urban retail water suppliers that may have unique circumstances that temporarily or substantially prevent them from implementing the Conversion Threshold PM in accordance with the above five-year schedule.

For any given reporting year during the five-year implementation schedule, if an urban retail water supplier cannot meet the annual 20 percent increment in measurement requirements based on classification mapping results and subsequent actions for meeting the mixed-use meter conversion requirements, the urban retail water supplier shall include in its Annual Water Use Report an explanation and its plan to catch up and complete the process by Year 5 for approval by the State Water Board.

4.3 Guidelines and Methodologies

DWR's recommended Conversion Threshold PM does not require urban retail water suppliers to change their billing systems or other established account management practices. However, the related CII Classification System PM requires classification of CII-DIMs. DWR recommends that urban retail water suppliers follow DWR's account mapping guidance based on the final adopted CII Classification System PM, which will be developed after the State Water Board's adoption of the regulation. Urban retail water suppliers must include a description of their progress related to the Conversion Threshold PM in their Annual Water Use Reports pursuant to WC Section 10609.24(a)(3).

Data Provided or Obtained by the Urban Retail Water Supplier

Urban retail water suppliers will be responsible for identifying irrigated CII landscape areas served by mixed-use meters that are at or exceed the minimum size conversion threshold.

- Urban retail water suppliers must locate and measure the landscape area associated with mixed-use meters to support the identification of qualified CII landscape areas for the Conversion Threshold PM.
- DWR recommends that where an irrigated CII landscape is served by a combination of DIMs (or equivalent technologies) and mixed-use meters, only the landscape areas being served the mixed-use meters will be subject to the Conversion Threshold PM requirements.
- Measurement of irrigated landscape areas for new service connection requests is not required; all new service connections with irrigated landscapes greater than 5,000 square feet are required to implement a DIM, per WC Section 535.

Geolocate or Map Meters and Landscape Areas

- Urban retail water suppliers shall geolocate DIMs (or equivalent technologies) and mixed-use meters to assist in identifying those CII landscapes that may be served by mixed-use meters or both mixed-use meters and DIMs (or equivalent technologies).

- For urban retail water suppliers that do not have a geographic information system, the meters' geolocation (latitude/longitude) may be recorded in a spreadsheet for later incorporation into a geospatial database.
- Urban retail water suppliers shall map irrigated landscape areas that exceed the minimum conversion threshold potentially served by mixed-use meters and geolocate all associated meter(s).
 - Identify exempt landscapes, which are not subject to the Conversion Threshold PM, but are eligible to implement the landscape BMP(s) identified in the CII-BMPs Performance Measure, as applicable. Urban retail water suppliers lacking knowledge of exempt landscapes within their service areas are recommended to start by identifying them with the NAICS used for their corresponding business registrations. This information shall be verified by the urban retail water suppliers.
 - DWR recommends that the urban retail water supplier identify and measure associated SLAs in order to use the *MAWA_SLA* described in CII-DIMWUS for the landscape.

Irrigated Landscape Area Measurement

Urban retail water suppliers must measure the CII landscape areas irrigated with mixed-use meters in their service areas to support the implementation of the Conversion Threshold PM. This landscape area will include only the actual irrigable-irrigated area. Urban retail water suppliers can measure the irrigated landscape area using any of the following methods:

- **Methods Described in BMP5 Handbook.** The principles described in *BMP 5 Handbook: A Guide to Implementing Large Landscape Conservation Programs as Specified in Best Management Practice 5* (CUWCC, 1999) for cost-effectively measuring irrigated landscape areas remain applicable. The best method of measuring irrigated landscape area depends on many interrelated factors and varies by urban retail water supplier.
- **Aerial Imagery or Remote Sensing.** Landscape area measurements using aerial imagery or remote sensing, followed by a subsequent field verification, can provide a good size estimate of irrigated landscape areas. A field verification is recommended in general and is required in some circumstances. Some very large landscapes may not warrant a field verification when their size is certainly greater than 1 acre with no nearby DIMs. However, it is necessary for a landscape area close to 1 acre or with nearby DIMs (or equivalent technologies) that have not been fully mapped to be verified with field measurements. The purpose of the field verification is to ensure the attributable landscape areas to a specific mixed-use meter and, where necessary, reconcile the overlapping

irrigated landscape area that also may be served by another meter or a DIM (or equivalent technology). Urban retail water suppliers may require assistance from landscape managers in the verification.

