Municipal Recycled Water Resource Management Strategy

CALIFORNIA WATER PLAN UPDATE 2023

October 2024

Municipal Recycled Water Resource Management Strategy

CALIFORNIA WATER PLAN UPDATE 2023

Lead Author:
Tonianne Pezzetti, PG, CHG (Department of Water Resources)

Contributing Author:
Jennifer Pulido, PE (Department of Water Resources)

Contents

Figures

Table

Acronyms and Abbreviations

CCR	California Code of Regulations
DDW	Division of Drinking Water
DPR	direct potable reuse
GHG	greenhouse gases
IPR	indirect potable reuse
OAL	Office of Administrative Law
PFAS	polyfluoroalkyl substances
Portfolio	*California Water Resilience Portfolio*
RMS	resource management strategy
State Water Board	State Water Resources Control Board
Tittle 22	California Code of Regulations Title 22
UWMP	urban water management plan
Volumetric Annual Report	*Volumetric Annual Report of Wastewater and Recycled Water*
Water Supply Strategy	*California's Water Supply Strategy: Adapting to a Hotter, Drier Future*
WDR	waste discharge requirement

1. Introduction

Municipal recycled water (recycled water), purposely reused treated wastewater from a municipal treatment plant, is becoming an increasingly important component of California's water supply. It accounted for approximately 7 percent of the developed urban water supply statewide in 2020 and 13 percent in the greater Los Angeles/San Diego area, where recycled water use is highest. In future years, recycled water is expected to increase its percentage contribution to urban and agricultural water supplies, with passage of new recycled water regulations, and water supply uncertainties increase because of climate change.

This resource management strategy (RMS) was last updated in 2013. Since then, there have been significant changes in regulations regarding the use of recycled water and public acceptance of its use. In 2014 the State Water Resources Control Board (State Water Board) adopted revised statewide regulations for potable reuse for groundwater augmentation; in 2018 the State Water Board adopted regulations for reservoir water augmentation. Most recently, in December 2023, the State Water Board adopted new regulations for direct potable reuse (DPR) requirements that increase the importance of recycled water as a reliable water supply for future generations. Following State Water Board adoption, the Office of Administrative Law (OAL) approved the DPR regulations in August 2024, enabling public water systems to begin applying for and receiving permits after October 1, 2024. These regulations enable highly treated recycled water to be incorporated into public water supplies with treatment and monitoring to protect public health. Section 2, "Benefits of Integrating Recycled Water into a Water Supply Portfolio," of this RMS will provide additional discussion of the DPR regulations.

This 2024 RMS describes the status of recycled water in California, challenges to increasing its use, and resources needed to continue to increase recycled water use to meet demands and diversify regional and local water supplies. Recommendations for actions to increase recycled water use are included.

Definition of Municipal Recycled Water

The California Water Code (Water Code) defines recycled water as: "water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefor (sic) considered a valuable resource" (Water Code Section 13050[n]). California Code of Regulations (CCR) specifies

additional water recycling criteria for recycled municipal wastewater which is the water supply discussed in this RMS.

"Recycled water" and "reclaimed water" have the same meaning and can be used interchangeably. The California Water Plan and this RMS use the term "recycled water" to refer to municipal recycled water. Recycled water requires treatment at a permitted facility, which distinguishes it from graywater.

An important aspect of recycled water is the distinction of waste versus reuse. Historically, outflow from a wastewater plant was considered a "waste" – something to be discharged as quickly and as inexpensively as possible. As environmental awareness, treatment costs, and water supply challenges are being considered, there has been a shift toward recognizing recycled water as a valuable resource. This appreciation of the use of recycled water as a water supply has resulted in realizing the best use of treated wastewater is often as recycled water.

There are two components of recycled water quality that govern acceptable uses: constituents that have public health effects (e.g., bacteria) and constituents that have practical, non-health effects (e.g., boron on crops or salts on industrial processes). This RMS focuses on public health-related water quality, which is the predominant category governing the use of recycled water.

CCR Title 22, Division 4, Chapter 3 (Title 22) defines specific uses and limitations, such as requiring use not to exceed agronomic rates and nighttime irrigation, of recycled water for each level of treatment. Title 22 includes non-potable recycled water uses and indirect potable reuse requirements for groundwater recharge and reservoir water augmentation. The DPR regulations will be added to Title 22, Division 4, Chapter 17.

The term "recycled water" covers a wide range of water quality and uses making it important to understand how different types of recycled water can, and are, being used in California. Treatment levels and permitted recycled water use are aligned to protect public and environmental health. In general, the higher the level of treatment, the broader the permitted uses. Wastewater is treated to meet discharge requirements that are protective of the environment to enable it to be discharged within water or on land in California. Almost all wastewater treated in California can be recycled for some type of beneficial use. When treated to undisinfected secondary standards, generally the lowest permitted treatment level for discharge, recycled water can be used to grow fodder crops or other vegetation that does not come into

direct human contact. Levels of treatment and uses are discussed in Section 3, "Investment Needs and the Cost of Inaction," and in Appendix A, "Title 22 Permitted Non-Potable Recycled Water Uses."

The second aspect for water to be considered "recycled" as defined in the Water Code is that the use must be planned and implemented. Wastewater that is treated and discharged to the environment according to the facility's permit is a benefit to the environment and may incidentally be reused by downstream water users, but this incidental reuse (also referred to either as unplanned indirect reuse or de facto use) is not considered recycled water as defined in the regulations. Treated wastewater becomes recycled water when it is purposely conveyed from the point of treatment to the point of planned use. The State Water Board also requires completion and approval of an engineering report, which will be discussed later.

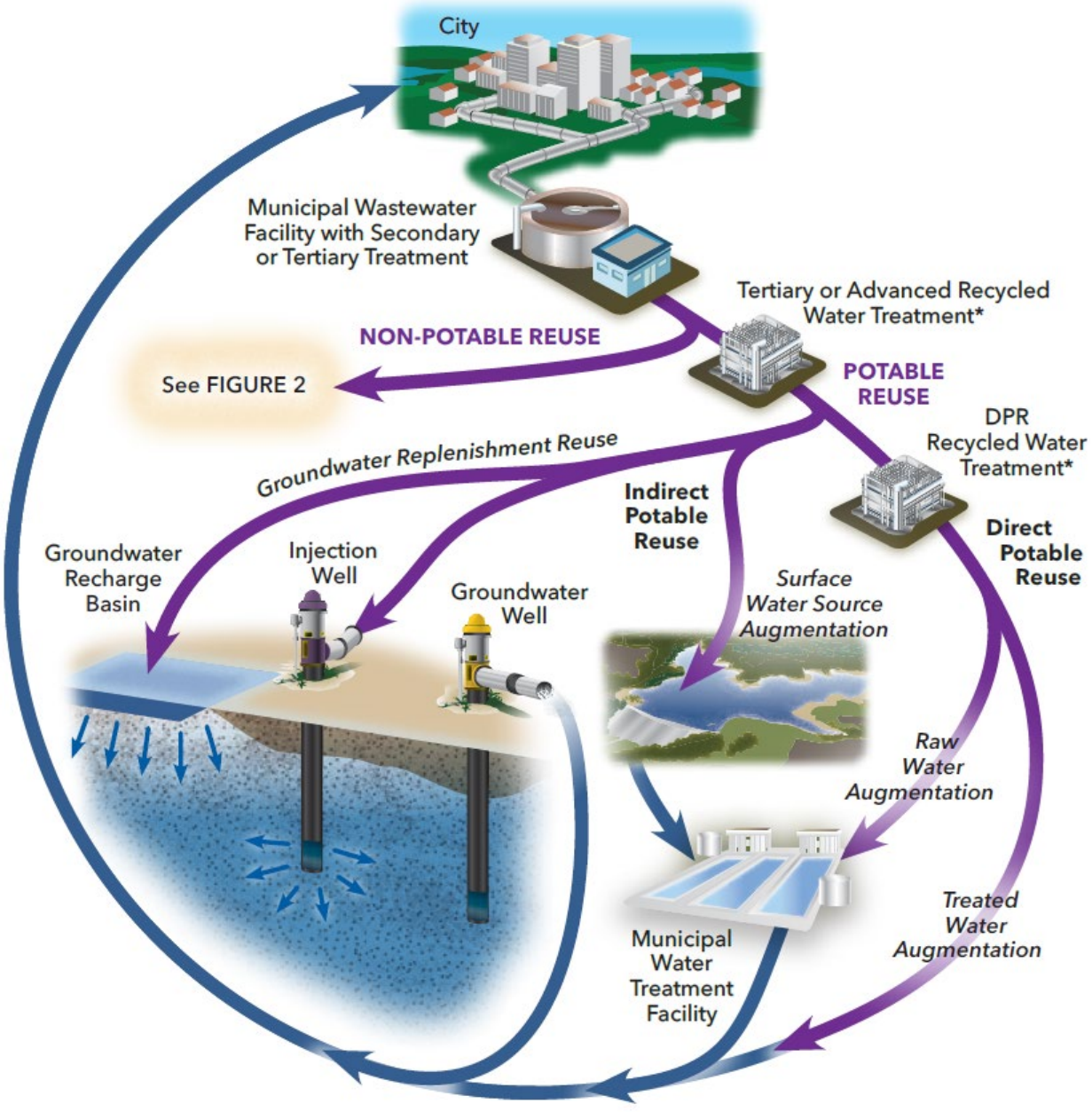
Recycled water projects are categorized as non-potable or potable.

- Non-potable recycling: any application not involving drinking water for human consumption, such as landscape or agricultural irrigation, commercial applications such as car washes or toilet flushing in office buildings, or industrial processes such as in oil refineries or cooling towers.
- Potable recycling: any application that replenishes or augments drinking water supplies. It can be further distinguished as direct or indirect:
    - DPR is treated water conveyed directly from the advanced recycled water treatment plant to raw or treated drinking water supply lines, a practice that is possible with the new regulations adopted by the State Water Board and approved by the OAL. These regulations are discussed in Section 2, "Benefits of Integrating Recycled Water into a Water Supply Portfolio."
    - Indirect potable reuse (IPR) is treated water from the recycled water treatment plant discharged into recharge basins to infiltrate or injected directly into groundwater aquifers (groundwater replenishment reuse projects) or into surface water reservoirs used for drinking water supply (surface water source augmentation projects). Seawater intrusion barriers using recycled water are also groundwater recharge projects and are a form of IPR.

Figure 1 depicts potential pathways of recycled water projects developed by water and wastewater suppliers. The recycled water pathways shown in Figure 1 do not indicate the level of recycled water treatment. Existing California regulations (Title 22) specify required treatment levels for designated uses.

There is a wide range of how non-potable reuse is implemented in California. Figure 2 shows a few of the more common uses, as well as some of the more creative uses of municipal recycled water in the state.

Figure 1 Potable and Non-Potable Municipal Recycled Water



*Recycled water treatment for potable reuse (IPR or DPR) may be housed in the wastewater treatment facility but is shown here as separate buildings to distinguish different levels of treatment.

Figure 2 Examples of Non-Potable Uses of Municipal Recycled Water

Classifications of Recycled Water in California

Recycled water is classified by the level of treatment provided by the treatment facility. Permitted water uses protective of human health are identified for each level of treatment. As indicated above, water with a higher level of treatment has a wider variety of uses. State regulations mandate that producers and users of recycled water comply with treatment and use restrictions to protect public health and the water quality of receiving water bodies.

Wastewater generally is required to be treated to at least a secondary treatment level before it can be released to the environment. In some cases, such as seasonal

discharge limits, tertiary treatment of wastewater discharge may be required to protect public health or the environment.

Recycled water used for most urban applications requires tertiary treatment because of public health requirements. Tertiary treatment that complies with Title 22 has the fewest restrictions on use for practices other than potable applications. Tertiary treatment requires a greater amount of energy to produce and, depending on the energy source, can produce more greenhouse gases (GHG). GHG emissions can be reduced in several ways, including not overtreating water that can be beneficially reused at lower levels of treatment, reusing wastewater for uses needing a lower level of treatment than would be required for discharge to the environment, or incorporating green energy sources.

In general, the levels of treatment for recycled water use are based on levels of human exposure and pathways of exposure leading to infection. The required levels of treatment are specified in Title 22 of the CCR (Division 4, Chapter 3, Section 60301 et seq.), as shown in the table in Appendix A, "Title 22 Permitted Non-Potable Recycled Water Uses." The Title 22 regulations also specify monitoring and reporting requirements and on-site use area requirements.

Recycled Water Use in California

Municipal recycled water use for agriculture and urban irrigation has successfully occurred in California for more than 100 years. In 1910, 35 sites were using municipal recycled water for agricultural purposes. San Francisco's McQueen Treatment Plant supplied recycled water for irrigation in Golden Gate Park from 1932 until the plant was decommissioned in 1982 (Pinhey 2024). Active groundwater recharge with recycled water began in the 1960s in the Los Angeles area at Whittier Narrows and in Orange County in the 1970s. Uses have broadened and expanded as treatment has improved, and it is now used by hundreds of agencies at thousands of sites for irrigation, industrial uses, and potable water supply augmentation.

