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### **Title**

Making the Most of Landmark Recycled Water Investments in Los Angeles: Technical Advisory Recommendations for the Region

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### **Author**

burstein, mara elana

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# Making the Most of Landmark Recycled Water Investments in Los Angeles

TECHNICAL ADVISORY RECOMMENDATIONS FOR THE REGION



The Luskin Center for Innovation conducts actionable research that unites UCLA scholars with civic leaders to solve environmental challenges and improve lives. Our research priorities include the [human right to water](#), [community-driven climate action](#), [heat equity](#), [clean energy](#) and [zero-emission transportation](#). We envision a future where everyone has healthy, affordable, and resilient places to live, work, learn, and play.

## AUTHORSHIP

This report was produced by the Luskin Center for Innovation (LCI) at the University of California, Los Angeles (UCLA), and the UC Division of Agriculture and Natural Resources (UC ANR).

### Authors:

- Dr. Edith B. de Guzman, Cooperative Extension Specialist, LCI and UC ANR
- Dr. Gregory Pierce, Research and Co-Executive Director, LCI

### Advisory Editors:

- Maura Monagan, Policy and Government Affairs Manager, Los Angeles Waterkeeper
- Bruce Reznik, Executive Director, Los Angeles Waterkeeper

## ACKNOWLEDGMENTS

The report is a synthesis of input received from the 20 Technical Advisory Committee (TAC) participants listed on page iv. The sources of information include TAC participant verbal and written comments, and documents and presentations provided by the agencies.

We note that agencies which provided funding for this effort did not exercise any editorial control over the TAC or this report, and any errors or omissions in this report are the sole responsibility of LCI.

We acknowledge the Gabrielino/Tongva peoples as the traditional land caretakers of Tovaangar (the Los Angeles basin and So. Channel Islands). As a land grant institution, we pay our respects to the Honuukvetam (Ancestors), 'Ahihirom (Elders) and 'eyoohiinkem (our relatives/relations) past, present and emerging.

The analysis, views, recommendations, and conclusions expressed herein are those of the authors and not necessarily those of any of the project supporters, advisors, interviewees, or reviewers, nor do they represent the University of California, Los Angeles as a whole. Reference to individuals or their affiliations in this report does not necessarily represent their endorsement of the recommendations or conclusions of this report. The author is responsible for the content of this report.

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## PARTICIPANT LIST AND ACKNOWLEDGEMENTS

### Technical Advisory Committee

Lauren Ahkiam, Los Angeles Alliance for a New Economy  
Amy Childress, University of Southern California  
Nicholas Chow, University of Oxford  
Janet Clements, One Water Econ  
Jason Dadakis, Orange County Water District  
Eli Dennis, UCLA Sustainable LA Grand Challenge  
Alvar Escriva-Bou, University of California Los Angeles  
George Farah, Plummer  
Michael Gagan, Kindel Gagan  
Mark Gold, Natural Resources Defense Council  
Silvia González, University of California Los Angeles  
Jim Herberg, Orange County Sanitation District (retired)  
Wendy Katagi, Stillwater Sciences  
Mike Markus, Orange County Water District (retired)  
Daniel McCurry, University of Southern California  
Erik Porse, University of California Agriculture and Natural Resources  
Donald Smith, Montgomery Watson Harza (retired)  
Eric Stein, Southern California Coastal Water Research Project  
Michael Stenstrom, University of California Los Angeles  
Robb Whitaker, Water Replenishment District (retired)

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### Agency Representatives

Michelle Barton, City of Los Angeles  
EJ Caldwell, West Basin Municipal Water District  
Bruce Chalmers, Metropolitan Water District of Southern California  
Anselmo Collins, Los Angeles Department of Water and Power  
Hubertus Cox, Los Angeles Sanitation and Environment  
Robert Ferrante, Los Angeles County Sanitation Districts  
Jesus Gonzalez, Los Angeles Department of Water and Power  
Joyce Lehman, Metropolitan Water District of Southern California  
Michael Liu, Los Angeles County Sanitation Districts  
Felicia Marcus, City of Los Angeles  
Joe McDermott, Las Virgenes Municipal Water District  
Traci Minamide, Los Angeles Sanitation and Environment  
Tracy Quinn, Heal the Bay and Metropolitan Water District of Southern California  
Barbara Romero, Los Angeles Sanitation and Environment  
Oliver Slosser, Las Virgenes Municipal Water District  
Johan Torroledo, Los Angeles Department of Water and Power  
Martha Tremblay, Los Angeles County Sanitation Districts  
Ray Tremblay, Los Angeles County Sanitation Districts  
Deven Upadhyay, Metropolitan Water District of Southern California  
Rafael Villegas, Los Angeles Department of Water and Power  
Virginia Wei, City of Los Angeles

## ACRONYMS

DPR	Direct Potable Reuse
ECLWRF	Edward C. Little Water Recycling Facility
HWRP	Hyperion Water Reclamation Plant
IPR	Indirect Potable Reuse
LA	Los Angeles
LACSD	Los Angeles County Sanitation Districts
LADWP	Los Angeles Department of Water and Power
LASAN	Los Angeles Sanitation and Environment
LAW	Los Angeles Waterkeeper
LCI	Luskin Center for Innovation
LVMWD	Las Virgenes Municipal Water District
MGD	Million Gallons Per Day
MWD	Metropolitan Water District of Southern California
PWSC	Pure Water Southern California
TAC	Technical Advisory Committee
UCLA	University of California Los Angeles
UC ANR	University of California Agriculture and Natural Resources
WBMWD	West Basin Municipal Water District
WRD	Water Replenishment District of Southern California

## EXECUTIVE SUMMARY

As water managers and communities in the Los Angeles (LA) region grapple with water scarcity and variability exacerbated by the climate crisis, there is widespread recognition that the region must further invest in equitable, climate-smart, integrated local water strategies. Expanding the use of recycled wastewater has emerged as a key, scalable water supply strategy that can offer certainty and reliability. In 2023, California also became the first state in the U.S. to authorize direct potable reuse, or blending purified wastewater directly into drinking water, underlining the potential for transforming the region from a net water importer into a more climate-resilient and water-secure region sustained largely by local water.

Several large, centralized wastewater recycling projects are currently in development in the region, with decisions that will drive upwards of \$20 billion in investment in local supply. While this provides reason for optimism, there are still many hurdles to overcome and potential negative consequences to avoid. Complexities to consider include:

- Designing systems to both maximize benefits and minimize impacts that could be damaging to people and the environment;
- Engaging the public in key decisions and fostering public trust;
- Ensuring costs are affordable both for customers and agencies;
- Safeguarding drinking water quality; and
- Facilitating coordination between agencies to create a resilient system that is regional.

To this end, Los Angeles Waterkeeper (LAW) and the UCLA Luskin Center for Innovation (LCI) led an effort that included convening an independent group of technical experts and facilitating a collaborative process to secure guidance on how to optimize wastewater recycling projects in the LA region. The primary goal of our effort is to ensure projects are executed as expeditiously as possible while minimizing costs and negative environmental and community impacts.