- **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. The measurements shall properly characterize the attributable landscape areas to a specific mixed-use meter and, where necessary, reconcile the overlapping irrigated landscape area that also may be served by another meter or a DIM (or equivalent technology).
- **CII Water User–Provided Information.** CII water user–provided irrigated landscape area measurements are acceptable if the measurements are verified by the urban retail water supplier.
- **Other Methods.** Other methods can be used, provided they meet the Data Accuracy Requirements specified below.

Urban retail water suppliers should note that all new or rehabilitated landscape areas that exceed the conversion threshold but do not require a new service connection must still be measured if a submeter is installed instead of a DIM. MWELo Section 492.1 requires the local agency, upon approval of the Landscape Documentation Package described in MWELo Section 492.3, to submit to the local water purveyor the Water Efficient Landscape Worksheet. Urban retail water suppliers can reference this information, if it is available, to assist with landscape area measurements.

Data Accuracy Requirements

To ensure data accuracy in the Annual Water Use Report, DWR recommends that urban retail water suppliers provide a detailed description of the methods used to identify CII landscape areas using mixed-use irrigation meters and obtain associated landscape area measurements. DWR recommends that this description include:

- Process used to identify and verify the mixed-use meter accounts contributing to the landscape irrigation.
- Process used to geolocate or otherwise map and verify mixed-use meter locations and landscapes.
- Irrigated landscape area measurement and verification methods.
- Confirmation, for each site, that the measured irrigated landscape area is not irrigated with a DIM (or equivalent technology).

- In cases in which both DIMs (or equivalent technologies) and mixed-use meters are used for landscape irrigation, the urban retail water supplier will need to measure the portion of irrigated landscape that is only served by the mixed-use meter.
- Methods or processes used to identify SLAs and exempt landscapes, if applicable. Include the basis for designating SLAs and exempt landscapes, if applicable.
- Data collection and verification process or procedures, including, but not limited to: documentation and records retention; update process; and follow-up procedures (if necessary).
- Credentials (such as licenses, certifications, educational, 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 CII landscapes and SLAs using mixed-use irrigation meters, if applicable; and documentation of methods and data supporting the mixed-use meter identification, location, landscape area measurement, and data verification, in accordance with any necessary Non-Disclosure Agreements and applicable private data laws and requirements.

The above information shall be available upon request by DWR and the State Water Board, and retained for the period the data is used, plus three years.

4.4 Other Implementation Challenges and Considerations

As detailed above, DWR has taken into consideration the implementation challenges identified during its necessary studies and investigations and stakeholder engagement relative to its recommendations associated with the Conversion Threshold PM. For reference and additional context, DWR has summarized the perspectives of urban retail water suppliers and stakeholders regarding these implementation challenges and other considerations, below.

Potential challenges with the implementation of the recommended Conversion Threshold PM are described generally in this section. As partners of the State in water conservation, urban retail water suppliers will face challenges implementing the Conversion Threshold PM with their CII customers who have mixed-use meters irrigating landscapes greater than the minimum size conversion threshold. Evaluating the technical and financial feasibility of a conversion is unique for each CII customer. Implementing In-Lieu Technologies or reducing the irrigated landscape may be easier; but urban retail water suppliers will still need additional support to encourage them to adopt and correctly implement the Conversion Threshold PM. Stakeholders were generally supportive of the recommended Conversion Threshold PM.

Account and Landscape Area Measurement Data

- **Identifying mixed-use meter irrigated landscapes.** Many urban retail water suppliers do not have measurements of the landscape areas associated with mixed-use meters. Urban retail water suppliers will face difficulties with identifying mixed-use meters and the associated irrigated landscape areas. In addition, some urban retail water suppliers do not have separate billing classifications for DIMs (or equivalent technologies), making it difficult for them to identify which meters may be mixed-use. Furthermore, many CII landscapes are served by both mixed-use meters and DIMs (or equivalent technologies). Many urban retail water suppliers will have to identify mixed-use landscapes and measure associated irrigated landscape areas.
- **Measuring the associated landscape area.** Measuring an irrigated CII landscape area requires coordination among the property owner, landscape manager, building owner, and the urban retail water supplier for either direct field measurements or for ground-truthing aerial imagery. This requires substantial resources for the costly and time-consuming measurements.