Tracking Use

The State has been tracking recycled water use since 1970, primarily by periodically surveying users and uses of recycled water. The State Water Board and the California Department of Water Resources (DWR) have prepared these periodic surveys. In 2018, the State Water Board revised and adopted its update to the *Water Quality Control Policy for Recycled Water* and included annual reporting requirements statewide for wastewater facilities to report the volumes of wastewater treated,

wastewater discharged, and recycled water produced and used. The *Volumetric Annual Report of Wastewater and Recycled Water*, (Volumetric Annual Report), has improved the understanding of how much wastewater is produced and treated in the state on an annual basis and will be used to help assess future recycling goals. Figure 3 displays the numbers and locations of treatment facilities in California responding to the 2020 survey, including recycled water producers (facilities providing additional treatment to wastewater initially treated elsewhere), treatment plants producing recycled water, and wastewater facilities not producing recycled water.

Figure 3 Wastewater Facilities in California in 2020

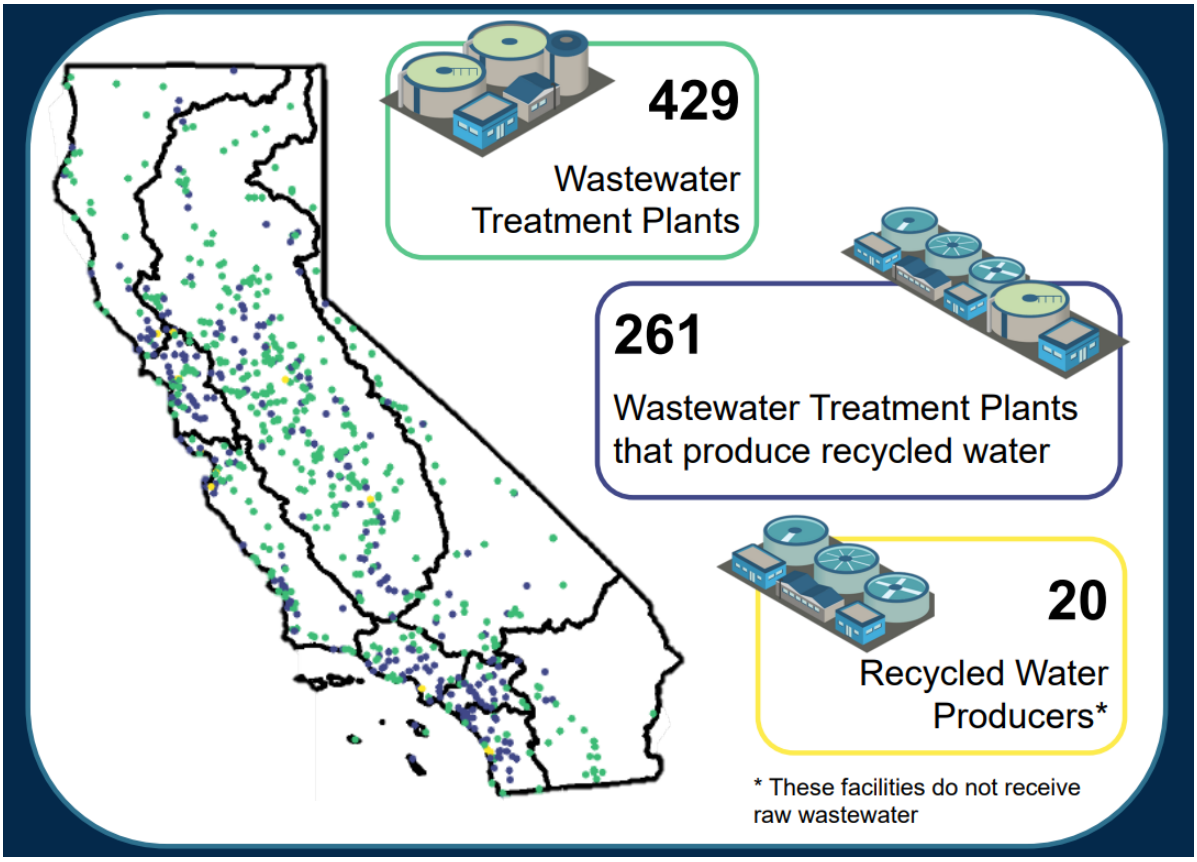


Figure 3 Source: State Water Resources Control Board website (2020 Volumetric Reporting of Wastewater and Recycled Water InfoGraphic)

The Volumetric Annual Report changed how recycled water had been tracked since the 1970s, so statewide recycled water estimates before 2018 are not directly comparable to estimates for 2019 and beyond. After 2019, neither land disposal supporting agriculture but lacking an engineering report, nor the release of treated water solely for environmental enhancement, were included when quantifying

statewide recycled water use. It is possible that these changes were the reason the estimated recycled water use was lower in 2019 relative to 2015. This decline was not expected because the financial investment made in developing recycled water infrastructure during the 2014–2017 drought and during the past 10 years was projected to result in observable increases in recycled water use in the state.

2020 Recycled Water Use in California

This RMS is a supporting document for *California Water Plan Update 2023*. Recycled water data for 2020 will be discussed in this RMS because *California Water Plan Update 2023* discusses water data through 2020. Recycled water data through 2022 are presented in graphs for reference.

The State Water Board reported 728,000 acre-feet of recycled water was beneficially reused in 2020 for a variety of uses (Figure 4). Figure 4 also shows the Volumetric Annual Report results for 2019 (686,000 acre-feet), 2021 (732,000 acre-feet), and 2022 (749,000 acre-feet). Although not directly comparable, Figure 5 presents recent data and historic data for reference.

Figure 4 Recycled Water Use Reported by the State Water Board, 2019–2022

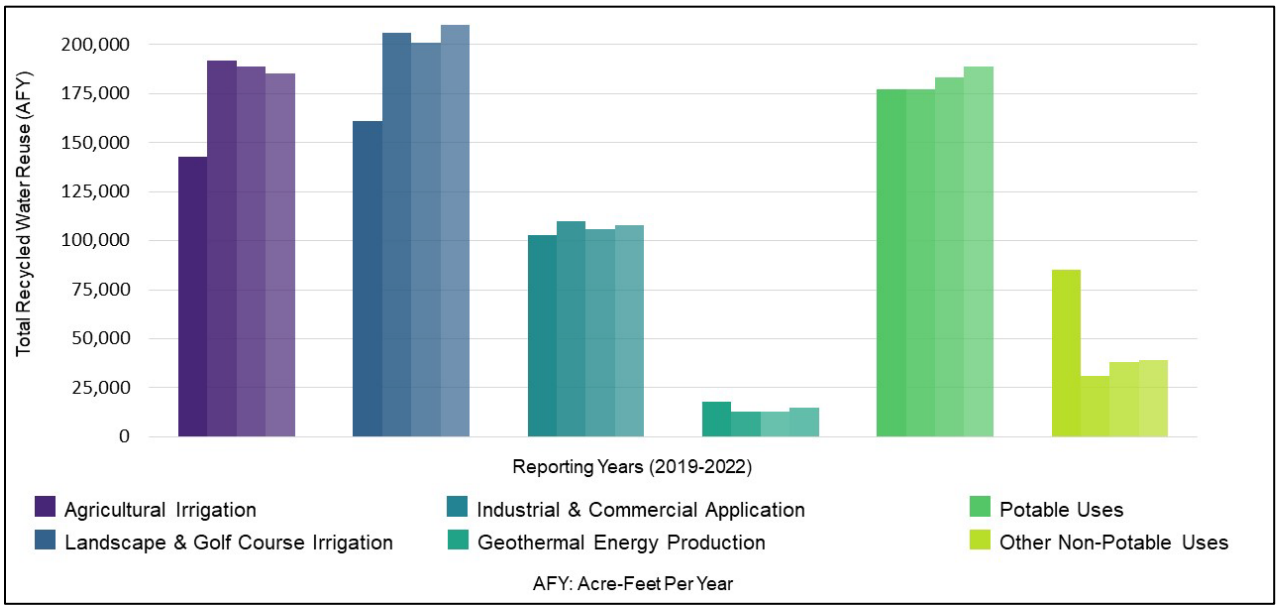


Figure 4 Source: State Water Resources Control Board website (2020 Volumetric Reporting of Wastewater and Recycled Water InfoGraphic)

Figure 5 Municipal Recycled Water Use in California Since 1970

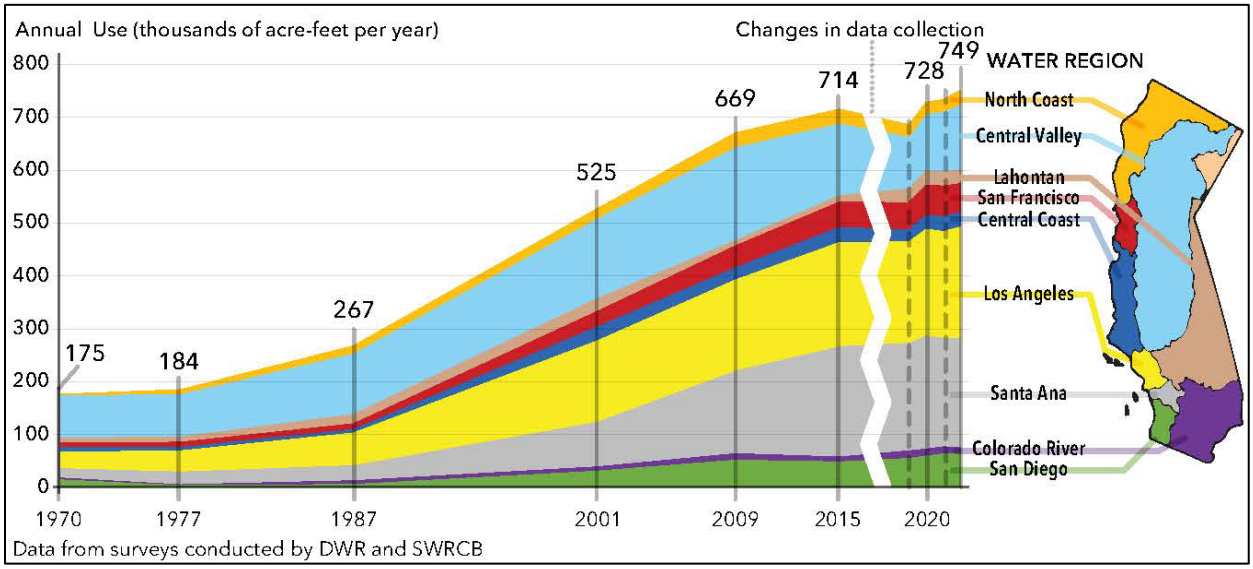


Figure 5 Notes: DWR=California Department of Water Resources, SWRC=State Water Resources Control Board
(1) The break in the graph between 2015 and 2019 is because of changes made to recycled water data collection in 2019. (2) Dashed lines shown for 2019 and 2021 data are for reference.

The total amount of inflow in 2020 to wastewater treatment facilities was 3.42 million acre-feet, excluding recycled water facilities that are treating effluent from a wastewater facility (Figures 3 and 6). Of this volume, 2.4 million acre-feet were discharged, and 728,000 acre-feet were beneficially recycled. The remaining outflow was either used in the plant, was biosolids, or was required by wastewater facility operating permits to be discharged to creeks, streams, and rivers to support environmental habitat. Environmental water, referred to as instream flow requirements, is not available for recycling and is shown in Figure 6 as "Discharged as Waste."

As shown in Figure 6, between 2019 and 2022, the percentage of recycled water reused increased from 20 to 25 percent of wastewater facility outflow. Water was discharged as effluent to oceans, rivers, creeks, and surface water bodies. A portion of this water may be available for additional recycled water projects. Because the discharged treated wastewater may be captured by downstream users and reused, possible reduction of water discharged into streams because of new recycling could potentially adversely affect downstream water rights holders or instream beneficial uses. Recognizing this, the Water Code requires that prior to making any change in the point of discharge, place of use, or purpose of use of treated wastewater, owners

of wastewater treatment plants will need approval from the State Water Board for that change. The State Water Board will review potential changes to ensure potential impacts on beneficial uses are considered before authorizing a change in the permitted discharge of municipal wastewater (Water Code Section 1211).