The process began with meetings with each of the following agencies:

- Las Virgenes Municipal Water District
- Los Angeles County Sanitation Districts
- Los Angeles Department of Water and Power
- Los Angeles Sanitation and Environment
- Metropolitan Water District of Southern California
- West Basin Municipal Water District

We then convened an interdisciplinary Technical Advisory Committee (TAC) to review and provide input on the major agency projects, programs, and policies discussed in Section 2 of this report. Next, we compiled the TAC's foremost questions and comments related to optimizing wastewater recycling in the LA region. In February 2024, agency representatives provided a briefing to the TAC and made available project information via fact sheets, technical memoranda, evaluation reports, and master plans. A full-day workshop, organized



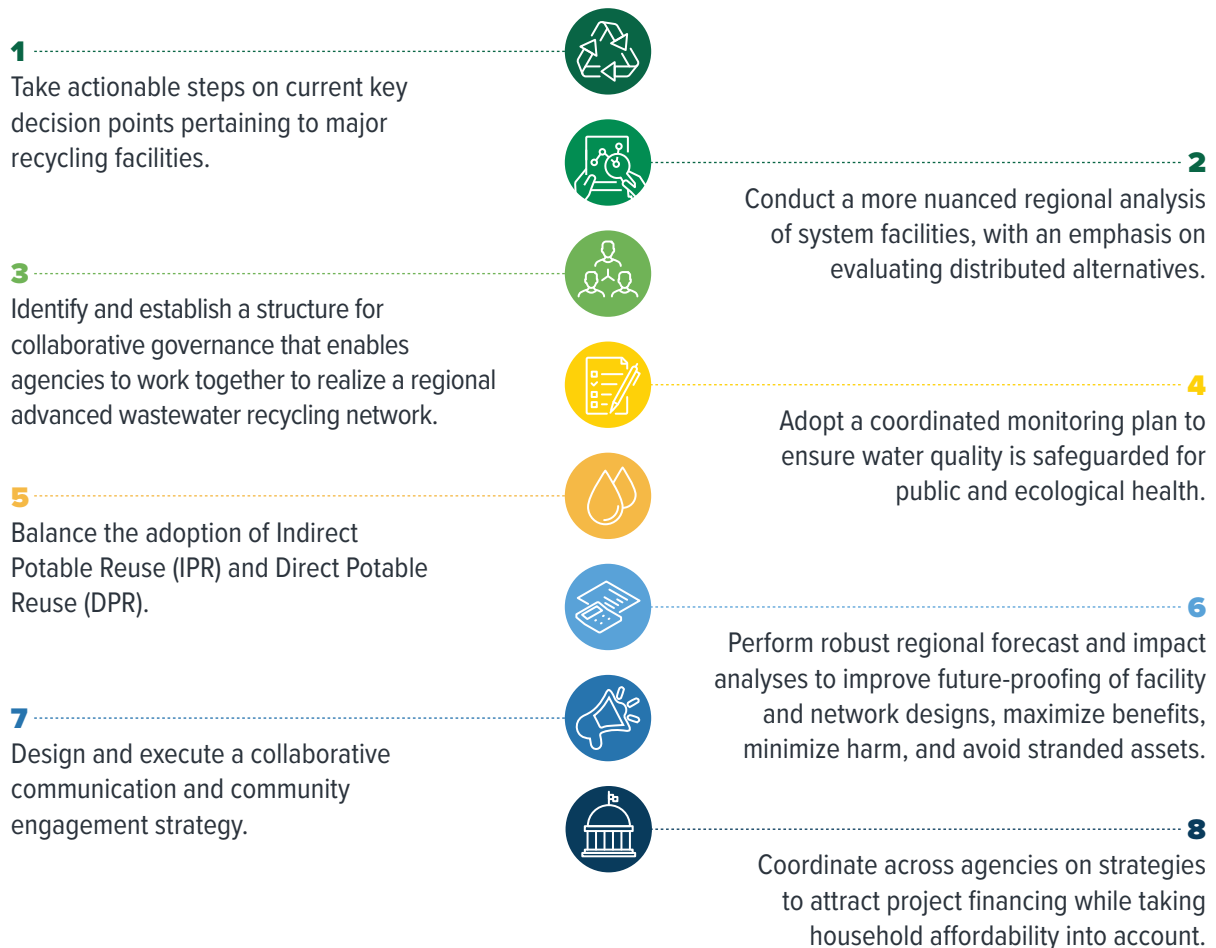
into two sessions and facilitated by LCI, was held at the UCLA Luskin Conference Center on February 22, 2024. The morning session included an abbreviated review of the proposed wastewater recycling projects presented by agency representatives and an open discussion during which TAC members were able to ask questions of agency representatives. The afternoon session was focused on pointed discussions to identify challenges, questions, and recommendations, and was attended only by TAC members, LCI, and LAW representatives.

This report presents an overall synthesis of input received from the TAC and is meant to provide recommendations on decision points currently facing the individual projects under development in the LA region as well as broader guidance on how to optimize the region’s wastewater recycling efforts while limiting negative impacts.

Input from the TAC is presented in the form of eight principal recommendations, discussed in greater detail in more than two dozen sub-recommendations in the body of the report. Following are the principal recommendations, followed by select sub-recommendations. See Section 4 for a complete list. TAC members were invited to review a draft of the initial synthesis based on this discussion but were not asked to review the final report. We thus note that some TAC members may have disparate views about some of the recommendations.

**FIGURE 1**

**Summary of recommendations**



**Recommendation 1.** Take actionable steps on current key decision points pertaining to major recycling facilities.

- As a region, determine the cost-benefit ratio of investing in the significant upgrades necessary to make the Edward C. Little Water Recycling Facility an effective and efficient part of the larger wastewater purification and distribution system versus having all future recycled water treatment of effluent from the Hyperion Water Reclamation Plant occur at the Hyperion facility.
- Pursue alternatives to building a Regional East/West Conveyance line as part of Pure Water Southern California (PWSC), including considering Antelope Valley-East Kern water banking.
- Adopt a recommendation regarding a Backbone Pipeline connecting Operation NEXT to PWSC no later than end-of-year 2024.
- Decide on treatment train options among the two main City of LA proposed alternatives: concentration of treatment at the Hyperion Plant versus at distributed facilities upstream.

**Recommendation 2.** Conduct a more nuanced regional analysis of system facilities, with an emphasis on evaluating distributed alternatives. The analysis should include the following parameters:

- Energy demand and cost of distribution: Conduct a more rigorous evaluation than existing reports on the long-term cost-benefit of centralized, distributed, and hybridized treatment throughout the system, and quantify the change in energy demand as wastewater is alternatively treated at the end of the system or in smaller distributed facilities.
- Aquatic and marine ecosystem impacts: TAC members noted that LA wastewater agencies should take a leadership role in dramatically reducing nutrient loading in tandem with their wastewater recycling efforts.

**Recommendation 3.** Identify and establish a structure for collaborative governance that enables agencies to work together to realize a regional advanced wastewater recycling network.

- Create an interactive map and online dashboard showing all existing and potential facilities, enabling agencies and their jurisdictions to see both existing and proposed project components, including pipelines.
- Unify the City of LA projects (currently Operation NEXT and Hyperion 2035), beginning with agreeing on a single name.
- Identify specific governance structure changes to increase leadership coordination and agency collaboration in the medium term.

**Recommendation 4.** Adopt a coordinated monitoring plan to ensure water quality is safeguarded for public and ecological health.

- Incorporate fail-safe drinking water quality monitoring systems in the design phase that include system monitoring and adaptive management to prepare for possible failures in the system, including cross media monitoring and the point of re-insertion into the drinking water distribution system.

## INDIRECT AND DIRECT POTABLE REUSE

There is considerable complexity in types of recycled water. However, for the purpose of this report, we focus on two main types:

**Indirect Potable Reuse (IPR)** water is wastewater treated, then blended with other environmental systems such as a river, reservoir, or groundwater basin, before the water is reused.

