Facing Challenges with Maximizing Water Reuse

Supplemental information to support CUWA's February 2021 issue brief

CALIFORNIA URBAN WATER AGENCIES

California water agencies are motivated to improve resilience through thoughtful implementation of water reuse and alternative water supplies.

The Governor's Water Resilience Portfolio seeks to support local and regional agencies maximize reuse in the next decade, tripling current levels.

Some municipalities have already made commitments, like Los Angeles, which has committed to recycle all of the city's wastewater by 2035.

Pressure to maximize beneficial reuse in lieu of discharging wastewater effluent is taking root.

CUWA agencies have conceptual plans in place to triple their water reuse by 2035.

Who is CUWA?

Established in 1990, California Urban Water Agencies (CUWA) is a nonprofit corporation of 11 major urban water agencies collectively delivering drinking water to approximately two-thirds of California's population. Water delivered by CUWA's 11 agencies is a lifeline supporting California's urban populations and powering the bulk of the state's $3.2 trillion economy.

MEMBER AGENCIES

Alameda County Water District
City of Fresno
City of San Diego Public Utilities Department
Contra Costa Water District
East Bay Municipal Utility District
Los Angeles Department of Water and Power
Metropolitan Water District of Southern California
San Diego County Water Authority
San Francisco Public Utilities Commission
Santa Clara Valley Water District
Zone 7 Water Agency

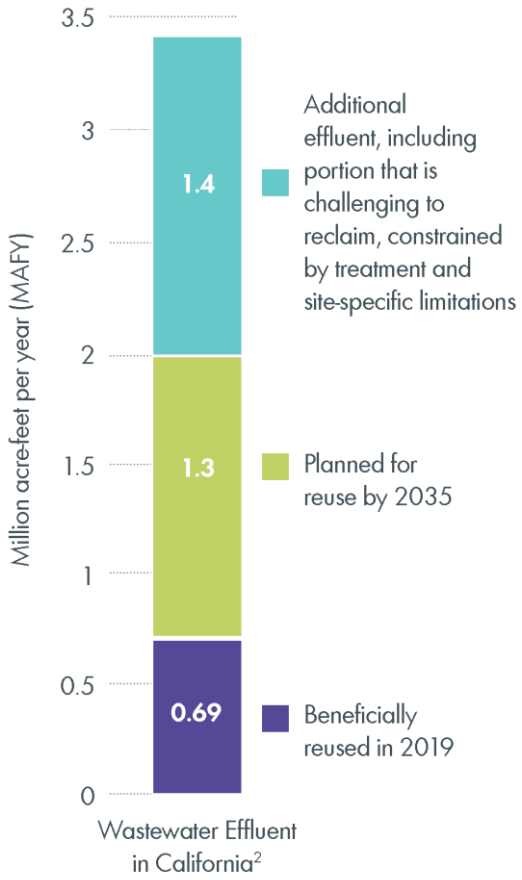
CALIFORNIA **URBAN WATER** AGENCIES

2.7 MAFY of wastewater effluent in California is currently not reused.

However, the ability to reuse all available wastewater effluent can be impacted by technology limitations and site-specific constraints. Matching available supply of wastewater effluent with potential demand for recycled and purified water within a region is an important step in determining what "maximizing reuse" means for a community. Additionally, where reverse osmosis (RO) is employed for water purification, technology limitations prevent reclamation of approximately 15% of the wastewater effluent, further limiting what is considered "reclaimable" flow.

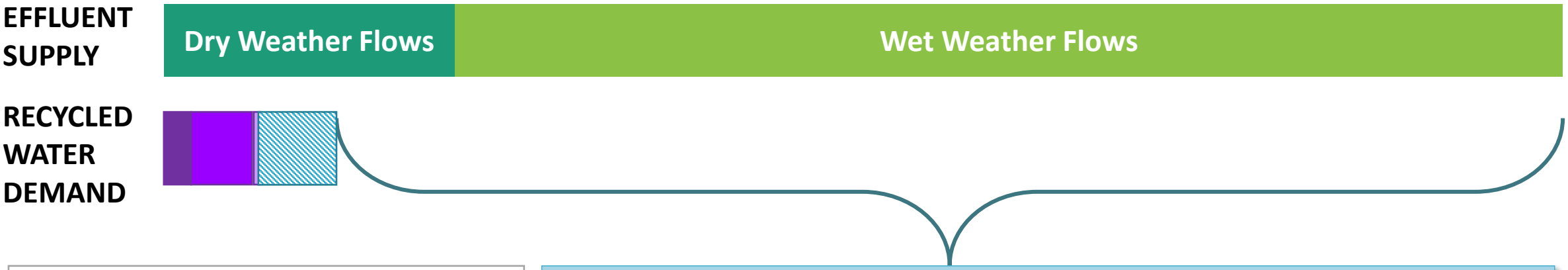
To maximize reuse, each community requires a customized reuse strategy based on a range of factors including geographic and geological characteristics, economic and social justice dynamics, and environmental needs.

To illustrate this point, the next several slides highlight how the three different communities with a significant amount of wastewater effluent available have widely varying demands and ability to reclaim available supply.



Source:
Based on 2019 volumetric annual reports the State Board received from 710 of 756 facilities (93%) as of December 21, 2020. Only includes recycled water categories consistent with California Code of Regulations Title 22 and the Recycled Water Policy, so land application is not counted as part of the "beneficially reused in 2019" category.

SFPUC: A Gap between Effluent Supply and Reuse Demand



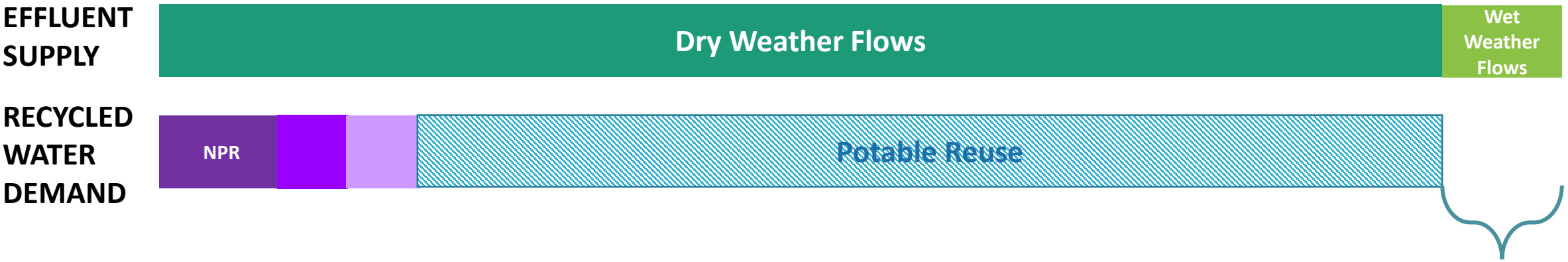
Key

- Wastewater Effluent – Dry Weather
- Wastewater Effluent – Wet Weather
- Non-Potable Reuse (NPR) – Irrigation
- NPR – Industrial/Cooling/Commercial
- NPR – Onsite
- Potable Reuse – Not Yet Implemented

Local considerations:

- Combined sewer system, wet weather flows unavailable for reuse
- Limited non-potable end uses, additional reuse would replace existing potable supplies
- Recent investments have increased reliability and diversification of potable water supplies
- Conservation with 42 gpcd, one of the lowest demands in the state
- No available capacity in environmental buffer (reservoir or groundwater basin)
- No water treatment plant within city limits for raw water augmentation
- Need for regulations on treated water augmentation

LADWP: Limited by Non-Reclaimable Flows



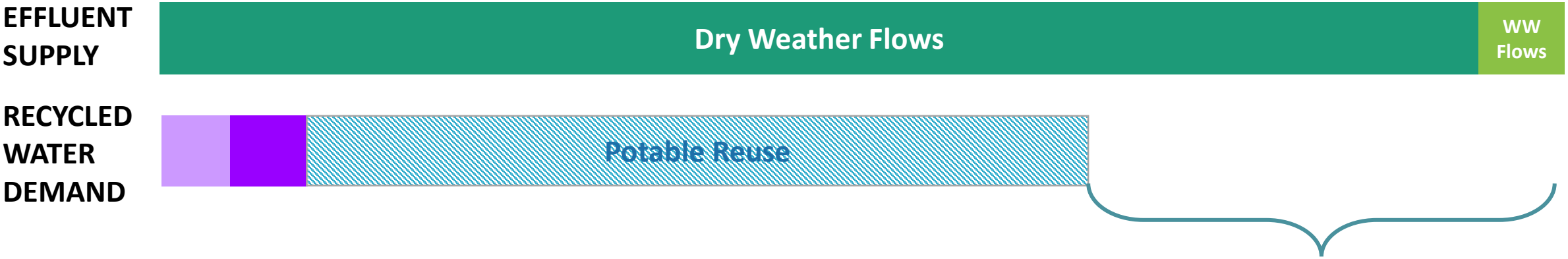
Key

- Wastewater Effluent – Dry Weather
- Wastewater Effluent – Wet Weather
- Non-Potable Reuse (NPR) – Irrigation
- Sold to Other Agencies for Customer Demand
- Seawater Intrusion Barriers
- Potable Reuse – Not Yet Implemented

Local considerations:

- Inability to equalize all peak wet weather flows
- Non-reclaimable flows (i.e., 15% process loss through reverse osmosis)
- Limited capacity in environmental buffers (reservoir or groundwater basin)
- Need regulations on treated and raw water augmentation

City of San Diego: Limited by Groundwater Basins and Non-Reclaimable Flows



Key

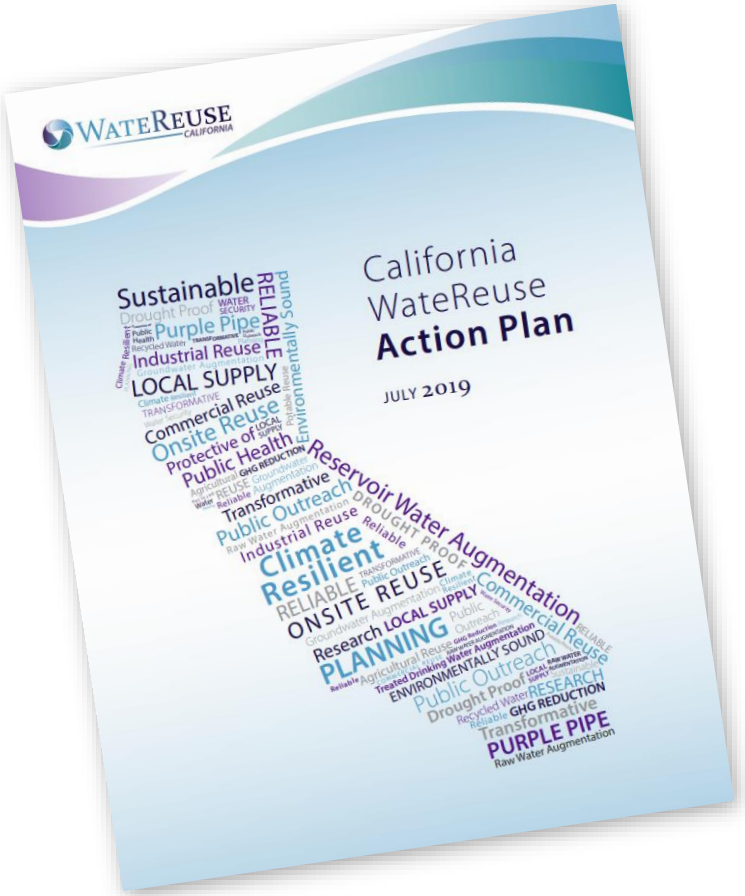
- Wastewater Effluent – Dry Weather
- Wastewater Effluent – Wet Weather (WW)
- Non-Potable Reuse (NPR) – Irrigation
- NPR – Industrial/Cooling/Commercial
- Potable Reuse – Not Yet Implemented

Local considerations:

- Non-reclaimable flows (i.e., 15% process loss through reverse osmosis)
- Limited capacity in groundwater basins
- Need regulations on treated and raw water augmentation

While California has made progress, the pressure to maximize reuse is greater than ever.