Figure 6 Annual Recycled Water Use as a Component of Collected Wastewater, 2019-2022

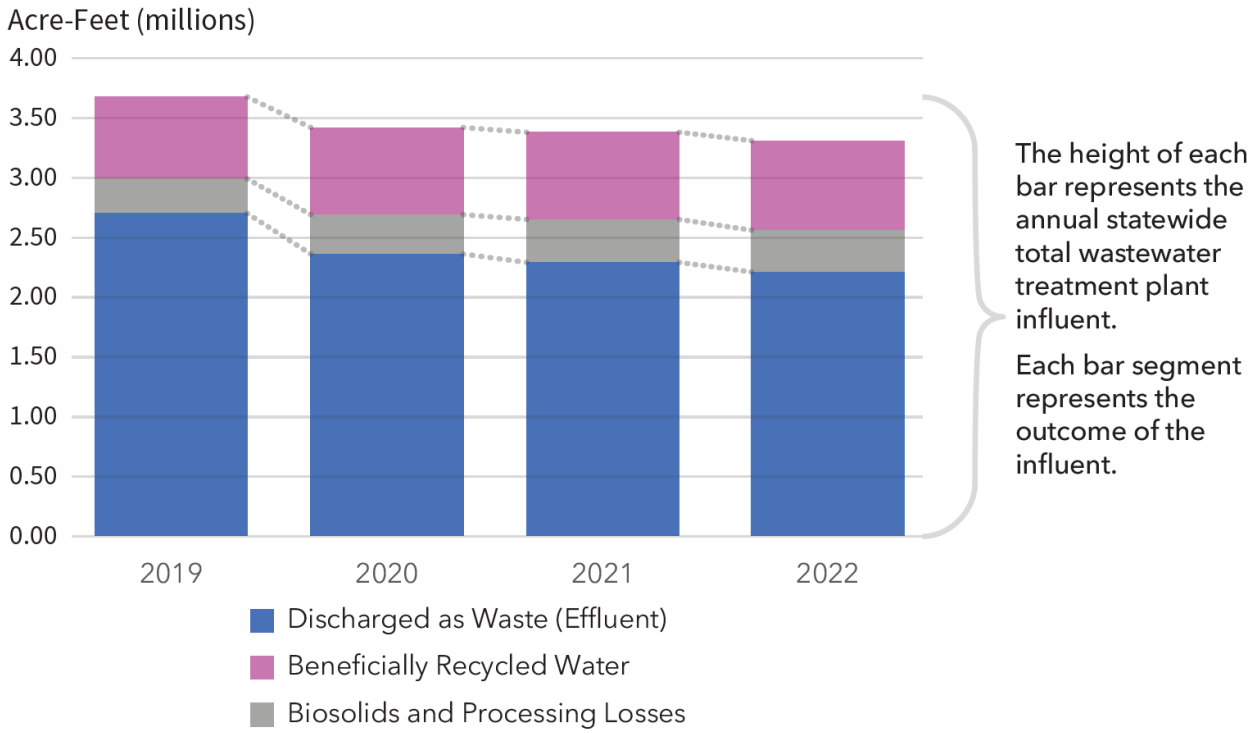


Figure 6.Note: Data to develop this graph from State Water Resources Control Board website (2022 Volumetric Reporting of Wastewater and Recycled Water InfoGraphic)

2030 and 2040 Goals Identified in the Water Supply Strategy

The 2022 *California's Water Supply Strategy: Adapting to a Hotter, Drier Future* (Water Supply Strategy) updates State priorities to address current and anticipated water supply shortages caused by long-term drought and the accelerating impacts of climate change. These goals are a part of a larger effort identified in the *Water Resilience Portfolio* (2020) to build California's water resilience to address anticipated water supply challenges.

The Water Supply Strategy identifies goals to increase annual recycled water use to 800,000 acre-feet per year by 2030 and 1.8 million acre-feet per year by 2040. The State Water Board funded a Water Research Foundation project to evaluate how much water is available in California for future recycling projects. The findings of this

2023 report include the estimate that 1.8 million acre-feet per year may be available for diversion from inland surface water and coastal disposal (Leverenz et. al. 2023). These findings indicate that, if wastewater discharge needs for brine discharge and instream flow requirements can be met and projects identified and constructed, Water Supply Strategy goals could be attained. Lists of known planned recycled water projects have been compiled by the State Water Board to assess the potential for meeting the recycled water goals identified in the Water Supply Strategy are discussed in Section 5, "Municipal Recycled Water and the Water Resilience Portfolio."

2. Benefits of Integrating Recycled Water into a Water Supply Portfolio

Municipal recycled water provides many benefits to local and statewide water supply reliability. It increases and diversifies local supplies, supports drought preparedness, provides environmental benefits, and can reduce energy consumption by lowering dependence on imported supplies. Municipal recycled water benefits the state and individual water users by reducing long-distance water conveyance and providing local water supplies that are generally a drought-resistant resource. It is a flexible water supply with a wide range of qualities that can be adapted to local needs to offset impacts and costs of uncertain imported supplies. Recycled water also supports climate change mitigation and adaptation strategies discussed in Section 3, "Investment Needs and the Cost of Inaction."

Local Supply

Municipal recycled water has the advantage of being locally generated and reused. Developing recycled water supplies provides a benefit and additional options for agencies that may depend on imported water supplies conveyed over extended distances. Depending on the energy source, recycled water may also have lower GHG generation than water conveyed over a long distance, have a higher level of reliability during drought, and provide a higher level of control than imported water.

Drought Preparedness

Establishing recycled water capacity provides a more reliable water supply resource for water managers to access during drought periods. Municipal recycled water has less variability during droughts than conventional groundwater or surface water resources because municipal water discharge continues during droughts, even if short-term drought conservation measures reduce domestic, commercial, and industrial wastewater discharge. For this reason, recycled water is referred to as drought resistant. Although drought can affect recycled water supplies, the impacts are generally not as severe as on other supplies, and recycled water supplies can recover more quickly as drought conditions lessen.

Energy Savings

Wastewater treatment serves two functions, (1) make the water suitable for discharge to the environment, and (2) enable the water to be beneficially reused. When projects

are analyzed for energy impact, treatment energy is allocated to these two functions. Wastewater treatment to protect the environment, and its required energy and GHG emissions, are allocated to pollution control. Any additional treatment necessary to enable the water to be used for other reasons is assigned to water supply. When recycled water is used as a water supply source, the energy required above that required for discharge to the environment, plus the energy needed for distribution, is what would be compared with the energy needed for alternative water supply options.

Implementing municipal water recycling could reduce energy consumption compared to fresh water sources, which can also support California's climate change mitigation efforts. The water sector uses a significant amount of energy to convey water from source to use. The State Water Project uses 2 to 3 percent of the total energy consumed in the state and is the single largest user of electricity in California (Natural Resources Defense Council 2004). Water recycling can provide a lower-energy source of local water compared with importing water from other regions, or desalination of seawater or brackish water. Energy savings are greatest when recycled water is used near wastewater treatment sources and when additional treatment is not required beyond the treatment needed for wastewater disposal.

Energy savings realized by implementing a recycled water project depend on multiple factors, including whether the source of the water offset by the recycled water has a higher energy intensity, the amount of increased treatment needed to reuse the water above that already required for discharge, and distance to the point of recycled water use. Research is ongoing to optimize existing treatment methods and to develop lower-energy recycling methods, which would reduce GHG emissions during the water recycling process. Overall, it is assumed that implementing recycled water would provide a net energy benefit by developing local resources versus importing fresh water. Increased energy efficiency would also be realized by considering "fit-for-purpose" in recycled water use planning by avoiding treating water to a higher level than is necessary for its planned reuse, as discussed further in the Fit-for-Purpose Reuse section below.

Human Right to Water

In Water Code Section 106.3, the State recognizes that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." The human right to water extends to all Californians. Recycled water can support human right to water by increasing water supplies in multiple ways. It can extend local water supplies through either meeting

non-potable demands or through IPR by recharging existing groundwater or surface water supplies. DPR regulations allow streamlined permitting of projects that propose to use recycled water to directly augment water supplies.

Environmental Enhancement

Recycled water can support environmental habitat. Wastewater facilities may be required to maintain certain discharges to creeks or rivers as part of operating permits. Treated wastewater may also be discharged to wetlands to enhance habitat.

Recycled water is used for groundwater injection barriers in several locations along the Pacific Ocean to protect potable water in coastal aquifers without natural barriers. This protects the potable water from seawater intrusion. Because a portion of the water injected for the seawater barrier will migrate inland, seawater intrusion barriers provide a dual benefit of seawater intrusion protection and aquifer replenishment.

Potable Reuse

Recycled water can directly or indirectly augment potable water supplies. This has multiple benefits. It expands locally available water supplies, reduces wastewater discharge, and maximizes the wastewater treatment investment for the local wastewater agency. Potable reuse requires additional treatment, extensive monitoring, and well-planned implementation to protect public health. Each of these requires significant financial investment, technical and managerial capability, and commitment from the water supplier.

Indirect Potable Reuse

IPR requires an environmental barrier, either an aquifer or a surface water reservoir. The required residence time of the recycled water within the aquifer or reservoir offers an opportunity for natural treatment to occur and provides a buffer between recycled water treatment and potable reuse if temporary lapses occur in the prior treatment process. After extraction from an aquifer barrier, the water can be used without restriction or added to a potable water distribution system. After extraction from a surface reservoir, the extracted water will receive further treatment at a water treatment plant before being added to a potable water distribution system.

Tertiary-treated or advanced-treated water can be used for IPR, depending on the project type, planned residence time, availability of water that could be blended with recharge water, and the reservoir size. Tertiary-treated water has been safely used in California to recharge aquifers used as drinking water supplies since the 1960s.

Direct Potable Reuse

In December 2023, the State Water Board adopted regulations prepared by its Division of Drinking Water (DDW) to enable advanced-treated recycled water to directly augment potable water supplies without an environmental barrier. The regulations are incorporated into Title 22 and establish minimum uniform water recycling criteria required to adequately protect public health when DPR projects are implemented. The regulations address two DPR approaches:

- Raw water augmentation: adding recycled water immediately upstream of a public water system's water treatment plant. This could include storage of advanced-treated water in a tank or into a surface water impoundment that is too small to be considered IPR.
- Treated water augmentation: adding advanced-treated water directly into a water distribution system.

The proposed DPR regulations are discussed in Appendix B, "Potable Reuse of Recycled Water."

Variable Water Sources for Non-Potable Uses

Some water demands commonly served with potable water could be met with non-potable water. For example, recycled water could be used for non-potable purposes such as irrigation, urban landscapes, and some commercial and industrial uses. Water suppliers can optimize the use of limited potable water supplies by providing recycled water to meet non-potable local water demands.

Alternative to Land Disposal

When a wastewater facility does not have a surface water body that can receive treated wastewater, the facility may use land disposal or an evaporation pond. Purposely recycling this water can provide an alternative that can offset local water use and reduce nitrate impacts to local groundwater.

Land Application

A wastewater facility may spray treated wastewater onto fields at a rate that does not induce runoff. The field also could be used for cattle grazing or growing crops, such as alfalfa or other fodder crops, which are permitted under Title 22. Both approaches could reduce use of other available water supplies to meet those demands and provide economic benefit to the local agricultural community. Growing crops

provides an additional benefit of the agricultural crop utilizing the nitrates in the wastewater and reducing potential environmental nitrate impacts.

Currently, the regional water quality control boards (RWQCBs) categorize grazing land and agricultural crop irrigation with treated wastewater as disposal unless an engineering report for the production, distribution, and use of recycled water (engineering report) has been submitted to and approved by DDW. Because of the time and expense to prepare these reports, many smaller wastewater facilities have not prepared an engineering report and are practicing agricultural use of recycled water in compliance with the facilities' waste discharge requirements (WDRs). These facilities are not credited with agricultural use of recycled water which can underestimate how much agricultural land is being successfully irrigated with treated wastewater. It also does not provide a State incentive for reusing treated wastewater as a water resource and reduces opportunities for knowledge transfer. If this practice is recognized and expanded, such as providing technical assistance to facilities to prepare an engineering report, it would beneficially support the agricultural community in areas where local groundwater levels may be declining and provide needed fodder crop products to support local livestock.

Evaporation and Percolation Ponds

Wastewater facilities that are not able to discharge treated wastewater to local surface water bodies usually maintain basins, which are also referred to as holding, evaporation, or percolation ponds. In situations where these usually unlined basins contain secondary effluent, which may have elevated levels of nitrates, the percolation of this water into the underlying groundwater aquifer may negatively affect groundwater quality. In some cases, these wastewater facilities are reported in urban water management plans (UWMPs) to percolate water, which incidentally beneficially replenishes the aquifer. To be classified as a groundwater recharge project the treated effluent must be intended to recharge groundwater and is required to be treated to at least tertiary levels.

As an alternative to evaporation or holding ponds for secondary effluent where there is no planned use of this water, this water could be effectively used to irrigate local fodder crops, as some wastewater agencies are doing. The State could develop a plan to support agricultural use of recycled water by providing funds to wastewater agencies to purchase or repurpose nearby land and install the needed conveyance to implement onsite agricultural use of treated effluent. This would result in the beneficial reuse of water now depleted by evaporation or adversely affecting local

groundwater quality, and it would enable the wastewater facilities to directly manage the use of the land.

