CALIFORNIA URBAN WATER AGENCIES

FACING CHALLENGES WITH MAXIMIZING WATER REUSE

In the face of climate change, aging infrastructure, and emerging water quality challenges, California water agencies are motivated to improve resilience through thoughtful implementation of water reuse and other alternative water supplies. Meanwhile, there is growing pressure to maximize beneficial reuse in lieu of discharging wastewater effluent.

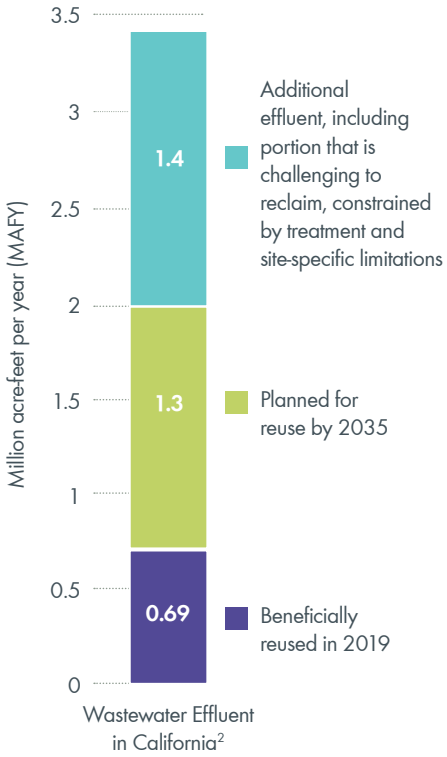
All forms of water reuse, including those not currently regulated under Title 22 (e.g., land application), are important parts of the solution to improve supply reliability statewide. Underscored by the Governor's Water Resilience Portfolio's support to triple current levels of water recycling in the next decade, some cities are proactively setting goals to maximize reuse of all wastewater effluent. 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[1].

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. Regardless of the type of reuse applied — from non-potable to potable reuse, centralized to onsite reuse — there are significant challenges that must be overcome to maximize its application. Agencies need adequate time and resources to conduct community outreach, gain stakeholder buy-in, and mitigate potential environmental justice concerns. Statewide momentum in the areas illustrated below is critical to achieving ambitious reuse goals.

This paper aims to increase awareness of the obstacles California water and wastewater agencies face in maximizing reuse and presents strategies to enable greater progress.

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 member agencies is a lifeline supporting California's urban populations and powering the bulk of the state's $3.2 trillion economy. CUWA agencies have conceptual plans in place to triple their water reuse by 2035.



The State Board estimates 2.7 MAFY of wastewater effluent in California is currently not reused.[2] While there are plans to reuse approximately 2.0 MAFY by 2035, there are no plans to reuse the remaining 1.4 MAFY of wastewater effluent, which includes a portion that is not easily reclaimable and limited by site-specifc constraints.

[1] EPA Potable Reuse Compendium (2018).

[2] 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.

FUNDING WATER REUSE

Most agencies are not able to develop reuse projects without state or federal financial assistance. To fund the 1.3 MAFY of planned reuse projects in California over the next decade, agencies need $13.2 billion[3]. Because the Clean Water State Revolving Fund has a $3 billion backlog of reuse projects waiting for funding, and Proposition 1, Proposition 68, and other existing bonds are largely exhausted, new sources of funding are necessary to enable utilities to cost-effectively implement water reuse (including both capital and operating costs).

The life cycle cost for alternative water supplies varies on a site-specific basis. In some locations reuse projects are more costly than continuing to purchase existing supplies[4]. However, the Governor's Water Resilience Portfolio predicts that by 2035, recycled supplies, which are often more expensive than imported water, would cost roughly the same as imports.

>> Because an estimated 9.4 million people in CUWA agencies' collective service areas (35% of people served) are low income, low income affordability[5] is a major consideration when planning for reuse and alternative supplies.