The California WateReuse Action Plan provides a clear and concise strategy to advance water reuse in California over the next 30 years to help address the state's greatest water challenges as part of a comprehensive water resilience portfolio.



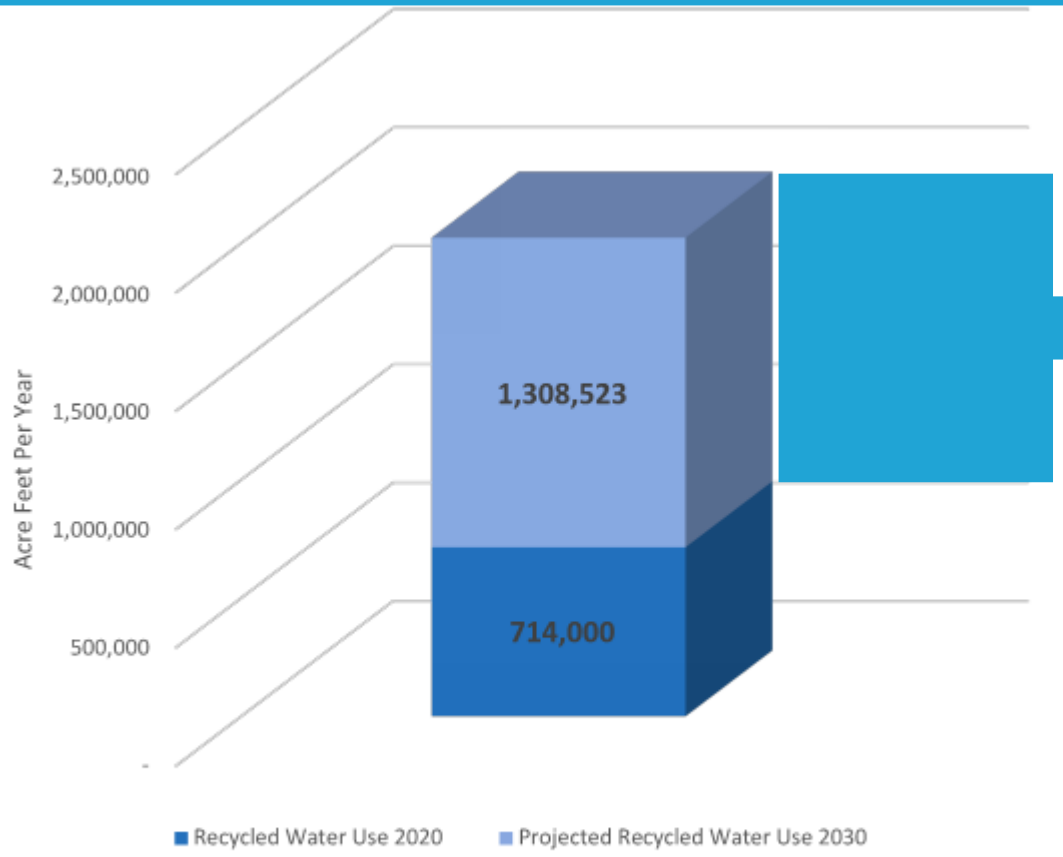
Lawsuits from environmental groups are arising across California, such as the 2020 LA Superior Court decision on LA Waterkeeper v. State Water Resources Control Board that was recently appealed, compelling regulators and municipalities to re-evaluate the practice of disposing of wastewater into natural water bodies, when it could instead be used productively to ensure the sustainability of the State's water resources.

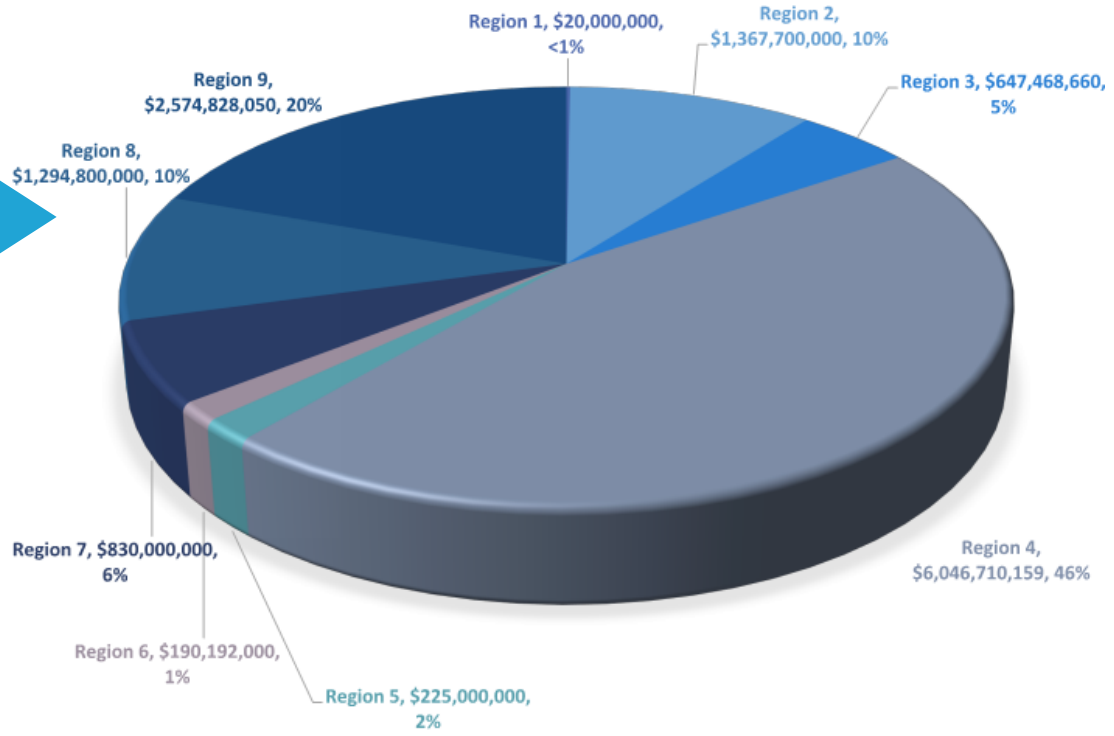
Statewide momentum toward increased funding, regulatory clarity, regionalization, and innovation will be critical to achieving ambitious reuse goals.

- Funding Water Reuse
- Balancing Competing Needs and Uses
- Water Quality and Source Control
- Salinity and RO Concentrate Management
- Collaboration and Regional Approaches
- Regulatory Alignment

This issue brief will increase awareness of the obstacles (left) that California water and wastewater agencies face in maximizing reuse, along with strategies to enable greater progress.

To fund the 1.3 MAFY planned reuse projects in California over the next decade agencies need $13.2 billion.





Region 1 North Coast; Region 2 Bay Area; Region 3 Central Coast; Region 4 LA/Ventura; Region 5 Central Valley; Region 6 Sierra/Eastern Sierra; Region 7 Colorado River; Region 8 Santa Ana River Watershed; Region 9 San Diego/Inland Counties

**Two large projects included in this total may not reach full production until 2035*

***Based on the 2015 State Water Board and Department of Water Resources Survey*

Source: WateReuse California Funding Survey 2019

More funding is necessary to enable utilities to access water reuse cost-effectively.

9.4 million people in CUWA Agency service areas, or

of people served, are low income.

The impact of the global pandemic will only worsen both affordability for customers and revenue for municipalities over the next decade, with a projected 25 percent decline in municipal water and wastewater capital expenditures due to lower income and deferred payment.

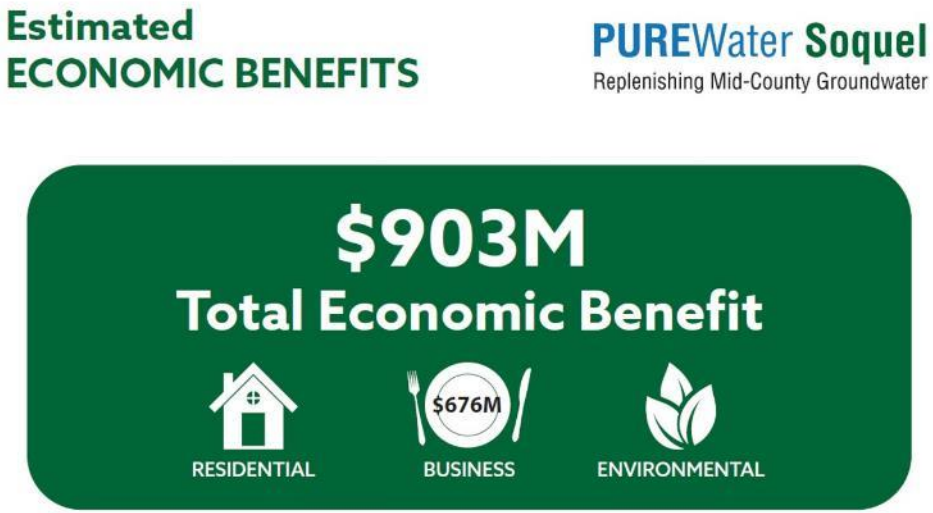
The Governor's Water Resilience Portfolio predicts that recycled supplies, which are often more expensive than imported water, would cost* roughly the same as imports by 2035.

Grants and low-interest loans are critical to maximizing reuse. However, the Clean Water State Revolving Fund (CWSRF) has a $3 billion backlog of reuse projects waiting for funding, and Proposition 1, Proposition 68, and other existing bonds are largely exhausted.