Feasibility of Converting a Mixed-Use Meter to a Dedicated Irrigation Meter

Stakeholders identified that mixed-use meter conversions often require incentive programs, and these conversions are frequently not cost-effective for most CII landscapes. In addition, as noted in Section 3, converting a mixed-use meter to a DIM (or equivalent technology) does not guarantee water savings. The benefits need to outweigh the costs and complexity of converting to a DIM for the conversion to be cost-effective for the CII water user. Additional findings noted by DWR include the following:

- Additional investments and assistance to change water use behavior is necessary and may include professional water management services, water audits, and tracking water budgets.
- Converting mixed-use meters is not cost effective for CII customers without incentives offered by urban retail water suppliers, and sometimes not even then,

depending on the complexity of the system and how much water or wastewater rate savings may be achieved.

- There are significant challenges with evaluating the feasibility of converting a mixed-use meter, including assessing the existing pipe configurations, hardscapes, irrigation system layouts, potential tie-ins, mature trees, existing buildings, flow and pressure requirements, and local/municipal requirements. Achieving cost-effectiveness with splitting a mixed-use meter becomes more difficult to achieve with two or more lateral tie-ins to the irrigation system.
- Splitting a mixed-use meter will often require the CII customer to pay a new monthly fixed charge for the new DIM, based on the meter size, which increases the fixed cost to the CII customer without a guarantee of project payback.
- Outdoor water savings take time to achieve, given both implementation timing and establishment periods required for drought-tolerant landscaping to succeed (LADWP, 2021).

Other Considerations

Many CII water users may not have the resources or staff to implement the offered water efficiency programs. For many, the lack of productivity cost, or additional landscaping cost, exceeds the cost of wasted water.

4.5 Annual Reporting Requirements

DWR's recommended Conversion Threshold PM does not require urban retail water suppliers to report water use with mixed-use meters on CII landscapes. Rather, it requires urban retail water suppliers to identify mixed-use meters, measure the irrigated landscape area, and, as appropriate, implement one of the compliance pathways for those irrigated CII landscapes served by mixed-use meters that exceed the minimum conversion size threshold. Urban retail water suppliers will have to report on the progress of implementing the Conversion Threshold PM in their respective Annual Water Use Reports. Additional details relative to the annual reporting requirements are as follows:

- The Conversion Threshold PM applies to CII landscapes irrigated with mixed-use meter(s) and includes regular landscape areas and SLAs that exceed the minimum size conversion threshold of 1 acre measured on a per-parcel basis.
- DWR recommends that implementation of the Conversion Threshold PM be coordinated with the CII-BMPs Performance Measure and the In-Lieu Technologies PM, as well as with CII-DIMWUS.

DWR also recommends the following reporting requirements:

- Reporting on the implementation of performance measures cannot occur until they have been adopted by the State Water Board.
- The performance measure annual reporting requirements are specific to each urban retail water suppliers' annual milestones, which are at the end of each implementation year and not on specific annual water use reports.
 - There will be differences in reporting between urban retail water suppliers implementing the performance measure on a calendar year or fiscal year basis.

Refer to Table 4-1, below, for additional information regarding the annual reporting requirements.