**Direct Potable Reuse (DPR)** water is wastewater treated, then reinserted directly into a potable water supply distribution system downstream of a water treatment plant or into the source water supply immediately upstream of the water treatment plant.

See Related Reading and Resources for additional terms and information. (Water ReUse Association, [Water Reuse 101 Glossary](#).)

**Recommendation 5.** Balance the adoption of Indirect Potable Reuse (IPR) and Direct Potable Reuse (DPR).

- Phase in IPR first to the fullest extent possible, maximizing the benefits of a system that can come online more quickly and with higher public acceptance.
- Use DPR to fill remaining gaps in service and end use, where DPR would provide significant benefits, and evaluate expansion opportunities.

**Recommendation 6.** Perform robust regional forecast and impact analyses to improve future-proofing of facility and network designs, maximize benefits, minimize harm, and avoid stranded assets.

- Conduct a regional demand forecast analysis that takes into account realistic population projections, impacts of ongoing water use efficiency and potential conservation associated with state regulations, climate change impacts, potential time and pollution burdens on local communities, and demands at the per-capita and large-scale end user levels.

**Recommendation 7.** Design and execute a collaborative communication and community engagement strategy that offers a clear narrative, emphasizes the benefits of a secure water supply, meets the needs of regional and local audiences, and is delivered by trusted messengers.

- Construct a compelling story about the positive impacts of the projects that includes:
  - Communicating that the foundational value of investment in these projects is that the region — and all households and businesses — will not run out of water in a drought, emphasizing water security benefits.
  - Informing about benefits that will accrue to other parts of the state and the American West, by reducing reliance on imports from the Colorado River, Bay-Delta, and Owens Valley/Mono Lake.

- Convene agency committees to hold regular and ongoing public meetings as a forum for agencies to present updates and for communities to be in dialogue and provide feedback:
  - Ensure that communities have opportunities to give meaningful input and feedback on project aspects such as pipeline routing and what benefits they want to prioritize, such as whether to have green infrastructure incorporated around project sites. This includes agencies developing or adopting a community engagement framework incorporating best practices for community engagement.
  - Prioritize the concerns and interests of environmental and economic justice community-based stakeholders and historically disadvantaged communities in the following three areas: communities adjacent to where recycled water will be produced, places through which recycled wastewater will be transported, and areas where recycled wastewater will be used.

**Recommendation 8.** Coordinate across agencies on strategies to attract project financing while taking household affordability into account.

- Organize a multi-agency effort, further solidified by implementing the recommendations above, to leverage currently-deficient state funding and financing for these projects, including the upcoming climate bond.
- Ensure that customers who use less water do not pay as much relative to those who have historically been at higher rate tiers.

We reiterate that the preceding is only a partial list of the recommendations, which are presented in full in Section 4. This effort is meant to stimulate continued discussions and actions in support of greater coordination to address the main challenges and opportunities facing the region's recycled water goals. This report is by no means the first or final word. It is the intent of LAW, LCI, and members of the TAC to continue to provide research and advice to further these individual projects and regional efforts to ensure local water supply security, resilience, and equity.

# 1. MOTIVATION

Droughts have long been a defining and recurring feature in Southern California. Climate change has and will continue to make reliance on imported water supplies in the region both less feasible and less advisable over the coming decades. Given the uncertainty around imported supply, all the major regions in the state, including Los Angeles (LA), have already begun to invest in reducing reliance on imported water and making supply more local over time. The LA region has also set further aspirations to do so with specific near-term targets. For instance, LA County's Water Plan, released in late 2023, calls for 80% local water reliance by 2045 (compared with approximately 40% local water currently).

Several multi-pronged strategies combine to form a menu of options to achieve greater local water supply reliance. These include decreasing imported water demand through water conservation or local trading, as well as increasing local water supply through water recycling and expanded stormwater capture. In considering the menu of available options, centralized wastewater recycling emerges as the most reliable and feasible source of new water for the region. This opportunity is exemplified in the four centralized wastewater recycling projects that have broken ground in the LA region recently, two of which are landmark in size and scope and comprise a large focus of this report (i.e., Pure Water Southern California and Operation NEXT/Hyperion 2035). Collectively, this regional effort may represent the most important water supply investment in the American West in the last half century.

Although these projects are current and their development is relatively recent, their genesis goes back many years. Discussions around realizing major wastewater recycling projects have been occurring for decades, and despite some narratives to the contrary, such projects have long been feasible from a technological standpoint. The success of the Orange County Water District's Groundwater Replenishment System clearly illustrates this point. However, despite the technological feasibility of recycled water to serve as a major component of regional water supply, the direct potable reuse (DPR) of recycled water was only fully authorized by the California State Water Resources Control Board in late 2023. This development makes California the state to have the most comprehensive recycling regulations in the United States, and is a critical advancement that unlocks the full potential of water recycling.

There is a tension, which is a major focus of this report, between the individual agency and collective regional nature of recycling efforts in the LA region. From one perspective, water agencies are historically fragmented and have largely been left to their own devices with respect to water supply management. Accordingly, more recent local water supply diversification efforts are also very much self-directed, with limited state guidance. Several regions in the state are thus falling behind their own self-proclaimed targets even as the urgency to increase reliance on local water supply grows. On the other hand, aspects such as joint funding and permitting needs and newfound DPR potential underline the collective nature of individual recycling projects in LA. Both the real and perceived success of one recycling project in LA will affect the success of others, and no one agency wants to be alone as the first to implement DPR at scale.

The joint effort between the UCLA Luskin Center for Innovation (LCI) and LA Waterkeeper (LAW), culminating in this synthesis report, focuses in part on decision-points currently facing the individual projects under development in the LA region. Even more so, this effort aims to highlight the projects' collective potential, including the need and opportunity for more direct coordination and integration between projects to realize regional goals. Near-term questions remain and decisions have yet to be made — or finalized — that will determine the size, configuration, and ultimate success of recycling projects in the region. Planning for such projects is difficult given uncertainties in wastewater flows, emerging regulations from multiple directions, and the coordination needed across agencies. Additionally, decisions around landmark issues that will determine the character of the region's water supply for decades can also be hindered by politics. Within this context, we embarked upon this joint effort to form an independent committee in the spirit of advising the agencies on difficult decisions that might otherwise be constrained by inter-agency and inter-jurisdictional politics or hampered by limited public trust.

The goal of our effort was to secure feedback on how to maximize wastewater recycling projects in the LA region as expeditiously and efficiently as possible while minimizing costs and negative environmental and community impacts. Accordingly, in fall 2023, we began meeting with the individual agencies working on recycling projects and forming a Technical Advisory Committee (TAC) of 20 members to provide expertise on these questions and decision points. We then convened the TAC and the six primary agencies involved in these projects, first for a virtual briefing on the projects, held on February 9, 2024, and then for an in-person convening on February 22, 2024, to discuss and provide insights and guidance on the key questions that need to be answered to achieve regional success. This report synthesizes the TAC's overall input — the process and outcomes are further described in Sections 3 and 4.

## 2. THE AGENCIES AND PROJECTS

We first attempt to briefly characterize the relevant public agencies — which include wholesale water, retail water, and retail sanitation types — and their pending or planned major near-term wastewater recycling projects in Los Angeles. We inevitably omit some project-level details as this section is intended to set the context for discussion of major project or regional level decision-making, which was the focus of our engagement and analysis. We present parameters and estimates as reported by agencies but note that there are some discrepancies within and between estimates for projects. Causes of the discrepancies include differing cost accounting approaches and varied assumptions for estimating project configurations and capacities.