*For more information on the comparative cost of water reuse, contact Jennifer West of WateReuse California at jwest@waterreuse.org .

CALIFORNIA URBAN WATER AGENCIES

The value proposition for reuse can extend beyond conventional dollars and cents.



Source: Technical Memorandum: Estimating Benefits of the Pure Water Soquel by Brent Haddad, Ph.D., and Bryan Pratt, D. Cand (2018)

Soquel Creek Water District (SqCWD) is pursuing a groundwater injection potable reuse project, called Pure Water Soquel, that would restore the overdrafted local groundwater basin and provide protection against seawater intrusion. To fund the project, SqCWD took the following steps:

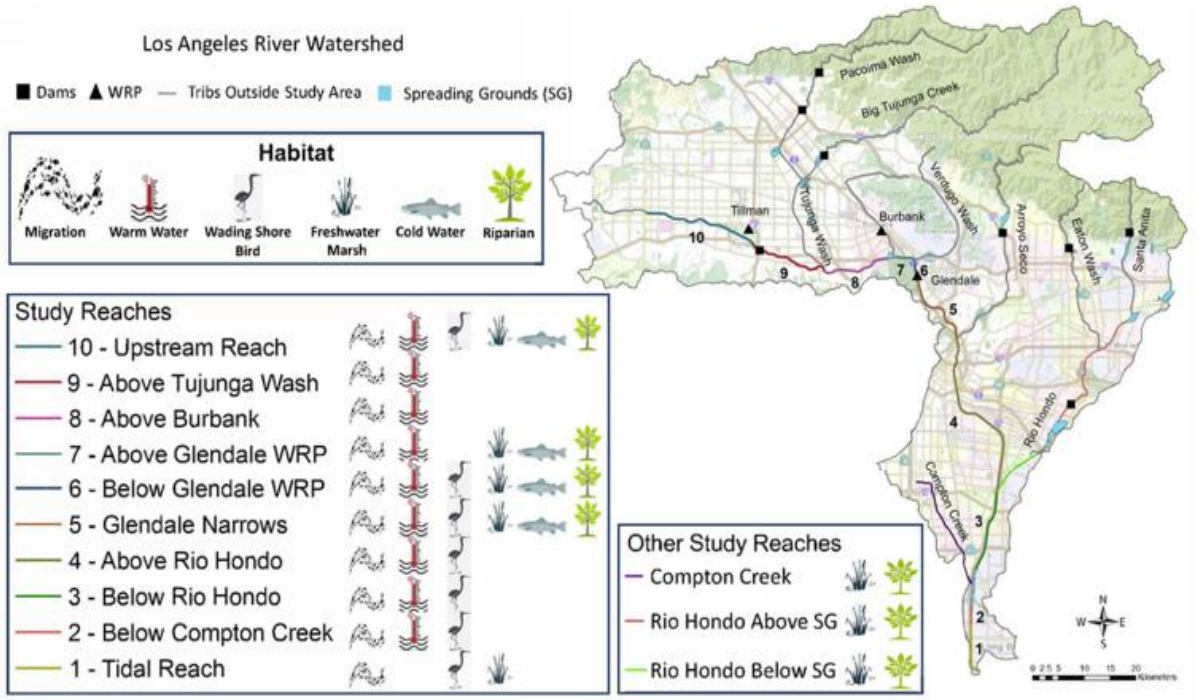
1. **Approved rates** through Prop 218 for the $90M project
2. **Grant money** through Prop 1 for $2M in planning and $50M in implementation
3. **Low-interest loans** through SWRCB's seawater intrusion control and EPA's WIFIA programs

Unlike projects where the purified water cost is juxtaposed against the cost of increasingly costly imported water, SqCWD faced different drivers. The University of California, Santa Cruz conducted a study that framed up the project's cost proposition in terms of benefits to residential customers, commercial businesses, environmental, and customers outside of SqCWD's service area. **In addition to $903 million in monetized benefits, the project's non-monetary benefits include:**

- **Enabling development of 2,100 housing units and avoiding a development moratorium**
- **Maintaining 725 jobs or 3.8 percent of employment in SqCWD's service area**

SqCWD framed the value proposition in these terms to gain more support in the community and from outside funding agencies.

Reducing discharge flows from wastewater facilities could impact ecosystems that have grown to rely on its presence.



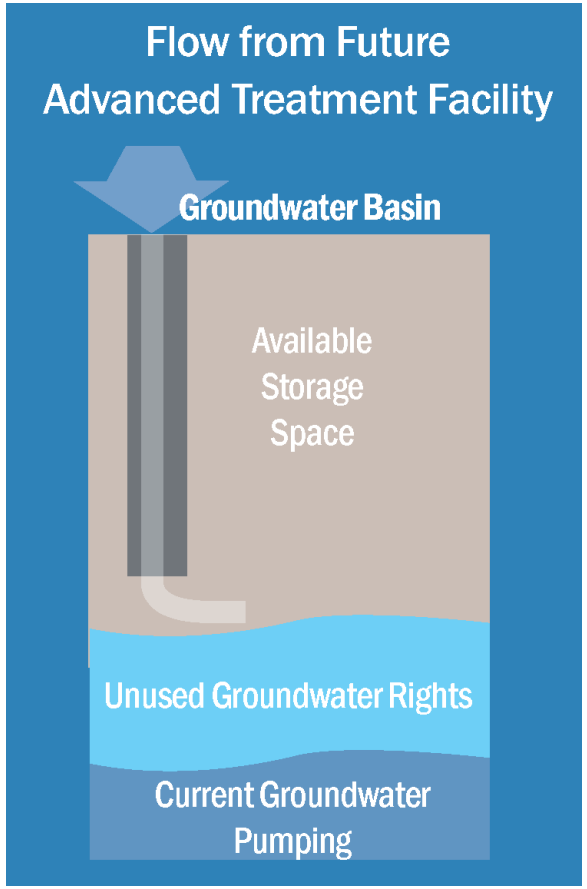
Minimum flow requirements create a dynamic tension with agencies working to balance the need for reuse with existing recreational and environmental use.

Through the Los Angeles River Flows Project, the State Board is developing technical tools and approaches to define ecologically protective flows necessary to support specific species and habitats, sustaining beneficial uses in compliance with Water Code Section 1211.

Source:
Los Angeles River Flows Project Fact Sheet (2020).

The environment is also key to maximizing reuse.

Groundwater basins and reservoirs provide not only an environmental buffer for potable reuse but also important storage for purified water. However, storage is finite, limited by stormwater infiltration and seasonal use. Storage also requires coordination with local agencies in order to rely on groundwater as a source of supply to free up space over time.

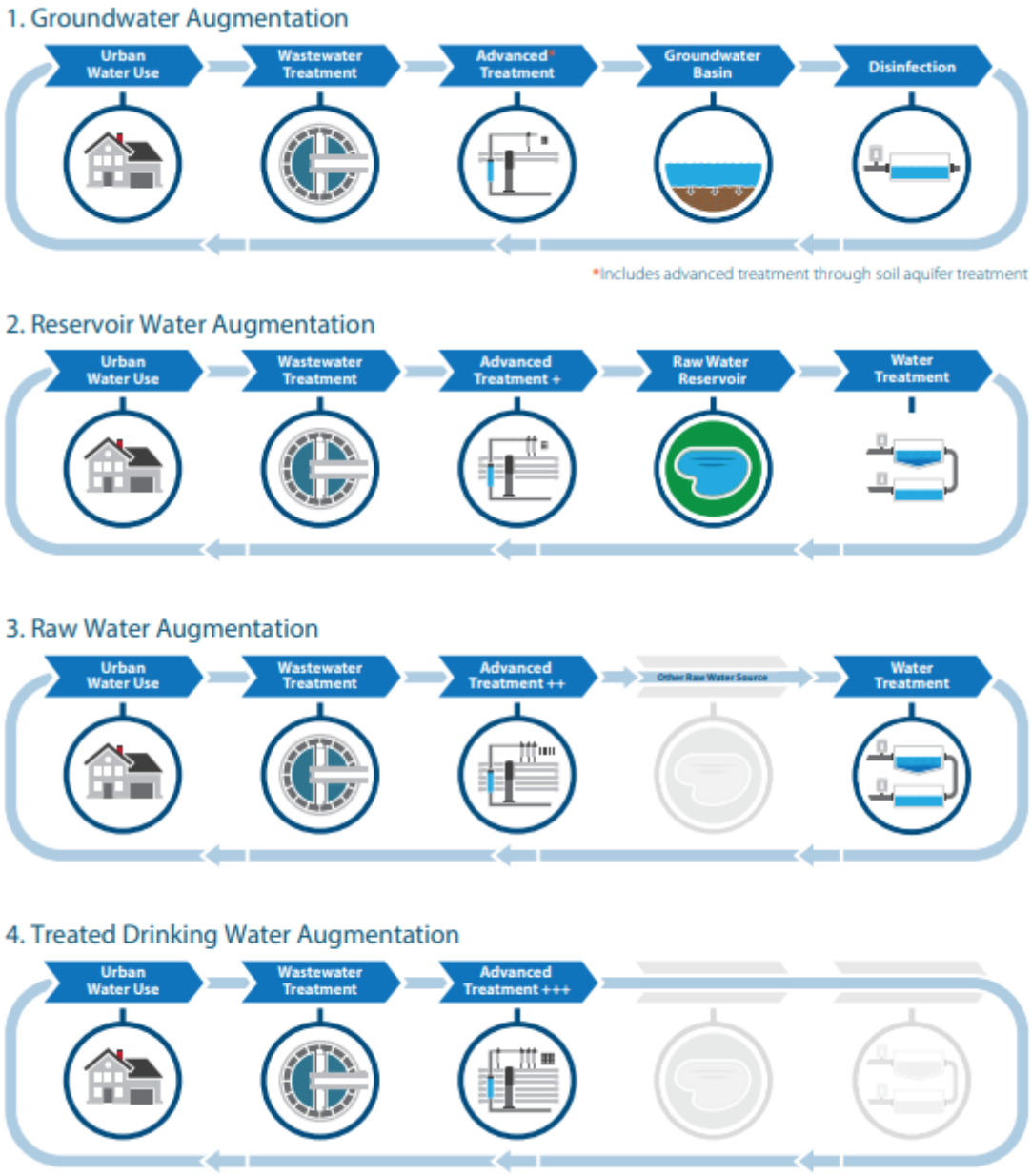


Successful use of storage in groundwater basins is maximized when more utilities use groundwater. Water Replenishment District of Southern California (WRD) has been working with small water utilities to further develop their access to groundwater supplies so that purified water will be utilized locally once it replenishes the groundwater basins.

Where no environmental buffer is available, raw or treated water augmentation could enable reuse.