BALANCING COMPETING NEEDS AND USES

Minimum flow requirements create a dynamic tension to balance reuse with existing recreational and environmental use. Reducing discharge flows from wastewater facilities could impact ecosystems that rely on its presence. 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.

Groundwater basins and reservoirs provide an environmental buffer for potable reuse and important storage for purified water. However, storage is finite, limited by stormwater infiltration and seasonal use. Storage also requires coordination with local agencies to rely on groundwater as a source of supply to free up space over time.

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.

WATER QUALITY AND SOURCE CONTROL

California water agencies are moving deliberately yet cautiously toward potable reuse strategies. While there is growing public concern about constituents of emerging concern (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. The State Board is also staffing a new task force to focus on building a comprehensive strategy for CEC monitoring and management.

Protecting public health involves a combination of treatment and enhanced source control strategies. Utilities would benefit from shared guidance on risk assessment and management frameworks for source control built on the work of other reuse facilities.

To re-tool wastewater facilities as a source of supply for reuse, some agencies may also need to upgrade existing systems to improve tertiary filtration, achieve greater nitrogen removal, and equalize flow, all while continuing to manage wet weather flow. These improvements protect water quality, but they also increase life cycle cost and maintenance requirements.

Meanwhile, environmental stewardship and industry control of chemicals before they enter the environment are crucial to reduce treatment cost and improve water quality.

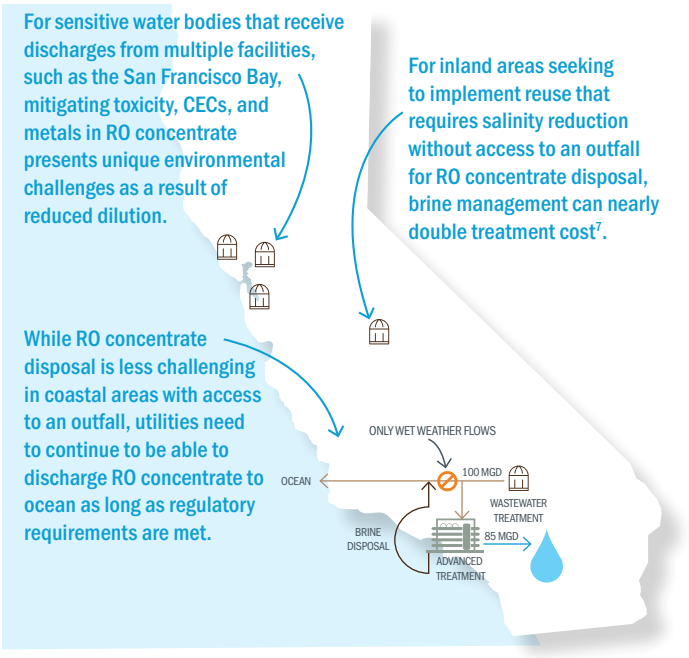
>> Maximizing reuse statewide must take into account the life cycle cost and maintenance implications associated with source control and upstream treatment improvements.

The Los Angeles Department of Water and Power's (LADWP) Operation NEXT Program is a joint partnership with the City's Bureau of Sanitation (LASAN) to maximize available wastewater effluent from the Hyperion Water Reclamation Plant by 2035 for beneficial reuse. LADWP is also working on a joint master plan with the Water Replenishment District of Southern California to maximize use of the West Coast and Central groundwater basins as storage for this 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. These emerging partnerships can work together to overcome supply and treatment challenges.

[3] WateReuse California Funding Survey (2019). [4] CUWA Advancing Water Supply Reliability (2017). [5] CUWA affordability assessment based on estimated customers below 200% of the federal poverty level (2020).