FIGURE 2

Water management agency service areas

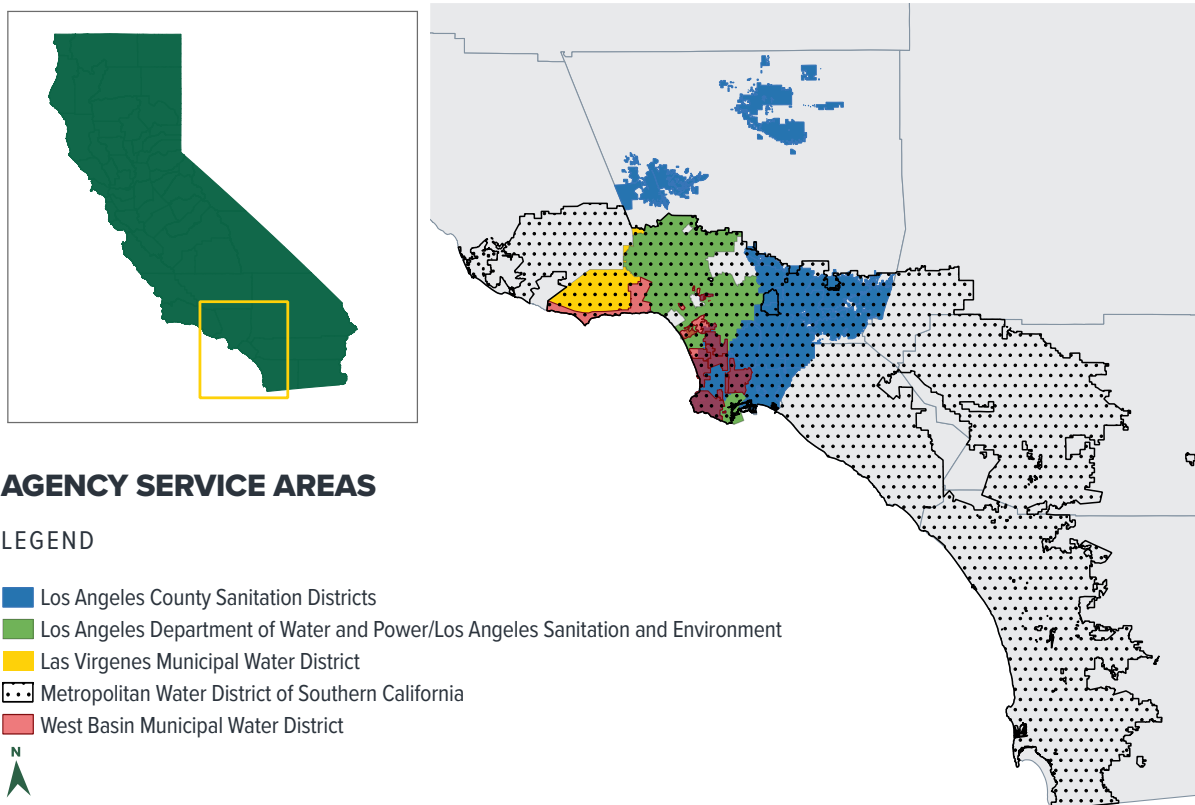


TABLE 1

## Overview of the major recycled water projects under development in the LA region \*

Public Agency Name	Project Name	Estimated Completion	Capacity (Million Gallons per Day)	Publicly-Available Cost Estimates
Metropolitan Water District of Southern California & LA County Sanitation Districts	Pure Water Southern California	Phase 1 completion: 2032 Phase 2 completion: 2036 <sup>1</sup>	Phase 1: 115 MGD Phase 2: 35 MGD Total: 150 MGD <sup>2</sup>	\$6.39 Billion <sup>3</sup>
LA Sanitation and Environment	Hyperion 2035	Phase 1: 2033-35 Phase 2: 2038-39 Phase 3: 2045-50	Phase 1: 50 MGD Phase 2: 40 MGD Phase 3: 140 MGD Total: Up to 190 new MGD (up to 230 MGD total)	\$4.8 Billion
LA Department of Water and Power	Operation NEXT <sup>4</sup>	Phase 1: 2034 Phase 2: 2038 Phase 3: 2050	Phase 1: 50 MGD Phase 2: 40 MGD Phase 3: 120 MGD Total: 210 MGD	\$3.5 Billion (DPR by 2046) \$7.9 Billion (DPR by 2035)
Las Virgenes-Triunfo JPA	Pure Water Project Las Virgenes-Triunfo <sup>5</sup>	2028	7.5 MGD	\$364 Million
West Basin Municipal Water District	Edward C. Little Water Recycling Facility <sup>6</sup>	2035-2040	70 MGD	\$800 Million

## \*Notes about Table 1:

- Cost estimates are those most recently available and are provided in today's dollars.
- Estimates provided by the agencies do not use the same methods and thus do not lend themselves to direct comparison. For example, estimates for the MWD project include design, treatment, and conveyance, whereas those for the LASAN project include program construction costs only.
- LASAN and LADWP projects present two possible alternatives for the City of Los Angeles and do not represent mutually exclusive components. Their MGD capacities and related costs should thus not be added together. Similarly, WBMWD's plans for ECLWRF differ from the City agencies' visions for that facility, and capacities vary as a result.
- For context, one million gallons of treated wastewater roughly equates to enough water for 9 average households for one year, based on recent estimates.

- 1 Phase 2 timing as reported in "Notice of Preparation of a Draft Environmental Impact Report and Notice of Public Scoping Meetings" issued to California Office of Planning and Research, Responsible Agencies, Trustee Agencies, and Other Interested Parties for the review period September 30, 2022, to November 14, 2022.
- 2 Figures as reported in "Pure Water Southern California: Convening PWSC Introduction" presentation to the TAC on February 9, 2024.
- 3 Ibid.
- 4 Estimated timeline, MGD capacities, and costs as reported in "Operation NEXT Water Supply Program" presentation to the TAC on February 9, 2024.
- 5 Estimated timeline, capacity (for new Advanced Water Purification Facility only), and costs as reported in "Pure Water Project Las Virgenes-Triunfo" presentation to the TAC on February 9, 2024.
- 6 Estimated timeline and capacity as reported in 2022 "Recycled Water Master Plan: West Basin Municipal Water District." Estimated cost as reported in personal communication to Bruce Reznik by WBMWD leadership.



## 2.1. Metropolitan Water District of Southern California / Los Angeles County Sanitation Districts: Pure Water Southern California

The **Metropolitan Water District of Southern California** (MWD) is a state-established cooperative special district comprised of 26 cities and other member water agencies serving nearly 19 million people in six counties. MWD draws on supplies from the Colorado River through the Colorado River Aqueduct, which it owns and operates; from Northern California via its participation in the State Water Project; and from exchanges and transfer arrangements. Demands on MWD also are managed through conservation and local resource programs. An increasing percentage of Southern California's water supply comes from conservation, water recycling, and recovered groundwater.

The **Los Angeles County Sanitation Districts** (LACSD) is a regional public agency consisting of 24 independent special districts serving over 5.6 million people in 78 cities and the unincorporated territory within LA County. LACSD provides wastewater and solid waste management and converts waste into resources such as recycled water, energy, and recycled materials. LACSD operates 11 wastewater treatment plants. The A.K. Warren Water Resource Facility (formerly Joint Water Pollution Control Plant) in Carson is the largest of these plants and one of the largest in the country, and discharges approximately 280 MGD to the ocean daily.