If required to maximize reuse, some agencies would have to rely on less seasonal or storage-limited reuse strategies like raw or treated water augmentation. While the State Board is committed to publishing raw and treated water augmentation regulations by 2023, some agencies will not have the technical, managerial, or financial (TMF) capacity to implement such advanced reuse strategies.

Flexibility and regionalization become increasingly important to support each agency's reuse strategies.

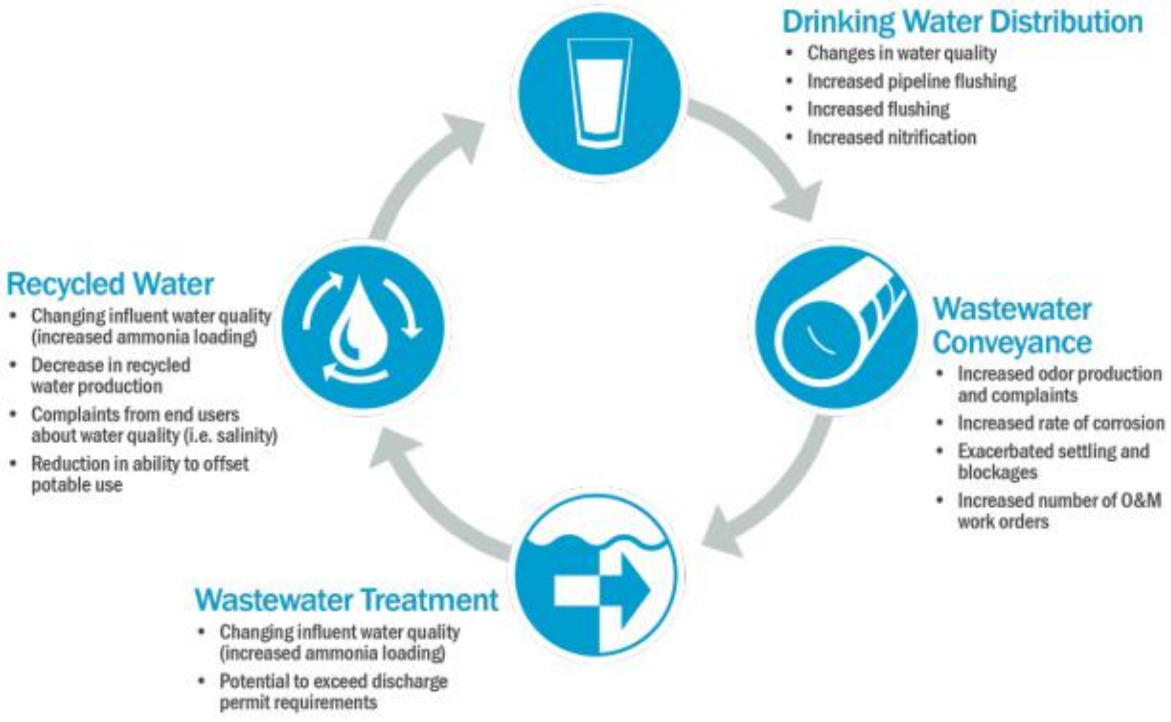


Source:
California Water Reuse Action Plan (2019).

Declining flows in the urban water cycle can potentially impact cost and wastewater available for reuse.

CUWA researched the potential impacts of declining flows on interconnected water, wastewater, and recycled water systems. Declining flows can alter the treatment and cost-effectiveness of recycled water infrastructure by changing factors considered in system design, such as anticipated influent volumes and wastewater quality.

As indoor water use decreases, the availability of treated wastewater for water reuse decreases, thus decreasing production potential. Declining flows can also result in generation of more concentrated wastewater streams, with elevated concentrations of total dissolved solids, nitrogen species, and organics, requiring more chemicals and subsequently increasing costs.



Source:
Adapting to Change: Declining Flows and Utility Systems by CUWA (2017).

The State Board is currently staffing a new task force to focus on building a comprehensive strategy for constituents of emerging concern (CECs) monitoring and management.

Environmental stewardship and industry control of chemicals before they enter the environment are crucial to reduce treatment cost and improved water quality. While there is growing public concern about CECs, such as per- and poly-fluorinated alkyl substances (PFAS), and other trace chemicals, there are safeguards in place for protecting public health, including robust treatment strategies and a Science Advisory Panel that meets every 5 years to guide future actions relating to CECs.

California water agencies are moving deliberately yet cautiously toward potable reuse strategies to avoid any missteps in purified water quality that could undermine the progress made in public acceptance over the past two decades.

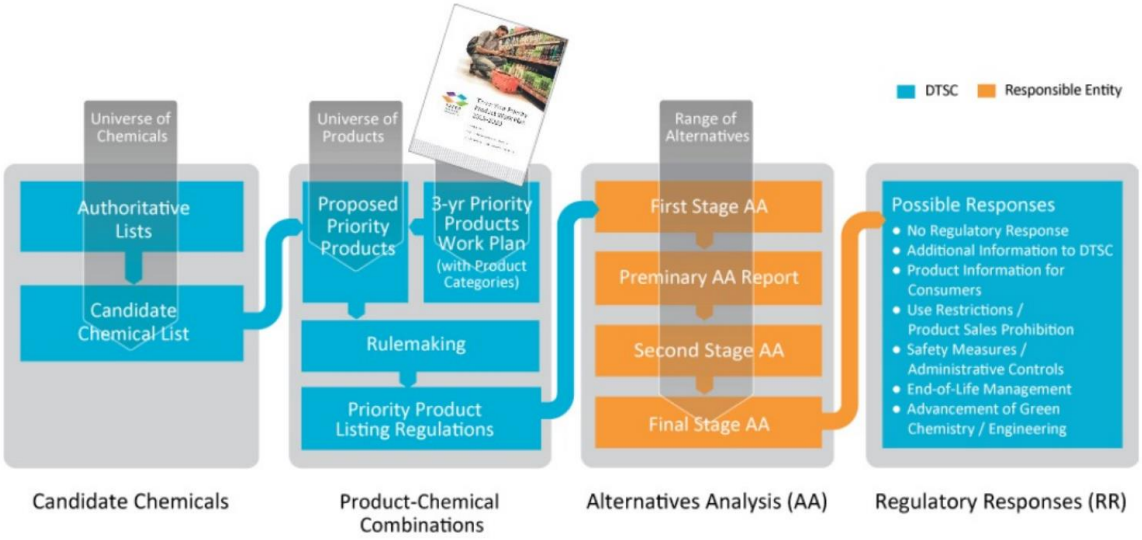
Over seven years, Orange County Water District has found all monitored PFAS compounds below detection levels in its purified water and can provide helpful data to support public conversations statewide.

Utilities need shared guidance on risk assessment and management frameworks for source control that build on the work other reuse facilities have done.

Several agencies in California overlap on the topic of CECs and source control:

- Department of Toxic Substances Control's (DTSC's) Safer Consumer Products Program
- Department of Pesticide Regulation
- Office of Environmental Health Hazard Assessment (OEHHA)
- State Board: SWAMP, GAMA, Recycled Water Policy, RWQCBs, DDW, Nonpoint Source Program, **and a new source control task force to build a comprehensive strategy for CEC monitoring and management**.

More interagency coordination is needed to achieve a cohesive approach to source control. The MOU that the Department of Pesticide Regulation has with the State Board serves as an example of much needed inter-agency coordination.

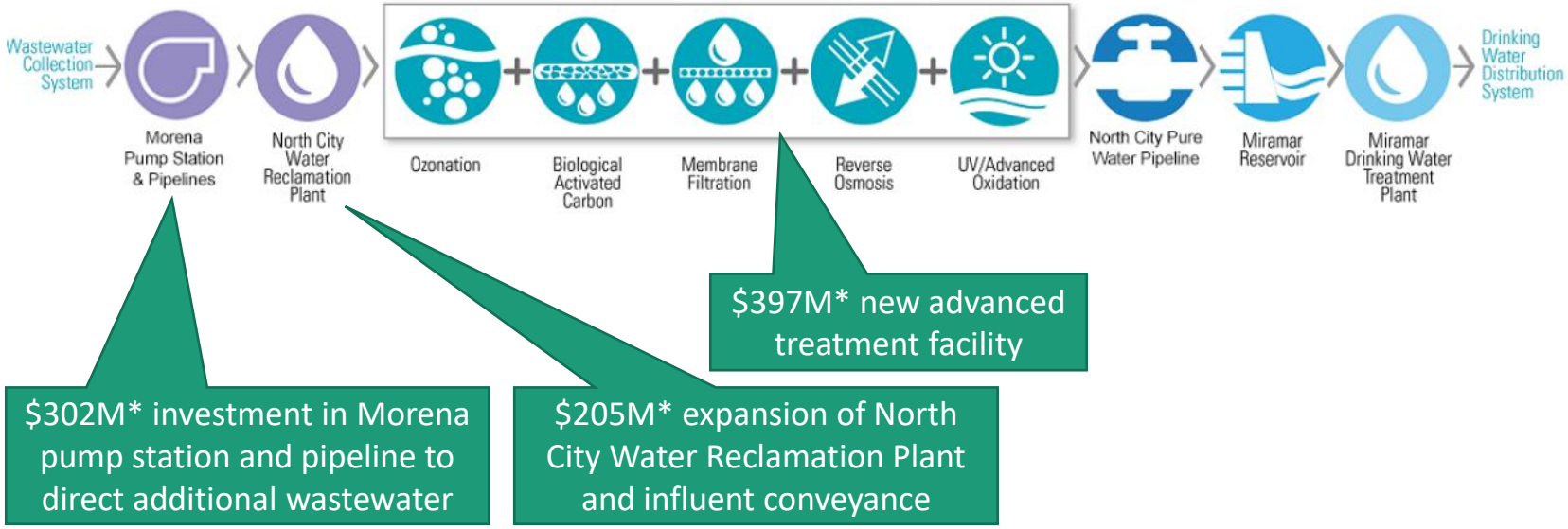


This flow chart lays the framework of the DTSC's Safer Consumer Products Program, which aims to reduce toxic chemicals in the products that consumers buy and use. This program is just one of the many in California that exist to reduce the level of CECs that reach wastewater treatment plants through source control.

Source:
DTSC Safer Consumer Products Program Three Year Priority Work Product Plan (2018).

To re-tool wastewater facilities as a source of supply for reuse, some existing wastewater treatment systems require upgrades.

Some agencies may need to upgrade existing systems to improve tertiary filtration, achieve greater nitrogen removal, and equalize flow, all while continuing to manage wet weather flow. Reductions to source influent flow volumes also impact reuse goals and increase costs. While these improvements protect water quality, they increase cost, operation, and maintenance. **Maximizing reuse statewide must take these costs into account.**



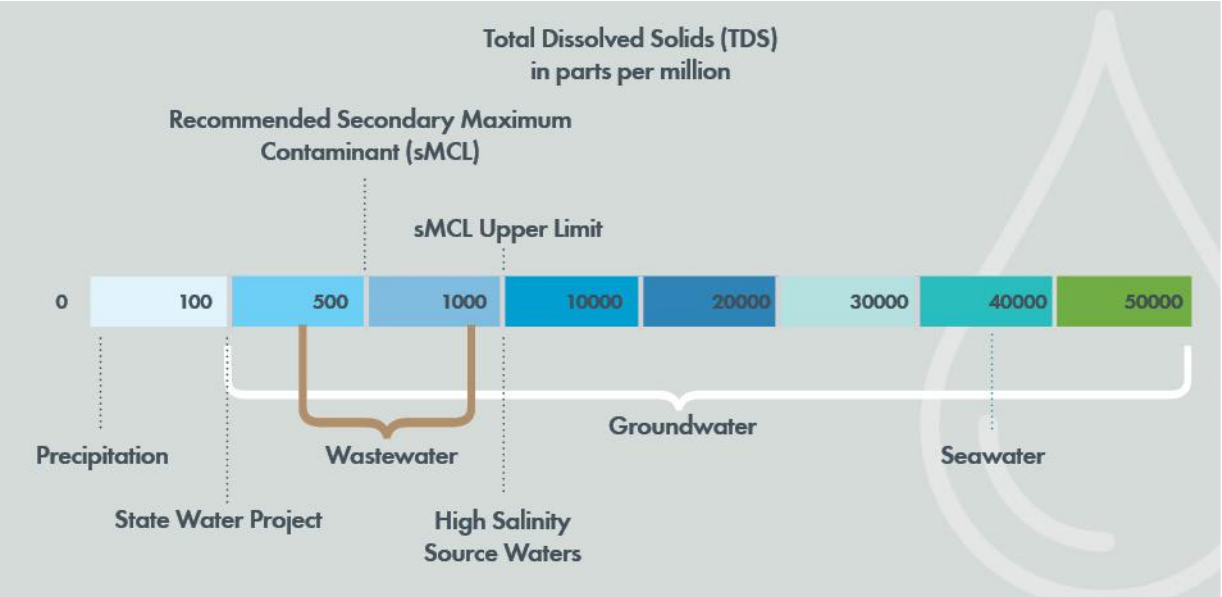
To reduce dependency on imported water and reduce ocean discharges by 50%, the City of San Diego initiated the Pure Water Program. For Phase 1, the City made significant investment in upstream infrastructure and wastewater treatment plant upgrades to enable a new advanced treatment facility. The City estimates reuse to cost essentially the same as constructing secondary treatment at Point Loma and purchasing imported water, rendering the cost of Pure Water Program comparatively affordable.

*2018 estimates that include design, construction, and construction management. Add another $40M for insurance, utility relocation, and contingency.

Salinity management is a critical need and benefit of reuse.

Concentrated with previous use, some wastewater has a high level of salinity, which may constrain recycled water use. High salinity levels in the water supply can impact agricultural production, households, industries, and water utilities. Salinity can therefore limit the use of local groundwater supplies for use as a drinking water source and can restrict recycled water use. Regulatory agencies are concerned about the environmental impacts of salinity to stream ecosystem health[1].

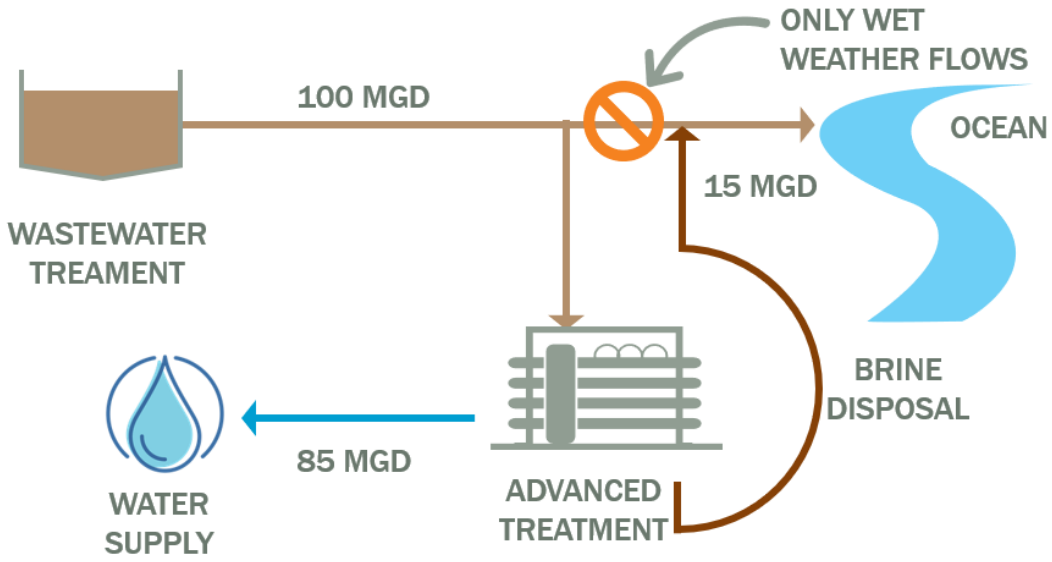
Removing salt is a net economical benefit, based on the savings its removal can realize for residential, commercial, industrial, and municipal users. USBR estimates the benefit of salt removal as $200 per ton of salt removed at a cost of $110 per ton of salt removed results in a net savings of $90 per ton of salt removed[2].



As evidenced by the varying level of total dissolved solids (TDS)[3], a metric for salinity in our water supplies, the range of salinity reduction required depends on the source of supply. Reliance on imported water supplies could have a significant impact on salinity in a given region, especially where Colorado River Water is a significant portion of the supply.

Source:
[1]San Diego Regional Water Quality Control Board's Executive Officer's Report to its Board (2016)
[2]Escalated to 2020 dollars from USBR Technical Memorandum No. EC-04-02 Economic Impacts from Salinity in the Lower Colorado River Basin (2004)
[3]State Water Resources Control Board Groundwater Information Sheet: Salinity (2017)

Maximizing reuse would result in less wastewater effluent being available to blend with the RO concentrate.



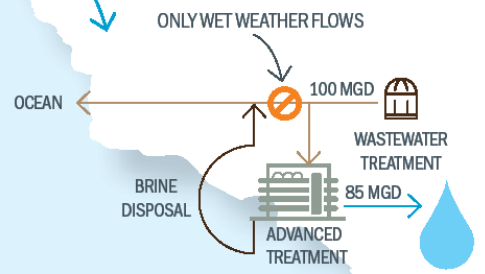
The best available technology for salinity reduction, RO, concentrates removed salt in 15 to 20% of the influent flow as a waste stream called RO concentrate (or brine). Utilities must therefore address toxicity, CECs, ammonia, and metals in RO concentrate prior to disposal. With less wastewater effluent available for dilution, additional treatment or infrastructure improvements may be necessary to comply with water quality objectives and/or achieve adequate dispersion.

RO concentrate disposal can be technically and financially challenging, depending on location, receiving waters, proximity to other facilities generating RO concentrate, and existing infrastructure.

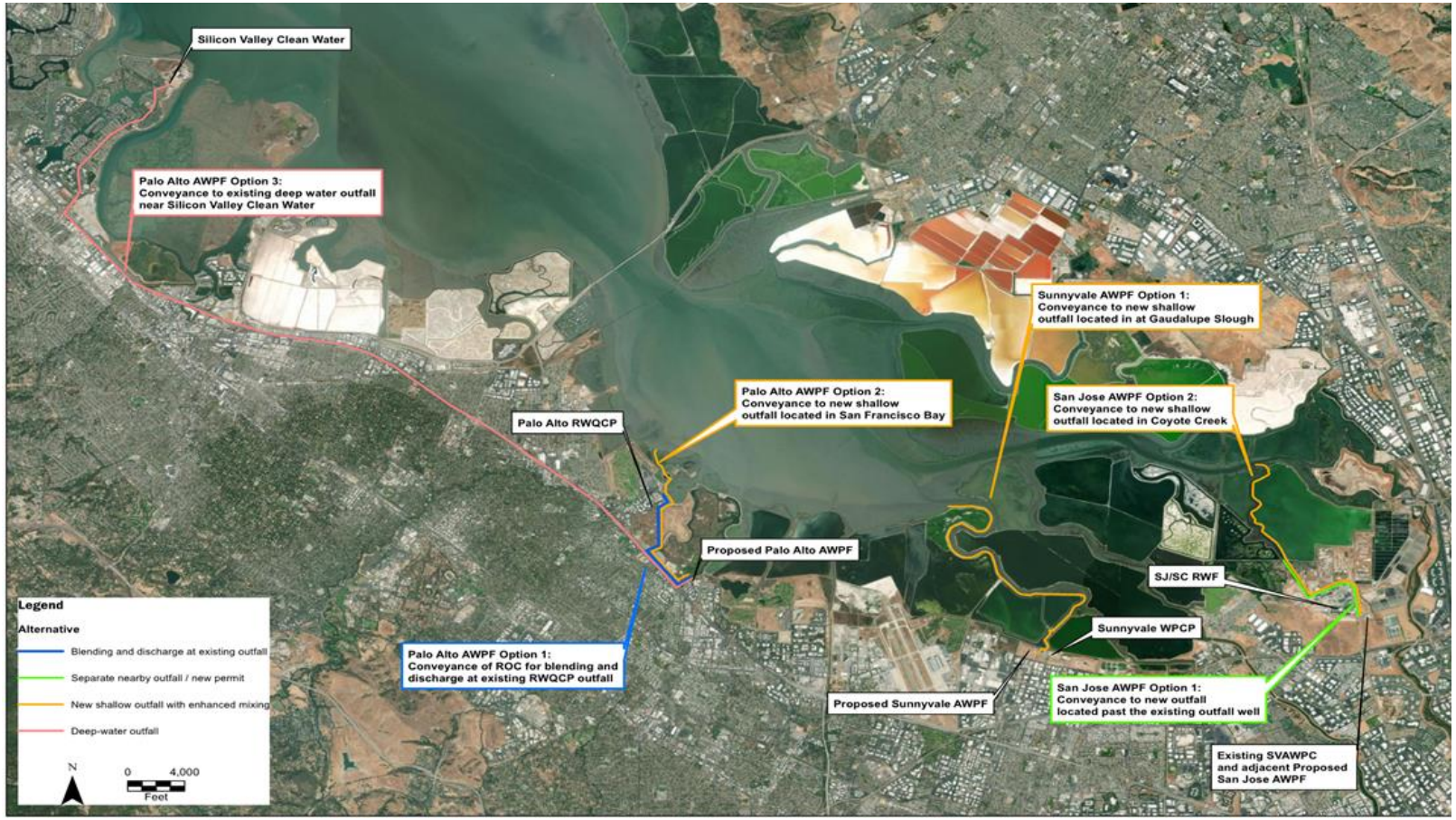
For sensitive water bodies that receive discharges from multiple facilities, such as the San Francisco Bay, mitigating toxicity, CECs, and metals in RO concentrate presents unique environmental challenges as a result of reduced dilution.

For inland areas seeking to implement reuse that requires salinity reduction without access to an outfall for RO concentrate disposal, brine management can nearly double treatment cost .

While RO concentrate disposal is less challenging in coastal areas with access to an outfall, utilities need to continue to be able to discharge RO concentrate to ocean as long as regulatory requirements are met.



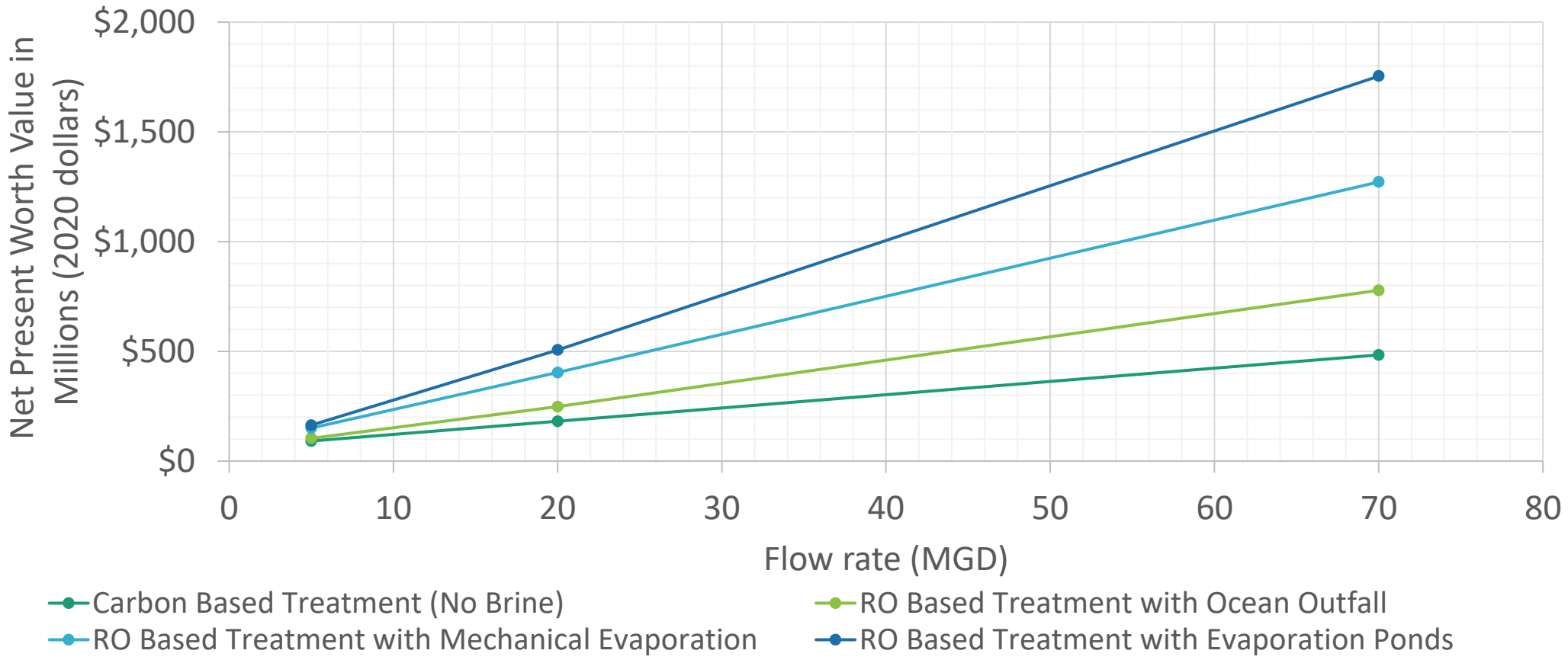
Valley Water faces unique RO concentrate disposal challenges when seeking to discharge into the San Francisco Bay.



Order R2-2019-0017/NPDES Permit CA0038873 Waste Discharge Requirements for Nutrients from Municipal Wastewater Discharges to San Francisco Bay is a region-wide permit that sets monitoring and reporting requirements as well as a mandate to evaluate potential nutrient discharge reduction through treatment optimization, sidestream treatment, or wastewater treatment plant upgrades. Seeking to maximize reuse in its service areas, Valley Water faces the challenge of disposing RO concentrate while still complying with this region-wide permit and potential changes to it.

Source:
Valley Water Countywide Water Reuse Master Plan (2020).

Brine management can more than double project cost.

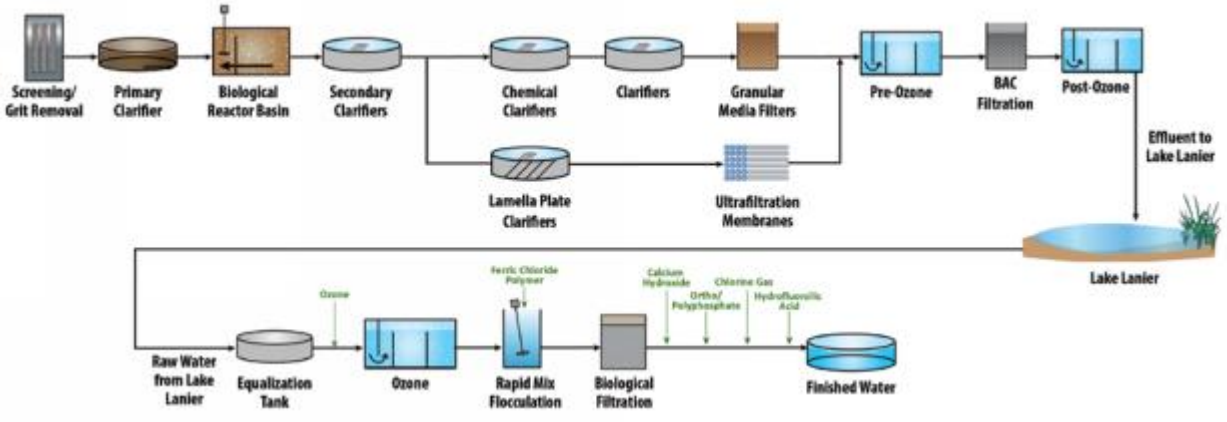


CALIFORNIA URBAN WATER AGENCIES

Source:
Cost curves extrapolated from 2012 WRRF Project 10-01
Fit for Purpose Water: The Cost of Overtreating Reclaimed Water.

Carbon based advanced treatment works well when treatment challenges can be overcome.

- **Total dissolved solids (TDS)**: below 500 mg/L or lower as dictated by region specific basin plan
- **Organics**: measured by total organic carbon (TOC) below 0.5 mg/L (or pursue alternative clause for higher level) in purified water, inclusive of diluent water (if any)
- **CECs**: meeting all federal and state requirements, including those for PFAS and 1,4-dioxane
- **Disinfection byproducts (DBPs)**: meeting all federal and state requirements, including those for bromate and NDMA, which can be formed in the treatment process
- **Nitrogen species**: total nitrogen below 10 mg/L or lower (or specific to nitrate) as dictated by region specific basin plan



Gwinnett County has practiced planned carbon-based advanced treatment for reservoir water augmentation since 2010, when the F. Wayne Hill Water Reclamation Center started returning highly treated reclaimed water to Lake Sidney Lanier, the county's sole source of drinking water supply.

Source:
WRF 15-11/4777 Ozone Biofiltration Direct Potable Reuse Testing at Gwinnett County 2018

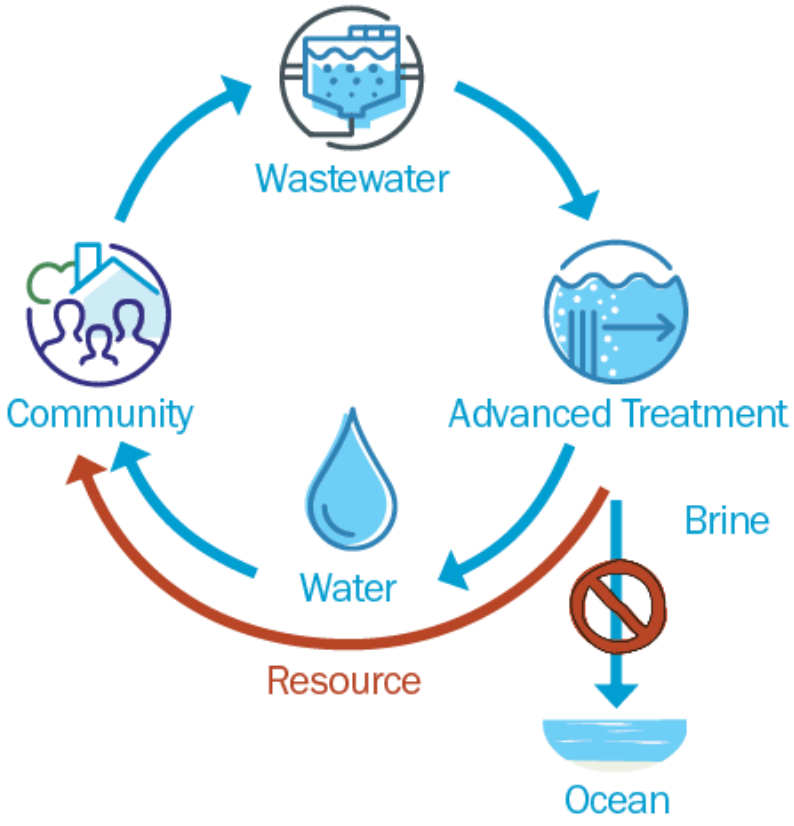
This case study shows how waste can be turned into a resource through RO concentrate reclamation in California.

Chino Desalter Authority (CDA) has turned the problem of disposal into an opportunity by partnering with a local limestone supplier to recover calcium carbonate from RO concentrate produced at Concentrate Recovery Facility (CRF) II.

Removing and repurposing calcium carbonate allows the CDA CRF II to:

- Increase water production
- Reduce volume of brine disposed, and
- Improve water quality of disposed brine thereby preventing plugging in the Inland Empire Brine Line.