Table 4-1 California Department of Water Resources’ Recommended Conversion Threshold Performance Measure Reporting Requirements

Reporting Schedule	Reporting Requirement	Expected Progress	Reporting Value
End of Year 1 after adoption as part of the Annual Water Use Report due the following January.	<ul style="list-style-type: none"> Description of the mixed-use meter conversion program. Identify all CII mixed-use meter accounts that may exceed the conversion threshold. Progress geolocating and measuring CII landscapes served by mixed-use meters and compliance pathway determination. 	<ul style="list-style-type: none"> Develop and report on the conversion threshold program that satisfies the adopted performance measure requirements. Geolocate mixed-use meters and measure irrigated landscape from the first 20 percent of all CII water user accounts (i.e., 20 percent of all CII water users with mixed-use meters geolocated, mapped, and compliance pathway determined). <ul style="list-style-type: none"> When a CII mixed-use meter is subject to the Conversion Threshold PM, the compliance pathway shall be determined in the same year the landscape is measured, and implementation of CII-DIMWUS or the In-Lieu Technologies PM for the mixed-use meter shall occur in the following year. 	<ul style="list-style-type: none"> Description of Conversion Threshold PM program that meets adopted program requirements, including data accuracy requirements and certification of landscape area measurements. Review and update the number and estimated total area of CII landscapes with mixed-use meters that may exceed the conversion threshold. If compliance pathway implementation has started, document per CII-DIMWUS or In-Lieu Technologies PM.
End of Year 2 after adoption as part of the Annual Water Use Report due the following January.	<ul style="list-style-type: none"> Progress geolocating and measuring CII landscapes served by mixed-use meters and compliance pathway determination. Progress implementing the selected compliance pathway(s). 	<ul style="list-style-type: none"> Geolocate mixed-use meters and measure irrigated landscape from the second 20 percent of all CII water user accounts (i.e., 40 percent of all CII water users with mixed-use meters geolocated, mapped, and compliance pathway determined). Implement the determined compliance pathway for mixed-use meters from Year 1. 	<ul style="list-style-type: none"> Number of mixed-use meters exceeding conversion threshold and total irrigated area associated with each compliance pathway. Certification of landscape area measurements. Document implementation per CII-DIMWUS or In-Lieu Technologies PM.
End of Year 3 after adoption as part of the Annual Water Use Report due the following January.	<ul style="list-style-type: none"> Progress geolocating and measuring CII landscapes served by mixed-use meters and compliance pathway determination. Progress implementing the selected compliance pathway(s). 	<ul style="list-style-type: none"> Geolocate mixed-use meters and measure irrigated landscape from the third 20 percent of all CII water user accounts (i.e., 60 percent of all CII water users with mixed-use meters geolocated, mapped, and compliance pathway determined). Implement the determined compliance pathway for mixed-use meters from Year 2. 	<ul style="list-style-type: none"> Number of mixed-use meters exceeding conversion threshold and total irrigated area associated with each compliance pathway. Certification of landscape area measurements. Document implementation per CII-DIMWUS or In-Lieu Technologies PM. By Year 3, if there is substantial hardship, provide an implementation plan to meet the full mapping requirement, subject to approval by the State Water Board.
End of Year 4 after adoption as part of the Annual Water Use Report due the following January.	<ul style="list-style-type: none"> Progress geolocating and measuring CII landscapes served by mixed-use meters and compliance pathway determination. Progress implementing the selected compliance pathway(s). 	<ul style="list-style-type: none"> Geolocate mixed-use meters and measure irrigated landscape from the fourth 20 percent of all CII water user accounts (i.e., 80 percent of all CII water users with mixed-use meters geolocated, mapped, and compliance pathway determined). Implement the determined compliance pathway for mixed-use meters from Year 3. 	<ul style="list-style-type: none"> Number of mixed-use meters exceeding conversion threshold and total irrigated area associated with each compliance pathway. Certification of landscape area measurements. Document implementation per CII-DIMWUS or In-Lieu Technologies PM.
End of Year 5 after adoption as part of the Annual Water Use Report due the following January.	<ul style="list-style-type: none"> Complete geolocating and measuring all CII landscapes served by mixed-use meters and compliance pathway determination. Progress implementing the selected compliance pathway(s). 	<ul style="list-style-type: none"> Geolocate mixed-use meters and measure irrigated landscape from the last 20 percent of all CII water user accounts (i.e., all CII water users with mixed-use meters geolocated, mapped, and compliance pathway determined). Implement the determined compliance pathway for mixed-use meters from Year 4. 	<ul style="list-style-type: none"> Number of mixed-use meters exceeding conversion threshold and total irrigated area associated with each compliance pathway. Certification of landscape area measurements. Document implementation per CII-DIMWUS or the In-Lieu Technologies PM. Document completion of the Conversion Threshold PM.