Fit-for-Purpose Reuse

Water recycling involves treating wastewater to the quality necessary for its intended use or identifying beneficial uses of the quality of available recycled water. This approach to applying treated water for uses that align with its level of treatment is referred to as fit-for-purpose. It aligns available wastewater to locally available uses to maximize beneficial reuse and minimize additional infrastructure needs. The spectrum of allowable uses for each level of treatment is shown in Appendix A, "Title 22 Permitted Non-Potable Recycled Water Uses." Increasing the treatment of recycled water to expand reuse opportunities increases energy needs and GHG production associated with treatment. In more rural areas, where agricultural land is adjacent to urban areas or a wastewater plant, lower quality effluent can be used for agricultural irrigation, usually without increasing treatment levels. This enables higher-quality surface water or groundwater, replaced by recycled water, to be used as potable supply. Agricultural reuse also provides additional benefit by utilizing nitrogen compounds that may be present in treated wastewater.

Implementing fit-for-purpose practices in urban areas usually involves treatment above secondary standards. Uses of various types of secondary effluent may be more limited to protect public health. Higher levels of treatment can also be required for environmental discharge, depending on beneficial uses and specific water quality issues in the receiving water.

3. Investment Needs and the Cost of Inaction

There are multiple reasons why more treated wastewater is not reused in California. The reasons are primarily associated with funding and misconceptions about recycled water. Current practices of considering treated wastewater as a waste and not a reusable resource result in not utilizing a usable water supply and the loss of taxpayer and ratepayer dollars spent to treat wastewater for discharge. As climate change impacts affect water supplies, increasing recycled water use offers an opportunity to support water supply diversification and reliability.

Changing Water Supplies

Reliance on conventional surface and groundwater supplies is expected to be more challenging in the future, in part because of climate change and regional water infrastructure limitations. Treated wastewater offers an opportunity to access an alternate water supply available near most urban centers or the rural-urban interface. Diversification of water supply options will be a critical component of future water supply reliability.

Recycled water has been a component of California's water supplies for more than 100 years, but as shown in Figure 5, it was not until about 2000 that recycled water use supplied more than 500,000 acre-feet of water per year in the state. Recycled water in the southern portions of the state has become a widely used water supply portfolio component, supporting potable and non-potable uses. As of 2023, in Orange County, a national leader in the use of recycled water to support potable water supply, the Groundwater Replenishment System is recycling 100 percent of the reclaimable wastewater from the county's sanitation district. The Groundwater Replenishment System provides additional treatment to the secondary effluent produced at the adjacent wastewater treatment facility so that the recycled water is safe for its subsequent reuse (Figure 7).

Recycled water is not a drought-proof resource. In 2015, when Governor Jerry Brown required urban water users to reduce water use by 25 percent, wastewater flows to treatment plants were also reduced. This reduction resulted in lower recycled water availability. During discussions with wastewater plants conducted as part of the survey of how much recycled water was used in 2015, it was reported to DWR that several facilities had not been able to supply the usual volume of recycled water or

Figure 7 Reverse Osmosis at the Groundwater Replenishment System

had not been able to supply any at all. Future efforts to reduce urban water use are expected to affect wastewater flows and the amount of available recycled water.

Use of recycled water is expected to increase as agencies consider implementing IPR and DPR. Although only a few agencies indicated in 2020 UWMPs that DPR will be a component of its water supply by 2040, many agencies informally are reportedly evaluating DPR feasibility for future use. In the State Water Board's most recent assessment of planned increases in recycled water use (State Water Resources Control Board 2024), several projects are planned along the coastal regions of southern California for IPR and DPR. These projects will use water from some of the largest wastewater facilities in the state currently discharging to the Pacific Ocean. These agencies, and others, are pilot testing advanced water treatment. Additionally, agencies continue to propose IPR projects for review and permitting. The City of San Diego is beginning installation of pipelines that will be key components of its Pure Water San Diego project, expected to be one of the first IPR surface water augmentation projects in the state. It should be noted that the construction of treatment and conveyance facilities in urbanized areas for these projects will

represent significant financial investment by the involved agencies to reinforce water supply reliability.

Why Agencies are Not Recycling Treated Wastewater

Currently, the only information on why wastewater is not being recycled is collected in UWMPs, which are prepared by medium and large water suppliers to assess future water supply reliability. UWMPs are submitted to DWR every five years and include discussion of wastewater and recycled water use within their service areas. If a water supplier is neither using nor plans to reuse treated wastewater, the water supplier indicates the reason. In the 2020 UWMPs, the most common reasons cited by UWMP preparers include:

- Lack of conveyance or treatment infrastructure.
- Wastewater does not meet Title 22 standards (see "Education" subsection below).
- There are no customers for recycled water.
- Water demands are sufficiently met with existing supplies.

Of the 410 water supply agencies that prepared 2020 UWMPs, 46 percent do not include recycled water in current or future supply planning through 2040. Of the 690 wastewater facilities submitting the required Volumetric Annual Report, 62 percent are neither directly nor indirectly beneficially reusing treated wastewater.

The common message within the State Water Board and UWMP data sets is that recycled water use is underutilized. There is a basic misunderstanding about what recycled water is and how it can be used even within the water and wastewater industry. Many agencies cite the limitations above as reasons why wastewater is not being beneficially used to meet water needs, even as climate change impacts affect the availability of traditional supply sources.

It would be helpful to evaluate the assessment of planned recycled water projects recently compiled by the State Water Board, the outcomes of State grant and loan funding awarded in the past 10 years, and the reasons for not including recycling in the UWMPs. Then, using the tools developed for the Water Research Foundation evaluation to assess recycled water potential, focus on the key steps the State can implement to increase water supply from implementing additional recycled water projects.

Another action to support increased evaluation of recycled water could occur during the WDR renewal process. If funding becomes available, the RWQCBs and the State Water Board could provide resources and support in the form of technical assistance to a wastewater provider to support project planning, applications for funding, or engineering report development. This support could include an assessment of whether treated wastewater could be used in ways other than directly discharging it as waste to support the State Water Board's inventory of potential recycled water projects and identify additional funding needs. Currently, State grant funds to support recycled water use are distributed to qualifying applicants. But the grants do not cover ongoing operations and maintenance costs. Small agencies that do not have the staff or financial support usually do not submit applications or engineering reports. A change to be considered would be to allocate State funds for technical assistance to support recycled water projects for small- and medium-sized wastewater facilities that augment local supplies and provide additional water resiliency for smaller communities.

DWR could also require UWMP preparers to provide more information as to why they are not considering implementing municipal wastewater recycling. This could include better assessment of wastewater quality currently being discharged and potential uses, use options with wastewater treatment upgrades, and a general estimate of costs to upgrade treatment and conveyance. This information would directly support preparation of new WDRs and estimates for investment needed to increase recycled water use.

Climate Change

Adaptation

Climate change will increase temperatures and affect precipitation patterns. California is expected to experience rapidly changing periods of extreme dryness and intense precipitation. Because of the warming climate, water demand is anticipated to increase while concurrently reducing water supply availability and reliability. These variable weather cycles differ from the conditions for which State, federal, and local water systems were initially designed. Increasing use of recycled water could provide a consistent reliable water resource to supplement the water supply lost because of climate change and balance water supply options during extended drought periods.

Rising temperatures from climate change will increase surface water evaporation with less water available for use. This can affect locations that depend on surface water for

water supply, groundwater recharge, or conveyance of water from one location to another. Rising temperatures are also expected to reduce the amount of water available for importation, which could benefit threatened ecosystems that will also be grappling with adapting to climate change. Increasing recycled water use can directly offset temperature impacts to water supplies with the addition of recycled water to surface water reservoirs and aquifers, both of which are permitted actions in California. The use of recycled water for non-potable and potable uses can also reduce the need for importing water and conveyance evaporative losses.

Along the coast, increased temperatures from climate change will lead to sea level rise from melting of glaciers and ice sheets, and from thermal expansion of warming seawater. In addition to directly affecting coastal communities and infrastructure, sea level rise can increase saltwater intrusion into coastal aquifers. Salinity barriers, such as those operating in Los Angeles and Orange counties, can be created by injecting recycled water along the coast to protect inland groundwater resources.

Mitigation

The "greenhouse effect" refers to certain gases in the Earth's atmosphere that trap heat like a blanket and effectively warm the planet. Increasing emissions of these gases through human activities are thickening this blanket and causing global warming. The biggest contributor of human-caused emissions is the burning of fossil fuels for energy and transportation. Reducing the emissions from these human activities is essential for halting climate change and avoiding the most severe global impacts.

Energy is needed for producing recycled water as well as brine management and conveyance. Although California has increased its renewable energy resources, half of the state's electric generation is sourced from burning natural gas. Combustion of natural gas increases greenhouse gas emissions and further advances global warming. As a result, although recycled water can be part of a climate-resilient water supply, the operation of its facilities has the potential to affect greenhouse gas reduction goals if fossil fuel powered plants are used as the primary source of energy.

Energy demand for recycled water use can be reduced by focusing on lower levels of treatment, fit-for-purpose, or by adjusting treatment levels seasonally, as needed. This helps reduce excess or unnecessary energy usage for over-treatment (treating recycled to a higher level than needed for the designated use (see Appendix B, "Potable Reuse of Recycled Water") and limits emissions to only what is needed for the recycled water use. In this way, municipal water providers can utilize recycled

water with lower levels of treatment for non-potable uses to supplement supplies without needing to provide higher level of treatment when it is not necessary for the intended water use. It also allows for prioritizing of lower energy recycled water uses that reduces GHG emissions.

Using renewable energy sources would eliminate GHG emissions associated with the energy required for producing recycled water. Renewable energy sources are not currently the dominant energy source but are expected to dramatically increase as California moves toward carbon neutrality goals by 2045. Senate Bill 100, also known as the 100 Percent Clean Energy Act of 2018, establishes that eligible renewable energy resources and zero-carbon resources supply 100 percent of retail sales of electricity to California end-use customers and 100 percent of electricity procured to serve all State agencies by December 31, 2045. This creates the potential for recycled water to be partially, or even fully, powered by renewable energy.

It is possible that the high energy demands of recycled water may make GHG emission goals harder to attain. Water managers that are required to meet California's carbon neutrality goals may not yet be equipped with producing recycled water from renewable energy sources. Water managers are encouraged to include an energy alternatives analysis when evaluating water supply portfolios to support renewable energy approaches. Additionally, new technologies that will lower energy demands for producing recycled water are needed.

As water suppliers assess the potential for recycled water opportunities to mitigate climate change impacts to water supplies, they will need to assess and compare energy demands for importing water sources versus recycled water and other alternative water sources. This will include considering non-potable and potable water uses, including DPR.

Investment Needs

The State of California has invested billions of dollars in the form of grants and loans to water agencies to design and implement recycled water projects. The volume of total recycled water beneficially reused in California has increased less than 3 percent since 2015, when drought funds and Proposition 1 funds were directed to increasing recycled water use in the state. The survey of recycled water use conducted in 2015 was a "baseline" survey because it was a drought year and there had not been enough time for projects funded by State recycled water funds to begin producing water. As the State evaluates the needed level of funding and to invest it, approaches to improve funding distribution should be considered to expand additional water

supplies and support agencies that may not have benefited from earlier State funding.

Infrastructure

Infrastructure improvement is critical to increasing recycled water use. Key considerations include treatment improvements, storage options, and conveyance improvements, and how these improvements will benefit the recycled water producers and users. There have been cases where developers or groups needing additional water have funded recycled water infrastructure or conveyance improvements in exchange for an offset of higher quality water toward the new project. Ownership of the water and customer issues are discussed in Section 4, "Barriers to Implementing Municipal Recycled Water."

Treatment Improvements. Analysis of matching level of treatment with potential uses is essential when considering treatment improvements. If a water supplier determines the existing quality of recycled water available is insufficient for identified water demands, it may suggest a need to evaluate wastewater treatment improvements and funding mechanisms.

As indicated earlier, aligning water quality with water needs is fundamental, especially when considering minimizing additional capital expenditures, facility operations and maintenance, or GHG emissions. If there are no known agricultural users in the area, there may be limited opportunities for reusing water treated to undisinfected secondary water standards. Similarly, irrigating tree crops with recycled water would require a higher secondary level of treatment.

The feasibility of IPR and DPR are also being considered by water suppliers. Assessment would include needed facility improvements, additional treatment and monitoring to assess and document public health water quality protections, and public outreach.

Conveyance Improvements. A common issue for increasing the use of recycled water is moving the water from treatment to the location of use. Usually there are extensive challenges associated with conveyance, including installation and maintenance. Some water suppliers have been successful in identifying existing conveyance that is no longer being used because of other system improvements. Conveyance challenges are discussed in Section 4, "Barriers to Implementing Municipal Recycled Water."