The **Pure Water Southern California Program** (PWSC) is a partnership between MWD and LACSD. The program aims to create a new water supply to help meet the region's needs by providing up to 150 MGD or 155,000 acre-feet-per-year of water. Wastewater treatment and purification will occur at LACSD's Carson facility. As an IPR supply, the water will replenish groundwater basins and be used by industries. In a latter phase, as a potential DPR supply, the water could be integrated into MWD's existing drinking water treatment and delivery system.

## 2.2. West Basin Municipal Water District: Edward C. Little Water Recycling Facility

The **West Basin Municipal Water District** (WBMWD) is a member agency of MWD and the sixth largest water district in California, indirectly serving approximately 885,000 residents. WBMWD provides drinking and recycled water to retail agencies which in turn serve individual customers within its 185-square mile service area in southwest Los Angeles County.

WBMWD operates the **Edward C. Little Water Recycling Facility** (ECLWRF) in the City of El Segundo, a facility capable of producing up to 40 MGD of recycled water. WBMWD currently receives secondary effluent from the Hyperion Water Reclamation Plant. ECLWRF and its four satellite treatment facilities use this source water to produce five types of customer-tailored, fit-for-purpose recycled water, which are provided to more than 400 industrial, commercial, and public facilities via more than 100 miles of a dedicated purple pipe distribution system. Treated water is also provided to the Water Replenishment District of Southern California (WRD) for a seawater intrusion barrier to protect the local groundwater basin. Depending on the City of Los Angeles' plans for recycled water, ECLWRF could fit into the City's recycled water system in different ways: it could continue to receive and treat wastewater from LA Sanitation

and Environment (LASAN) to recycle for non-potable uses; the facility could be upgraded and possibly expended to receive and purify even more water from LASAN for recycling (possibly even for potable uses); or the City of LA could build out new infrastructure and bypass ECLWRF completely.

### 2.3. Los Angeles Sanitation and Environment / Los Angeles Department of Water and Power: Hyperion 2035 / Operation NEXT

**Los Angeles Sanitation and Environment (LASAN)** oversees the City of Los Angeles' wastewater, solid waste management, and stormwater programs. Hyperion Water Reclamation Plant (HWRP) is located in Playa Del Rey and has been operating since 1894, serving a population of 4 million over 600 square miles with a sewer system of 6,700 miles and an average flow of 260 MGD. The plant currently discharges about 220 MGD of treated wastewater into Santa Monica Bay per day. Another 30-40 MGD is sent to ECLWRF managed by WBMWD for a variety of non-potable wastewater uses.

**Hyperion 2035** is LASAN's vision for recycling 100% of the water flowing through HWRP by 2035, and is a component of meeting the City's water sustainability goals as described in the City's Green New Deal. Under this program, HWRP will be transformed by producing up to 190 MGD of recycled water for potable use. The current secondary wastewater treatment process will be replaced with membrane bioreactors followed by reverse osmosis and UV-advanced oxidation. Additional treatment processes for excess wet weather flows, which can reach the plant during storm events, will also be implemented as part of the transformation. A goal of Hyperion 2035 is to make better use of the wastewater flowing to ECLWRF by converting it into recycled water for potable reuse applications.

The **Los Angeles Department of Water and Power (LADWP)** is the largest municipal water and power utility in the nation and the water supply agency for the City of LA. Established more than 100 years ago, LADWP works to deliver reliable, safe water and electricity to 4 million residents and businesses in LA. LADWP's primary sources of water supply are: the Los Angeles Aqueducts, which bring water from the Eastern Sierra Nevada Mountains through the Owens Valley; local groundwater; and supplemental water purchased from MWD, which is delivered through the Colorado River Aqueduct and the State Water Project's California Aqueduct.

These three sources have historically delivered an adequate and reliable supply to serve the City's needs. Implementation of recycled water projects, including LADWP's **Operation NEXT**, is expected to fill a larger role in Los Angeles' water supply portfolio going forward. Through Operation NEXT, LADWP intends to maximize the new supply produced via LASAN's Hyperion 2035 by constructing infrastructure to transport purified recycled water to several groundwater basin aquifers for integration into the distribution system for IPR. With evolving regulations, LADWP also intends to send water directly to the Los Angeles Aqueduct Filtration Plant for additional purification as DPR.

## 2.4. Las Virgenes Municipal Water District: Pure Water Project Las Virgenes-Triunfo

The **Las Virgenes Municipal Water District** (LVMWD) is one of MWD's 26 member agencies, and is currently entirely dependent upon imported water supplies. The Las Virgenes-Triunfo Joint Powers Authority (JPA) serves approximately 75,000 people in the communities of Westlake Village, Agoura Hills, Calabasas, Hidden Hills, and unincorporated areas of western Los Angeles County and eastern Ventura County.

The JPA is implementing **Pure Water Project Las Virgenes-Triunfo**, which includes infrastructure to deliver recycled water to a proposed advanced water treatment facility. The project aims to eliminate the discharge of recycled water into Malibu Creek, balance seasonal variation of recycled water demand, and use the advanced treated water as a source of potable, locally-produced water.

### 3. OPTIMIZING WASTEWATER RECYCLING EFFORTS

#### 3.1. Methods

To obtain guidance about local and regional advanced wastewater treatment projects, LAW and LCI first met one-on-one, and to the extent possible in-person, with each of the six project agency teams. We then convened an interdisciplinary TAC to review and provide input on the agency projects and programs discussed in Section 2 of this report. Agency representatives conducted presentations for the TAC during a briefing held via Zoom on February 9, 2024. Additional project information, such as fact sheets, technical memoranda, evaluation reports, and master plans were provided by the agencies and shared with the TAC.

TAC members were invited to fill out a survey in advance of the briefing, with most members responding. The survey included open-ended responses to identify the most important questions and recommendations that the TAC had related to optimizing wastewater recycling in the LA region. TAC members were asked to consider questions and recommendations in the following categories:

- Technical
- Regulatory
- Financial
- Political
- Public engagement
- Other

FIGURE 3

TAC participants at the February 22, 2024 convening



We conducted a thematic analysis of the survey results primary themes and captured the overarching topics of concern. This thematic analysis and our engagement with agencies then informed the agenda for a full-day workshop held at the UCLA Luskin Conference Center on February 22, 2024. The workshop was organized into two sessions and was facilitated by LCI. The morning session included: an abbreviated review of the proposed wastewater recycling projects presented by agency representatives; a summary of anonymized survey results categorized into six themes (see the following section); and an open discussion during which TAC members were able to ask questions of agency representatives. The afternoon session was attended only by TAC members, LCI, and LAW representatives. LCI facilitated a discussion around the six themes in the following section in order to identify challenges, questions, and recommendations under each theme.

## **3.2. Themes**

The thematic analysis of the TAC's responses to the survey yielded six themes, which are introduced below in no particular order. A list of the questions and comments received under each of the themes is shared in the appendices.

### **1: System Design to Maximize Benefits and Minimize Negative Impacts**

Topics raised under this theme included: the extent to which systems will be distributed or centralized; the extent to which existing infrastructure can be used or upgraded as opposed to building new infrastructure; integration of systems and infrastructure across agencies; the extent to which IPR versus DPR should be pursued; and matching production and use capacities.

### **2: Cost Affordability**

TAC members brought up the following topics related to affordability: how to minimize costs; financing opportunities to fund the projects; revenue models and authorities; how to evaluate resilience benefits and costs; and ensuring end-use affordability metrics are met.