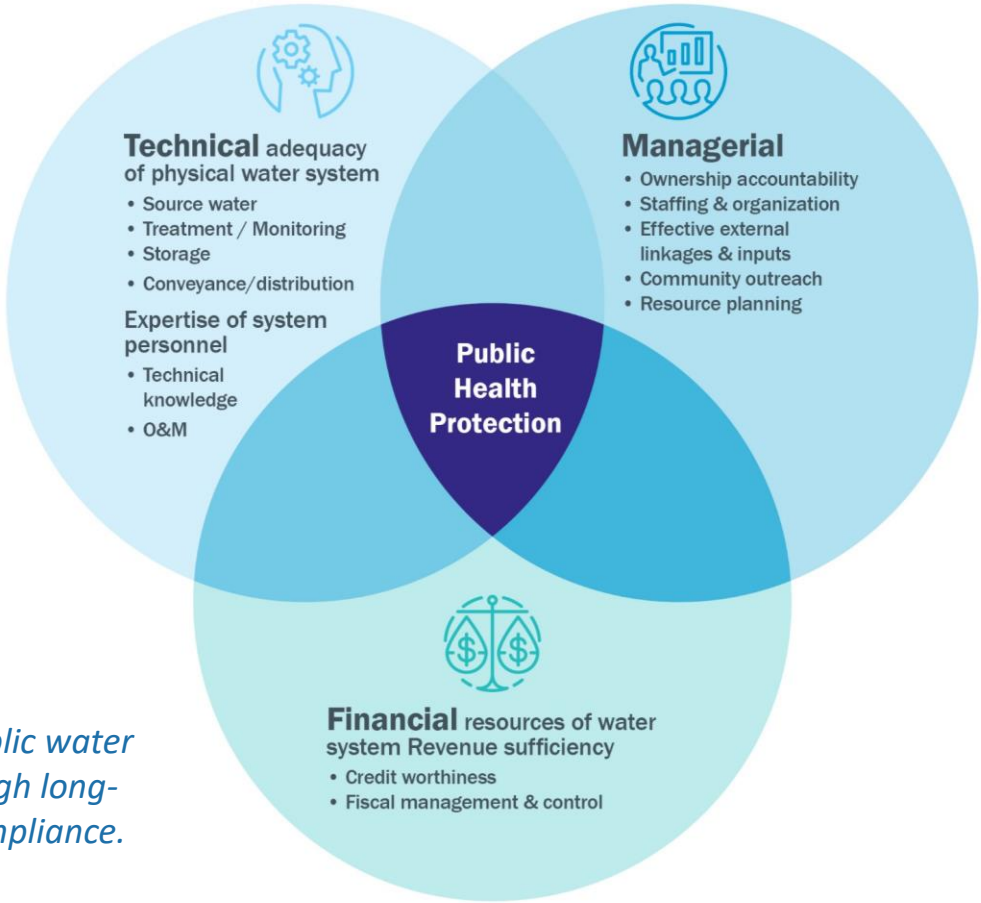
While the treatment train required to remove minerals for beneficial reuse is complex, the concept shows how public/private partnerships can help utilities move closer to maximizing reuse of not only water but also solids.



Source:
Multi State Salinity Conference 2019

Fundamentally, reuse requires partnership.

To maximize reuse, agencies will increasingly need to engage multiple agencies to achieve ambitious reuse goals. Without the same resources as large retailers or wholesalers, small retailers can face limitations in the ability to access not only economies of scale but also the TMF capacity required for more sophisticated forms of reuse, including raw and treated water augmentation.



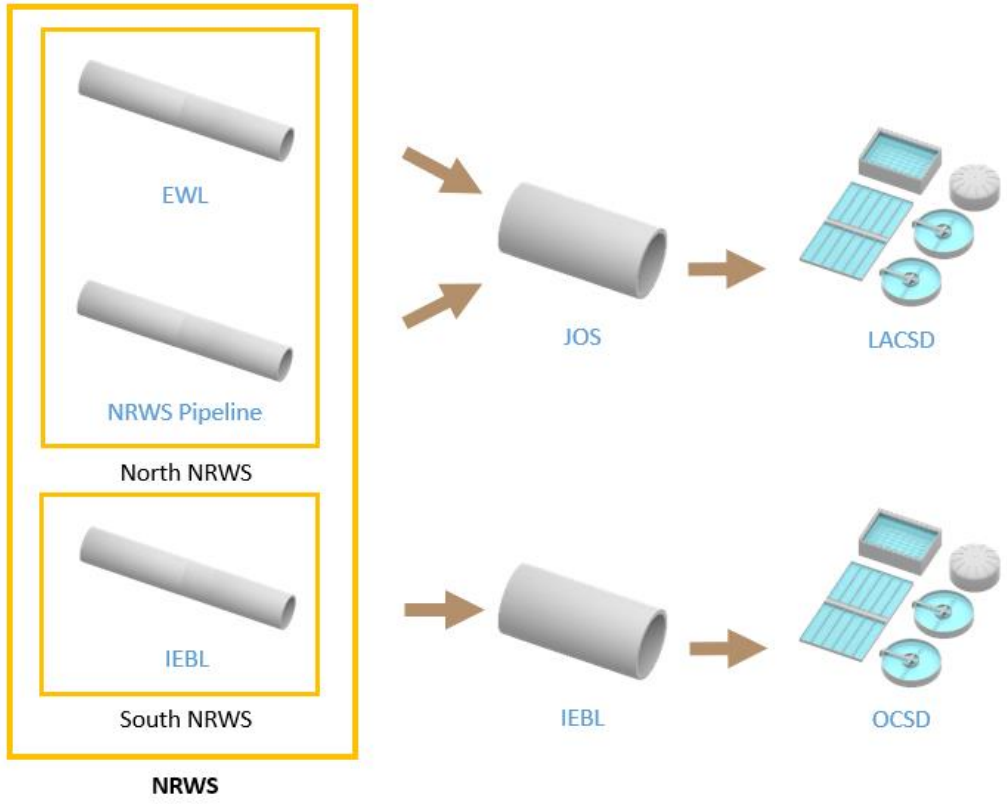
TMF is defined as the capability of public water systems to protect public health through long-term sustainability and regulatory compliance.

Source:
Valley Water Countywide Water Reuse Master Plan (2020).

Regional approaches and shared infrastructure are increasingly important to enable reuse for all agencies.

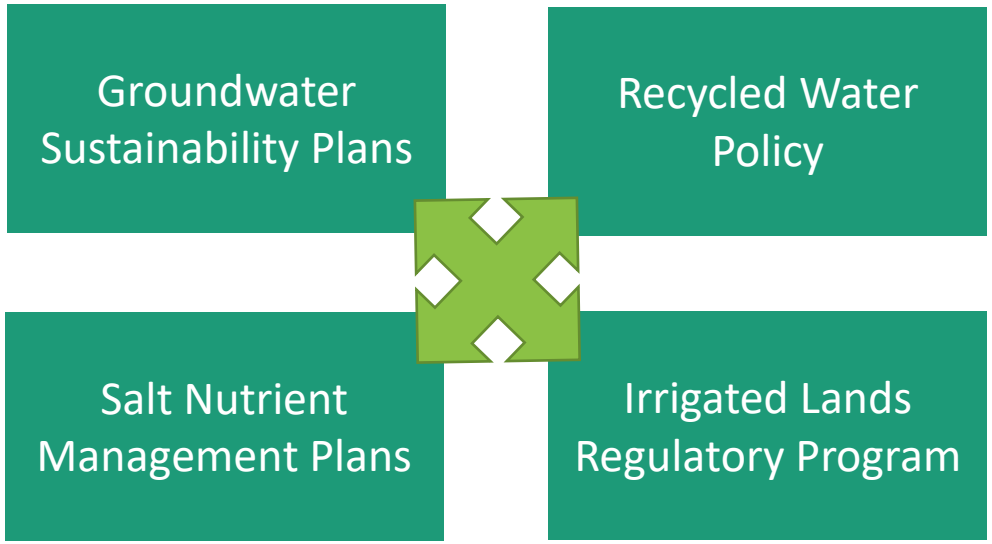
Many agencies that would otherwise embrace water reuse as part of a diverse supply do not have access to critical elements such as wastewater effluent, storage for recycled water during times of low demand, a water treatment plant, or distribution system. RO concentrate management becomes infeasible without regional collaboration through brine lines, regional discharge permits, or innovative mineral recovery facilities. **Incentivizing regional approaches for reuse and RO concentrate management through funding and flexible regulatory frameworks will help support successful and cost-effective reuse statewide.**

As an example of shared infrastructure, the Inland Empire Utilities Agency (IEUA) operates the Non-Reclaimable Wastewater System (NRWS), which is infrastructure for disposal of high-salinity wastewater (brine) and other non-reclaimable high-strength wastewater. The NRWS is comprised of three pipelines: the NRWS pipeline, the Etiwanda Wastewater Line (EWL), and the Inland Empire Brine Line (IEBL). The NRWS pipeline and the EWL ultimately convey flow to the Los Angeles County Sanitation Districts (LACSD) through the Joint Outfall System (JOS). The IEBL directly conveys flow to the Orange County Sanitation District (OCSD) by gravity.



Reuse requires breaking down traditional silos among the State's water and land management agencies.

The Governor's Water Resilience Portfolio aims to institutionalize better coordination across state agencies to improve water management. Aligning government policies, regulations, and programs would further enable integrated approaches and strengthen reuse solutions. Enhancing existing programs, like Integrated Regional Water Management (IRWM), can further promote greater collaboration for a more balanced approach to addressing California's water needs.



As an example, creating greater collaboration, alignment, and a more flexible regulatory approach between these 4 state programs that have overlapping authority in California's groundwater basins would help improve efficiencies and streamline the process of implementing groundwater recharge.

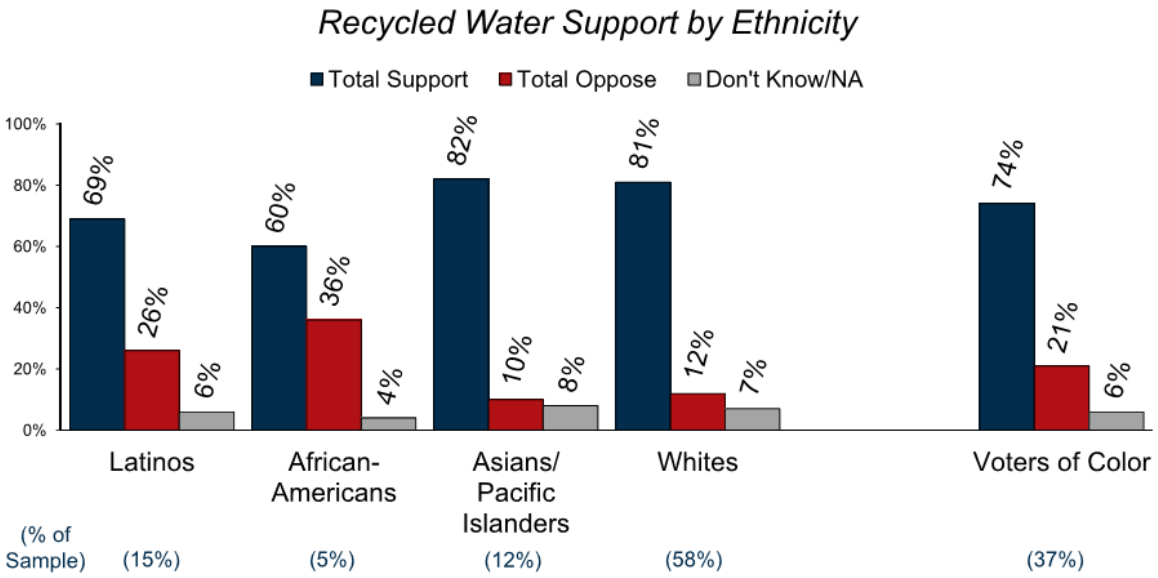
Agencies need adequate time and resources to conduct community outreach, gain stakeholder buy-in, and mitigate environmental justice concerns.

As the City of San Diego can attest, a successful reuse program requires trust. The City's Pure Water Program started back in the early 1990s as a solution to overcome extreme drought and proactively divert flow from an outfall with an expiring secondary treatment waiver. As the Program gained momentum, the 1998 election year brought public opposition. A group of protestors claimed the City was taking wastewater from its wealthiest District and providing it to a more disadvantaged and ethnically diverse District, bandying the phrase "**making the poor drink the affluent's effluent**." While untrue, the outcry garnered media attention. Coupled with community opposition, a lawsuit from the taxpayer group, leadership transitions, Jay Leno making jokes about "**toilet-to-tap**", and the National Academy of Sciences publishing a report supporting but qualifying potable reuse as an "**option of last resort**", community outcry set the Program back 20+ years.

Since then, the City successfully advanced the Program by implementing the following approaches:

- Removing any semblance of unequitable distribution of purified water
- Engaging proactively with a multicultural set of stakeholders and strong community voices
- Conducting educational programs, including tours and tastings of demonstration facility purified water

Acceptance of reuse is generally not based on belief in technology but rather trust. Taking the time to conduct one-on-ones and develop community outreach programs are key potable reuse success.



In general, communities of color are less supportive of water reuse.

Source:
WRF 13-02 Model Communications Plans for Increasing Awareness and Fostering Acceptance of Direct Potable Reuse

CALIFORNIA URBAN WATER AGENCIES

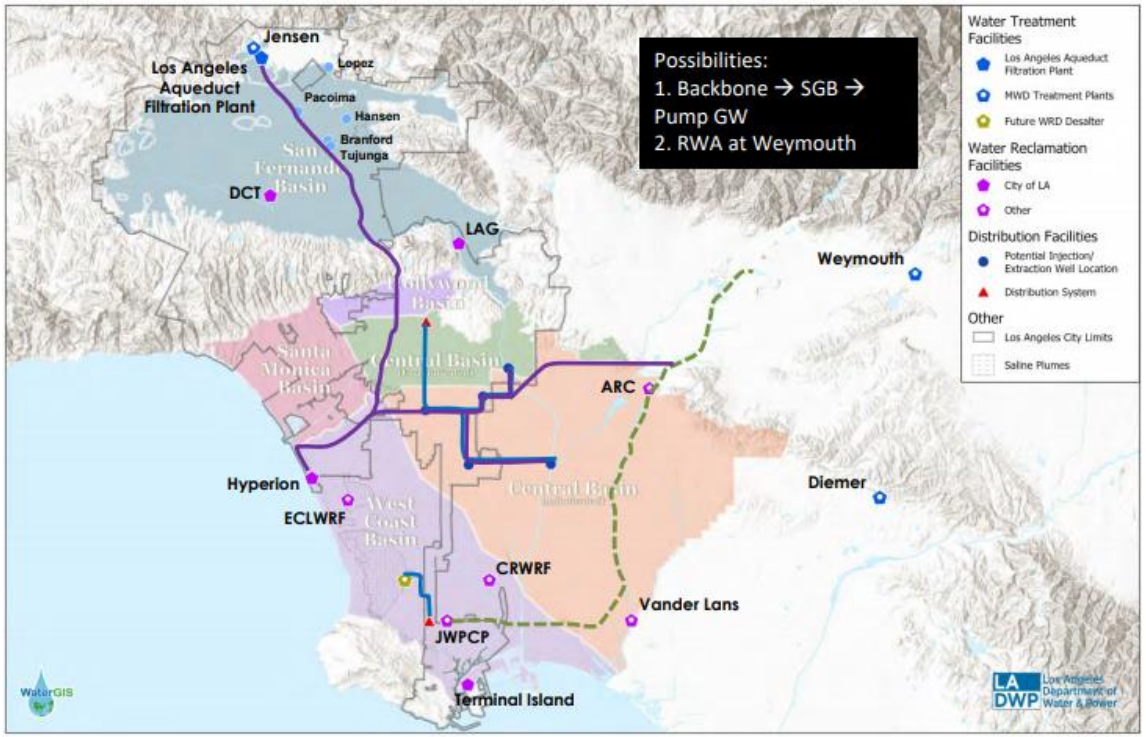
An example that reveals the obstacles and opportunities to maximizing reuse today is Operation NEXT, the City of Los Angeles's goal for reuse of all wastewater effluent.

To achieve the ambitious goal of recycling all available treated wastewater for beneficial reuse from the Hyperion Water Reclamation Plant (HWRP) by 2035, **City of Los Angeles Department of Water and Power (LADWP)** and **Bureau of Sanitation (LASAN)** have entered a joint partnership. LADWP is also working on a joint master plan with **Water Replenishment District of Southern California (WRD)** to maximize use of the West Coast and Central groundwater basins as storage for purified water. LADWP has also entered into a Letter of Intent with the **Metropolitan Water District (MWD)** on their Regional Recycled Water Program with the Sanitation Districts of Los Angeles County to evaluate increased collaboration at the regional level.

In addition to navigating complex regional partnerships, several other obstacles must be overcome to achieve LA water reuse goals, including:

- **Financial:** External funding is needed to help offset cost of entire program.
- **Technical**: LASAN needs to maintain wet weather capacity while expanding treatment within tight existing footprint at HWRP.
- **Regulatory**: Capitalizing on the existing Los Angeles Aqueduct Filtration Plant through raw water augmentation in parallel with an evolving set of DPR regulations.
- **Institutional**: WRD will be encouraging their retailers to support the conjunctive use of purified water supplies utilizing local groundwater storage. Potential partnerships to access MWD's treatment plants and distribution systems.
- **Community**: Overcoming any potential concerns on the safety of purified water.
- **Environmental**: Evaluating ways to manage brine from the RO treatment process .

Forging a common understanding between agencies with historically different goals is new ground. This emerging partnership must tackle these challenges together to achieve maximum reuse.



Source:
WateReuse Symposium 2020

Developing approaches to overcoming these challenges will enable California agencies to meet expanding water reuse goals.

Expand funding opportunities as indicated in the 2019 California Water Reuse Action Plan, which include selling bonds to leverage more funding, passing new bonds with significant grant funding, streamlining the funding application process, and increasing staffing to manage these programs.

Develop regulations for raw and treated water augmentation that address limited storage, clarify the limitations of ocean disposal of RO concentrate, enable health-based purified water quality goals that enable lower cost treatment, enhance IRWM and promote integrated planning frameworks that consider collective water supplies in the NPDES permitting process.

Support research and funding to accelerate innovation around cost-effective RO concentrate reuse and disposal and a market for reclaimed materials to turn a waste problem into a resource opportunity. Further develop acceptance of alternative treatment strategies.

Incentivize regional approaches and leadership among large utilities and wholesalers to pool resources with smaller utilities for access to more complex and costly potable reuse systems.

Develop shared guidance on risk assessment and management frameworks for source control that build on the work by others. Encourage environmental stewardship to improve source control both at the community level and broader among industries.

Engage the environmental community in meaningful conversations about dual and sometimes competing goals. Create informative and flexible guidance for agencies to make decisions on the future of the ecosystems interrelated with wastewater effluent.

Acronyms

Bureau of Sanitation (LASAN)
Chino Desalter Authority (CDA)
City of Los Angeles Department of Water and Power (LADWP)
Clean Water State Revolving Fund (CWSRF)
Concentrate Recovery Facility (CRF)
Constituents of Emerging Concern (CECs)
Department of Toxic Substances Control's (DTSC's)
Disinfection Byproducts (DBPs)
Division of Drinking Water (DDW)
Etiwanda Wastewater Line (EWL)
Groundwater Ambient Monitoring and Assessment (GAMA)
Inland Empire Brine Line (IEBL)
Inland Empire Utilities Agency (IEUA)
Joint Outfall System (JOS)
Los Angeles County Sanitation Districts (LACSD)
Metropolitan Water District (MWD)
Memorandum of Understanding (MOU)
Million Gallons per Day (mgd)
N-nitrosodimethylamine (NDMA)
Non-Reclaimable Wastewater System (NRWS)
Non-Potable Reuse (NPR)
Office of Environmental Health Hazard Assessment (OEHHA)
Orange County Sanitation District (OCSD)
Per- and Poly-Fluorinated Alkyl Substances (PFAS)
Regional Water Quality Control Board (RWQCB)
Reverse Osmosis (RO)
Secondary Maximum Contaminant Level (sMCL)
Soquel Creek Water District (SqCWD)
Surface Water Ambient Monitoring (SWAMP)
Technical, Managerial, and Financial (TMF)
Total Dissolved Solids (TDS)
Total Organic Carbon (TOC)
Wastewater Treatment Plant (WWTP)
Water Replenishment District of Southern California (WRD)

Acknowledgements

- Steering Committee
  - Martha Tremblay (SCSC)
  - Julie Minton (WRF)
  - Jennifer West (WateReuse California)
  - Wendy Ridderbusch (CalDesal)
  - Paul Liu (LADWP)
  - Raymond Jay (MWD)
  - Lesly Dobalian (SDCWA)
  - Paula Kehoe (SFPUC)
  - Hannah Ford & Wendy Broley (Brown and Caldwell)
- CUWA Reuse Committee
- Agency Partners
- Interviewees
  - Jennifer West (WateReuse California)
  - Jason Dadakis (OCWD) and Eros Yong (OCSD)
  - Paul Liu, Rafael Villegas, and Manual Aguilar (LADWP), Diane Gatza (WRD), and Huub Cox and Tim Defeta (LASAN)
  - Regional Water Quality Control Board – Melissa Gunter (San Francisco)
  - State Water Resources Control Board – Darrin Polhemus (DDW) and Karen Mogus, Shala Faranhak (Division of Water Quality)

WateReuse California

Cal Desal

SCSC Southern California Salinity Coalition

The Water Research Foundation