Storage. Storage can help improve a supplier's ability to provide recycled water when demands are highest. Storage can be used to manage daily or seasonal peaks. For example, recycled water demands may be higher at night when most urban irrigation occurs. Or seasonal storage could be used to store winter water when irrigation demands are generally lower.

Brine Management. As discussed in Section 4, "Barriers to Implementing Municipal Recycled Water," brine management is a key aspect of producing higher quality recycled water because the treatment process may result in brine production. Developing local or regional solutions, such as conveyance (brine lines) or disposal options, may involve infrastructure investment.

User Site Requirements. There are facility requirements on sites where recycled water is used. The primary objective is protecting public health from misuse of the recycled water and cross-connections between recycled water, potable water, graywater, and other non-potable water supplies that may be on the use sites. In addition to the costs of the facilities, there are periodic costs for inspections and testing for cross-connections. These requirements are included in the State Water Board's *Cross-Connection Control Policy Handbook*, Title 22 of the California Code of Regulations, and the California Plumbing Code, which also has the force of regulations.

Operation and Maintenance Requirements. Higher levels of recycled water treatment require operators with higher certification levels to staff the facilities. Recruiting staff, training new and existing staff, and supporting staffing needs in frontline communities must be considered in recycled water planning. In addition, increased costs for chemicals, electricity, and equipment maintenance are uncertainties that may increase overall costs and must be considered during project planning.

Education

Expanding recycled water education is key to increasing its use. Education can help enhance understanding of the types of recycled water and how they can be used. In addition, providing information to the public on treatment, safety, and protections will help support expanded uses, including DPR.

There is a misconception by some that "Title 22 standards" is synonymous with tertiary treatment for reuse. Tertiary-treated water is one type of recycled water discussed in Title 22, which presents requirements and uses of treatment levels

ranging from undisinfected secondary to advanced treatment. Where secondary treatment is adequate for treated wastewater discharge but there are no potential uses of water treated to secondary levels allowed by Title 22 within a reasonable vicinity of the current treatment plant, adding tertiary treatment might facilitate reuse. Informing water and wastewater professionals regarding terminology, and how current regulations and water supply challenges support expanding recycled water's future use, could expand recycling practices throughout the state.

A potential source of misunderstanding may be how to refer to recycled water when discussing possible DPR projects. It will be important for water suppliers considering DPR to provide public information to customers early in the process about the proposed project. Information regarding the protections and monitoring required for DPR, as well as what chemicals are removed during treatment, are expected to be important for public acceptance.

The "why" of recycled water education will also be important. As mentioned above, climate change is expected to bring periods of extreme drought and flood. The Water Supply Strategy estimates that the hotter, drier climate could diminish the state's water supply by as much as 10 percent by 2040 (between 6 million and 9 million acre-feet per year). Alternative water supplies, including recycled water, could improve the state's water supply reliability when environmental conditions are uncertain and rapidly changing. Educating the public about long-term water supply challenges and their effect on employment, the economy, the environment, and quality of life, may foster broader public support for, and the advancement of, recycled water projects.

Agriculture

As discussed above, reuse of treated wastewater for agriculture may be more easily implemented in rural areas because it often does not involve upgrading treatment and adding conveyance is usually not as difficult as in urban areas. Wastewater agencies have reported challenges in local agricultural communities not "wanting the water" because it has limitations with the types of crops that can be grown and requires special handling and signage (Figure 8).

Agencies currently recycling water for agricultural reuse have implemented a variety of methods to encourage the practice, including lease agreements and reduced or no-cost water. One successful approach is for the wastewater agency to own the land, which enables a wastewater facility to have assurance that the practice will continue. The State could develop a targeted fund to enable wastewater agencies to purchase

or repurpose land, install conveyance facilities to support agricultural reuse, or develop a program to provide outreach and support agencies seeking financial or technical support. This program could also support wastewater agencies with secondary effluent evaporation or recharge ponds.

Figure 8 Agricultural Reuse Signage

The Cost of Inaction

Recycled water is the most widely available alternative water supply to augment locally available resources. Wastewater treated at almost all facilities in California is beneficially usable without additional treatment, although permitted uses may not be readily available in the proximity of urban wastewater facilities without additional treatment. Aligning water quality, infrastructure, and potential customers requires planning and coordination and has always been a key aspect of recycled water development. Climate change, water supply scarcity, and new technologies necessitate reevaluating feasibility studies to assess whether previously considered projects may now be viable. It may also be necessary to evaluate new IPR and DPR uses of recycled water that were not previously permitted. As indicated earlier in this section, this additional planning could be done as part of WDR updates or providing

additional information in an UWMP. UWMP preparers in 2025 could be required to provide additional information, beyond the current simple statements or tables, as to why recycled water is not being considered for implementation. Additional WDR and UWMP actions could help improve California's ability to increase the use of recycled water to support water supply challenges during expected water supply challenges resulting from climate change.

4. Barriers to Implementing Municipal Recycled Water

As indicated in the introduction of this RMS, recycled water use is increasing and is expected to continue to increase. The challenges to expanding recycled water use are discussed below. Some of these issues have been presented earlier in this RMS, but they are presented again here to consolidate discussion on challenges.

Challenges

There are many reasons a customer begins to use recycled water. It can be because there are financial incentives such as cheaper water or a more reliable supply. Some of these reasons are easy to address and others may be more difficult.

Water Ownership or Control

There are multiple situations where the control or ownership of recycled water may affect potential projects. Some of these issues are presented here but are not in detail because of their complexity.

Recycled water is distributed by both wastewater and water agencies, which may not be under the same organization, such as a city or county. When wastewater and water agencies are separate entities, there can be challenges related to customer base. Geographic jurisdiction and the legal functions of agencies (e.g., wastewater treatment, discharge, or water supply) can hinder planning and present institutional challenges to constructing and implementing a recycled water project. Collaboration or agreements may also be needed when wastewater agencies are not legally able to deliver recycled water directly to a customer. In these situations, the water and wastewater agencies can work together where recycled water is generated by one agency and delivered by the other.

Supplying water to a customer generates revenue for a water supply agency. If a customer switches to recycled water supplied by a separate entity, the water supplier may lose revenue. There may be additional water supply availability for the water supplier, but there may be short-term budgetary impacts. This may require cooperation and collaboration between the organizations.

Other issues may include whether reuse could affect surface water rights if water supply is augmented with locally produced recycled water. Also, potential downstream impacts may play a role in whether a wastewater agency is allowed to reduce or eliminate its discharge to recycle.

Another issue associated with ownership can occur if an organization provides financial assistance to upgrade conveyance or treatment facilities. There may be agreements or requirements to deliver water to a party that has invested in facilities to receive recycled water. This can cause complications during periods of limited water availability or competing water interests.

Conveyance Challenges

The costs and challenges of maintaining a third infrastructure system, separate from potable water delivery and wastewater collection, can be challenging. Issues such as rights-of-way, maintaining necessary spacing with other infrastructure, protecting against and monitoring for cross-connections, and pumping requirements for water movement within the system all may be associated with installing and maintaining infrastructure to deliver recycled water. For these reasons, some agencies have not been as aggressive at expanding recycled water conveyance infrastructure. Figure 5 shows that the rate of expansion of recycled water use after 2010 slowed when compared to earlier periods of expansion. Specific reasons for this slow-down are not known, but anecdotal information indicates that maintaining a separate distribution system is a factor.

A second anecdotal reason for the slow-down in recycled water implementation in the 2010s is that agencies were waiting for DPR because it would not require a separate distribution system. Conveyance would most likely be required to move the water from one treatment plant to the other, but it would be moving water directly between two points versus distributing water among users. With approval of the DPR regulations by OAL (effective October 1, 2024), implementation of recycled water projects may accelerate.

Demand Variability

Non-potable recycled water often has demand cycles which can create challenges or require storage. Urban irrigation with recycled water usually occurs at night to minimize public exposure and reduce energy costs. Storage to hold produced recycled water supports meeting nightly demands. Seasonal variability also occurs for most types of irrigation because it usually is not needed in the winter. This may result

in the need for larger surface or groundwater storage, or the need for discontinuing recycled water production in the winter.

Brine Management

When recycled water treatment is increased from secondary to tertiary or advanced, reverse osmosis is often added to the treatment process. A byproduct of reverse osmosis is brine, a high-salinity liquid. Management and disposal of brine can be expensive because of its high salt content. At coastal facilities, brine is often co-mingled and diluted with discharged wastewater plant effluent and disposed of at ocean outfalls. Disposal of brine at inland facilities can be challenging if a brine line, a dedicated conveyance to move inland brine to an ocean outfall, is not available. As inland communities evaluate the options for DPR and additional IPR, brine disposal options will be a key issue to be considered.

The lack of brine disposal or management options affects recycled water expansion. Research into improved methods for brine disposal could support future recycled water projects. Brine management research is ongoing for desalination, which also uses reverse osmosis treatment, and could improve recycled water brine management. Brine management innovations and solutions will benefit both water supply practices, particularly in inland communities.

Declining Wastewater Flows

Per capita wastewater generation in California has declined over the past 10 years as residential, commercial, and industrial water conservation and water use efficiency has increased. Water use efficiency standards for indoor residential plumbing fixtures and appliances has reduced indoor water use. As wastewater generation decreases, potential impacts include collection system flow and increased corrosion, wastewater treatment plant operation, and availability of recycled water (Office of Water Programs 2022). As discussed in Section 2, "Benefits of Integrating Recycled Water into a Water Supply Portfolio," declining wastewater flows occur during drought periods.

Wastewater flows into treatment plants are declining as Californians conserve and decrease the amount of water used in their households and for landscapes. The *Making Conservation a California Way of Life* regulations, which will decrease indoor water use standards over time, are expected to put additional downward pressure on indoor water use because overall statewide population trends are predicted to remain flat. There is potential for declining wastewater flows to affect future water

recycling goals. A California Urban Water Agencies white paper, *Adapting to Change: Utility Systems and Declining Flows* (2017) indicates that declining flows can alter treatment and cost-effectiveness of recycled-water infrastructure by altering factors considered in system design, such as anticipated flow and water quality. It could also result in underutilized assets and changes to wastewater processes to maximize recycled water opportunities. Additional study is warranted to assess effects of increasing indoor water use efficiency on overall recycled water availability and use.

Emerging Contaminants

A challenge for the reuse of water is the potentially harmful constituents that may remain after treatment. This is usually more of an issue with lower treatment levels and is a key issue considered for Title 22 water uses. The manufacture of new chemicals and associated monitoring and testing is an important aspect of recycled water use. The State Water Board periodically convenes panels of scientific experts to use a risk-based framework to evaluate potential exposure and risk from emerging contaminants in recycled water. The findings of the panels are then used to inform monitoring and management of such emerging contaminants in recycled water for both human and environmental health.

Per- and polyfluoroalkyl substances (PFAS) are a class of such constituents of emerging concern in water supply and wastewater treatment. This group of chemicals is referred to as "forever chemicals" because they do not break down over time, are widespread, resist treatment, and can bioaccumulate. Proposed regulations may drive requirements for additional treatment or limit permissible uses of certain types of recycled water. PFAS may also be a concern in brine from reverse osmosis, especially for inland communities.

User On-Site Facility Modifications

Switching from potable to recycled water for irrigation, commercial, or industrial uses usually requires some change in operation or facility modification. Irrigation may have to occur at off-hours where people are not present. Commercial or industrial facilities may have to be replumbed or processes modified because of lower quality water or human exposure potential. These changes require financial and operational commitment on the part of the supplier and the user of the water.

Energy

As the level of treatment of recycled water increases, the energy demands of additional treatment steps and GHG emissions increases. These are decisions each supplier of recycled water makes as the costs and benefits are analyzed for recycled water programs.

Regulatory Requirements

Recycled water producers have reported challenges with recycled water requirements and when seeking recycled water customers who do not want additional regulatory constraints. Regulations for non-potable and potable recycled water use are complex and require significant and ongoing investment to implement required treatment improvements, operation, monitoring, and reporting. In addition, the requirement of an engineering report for some land disposal where secondary water is used for agricultural irrigation may result in underreporting by agencies that chose not to prepare and submit one. Finally, the DPR regulations are rigorous requirements to protect public health and may limit implementation in small communities.

Changing Ownership

Ownership of use sites can change recycled water use. This can be true for a wide range of facility types, including industrial facilities or irrigated lands. For example, a wastewater facility was providing water to a farmer, who then sold the land. The new owner would not accept the recycled water and the wastewater facility needed to identify a new location to receive the water.