### **3: Reducing Ecological Impacts**

Topics under this theme included: the fate of concentrated brine; ensuring environmental flows; and ensuring robust real-time water quality monitoring to protect receiving bodies.

### **4: Ensuring Safe Drinking Water**

TAC members raised the following topics related to safe drinking water: real-time monitoring for pollutants; distribution system and plumbing chemistry impacts; and ensuring adequate water access for all communities.

## **5: Community Engagement**

Community engagement topics raised by the TAC included: moving the LA region toward acceptance of recycled water, especially related to DPR; ensuring equity is considered in distribution system design and siting; and ensuring community priorities for engagement are considered.

## **6: Governance and Agency Coordination**

TAC members brought up these topics under governance and agency coordination: resilient water for the whole region; adequate staffing and commitment of executive resources; and how to ensure other pressing challenges and opportunities are addressed.

## 4. RECOMMENDATIONS

The TAC engaged in a facilitated discussion around the six themes at the February 22 convening. The following eight principal recommendations, discussed in greater detail in more than two dozen sub-recommendations, emerged from this facilitated discussion. TAC members were invited to review a draft of the initial synthesis based on this discussion but were not asked to review the final report. We thus note that some TAC members may have disparate views about some of the recommendations.

### 4.1. Take actionable steps on current key decision points pertaining to major recycling facilities

There are several key decisions that must be made by agencies involved in one or more projects that must be made as quickly as possible as they present key inflection points for how each project is developed individually and how they can best be integrated. Four immediate examples include:

- As a region, determine the cost-benefit ratio of investing in the significant upgrades necessary to make ECLWRF an effective and efficient part of the larger wastewater purification and distribution system versus having all future recycled water treatment of effluent from HWRP occur at the Hyperion facility.
- Pursue alternatives to building a Regional East/West Conveyance line as part of PWSC, including considering Antelope Valley-East Kern water banking.
- Adopt a recommendation regarding sizing of a Backbone Pipeline connecting Operation NEXT to PWSC of 108-inch diameter no later than end-of-year 2024.
- Decide on treatment train options among the two main City of LA proposed alternatives: concentration of treatment at HWRP versus at distributed facilities upstream.

### 4.2. Conduct a more nuanced regional analysis of system facilities, with an emphasis on evaluating distributed alternatives

Compared to more centralized systems, distributed systems may provide benefits including reduced energy demand for pumping and conveyance. As raw wastewater moves downstream through the regional collection system, water quality decreases. Distributed treatment thus also has the benefit of reducing the amount of treatment required. On the other hand, upfront costs are typically higher. Both the MWD and City of LA projects have conducted assessments of decentralized alternatives, but the TAC recommends that these major projects would benefit from more robust study of more distributed options.

Include the following parameters in the analysis:

- **Water quality and supply.** A more comprehensive analysis than existing consultant reports would consider joint system optimization to evaluate water quality and supply outcomes. This is true especially for the City of LA project proposals but also for PWSC. Potential end-uses of both IPR and DPR, inclusive of cost and energy requirements, must be comparatively modeled.

- **Energy demand and cost of distribution.** Conduct a more rigorous evaluation than existing reports on the long-term cost-benefit of centralized, distributed, and hybridized treatment throughout the system, and quantify the change in energy demand as wastewater is alternatively treated at the end of the system or in smaller distributed facilities. The evaluation would include opportunities for built-in flexibility that allows for modified operations in future decades, including going beyond what is already planned in upstream reclamation projects such as at the Donald C. Tillman Water Reclamation Plant.
- **Aquatic and marine ecosystem impacts.** Wastewater recycling projects, particularly at coastal discharge plants, should include thoughtful consideration of reducing nutrient loading as part of facility upgrades. While the State Water Resources Control Board is considering adopting regulations for such discharges, we do not know when this process will be completed (which could take 5 to 10 years or more). As such, TAC members noted that LA wastewater agencies should take a leadership role in dramatically reducing nutrient loading in tandem with their wastewater recycling efforts. Treatment approaches and technologies used for nutrient reduction also improve source water quality for advanced treatment, making facility operations more efficient and improving purified recycled water quality. Additionally, the fate of reverse osmosis concentrate discharges and nutrient load reduction impacts on ocean acidification should be accounted for.
- **Preserving environmental flows.** Ensure that increased upstream reclamation does not unduly impact rivers and creeks dependent on treated discharge to maintain flows needed for ecological health and recreation.

### 4.3. Identify and establish a structure for collaborative governance that enables agencies to work together to realize a regional advanced wastewater recycling network

In the short term:

- Create an interactive map and online dashboard showing all existing and potential facilities, enabling agencies and their jurisdictions to see both existing and proposed project components, including pipelines.
- Unify the City of LA projects (currently Operation NEXT and Hyperion 2035), beginning with agreeing on a single name.
- Ensure that resources are made available for agencies advancing recycled water, but are currently insufficiently staffed to hire the necessary talent to advance projects to meet stated project timelines.

Simultaneously, identify specific governance structure changes to increase leadership coordination and agency collaboration in the medium term. The region's governing agencies will need to explore and decide on governance structure changes to adopt, such as the following suggested by the TAC:

- Appointing a single program manager to oversee City of LA projects. Consider establishing a subcommittee with a program manager, and/or a council committee



or designated board to address the respective governing boards, unions, and other structural differences of the relevant City agencies.

- Implementing the recommendations of an external negotiator/mediator familiar with the challenges of shared governance.
- Assembling a joint committee of agency boards to meet on a regular basis. Such a body would give a forum for project managers and staff to provide updates and raise challenges.
- Forming a Joint Powers Authority among MWD, LACSD, LASAN, and LADWP. This option could allow for other revenue streams, among other benefits, but would also add another agency that would be involved in all decision making.
- Pursuing an arbitration model. This would enable big-picture agreement to occur even if details are not all agreed upon.

#### **4.4. Adopt a coordinated monitoring plan to ensure water quality is safeguarded for public and ecological health**

Incorporate fail-safe drinking water quality monitoring systems in the design phase that will protect against inevitable risks. Agencies should plan for, design, and manage data and monitoring as part of a holistic infrastructure system. This should include:

- System monitoring and adaptive management to prepare for possible failures in the system, including cross media monitoring and the point of re-insertion into the drinking water distribution system.
- An approach to address pollution from under-regulated sources. Specifically, agencies should create a list of contaminants of emerging concern (CECs) that are not currently regulated and commit to managing these for the first three years of operation, and update the list as new CECs emerge.

#### **4.5. Balance the adoption of Indirect Potable Reuse and Direct Potable Reuse**

While there was not full agreement among the TAC regarding how to balance IPR and DPR, the prevailing sentiment was to rely on a combination of the two technologies as follows:

- Phase in IPR first to the fullest extent possible, maximizing the benefits of a system that can come online more quickly and with higher public acceptance.
- Use DPR to fill remaining gaps in service and end use, where DPR would provide significant benefits, and evaluate expansion opportunities. In these circumstances, DPR could significantly decrease costs, carbon footprint, and other environmental and community impacts.
- Ensure robust protections and redundancies are in place to avoid failures which would undermine public trust.