Table 4-1 California Department of Water Resources' Recommended Conversion Threshold Performance Measure Reporting Requirements (contd.)

Reporting Schedule	Reporting Requirement	Expected Progress	Reporting Value
End of Year 6 after adoption as part of the Annual Water Use Report due the following January.	<ul style="list-style-type: none"> Complete implementation of the compliance pathway(s). 	<ul style="list-style-type: none"> Implement the determined compliance pathway for mixed-use meters from Year 5. Completion of compliance pathway implementation. 	<ul style="list-style-type: none"> Total irrigated area associated with each compliance pathway. Certification of landscape area measurements. Document implementation per CII-DIMWUS or In-Lieu Technologies PM.

Key:

CII = commercial, industrial, and institutional

Conversion Threshold PM = Conversion Threshold Performance Measure

DIM = dedicated irrigation meter

CII-DIMWUS = Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard

In-Lieu Technologies PM = In-Lieu Technologies Performance Measure

5.0 Glossary

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

best management practice. A set of practices, measures, or procedures that are beneficial, empirically proven, cost effective, and widely accepted by the professional community.

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).

conversion threshold. The minimum size threshold for converting mixed-use commercial, industrial, and institutional dedicated irrigation meters or In-Lieu Technologies Performance Measure.

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 that 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 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.

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).

In-Lieu Technologies. Technologies that improve landscape water use efficiency by any means other than the direct measurement of water use that is an equivalent

technology. In-Lieu Technologies refers to the devices, equipment, or analytical methods that are defined in the California Department of Water Resources' recommended In-Lieu Technologies Performance Measure.

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).

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).

lot size. The total parcel area, less the building footprint.

maximum applied water allowance. The upper limit of annual applied water for the established landscaped area, as specified in the Model Water Efficient Landscape Ordinance. It is based upon the area's reference evapotranspiration, the evapotranspiration factor, and the size of the landscape area.

mixed-use meter. A meter serving both indoor water use and outdoor landscape irrigation.

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).

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).

service connection. The point of connection between the customer's piping or constructed conveyance, and the water system's meter, service pipe, or constructed conveyance (California Health and Safety Code Section 116275(s)).

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).

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 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).

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6.0 References

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- LADWP (Los Angeles Department of Water and Power). 2021. LADWP Comment Letter to DWR Water Use Efficiency Branch, Subject: Final Recommendations for Residential Outdoor and Commercial, Industrial, and Institutional with Dedicated Irrigation Meters Outdoor Standards, CII Classification System, and the Guidelines and Methodology, dated November 24, 2021, signed by Terrence McCarthy, Water Resources Policy Manager.
- Mitchell, David L. and Thomas W. Chesnutt 2017. CII Water Use and Drought Response: Case Study of California Water Service. March.

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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 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 Performance Measures for Commercial, Industrial, and Institutional Water Use. DWR Report Number: WUES-DWR-2021-15.
- DWR (California Department of Water Resources). September 2022.
Recommendations for Commercial, Industrial, and Institutional Water Use Best Management Practices Performance Measure. DWR Report Number: WUES-DWR-2021-16.
- DWR (California Department of Water Resources). September 2022. Best Management Practices for Improving Efficiency in Commercial, Industrial, and Institutional Water Use: Key Successes and Challenges in California. DWR Report Number: WUES-DWR-2021-16.T.1.
- DWR (California Department of Water Resources). September 2022.
Recommendations for Commercial, Industrial, and Institutional Water Use Classification System Performance Measure. DWR Report Number: WUES-DWR-2021-17.
- DWR (California Department of Water Resources). September 2022.
Recommendations for In-Lieu Technologies for Dedicated Irrigation Meters for Commercial, Industrial, and Institutional Outdoor Irrigation Water Use Performance Measure. DWR Report Number: WUES-DWR-2021-19.

DWR (California Department of Water Resources). September 2022. Stakeholder Outreach Summary for Developing Urban Water Use Efficiency Standards, Variances, and Performance Measures. DWR Report Number: WUES-DWR-2021-20.

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