Public Acceptance

As public awareness of recycled water use has increased through signage, fill stations during drought, and news and social media, it has become more widely accepted. The successful long-term potable water augmentation of the groundwater basin in Orange County's groundwater replenishment system has also contributed significantly to public understanding and acceptance. DPR is the next step forward. Several surveys have been conducted over the past several years to gauge public acceptance and agencies have conducted tours of facilities to support public education. It will be important for agencies to expand and continue public outreach and demonstrate public health protection as projects are planned and permits are applied for and approved.

Terminology

The term "recycled water" refers to a wide range of water types which are defined by water quality and the level or degree of treatment. Using a single term can be confusing because the wide range of applications of recycled water are controlled by treatment level. Water professionals need to be clear and consistent in using the term and should avoid using the term "Title 22" water to indicate a particular level of recycled water. Using correct terminology for the type of recycled water being produced or used is important for public understanding and acceptance.

Potential Streamflow Reduction

Increasing direct municipal recycled water use can reduce the volume of water discharged into streams. This may affect downstream users or instream beneficial uses. Prior to making any change in the point of discharge, place of use, or purpose of use of treated wastewater, the project proponent must coordinate with the State Water Board's Division of Water Rights to assess whether the project complies with Water Code Section 1211. If the proposed recycled water project will result in reduced stream flows, an approved wastewater change petition may be required pursuant to Water Code Section 1211 so that these changes will not injure any other legal user of the water involved, will not unreasonably affect instream uses including fish and wildlife, and is in the public interest (State Water Resources Control Board 2018).

Environmental Justice

Although not necessarily a challenge to implementing recycled water projects, environmental justice is an important issue consideration. It should be included in early planning to ensure the equitable distribution of benefits and impacts of recycled water project use and infrastructure. Environmental justice considerations include public outreach on how the water will be used, availability for use, and how its availability will benefit the local economy and environment. The types of uses and use practices of recycled water, when conducted in accordance with regulations, are protective of public health, so health considerations should not result in environmental justice issues.

Costs

Expanding water supply reliability by adding recycled water to a portfolio of water supplies will require some additional cost. Costs will depend on the level of recycled water to be incorporated and needed conveyance or treatment infrastructure. It is up

to the water and wastewater suppliers to assess options, coordinate with potential recycled water customers, consider potential climate change impacts, and make informed decisions based on customer needs and rate impacts.

The list of known future projects and potential information from current and future UWMPs can provide an indication of the costs associated with expansion of recycled water use.

Regulatory Oversight

A key factor in maintaining public support for recycled water use is confidence in the safety of recycled water and in the regulatory oversight provided at the State and local levels to ensure compliance with regulations. There is a cost to maintain the regulatory structure. At the State level, adoption of regulations and permitting of wastewater and potable and recycled water agencies is primarily financed by agency permit fees to cover costs borne by the RWQCBs and the State Water Board. Reliable funding is needed for DWR to maintain and update the California Plumbing Code to meet the needs of recycled water agencies and local officials who enforce the code and support and promote the inclusion of recycled water within the state's water supplies. The effectiveness of applying the California Plumbing Code to protect occupants on recycled water use sites and supporting future water supply planning is hampered by this lack of reliable funding source. Additional information about regulatory oversight of recycled water is in Appendix C, "Municipal Recycled Water Jurisdictions."

5. Municipal Recycled Water and the Water Resilience Portfolio

California's Water Supply Strategy was issued in August 2022. It provides specific actions and goals to support developing new water supplies and managing existing ones to prepare for changing climatic conditions. The Water Supply Strategy builds on actions in the administration's *Water Resilience Portfolio* (Portfolio) associated with observed climate-related impacts.

The Water Supply Strategy and the Portfolio identify recycled water as a key component to increasing water supply resources in California. The 2020 Portfolio, prepared under Governor Jerry Brown, identified recycled water as the focus of the fourth action for implementation by State agencies in support of supply diversification.

> 4. *Support local and regional agencies to recycle or reuse at least 2.5 million acre-feet a year in the next decade*.

The Portfolio describes four specific actions State agencies need to take to achieve its objectives. These actions address funding for projects, DPR regulations, water quality standards for onsite collection and potable reuse, and updating purple-pipe regulations. Recycled water conveyance piping is usually purple to help distinguish that the water is non-potable and to help protect against mistaking the pipes for potable water lines if repairs are needed.

The Water Supply Strategy, prepared by the Newsom administration, continues the importance of recycled water to future water supply. Under the objective to Develop New Water Supplies, action 1.1 is:

> 1.1 *Reuse at least 800,000 acre-feet of water per year by 2030 and 1.8 million acre-feet by 2040, with most of that additional recycling involving direct wastewater discharges that are now going to the ocean.*

Six implementation steps address funding, tracking, and supporting projects, including DPR.

Implementation Steps

1. The State will consider greater investments and leverage federal dollars where possible to build on the $3.2 billion in financing for water recycling projects that the State Water Board has provided to 94 projects since 2012. At roughly $15,000 an acre-foot, it would require a State, local, and federal investment of approximately $10 billion to achieve the 2030 goal, and $27 billion to achieve the 2040 goal of recycling an additional 1.8 million acre-feet of water.
2. By January 1, 2024, the State Water Board will work with local water and sanitation agencies to identify recycled water projects that hold the potential to be operational by 2030 and by no later than 2040.
3. The State Water Board will formalize a process currently underway by convening a strike team to identify and resolve permitting and funding obstacles.
4. The State Water Board will track the permitting and funding status of recycled water projects with a public, digital dashboard.
5. The State will support local water sustainability plans that include water recycling, including Operation NEXT/Hyperion 2035 (City of Los Angeles), Pure Water San Diego (City of San Diego), Integrated Water Resources Plan and Climate Action Plan (Metropolitan Water District of Southern California), and Water Supply Management Program 2040 (East Bay Municipal Utility District).
6. The State Water Board will act on direct potable reuse regulations by December 2023.

As of January 2024, The State Water Board has completed the second, third, and sixth steps, and is making progress on the remaining steps.

The fifth step identifies large urban water suppliers in Los Angeles, San Diego, and the San Francisco Bay Area that are developing and implementing significant projects to integrate recycled water more fully into their water supply portfolios. These projects will support local reliability and reduce the amount of recycled water being discharged into the Pacific Ocean and San Francisco Bay. The State will also be working with other suppliers to support urban and agricultural recycled water projects.

Water Supply Strategy Goals

The State Water Board has compiled a list of known recycled water projects (State Water Resources Control Board 2024) that are expected to be implemented by 2040. Based on this list, it is anticipated that the Water Supply Strategy goal of using 800,000 acre-feet per year of recycled water by 2030 will be met. Projects have not been identified to fully meet the 2040 goal of 1.8 million acre-feet per year, but it is expected that the approval of the DPR regulations will enable this goal to be met.

Recycled Water Policy

The *Water Quality Control Policy for Recycled Water* (2018) is another important document directing recycled water use in California. As stated in the policy, its intent is "to encourage the safe use of recycled water" and provide "direction to the regional water quality control boards (regional water boards), proponents of recycled water projects, and the public regarding the methodology and appropriate criteria for the State Water Board and the regional water boards to use when issuing permits for recycled water projects." Last updated in 2018, it identifies (Section 3.1.1.) goals for increasing recycled water use on a statewide basis from 714,000 acre-feet in 2015 to 1.5 million acre-feet by 2020 and to 2.5 million acre-feet by 2030. This document also initiated the annual reporting requirement for wastewater treatment facilities.

6. Recommendations

The following recommendations are proposed to support facilitating increased integration of recycled water into water supply portfolios.

1. **Support research to overcome impediments to the development of recycled water in California.** Research to improve methods for brine disposal, optimize treatment technologies and performance, and increase understanding of emerging issues would facilitate the development of future recycled water projects. Brine management research is ongoing for desalination, which also uses reverse osmosis treatment. Additional research is needed to improve recycled water brine management. Brine management innovations and solutions will benefit both water supply practices, particularly in inland communities. The optimal approach to implementing this recommendation is to continue State support of the National Alliance for Water Innovation, which is currently funding brine and optimization research.
2. **Reconsider the decision to require an engineering report for recycled water activities to be included in the Volumetric Annual Report.** There are two practices that had been included in recycled water surveys prior to 2019 that are not included in the reporting of the Volumetric Annual Report results. Tens of thousands of acre-feet per year of reuse could be added to the quantification of annual statewide municipal recycled water use by implementing this recommendation. The first excluded practice is a wastewater agency growing agricultural crops as part of wastewater disposal, in compliance with its waste discharge requirement. DWR will work with the State Water Board to identify facilities that may not have had reuse appropriately categorized. The second is discharge of treated effluent purposely used for environmental benefits, such as a wetland that is not part of the treatment process. These actions benefit California. The State Water Board indicates that these practices are tracked in the Volumetric Annual Report but are not reported as recycled water. Inclusion of these practices, or co-reporting them, would provide a more complete assessment to the public and recycled water community of how water is being recycled. It could support opportunities for knowledge transfer to other communities seeking to implement similar water recycling projects. Wastewater facilities are making purposeful decisions to beneficially reuse water that would have been directly disposed. For the environmental benefits, the water may not be used consumptively, but it supports wetlands or parklands. Disposal where there is an agriculture product supports the agricultural community and can reduce

ammonia and nitrogen impacts on local groundwater. The State Water Board will decide how this recommendation could be implemented. Options include changing the requirement for an engineering report if the practice is included in the waste discharge requirement and the agency has a proven safety record or developing an approach for small or frontline wastewater agencies to prepare an abbreviated engineering report.

3. **Establish a fund or mechanism for small wastewater facilities with percolation or evaporation ponds to enable purchase of land to redirect the treated wastewater to agricultural reuse for greater water resources benefit.** Most evaporation ponds also have some amount of subsurface leakage. When these ponds are retaining secondary effluent, the leaked retained water is adversely affecting local groundwater quality. Enabling the treated wastewater to be used to grow fodder crops would provide multiple benefits, including:
   A. Reducing nitrate loading to the groundwater by supporting agricultural uptake of nitrates.
   B. Increasing recycled water use without increasing GHGs by implementing "fit-for-purpose" practices.
   C. Supporting local agriculture and potentially reducing local agricultural groundwater use.

   This practice could require a change in policy or the identification of additional funding.

4. **Establish a dedicated staff person at DWR to maintain recycled water expertise and support recycled water use as a water supply.** There is an increased importance of recycled water and alternative water to support water supplies increasingly strained by climate change. This person could work within DWR as part of the alternative water supply team to identify and support the water supply benefits of increasing recycled water into local and regional water supply portfolios, including direct potable reuse (DPR) and agriculture. This person would work with other State agency personnel and the public and would maintain and update the California Plumbing Code.
5. **Conduct an in-depth study on how recycled water can be used to support agriculture in the Central Valley.** This would build upon earlier work such as Sheikh et. al. (2018), Thebo et. al. (2023), and Leverenz et. al. (2023). Implementation of this recommendation could be used to support Recommendation 2. The study would involve evaluating existing wastewater facilities, the amount of treated effluent not being recycled, and local

opportunities for recycling. Some of this work may already have been conducted by local agencies, but this would be a comprehensive review that could support frontline communities and support identifying low-cost and low-GHG solutions that support local agriculture that could identify and prioritize future funding opportunities.

6. **Quantify the potential costs of advanced treated water for DPR.** Water suppliers are seeking to identify new water supplies and replace existing supplies that may not be available in future years. DPR will be an option. Although every water supplier will have different conditions, a general quantification of what is needed to implement DPR would benefit water suppliers as well as provide guidance to the State in assessing how much DPR can be considered in meeting future water supply sustainability and assessing funding needs. Comparison of DPR GHG emissions and comparison to SWP and Colorado River conveyance and desalination, as well as other water supply options, will also support State and local assessments of water supply options. DWR would take the lead on this recommendation and work with other applicable State agencies and water suppliers. Some of this work has been generally done before, but the release of the DPR regulations would enable cost estimates to be made using the regulatory requirements.
7. **Require additional information in 2025 urban water management plans from agencies that are not planning to include recycled water projects in future water supply planning.** The 2025 urban water management plans (UWMPs) prepared by agencies not planning to use recycled water in the future would be required to provide additional discussion of why the agency is not supporting recycled water use, and what it has done to evaluate incorporating recycled water use. Information on specific requirements for what would be needed to implement recycled water use could be provided which would support planning for future statewide funding needs. Although previous UWMPs have requested reasons as to why agencies are not recycling, frequently provided statements imply that actual evaluation has not occurred, or they indicate a misunderstanding of recycled water quality and how recycling can be implemented. To provide the State with better understanding of additional investment needed to expand recycled water use, cost estimates for implementing recycled water programs could be required to be included in 2025 UWMPs. Agencies within areas already fully recycling treatment plant effluent would be exempt from this information. This effort will require modification to the portion of the California Water Code addressing UWMP requirements.