SALINITY AND REVERSE OSMOSIS CONCENTRATE MANAGEMENT

Salinity management is a critical need and benefit of reuse. Concentrated through previous use, some wastewater has a high level of salinity, which can constrain both potable and non-potable reuse. While some agencies are able to leverage recycled water for agricultural irrigation, groundwater banking, and other uses without advanced treatment, others must remove salt to make the supply suitable for end use (e.g., irrigation of salt-sensitive species) and meet water quality objectives. USBR estimates that salt removal results in a net savings of $90 per ton of salt removed based on benefits to residential, commercial, industrial, and municipal users[6].



The best available technology for salinity reduction, RO, concentrates removed salt as a waste stream called RO concentrate (or brine). RO concentrate is typically rejected at a volumetric rate of 15 to 20% of the influent flow. Maximizing reuse would result in less wastewater effluent being available to mix with the RO concentrate. 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.

>> Removing salinity from purified water is necessary, but the corresponding RO concentrate disposal is costly, compounded by location-specific challenges.

BRINE MANAGEMENT REQUIRES CONTINUED INNOVATION

MINIMIZING RO CONCENTRATE

Innovative brine minimization technologies can increase the level of recovery above the conventional 85% but comes at the price of additional energy, chemical, and maintenance requirements. More research is needed to demonstrate these concepts for long term operability.

A proven and accepted method for potable reuse in other states is carbon-based advanced treatment, which avoids RO if salinity is low enough or minimizes its use as a sidestream. Cost effective use of carbon based treatment will require higher purified water total organic carbon (TOC) goals than the 0.5 mg/L currently permitted for potable reuse in California. Over 73% of the potable water supplies in the United States have a TOC greater than 1 mg/L[8]. Requiring 0.5 mg/L TOC in purified water is a performance based goal that essentially requires RO. Allowing health-based purified water quality goals, such as TOC targets that match existing potable supply water quality, would render potable reuse feasible for more utilities while maintaining protection of public health.

CLOSING THE LOOP: RO CONCENTRATE AS A RESOURCE

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 II.

By removing calcium carbonate, CDA is able 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.

[6] State Water Resources Control Board Groundwater Information Sheet: Salinity (2017). [7] WRRF Project 10-01(2012). [8] AWWA (2017)

COLLABORATION AND REGIONAL APPROACHES

Agencies increasingly need to collaborate with multiple partners to achieve ambitious reuse goals and reduce costs. Without the same resources as large retailers or wholesalers, small retailers face limitations in the ability to access economies of scale and the TMF capacity required for more sophisticated forms of reuse, including raw and treated water augmentation.

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 is often infeasible without regional collaboration through brine lines or regional discharge permits.

Agencies who are pursuing similar reuse projects also need to work together to learn from each other and maintain coordination to maximize reuse.

>> Incentivizing regional approaches for reuse and RO concentrate management through funding and flexible regulatory frameworks helps support successful and cost-effective reuse statewide.

REGULATORY ALIGNMENT

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. One example specific to reuse is the overlapping authority and requirements of the Recycled Water Policy, Salt and Nutrient Management Plans, Irrigated Lands Regulatory Program, and Groundwater Sustainability Plans. Aligning government policies, regulations, and programs would further enable integrated approaches and strengthen reuse solutions.

Implementing and permitting reuse takes time. Many projects take over a decade to advance from conception to startup. While pressure to access the benefits of reuse may be urgent, agencies must spend the time necessary to thoroughly vet the reuse application and gain regulatory approval and community acceptance.

>> 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.

Agencies must work together to overcome these challenges. As energy, treatment cost, and conveyance differ from one service area to another, the case for reuse continues to be site-specific. Yet, our ability to completely reuse all available wastewater statewide is constrained by competing demands for continued in-stream flows, technology, and site specific limitations.

NEXT STEPS TOWARD WIDESPREAD REUSE

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 builds on work by others. Encourage environmental stewardship to improve source control both at the community and industry levels.

Engage the environmental community in meaningful conversations about dual and sometimes competing goals, and provide real world case studies and timelines for better public understanding. Create informative and flexible guidance for agencies to make decisions on the future of ecosystems interrelated with wastewater effluent.