#### **4.6. Perform robust regional forecast and impact analyses to improve future-proofing of facility and network designs, maximize benefits, minimize harm, and avoid stranded assets**

The TAC stressed the importance of tying the scope of the projects to changing regional forecasts in order to ensure designs are right-sized and match demand. Related recommendations include:

- Regularly update future demand projections, in coordination with or refining IPR processes, based on best available research that incorporates factors of future population, indoor and outdoor efficiency and related conservation gains, long-term drought impacts, and likely water price changes.
- Perform a water budget analysis for the region's water bodies that quantifies environmental flow needs and potential environmental impacts of changes to wastewater recycling facilities. Utilize California Environmental Flows Framework (CEFF) process to incorporate expert input to meet environmental flow needs and account for potential temperature effects.

#### **4.7. Design and execute a collaborative communication and community engagement strategy that offers a clear narrative, emphasizes the benefits of a secure water supply, meets the needs of regional and local audiences, and is delivered by trusted messengers**

Current communications and public engagement strategies appear to be missing a clear narrative about benefits. Construct a compelling story about the positive impacts of the projects that includes:

- Communicating that the fundamental value of investment in these projects is water security, and that the region — with all of its households and businesses — will not run out of water in a drought.
- Conversely, conveying that not having water represents a bleak, costly future which is avoidable with these investments.
- Transparently informing customers that while it is unlikely to see reduced water bills, there are many other economic, health, and environmental co-benefits that will result from these projects, such as local jobs and improved ocean health from reduced wastewater discharge/improved treatment.
- Informing about benefits that will accrue to other parts of the state and the American West by reducing reliance on imports from the Colorado River, Bay-Delta, and Owens Valley/Mono Lake.

Recruit trusted, respected spokespeople to augment and complement agencies' current communications strategy:

- While the government agencies implementing projects should continue to be spokespersons for their projects, additional well-regarded messengers should be identified and compensated.

- Faith in government institutions has generally been reduced in recent decades, and consequently, many of the implementing water agencies' approval ratings tend to hover around 40%. This highlights the need to bolster the agencies' outreach efforts with trusted outside voices. Consider community suitability and engage possible advocates accordingly. These may include: community leaders, community health workers, engineers, scientists, social media influencers, public health professionals, and others.
- Constitute a speakers' bureau with one representative from each project group.

Convene agency committees to hold regular, ongoing public meetings as a forum for agencies to present updates and for communities to be in dialogue and provide feedback:

- Ensure that communities have opportunities to give meaningful input and feedback on project aspects such as pipeline routing and what benefits they want to prioritize, such as whether to have green infrastructure incorporated around project sites. This includes agencies developing or adopting a community engagement framework incorporating best practices for community engagement.
- Prioritize the concerns and interests of environmental and economic justice community-based stakeholders and historically disadvantaged communities in the following three areas where time and pollution burdens may be feared based on past harms: communities adjacent to where recycled water will be produced, neighborhoods through which recycled wastewater will be transported, and areas where recycled wastewater will be used.

#### **4.8. Coordinate across agencies on strategies to attract project financing while taking household affordability into account**

Given the significant investment required to realize the LA region's multiple wastewater recycling projects, the TAC emphasized the need to engage in joint efforts to secure funding and simultaneously keep customer rates reasonable. Recommended steps include:

- Organizing a multi-agency effort, further solidified by implementing the recommendations above, to leverage currently-deficient state funding and financing for these projects — including the upcoming climate bond.
- Coordinating with elected officials and organizing around legislative priorities, with a focus on avoiding water insecurity.
- Ensuring that customers who use less water do not pay as much relative to those who have historically been at higher rate tiers. Develop a regional working group of water supply agencies to re-evaluate opportunities for developing rates efficiently to limit the passthrough cost impacts on low income and low consumption customers' bills.
- Partnering with advocates to move forward on affordability programs to minimize impacts to low income customers and ensure benefits, such as local jobs.

## 5. CONCLUSION

If implemented well, the four major centralized wastewater recycling projects that have been proposed in Los Angeles have the opportunity to affect water supply transformation and resilience for much of the region. Collectively, this regional effort may represent the most important water supply investment in the American West in the last half century.

Given its importance, but also its ongoing nature, Los Angeles Waterkeeper and the UCLA Luskin Center for Innovation convened an independent group of 20 technical experts and the relevant public agencies in an iterative engagement process in order to secure guidance on how to optimize wastewater recycling projects in the LA region. This effort resulted in the eight principal recommendations and more than two dozen sub-recommendations detailed in this report.

As noted above, this report is meant to prompt continued discussions and actions in support of greater coordination to address the main challenges and opportunities facing the region's recycled water goals. The report is by no means the first or final word on these projects or the regional effort.

A number of fronts of future research are provided in the report's recommendations. Looking ahead, LAW, LCI, and many members of the TAC seek to continue to provide research and advising along these lines and more to further these individual projects and optimize regional efforts. This report can also serve as a resource for other regions across the American West and beyond that are grappling with facilitating a just transition for local water supply security, resilience, and equity.

# APPENDIX A. FEBRUARY 22, 2024 CONVENING AGENDA



## Wastewater Recycling Technical Advisory Convening **AGENDA**

*Thursday, February 22, 9:00am-4:00pm*  
*UCLA Meyer and Renee Luskin Conference Center – Legacy Room*  
*425 Westwood Plaza, Los Angeles (Westwood), CA*

### **Outcome**

Feedback secured on how to maximize wastewater recycling projects in the Los Angeles region while minimizing cost and negative environmental and community impacts.

### **Agenda**

**\*\*\* 8:00-9:00 – OPTIONAL Full Breakfast @ Plateia \*\*\***

*Please first go to the Legacy Room at the Luskin Conference Center to get your meal voucher*

**\*\*\* 9:00-9:30 – Registration & Breakfast \*\*\***

- I. **Welcome & introductions**, *Greg Pierce & Bruce Reznik (9:30-10:00)*
  - a. Review agenda and goals for the day; housekeeping; self-introductions
- II. **Review proposed wastewater recycling projects**, *various (10:00-10:30, 5 minutes each)*
  - a. Pure Water Southern California, *MWD/LACSD*
  - b. Hyperion 2035, *LASAN*
  - c. OperationNEXT, *LADWP*
  - d. Ed C. Little Water Recycling Facility, *West Basin MWD (10 min exception)*
  - e. Pure Water Project Las Virgenes-Triunfo, *Las Virgenes MWD*
- III. **Optimizing LA region’s wastewater recycling efforts (open discussion)**, *facilitated by Greg Pierce (10:30-11:30)*
  - a. Address overarching themes, identify challenges, questions & recommendations
    - i. Includes showing summarized polling results
  - b. Q&A from the TAC to project developers/operators

**\*\*\* 11:30-12:30 – Lunch Break \*\*\***

- IV. **Continued optimizing discussion (TAC only)**, *facilitated by Greg Pierce (12:30-2:30)*
  - a. Address overarching themes, identify challenges, questions & recommendations

**\*\*\* 2:30-2:45 – Wellness Break \*\*\***

- V. **Identify steps forward**, *facilitated by Greg Pierce (2:45-3:30)*
- VI. **Wrap-up & next steps**, *Greg & Bruce (3:30-4:00)*
  - a. Recap discussions; discuss next steps
- VII. **Adjourn (4:00)**

## APPENDIX B. THEMATIC GROUPING OF QUESTIONS AND COMMENTS RECEIVED IN RESPONSE TO THE TAC SURVEY

### 1: Overall System Design to Maximize Benefits and Minimize Impacts

- Would love to see **City of LA coordinate on potential joint design opportunities** in time to inform MWD's CEQA process.
- I would **look at a projected future water portfolio** including increases in capturable stormwater, and possibly reduced groundwater due to climate warming. Then **use that information to decide what percentage of LA's water these projects should produce.**
- A potential concern is the **lack of an overlying regional system that assures the finished product water does not become "stranded."** Where is the treatment going to occur, what are the conveyance pathways to take treated water to future use points? Is there a **match in the capacity between treated water volume and end water use?**
- How are MWD, LADWP, and LASAN **coordinating their end use planning efforts** with one another and other affected agencies, including the West Basin Municipal Water District and the Water Replenishment District? **Are they looking to serve the same potential customers or are the uses and users different for each?**
- **What regulatory barriers do you see to implementation** of your concept?

### 2: Cost Affordability

- Estimate and budget sufficient money both at a **programmatic and a project level** within **different interest rate environments.**
- Identify outside sources of funding and **maximize conservation/efficiency** to limit impacts to low-income ratepayers.
- Evaluate opportunities for jointly funded and operated projects through a **countywide water surcharge.**
- Look for **regional financing for centralized facilities** that would enable regional groundwater banking/benefits.
- **Use affordability criteria** to help define the optimal project size and scope.
- Look to changes to your programs that **maximize the benefits even if it means downsizing** or changing the current project.
- Work with a **coalition to create and implement a finance plan** for the larger integrated project. Get stakeholders to work together to push for state and federal funding. Develop and support mechanisms for affordable rates - especially for low-income ratepayers.

### 3: Reducing Ecological Impacts

- Regulators, water/wastewater utilities, and NGOs should **work together now to address concerns with the future quantity and quality of ocean discharges** with large scale recycling in place.
- Not optimization, but **brine and effluent discharges** need to have very low nitrogen to reduce OAH.
- **Geographic circumstances and energy consumption** of treatment and conveyance need to be better understood.
- Long-term increase of **influent contaminant concentrations** is a concern.
- Are parties **maximizing nutrient reduction**?
- **How will brine be regulated** in a manner that doesn't hurt recycled water, yet helps reduce OAH impacts in the ocean?
- What analysis has been done regarding **RO concentrate quality** and suitability for ocean discharge?
- Was **climate information** used to inform the need for **reduced imports**?
- The larger projects will require long reaches of large diameter pipelines running through highly developed urban areas, **crossing environmentally sensitive habitats**. How thoroughly have these **pipeline routes been vetted** for feasibility?
- How can we better **align policies that may have competing goals** (e.g., reuse vs. env. flows)?

### 4: Ensuring Safe Drinking Water

- We need the **direct potable regulations** - they are still being developed. Start work early to bounce ideas off regulators.
- **IPR should be the first priority because** of lower cost, greater consumer confidence and less likelihood to have pathogen or CEC issues because of buffers.
- For DPR – utilize flow cytometry to demonstrate recycled water is pathogen indicator free. A **robust monitoring program** for the first few years will earn greater consumer confidence. Determine efficacy and opportunities for brine injection – TIRE (Terminal Island Renewable Energy) project as a model.
- We have the core technology to build these projects. The biggest challenge will be **developing the continuous monitoring sensors** that can identify non-spec water immediately.
- Is the state's maximum benefit provision under antidegradation policy applicable? How will DDW and the LA Regional Board effectively cooperate and coordinate the complex permitting required?
- Can we **provide advanced treated water that is nearly pathogen and CEC free 100%** of the time? How can we ensure that from a monitoring perspective?

- Many of the regulations have been set, the challenge will be strictly complying with them. How would you approach the regulators if you wanted to propose an alternate approach?
- How can we **improve real time monitoring and data flow** to ensure water quality is maintained?

## 5: Community Engagement

- It is critical to provide sufficient resources focused on communicating with stakeholders to **understand stakeholders concerns early** and to provide guidance to executive management and senior program leaders.
- What individuals/communities stand to suffer most from recycled water adoption and are we hearing their concerns?
- If you really think you are going to do treated water augmentation projects, you need to **start informing the public now**.
- Develop **public engagement/support campaign that engages trusted voices**. The campaign must be robust, target numerous stakeholders and be ongoing. Projects must **include significant community benefits** for impacted communities.
- **Conduct sustained outreach and education**, including K-12 programs, focused on recycled water, including current indirect potable and non-potable, as well as future direct potable reuse; consider an ambassador program for community groups to tour other reuse facilities and sites.
- Who are the **top 10-20 stakeholder groups that need to be brought onboard** for each project?
- **What are the major concerns from the public** and how can we better engage with them to address them?
- What have your public engagement efforts involved and what have you learned about **stakeholder desires and concerns? Is there public support for wastewater recycling across all of LA's diverse communities?**
- What will be the proactive educational campaign to generate wide-ranging support for IPR and DPR? **Affordability and consumer confidence are the critical issues**.
- There is a **big leap from groundwater/surface water augmentation and raw water/ treated water augmentation**. I'm not sure this has been addressed. How and when will you address this issue?



## 6: Governance and Agency Coordination

- **Establishing “float” [or slack] in schedules as well as “contingency” in cost estimates** is vital in setting appropriate political and public expectations and maintaining trust with stakeholders throughout the life of the effort.
- Develop studies to **evaluate optimized system designs for joint operations of reuse projects**; consider multiple factors (drought, passive/active conservation, retail rates and prices).
- What needs to happen to support **inter-City coordination and coordination with MWD**?
- What are the impediments to **enhanced coordination and cooperation between LADWP and LASAN**?
- **Establish joint governance**, such as joint steering committees, for those projects that are partnerships. Set up joint agency committees of board members/electeds to oversee projects and make recommendations back to their respective boards.
- Can everyone work together to get a regional network completed by 2035? What’s the **management structure** for the projects being planned?
- What are the **estimated resource needs and what is the resourcing plan** for the effort including both sourcing and timing? What does your overall anticipated organization structure look like with its reporting links to existing organizational structure?
- How are the agencies starting now to invest in **workforce development** pathways to ready an adequately sized construction/operations workforce?
- What is the projected need for **management talent in planning, design, construction and operations**? Where are you going to get the management talent required to focus on this program? **At what level will program leadership report within the hierarchy** to assure that they possess sufficient authority and focus to successfully guide the effort?

## APPENDIX C. RELATED READING AND RESOURCES

General reading on the topic:

- Annin, Peter. (2023). [\*Purified: How Recycled Sewage Is Transforming Our Water\*](#). Island Press.
- California State Water Resources Control Board. (2024). [Water Boards Recycled Water Policy and Regulations](#).
- Los Angeles County Public Works. (2023). [LA County Water Plan: Water Supply Resilience](#).
- Olivieri, Adam W.; Pecson, Brian; Crook, James; and Hultquist, Robert. “[Chapter Two - California water reuse—Past, present and future perspectives](#),” Editor: Paola Verlicchi, *Advances in Chemical Pollution, Environmental Management and Protection*, Elsevier, Volume 5, 2020, Pages 65-111. <https://doi.org/10.1016/bs.apmp.2020.07.002>
- WaterReuse Association. (2019). [Water Reuse Context & Terminology](#).

For more information about the projects discussed in this report, visit the project web pages:

- [Las Virgenes Municipal Water District: Pure Water Project Las Virgenes-Triunfo](#)
- [Los Angeles Sanitation and Environment: Hyperion 2035](#)
- [Los Angeles Department of Water and Power: Operation NEXT](#)
- [Metropolitan Water District of Southern California / Los Angeles County Sanitation Districts' Pure Water Southern California](#)
- [West Basin Municipal Water District: Edward C. Little Water Recycling Facility](#)



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