8. **Expand the State Water Board's Technical Assistance Funding Program to include recycled water development and implementation.** During a waste discharge permit renewal, the regional water quality control board and the State Water Board could provide resources and support to a wastewater facility that would otherwise not consider water recycling. Support could include project planning assistance, funding application assistance, or assistance in preparing an engineering report.

7. Related Resource Management Strategies

The following RMSs have linkages to municipal recycled water. These RMSs may not directly mention municipal recycled water, but there are common issues.

- **Agricultural Water Use Efficiency.** Depending on the level of treatment, recycled water can be used to irrigate any crop.
- **Conveyance – Regional/Local.** Distribution of recycled water is planned and implemented on local and regional levels with local conveyance systems.
- **Drinking Water Treatment and Distribution.** In the future, recycled water may be distributed via potable water distribution systems.
- **Economic Incentives – Loans, Grants, and Water Pricing**. Economic incentives are commonly used to facilitate initiation of recycled water projects, enable infrastructure development, or support the use of lower quality water.
- **Ecosystem Restoration.** Recycled water is often a water supply for ecosystem restoration projects.
- **Land Use Planning and Management.** Use of recycled water can be constrained by the availability of sites suitable for recycled water. Successful local planning can encourage locating potential recycled water users where recycled water is available, as well as planning infrastructure needs to support future growth.
- **Matching Water Quality to Use.** Recycled water could replace many instances where potable water is currently being used for non-potable applications.
- **Outreach and Engagement.** Introduction of recycled water as a local water supply resource requires extensive public outreach and education regarding its uses, as well as addressing local water quality and health effect concerns.
- **Recharge Area Identification, Utilization, and Protection.** Recycled water can be used for groundwater recharge.
- **Salt and Salinity Management.** Use of recycled water may have an overall impact on salinity of the underlying groundwater basin. As a result, the Recycled Water Policy includes provisions for preparation of salt and nutrient management plans. Recycled water production also may result in brine generation. Discharges of salts and chemicals into sewers from water softeners can increase wastewater salinity and negatively affect municipal recycling.

- **Urban Stormwater Runoff Management.** Stormwater can be used as a water supply mixing source for projects where recycled water is used for groundwater recharge.
- **Urban Water Use Efficiency.** Recycled water can be used for landscape irrigation and commercial or industrial applications. Gray water is discussed in this RMS.

8. References

California Urban Water Agencies. 2017. *Adapting to Change: Utility Systems and Declining Flows*. [Website] Viewed online at: https://static1.squarespace.com/static/5a565e93b07869c78112e2e5/t/5a568f078165f545d7122ebe/1515622156186/CUWA_DecliningFlowsWhitePaper_11-28-17.pdf. Accessed: March 13, 2024.

Leverenz, H., Tsuchihashi, R., Lescure, P., King, A., Hazard, J., Lim, K. 2023. *Identifying the Amount of Wastewater That Is Available and Feasible to Recycle in California*. Prepared for: Water Research Foundation, Alexandria VA and State Water Resources Control Board. [Website] Viewed online at: https://www.waterrf.org/resource/identifying-amount-wastewater-available-and-feasible-recycle-california-2. Accessed: March 13, 2024.

Natural Resources Defense Council. 2004. *Energy Down the Drain The Hidden Costs of California's Water Supply*. 78 pp. Prepared by: Cohen R, Nelson E, and Wolff G. [Website] Viewed online at: http://www.nrdc.org/water/conservation/edrain/edrain.pdf. Accessed: March 13, 2024.

Office of Water Programs, California State University, Sacramento. 2022. *Summary of Environmental Effects Evaluating effects of urban water use efficiency standards (AB 1668-SB 606) on urban retail water suppliers, wastewater management agencies, and urban landscapes (trees and urban parklands)*. Prepared for the California State Water Resources Control Board. [Website] Viewed online at: https://www.waterboards.ca.gov/conservation/regs/docs/task5-wastewater-excerpt.pdf. Accessed: March 13, 2024.

Pinhey, Nicholas. 2024. "Forgotten Facilities: Golden Gate Park's 1932 Recycled Water Plant." California Water Environmental Association. [Website.] Viewed online at: https://www.cwea.org/news/forgotten-facilities-golden-gate-parks-1932-recycled-water-plant/. Accessed: February 23, 2024.

Sheikh, B., K. Nelson, A. Thebo, B. Haddad, T. Gardner, J. Kelly, A. Adin, R. Tsuchihashi, S. Spurlock, and N. Funamizu. 2018. *Agricultural Reuse — Impediments and incentives.* Prepared for: Water Reuse Foundation, Alexandria VA. [Website] Viewed online at: https://www.waterrf.org/research/projects/agricultural-reuse-impediments-and-incentives. Accessed: March 13, 2024.

State Water Resources Control Board. 2024. *Water Supply Strategy Implementation - Planned Recycled Water Projects.* Prepared by: Division of Water Quality. February 15. [Website] Viewed online at: https://www.waterboards.ca.gov/water_issues/programs/recycled_water/docs/2024/planned-rw-projects.pdf. Accessed: April 9, 2024.

State Water Resources Control Board. 2023. *Initial Statement of Reasons, Direct Potable Reuse Regulations Title 22, California Code of Regulations.* Prepared by: Division of Drinking Water. July 21. [Website] Viewed online at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/rulemaking/dpr_draft_isor.pdf. Accessed: March 13, 2024.

State Water Resources Control Board. 2018. *Regulations Related to Recycled Water.* October 1. [Website] Viewed online at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/rwregulations.pdf. Accessed: March 13, 2024.

State Water Resources Control Board. 2016. *Water Reclamation Requirements for Recycled Water Use*. Order WQ 2016-0068-DDW. [Website] Viewed online at: https://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2016/wqo2016_0068_ddw.pdf. Accessed: March 13, 2024.

Thebo, A. L., J. L. Dery, and H. Cooley. 2023. *Addressing Impediments and Incentives for Agricultural Reuse*. Prepared for the Water Research Foundation, Alexandria VA. [Website] Viewed online at: https://www.waterrf.org/research/projects/addressing-impediments-and-incentives-agricultural-reuse. Accessed: March 13, 2024.

WateReuse California. 2019. *California WateReuse Action Plan*. [Website] Viewed online at: https://watereuse.org/wp-content/uploads/2019/07/WateReuse-CA-Action-Plan_July-2019_r5-2.pdf. Accessed: March 13, 2024.

9. Useful Web Links

Adapting to Change: Utility Systems and Declining Flows
https://static1.squarespace.com/static/5a565e93b07869c78112e2e5/t/5a568f078165f545d7122ebe/1515622156186/CUWA_DecliningFlowsWhitePaper_11-28-17.pdf

California Water Plan Update 2018
https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/California-Water-Plan/Docs/Update2018/Final/California-Water-Plan-Update-2018.pdf

California Water Plan Update 2023
https://water.ca.gov/Programs/California-Water-Plan/Update-2023

California's Water Supply Strategy: Adapting to a Hotter, Drier Future
https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Water-Resilience/CA-Water-Supply-Strategy.pdf

Cross-Connection Control Policy Handbook
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/2023/cccph-adopt-2023-12-19.pdf

Direct Potable Reuse Regulations
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/dpr-regs.html

Direct Potable Reuse Regulation Development
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/direct_potable_reuse.html

Human Right to Water Portal
https://www.waterboards.ca.gov/water_issues/programs/hr2w/

Making Conservation a California Way of Life
https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/docs/2016nov/113016_executive%20order_report.pdf

Metropolitan Water District of Southern California Climate Action Plan
https://www.mwdh2o.com/cap

Operation NEXT
https://www.ladwp.com/who-we-are/water-system/sources-supply/operation-next

Pure Water San Diego
https://www.sandiego.gov/public-utilities/sustainability/pure-water-sd

Regulations Related to Recycled Water (2018).
Title 17 and 22 portions of the California Code of Regulations applicable to recycled water compiled by the State Water Board. This document does not include the proposed DPR revisions.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/RWregulations_20181001.pdf

State Water Resources Control Boards Recycled Water Policy and Regulations
https://www.waterboards.ca.gov/water_issues/programs/recycled_water/

Volumetric Annual Report of Wastewater and Recycled Water
https://www.waterboards.ca.gov/water_issues/programs/recycled_water/volumetric_annual_reporting.html

Water Reclamation Requirements for Recycled Water Use (2016)
https://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2016/wqo2016_0068_ddw.pdf

Water Quality Control Policy for Recycled Water (Update 2018)
https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2018/121118_7_final_amendment_oal.pdf

Water Resilience Portfolio
https://resources.ca.gov/Initiatives/Building-Water-Resilience/portfolio

Water Supply Management Program 2040 (East Bay Municipal Utility District)
https://www.ebmud.com/water/about-your-water/water-supply/water-supply-management-program-2040

Appendix A. Title 22 Permitted Non-Potable Recycled Water Uses

The permitted uses of recycled water are grouped by the type of treatment provided to the wastewater. Specific uses are based, in general, on levels of human exposure and pathways of exposure leading to infection. The required levels of treatment are specified in Title 22 of the California Code of Regulations (Division 4, Chapter 3, Section 60301 et seq.). Table A-1 provides the different types of water uses and treatment levels allowed in California under Title 22. The five treatment levels include:

- Advanced.
- Disinfected tertiary.
- Disinfected secondary-2.2.
- Disinfected secondary-23.
- Undisinfected secondary.

The above list of types of recycled water is in order of treatment level, with "advanced" being the highest level (most thorough) and "undisinfected secondary" being the lowest level. These treatment levels have specific definitions within Title 22, except for "advanced" which has identified requirements but not a specific definition. In general terms, secondary treatment is oxidized wastewater. If secondary treatment includes disinfection, it can be designated as meeting certain coliform bacteria requirements. Disinfected secondary-2.2 recycled water has lower levels of coliform bacteria than disinfected secondary-23 recycled water. Disinfected tertiary recycled water has been filtered and subsequently disinfected. Advanced treatment includes reverse osmosis and oxidation treatment. Water that has undergone primary treatment only is not permitted for use as recycled water.

Recycled water undergoing the advanced treatment, the highest level of treatment, is usable for any type of non-potable use. It is not included as a column in Table A-1 because it is usable for all the uses shown in the table.

Potable uses of municipal recycled water are included in Appendix B, "Potable Reuse of Recycled Water." Appendix B includes discussion of proposed revisions to Title 22 to enable direct potable reuse in California, which are in the process of being

promulgated into California regulations at the time of preparation of this resource management strategy.

Table A-1 is an informal summary of the uses allowed. For the full text refer to California Code of Regulations, Title 22; Division 4, Environmental Health; Chapter 3, "Water Recycling Criteria."

Table A-1 Non-Potable Recycled Water Uses and Treatment Levels Allowed in California (2023)

Use of Recycled Water	Disinfected Tertiary	Disinfected Secondary -2.2	Disinfected Secondary -23	Un-disinfected Secondary
Urban Irrigation				
Parks, playgrounds, and school yards	Yes	No	No	No
Residential landscaping	Yes	No	No	No
Unrestricted-access golf courses	Yes	No	No	No
Any other irrigation uses not prohibited by other provisions of the California Code of Regulations	Yes	No	No	No
Cemeteries and freeway landscaping	Yes	Yes	Yes	No
Restricted-access golf courses	Yes	Yes	Yes	No
Agricultural Irrigation				
Food crops where recycled water contacts the edible portion of the crop, including all root crops	Yes	No	No	No
Food crops, surface-irrigated, above-ground edible portion, and not contacted by recycled water	Yes	Yes	No	No
Orchards or vineyards with no contact between edible portion and recycled water	Yes	Yes	No[a]	No[a]
Ornamental nursery stock and sod farms with unrestricted public access	Yes	Yes	Yes	No
Pasture for milk animals for human consumption	Yes	Yes	Yes	No

Use of Recycled Water	Disinfected Tertiary	Disinfected Secondary -2.2	Disinfected Secondary -23	Un-disinfected Secondary
Non-edible vegetation with access control to prevent use as a park, playground or school yard	Yes	Yes	Yes	No
Non-food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest or allowing access by the public	Yes	Yes	Yes	Yes
Fodder and fiber crops and pasture for animals not producing milk for human consumption	Yes	Yes	Yes	Yes
Seed crops not eaten by humans	Yes	Yes	Yes	Yes
Food crops undergoing commercial pathogen-destroying processing before consumption by humans	Yes	Yes	Yes	Yes
Ornamental nursery stock, sod farms not irrigated less than 14 days before harvesting, retail sale or allowing access by the public	Yes	Yes	Yes	Yes
Impoundments not for Groundwater Augmentation				
Non-restricted recreational impoundments, with supplemental monitoring for pathogenic organisms	Yes[b]	No	No	No
Restricted recreational impoundments and publicly-accessible fish hatcheries	Yes	Yes	No	No
Landscape impoundments without decorative fountains	Yes	Yes	Yes	No
Commercial, Industrial, Construction, and Infrastructure				
Flushing toilets and urinals	Yes	No	No	No
Priming drain traps	Yes	No	No	No
Industrial process water that may contact workers	Yes	No	No	No
Structural fire fighting	Yes	No	No	No
Decorative fountains	Yes	No	No	No
Commercial laundries	Yes	No	No	No
Consolidation of backfill material around potable water pipelines	Yes	No	No	No

Use of Recycled Water	Disinfected Tertiary	Disinfected Secondary -2.2	Disinfected Secondary -23	Un-disinfected Secondary
Artificial snow making for commercial outdoor uses	Yes	No	No	No
Commercial car washes, including hand washes if the recycled water is not heated, where the public is excluded from the washing process	Yes	No	No	No
Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist	Yes[c]	No	No	No
Industrial or commercial cooling or air conditioning not involving cooling tower, evaporative condenser, or spraying that creates a mist	Yes	Yes	Yes	No
Industrial process water that will not come into contact with workers	Yes	Yes	Yes	No
Industrial boiler feedwater	Yes	Yes	Yes	No
Non-structural fire fighting	Yes	Yes	Yes	No
Backfill consolidation around non-potable piping	Yes	Yes	Yes	No
Soil compaction	Yes	Yes	Yes	No
Mixing concrete	Yes	Yes	Yes	No
Dust control on roads and streets	Yes	Yes	Yes	No
Cleaning roads, sidewalks, and outdoor work areas	Yes	Yes	Yes	No
Sanitary sewer flushing	Yes	Yes	Yes	Yes

Table A-1 Notes:

[a] Per California Department of Public Health letter of January 8, 2003, to California Regional Water Quality Control Boards.

[b] Allowed with "conventional tertiary treatment." Additional monitoring for two years or more is necessary for disinfected tertiary recycled water that has not received conventional treatment.

[c] Drift eliminators and biocides are required if the public or employees can be exposed to mist.

Appendix B. Potable Reuse of Recycled Water

Potable Permitted Uses

Recycled water for indirect potable reuse (IPR) or direct potable reuse (DPR) is usually advanced treated water, except for some groundwater recharge projects that use recycled water treated to tertiary standards for surface spreading. Recycled water treated only to secondary standards (undisinfected, disinfected secondary–2.2, or disinfected secondary-23) is not permitted for any potable use, including groundwater recharge. For recycled water regulations, refer to the State Water Resources Control Board's (State Water Board's) *Regulations Related to Recycled Water* (2018). For specific information about permitting for non-potable uses of recycled water, refer to the State Water Board's Water Reclamation Requirements for Recycled Water Use (2016).

Treatment standards for DPR approved by the State Water Board in December 2023 differ from the treatment standards for IPR projects. DPR requires higher log reduction values for all regulated pathogens, in addition to additional monitoring, chemical barriers, stringent operations, ability to divert flow, and other requirements. The regulations for groundwater replenishment reuse projects and surface water source augmentation projects (Section 60320.201 and Section 60320.302, respectfully) use the phrase "full advanced treatment," but the definition depends on the type of potable reuse. The DPR regulations are considered a separate regulation and do not use this phrase.

Indirect Potable Reuse

IPR involves using recycled water at the required level of treatment to augment existing groundwater or surface water resources. The recycled water is required to remain in the groundwater aquifer or surface water reservoir for a period of time before the water is withdrawn. Extracted recharged groundwater can be directly reused or introduced into a drinking water distribution system. Water withdrawn from a surface reservoir is subsequently treated at the water treatment plant. The two approaches to IPR are groundwater replenishment through recharge basins or direct injection and surface water source augmentation, where recycled water is added to surface water reservoirs used for drinking water supply.

The key distinguishing aspect of IPR is the presence of an environmental barrier within the cycle of incorporating the recycled water into the existing water supply. This environmental barrier can be an aquifer or a surface water reservoir. The residence time of the recycled water within the aquifer or reservoir offers an opportunity for natural treatment to occur and provides a buffer between recycled water treatment and potable reuse if temporary lapses occur in the prior treatment process.

Projects implementing IPR require Division of Drinking Water review and regional board permits. Permits will identify project treatment, operational, monitoring, and reporting requirements to meet and document compliance with drinking water standards, pathogen control, dilution, and retention time.

Groundwater Replenishment

Tertiary-treated or advanced-treated water can be used for IPR, depending on the project type, availability of acreage for spreading facilities, recycled water quality, availability of water that could be blended with recharge water, and other project objectives. Tertiary-treated water can be used for groundwater recharge using spreading or recharge basins if an approved source and quantity of blending water is available. Advanced treatment is required for groundwater injection. Extensive characterization, modeling, and monitoring of the groundwater aquifer are required as part of the permitting process, as well as controlled well construction within designated boundaries of the project, and ongoing monitoring of the recharged groundwater aquifer.

Surface Water Augmentation

Surface water augmentation regulations were approved by the State Water Board in 2018. The regulations enable advanced treated recycled water to be added to a surface water reservoir used as a drinking water source. Extensive testing and modeling of reservoir conditions are required as part of the permitting process. The volume of recycled water allowed to be introduced to the reservoir in a project is based on the size of the reservoir to allow for adequate retention time in the reservoir. Extensive monitoring of the reservoir water quality and additional requirements are placed on the drinking water treatment plant, as well.

Direct Potable Reuse

The DPR regulations were approved in August 2024 and became effective October 1, 2024. The regulations are incorporated into Title 22, Division 4, of the California

Code of Regulations; specifically, Article 10 of Chapter 17. Article 10 establishes requirements for a public water system using treated municipal wastewater to augment a source of supply for a public water system's drinking water treatment plant (raw water augmentation) or for placement directly into a drinking water distribution system (treated water augmentation). Article 10 includes the requirements necessary to produce safe drinking water from municipal wastewater and would be applied in conjunction with other drinking water regulations adopted under the California Safe Drinking Water Act to ensure safe drinking water is delivered to the public. Because the DPR regulations clarify that municipal wastewater is considered surface water, they will occur in Chapter 17, "Surface Water Treatment."

Anticipated benefits of the DPR regulations include:

- Providing safe drinking water and a safe drinking water supply for Californians.
- Providing a relatively reliable, drought-proof, and sustainable option for drinking water or a drinking water supply.
- Providing an additional means for increased beneficial use of recycled water in California.
- Reducing some of the need and resultant costs for dual distribution systems.

The DPR regulations are explained in the *Initial Statement of Reasons* (ISOR) , prepared by the Division of Drinking Water and are available in the DPR regulations webpage along with other rulemaking documents. The ISOR provides the history of the DPR regulations development, defines the terms used in the regulations, and provides the rationale behind the specific regulatory requirements in the regulations. Refer to the DPR general information page for more information about the history of the DPR regulation development effort.

The regulations are consistent with state and federal Safe Drinking Water Act requirements and accomplish the California Safe Drinking Water Act objective of ensuring that public water system reliably delivers water for human consumption that is, at all times, pure, wholesome, and potable.

Several key aspects of the DPR regulations include:

- Compliance with the regulation of a specific DPR program or project will be by the direct potable reuse responsible agency, which must be a public water system.

- Projects are required to have a minimum level of treatment for pathogen and chemical control, and stringent real-time process monitoring with the ability to automatically divert flow of inadequately treated water.
- Project treatment and operations are required to be reliable, redundant, and robust. Projects must demonstrate adequate technical, managerial, and financial capacity to ensure compliance with regulatory requirements and the ability to produce DPR water that is pure, wholesome, and potable.
- Projects are required to conduct water quality monitoring for regulated and unregulated contaminants and must comply with standard drinking water standards for public water systems.

Although the DPR regulations require DPR projects to obtain drinking water supply permits in order to operate a DPR project and deliver DPR water, wastewater source control requirements and diversion of inadequately treated water requirements in the DPR regulations also means that waste discharge and water recycling permits would be required.

Appendix C. Municipal Recycled Water Jurisdictions

There are various responsibilities within State government for the treatment and use of municipal recycled water. The State Water Board is the primary State agency regulating recycled water. In addition to the statewide agencies; local, city, and county officials have a regulatory role affecting municipal recycled water projects.

State Water Resources Control Board

The State Water Resources Control Board (State Water Board) is comprised of multiple divisions that provide various roles and oversight of municipal recycled water. It protects water quality water rights, provides financial assistance, and oversees the regional boards.

Division of Water Quality

The Division of Water Quality develops State Water Board policies on recycled water, overseeing research and expert panels on recycled water, and overseeing the collection of the Volumetric Annual Report of recycled water use in California.

Division of Drinking Water

The Division of Drinking Water (DDW) regulates public drinking water systems and develops water recycling criteria (non-potable and potable reuse regulations) for the protection of public health. For recycled water projects, DDW reviews and approves engineering reports, provides recommendations to the regional boards for non-potable and potable reuse recycled water project permits, and oversees cross-connection prevention control. DDW also prepares the *Water Reclamation Requirements for Recycled Water* (2016).

The standards for wastewater reuse are intended to protect public health by adopting water recycling criteria based on water source and quality, and by specifying sufficient treatment based on intended use and human exposure. The treatment objective is to remove pathogens and other constituents, making the water clean and safe for the intended uses.

Division of Financial Assistance

The Division of Financial Assistance provides financial assistance in the form of grants or loans to local agencies to plan and implement recycled water projects.

Division of Water Rights

The Division of Water Rights, related to recycled water projects, assesses whether proposed recycled water projects comply with California Water Code (Water Code) Section 1211 regarding effects to downstream users and, at times, mandates the use of recycled water under the authority of Water Code Section 13550.

Regional Water Quality Control Boards

The regional boards have the role of permitting and providing ongoing oversight authority for water recycling projects. The regional boards issue and enforce permits for recycled water projects and protect surface water and groundwater quality from recycled water impacts.

Other State Agencies

Four other State agencies are directly involved with municipal recycled water issues in California. The California Department of Water Resources (DWR), the California Public Utilities Commission, the California Department of Housing and Community Development, and the California Building Standards Commission implement various sections of State law. Statutes governing municipal recycled water are currently contained within the Water Code, the California Health and Safety Code, the California Government Code, the Public Resources Code, and the Public Utilities Code, and regulations are in various subdivisions (titles) of the California Code of Regulations.

Department of Water Resources

DWR manages statewide water supply by evaluating and monitoring surface and groundwater conditions; and assessing potential for development of alternative water sources. DWR also considers the human right to water in its decision-making, program activities, and public engagement.

Strategic Planning Branch

The Strategic Planning Branch in the Division of Planning prepares the California Water Plan which analyzes how water has been used and will be used in the future. These analyses include alternative water supplies, such as recycled water.

Financial Assistance Branch

The Financial Assistance Branch in the Division of Regional Assistance provides financial assistance to local agencies for water supply projects, including recycled water supply projects.

Water Use Efficiency Branch

The Water Use Efficiency Branch in the Division of Regional Assistance adopts standards for recycled water indoor plumbing in the California Plumbing Code.

California Public Utilities Commission

The California Public Utilities Commission oversees rates and revenues of investor-owned utilities. It approves rates and terms of service for the use of recycled water by investor-owned utilities.

California Department of Housing and Community Development

As a proposing agency, the California Department of Housing and Community Development (HCD) proposes for adoption building standards for residential dwellings, including hotels, motels, lodging houses, apartment houses, dwellings, and residential building or structure accessories. HCD proposes for adoption substantially the same requirements as are contained in the current version of the Uniform Plumbing Code and may propose amendments as incorporated in the California Plumbing Code.

California Building Standards Commission

The California Building Standards Commission has broad oversight of adoption of standards for buildings, collectively known as the California Building Standards Code (California Code of Regulations, Title 24), which includes the California Plumbing Code (Part 5 of Title 24). It adopts standards for gray water systems in non-residential structures and for non-potable water systems within buildings over which it has jurisdiction in the California Plumbing Code. It has also been charged with developing mandatory and voluntary building standards for alternate non-potable water systems, including recycled water, graywater, onsite treated water, and

rainwater catchment systems. Other State agencies can adopt amendments to the building standards under the oversight of the Building Standards Commission.

Local Agencies

Local Building Officials

Local building officials oversee building design, including plumbing. They enforce building standards, including the California Plumbing Code.

County Environmental Health Departments

County environmental health departments protect drinking water systems by enforcing cross-connection control and reviewing and making recommendations on proposed recycled water sites. DDW may also delegate some responsibility for review of new sites and cross-connection control to the local county health department with the permission of the local recycled water provider or administrator.

Owners, Operators, and Users

Local or regional public agencies, such as cities and water districts, are primarily responsible for the construction and operation of recycled water treatment plants and pipeline distribution systems. Investor-owned utilities own and operate recycled water facilities in a few instances. The actual use of recycled water occurs at thousands of publicly and privately owned sites. The site owners are responsible for the construction and maintenance of the on-site piping and appurtenances and for the safe use of the recycled water.


DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA