East Bay Municipal Utility District

Updated Recycled Water MASTER PLAN

FEBRUARY 2019

EAST BAY MUNICIPAL UTILITY DISTRICT

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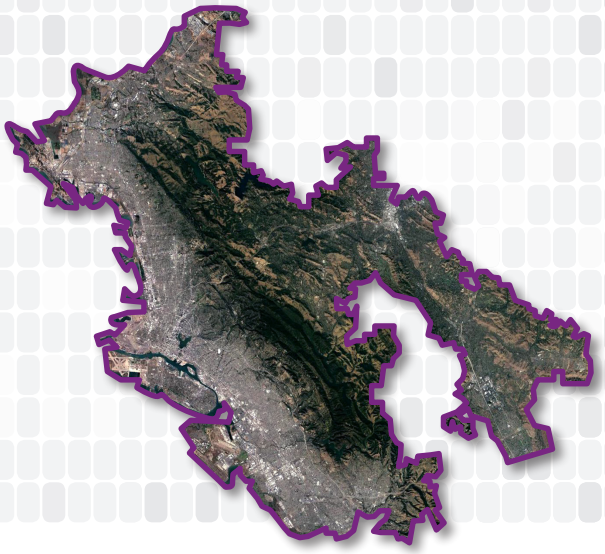
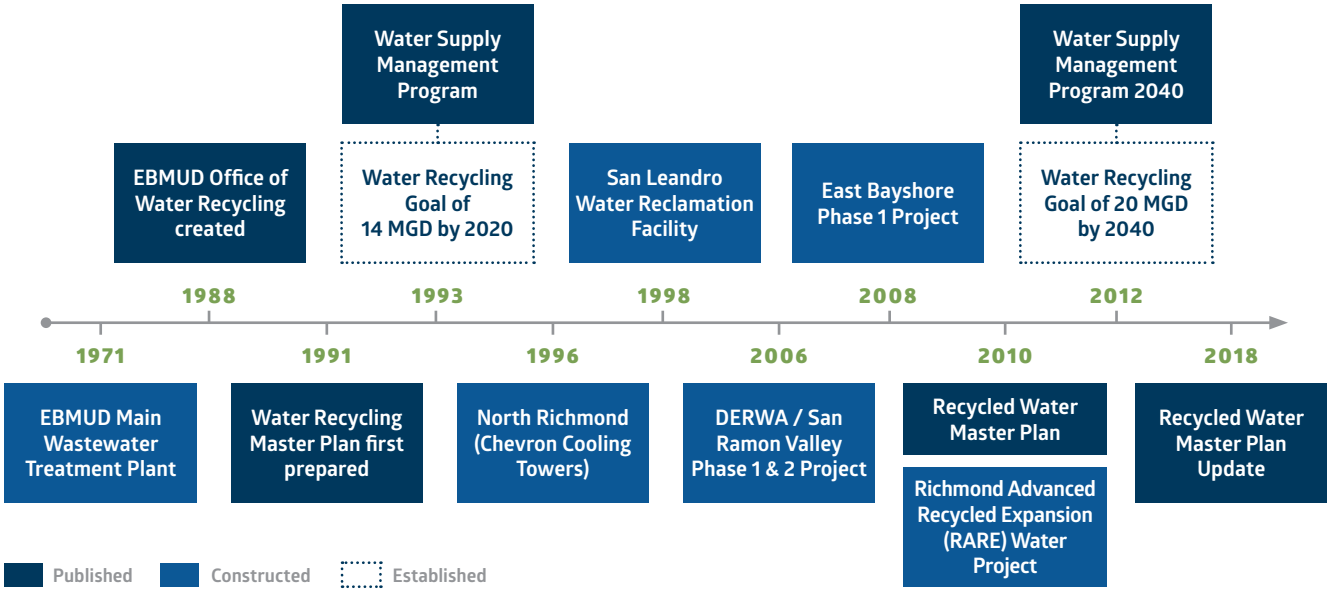


Purpose

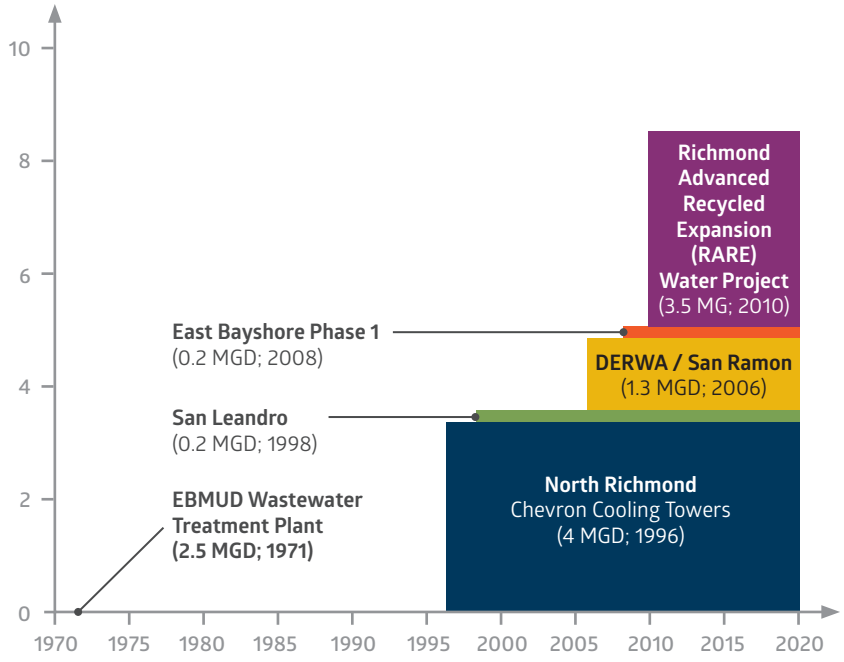
East Bay Municipal Utility District (EBMUD or District) provides drinking water for 1.4 million customers in Alameda and Contra Costa counties. During the period 2009 through 2018, EBMUD produced, on average, about 175 MGD of potable water. EBMUD's Main Wastewater Treatment Plant protecting San Francisco Bay and serving 685,000 customers, discharges approximately 60 MGD of treated water to the Bay. EBMUD is one of only a handful of large water utilities in California that provide both drinking water and wastewater services to a large urban area. This creates increased opportunities for integrating recycled water into its source water portfolio, including the future possibility of potable reuse.

EBMUD has been recycling water for irrigation and in-plant processes at its main wastewater treatment plant since 1971 and began its first golf course recycled water irrigation project in 1984. The Board of Directors created the Office of Water Recycling in 1988 to centralize and expand water recycling. The initial goal of the EBMUD recycled water program was to expedite recycled water projects in response to the drought that lasted from 1987-1992. Today, the goal of the program continues to be the planning, development, and implementation of recycled water projects throughout EBMUD's water service area in order to reduce the demand on EBMUD's drinking water supplies.

EBMUD's first comprehensive "Water Reclamation Master Plan" was developed in 1991. Its goals were to identify potential water reuse opportunities, develop and rank feasible projects, and provide recommendations for implementing high priority projects. The 1991 plan included irrigation projects as well as cooling tower and industrial use projects. In 1993, EBMUD implemented the Water Supply Management Program (WSMP) and established a recycled water goal of 14 MGD by 2020. In 2012 EBMUD's WSMP 2040 Plan updated the recycled water goal to a total of 20 MGD by 2040. During the drafting of the WSMP 2040 Plan in 2010, an updated "Recycled Water Master Plan" identified potential projects that could be implemented to meet the 20 MGD by 2040 recycled water goal. That amount could save enough water to supply the indoor and outdoor water needs of more than 220,000 EBMUD residents per day.



Currently, there is approximately 9 MGD of recycled water production capacity within EBMUD's water service area. Current recycled water uses can include irrigation, office building toilet flushing, and feed water to cooling towers and industrial boilers. Given numerous factors, including statewide population growth, climate change, ecosystem challenges, and legislative and regulatory pressures, EBMUD envisions additional expansion of water recycling efforts will be necessary in the future. This comprehensive update to EBMUD's Recycled Water Master Plan evaluates the existing recycled water system and identifies and assesses opportunities for non-potable and potable reuse to prepare for the future needs of expanded water recycling efforts, and define EBMUD's path forward to meet or exceed the goal of 20 MGD by 2040.



WHAT IS RECYCLED WATER?

Recycled water is highly-treated wastewater that is safe for a variety of beneficial uses. Recycled water is regulated by Title 22 of the California Code of Regulations (Title 22), which dictates the level of treatment required for various allowed uses in California. Recycled water is closely monitored and tested to demonstrate that it meets stringent health and safety standards set by the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) and enforced locally by the San Francisco Bay Regional Water Quality Control Board (Regional Board).

Recycled water has been used for non-potable purposes across California, including in the Bay Area, for decades. Tertiary treated water can be used to irrigate parks, golf courses, and schoolyards and is suitable for many industrial applications such as cooling towers and toilet flushing in commercial and multi-family residential buildings.

Water agencies across the state rely on recycled water as a major element in their water supply portfolio. Currently, many agencies are evaluating and planning for advanced water treatment or purified water projects to produce potable water. The SWRCB has established a statewide goal of recycling 2.5 million acre-feet per year (about 2,200 MGD) by 2030.

Current EBMUD Recycled Water Program

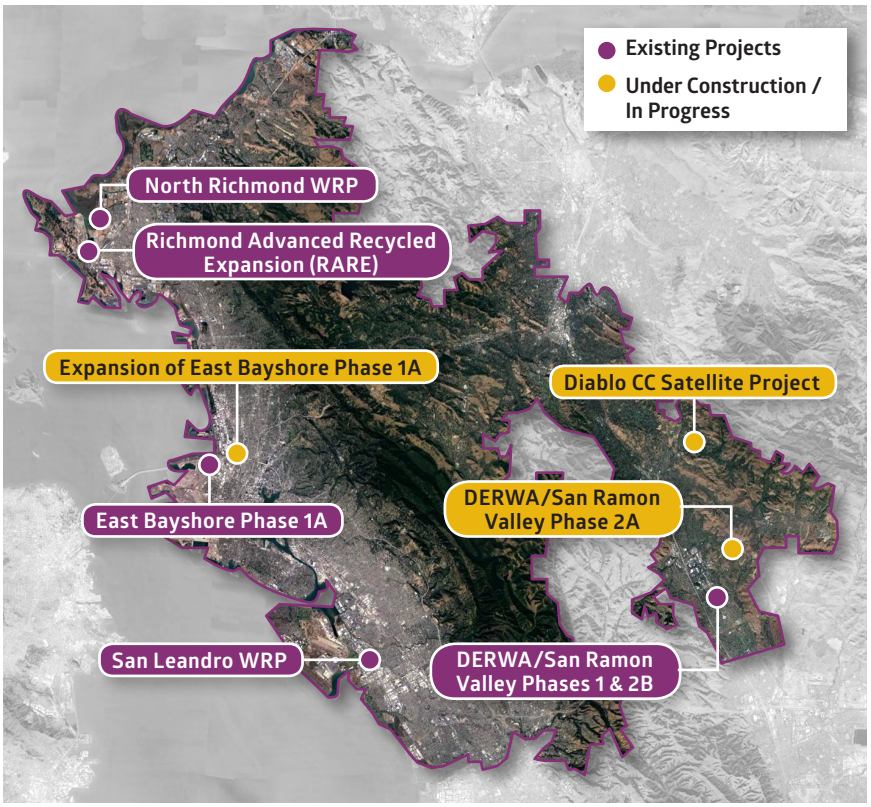
Recycled water use is a critical element of EBMUD's water supply management policies, as any demand met with recycled water reduces the demand for limited drinking water supplies. In addition to increasing water supply reliability and lessening the effect of extreme rationing during droughts, recycled water use:

- Delays or eliminates the need to construct more potable water facilities;
- Sustains the economy with increased water supply reliability;
- Protects San Francisco Bay by reducing treated wastewater discharges;
- Safeguards investments in parks and landscaping with a drought-proof or drought-resistant water supply; and
- Contributes to a green and healthy environment.

EBMUD's recycled water program has grown significantly since its inception to provide more recycled water to a diverse array of customers, including partnerships with other wastewater treatment entities in its water service area. In addition to treating secondary effluent at the East Bayshore Recycled Water Treatment Plant for landscape irrigation, EBMUD partners with:

- West County Wastewater District for the North Richmond Water Recycling Plant and the Richmond Advanced Recycled Expansion (RARE) Water Project to provide recycled water to the Chevron Richmond refinery for cooling towers and boilers.
- Dublin San Ramon Services District (DSRSD) to make recycled water available in the San Ramon Valley for landscape irrigation.
- City of San Leandro to make secondary effluent available for golf course and City landscape irrigation.

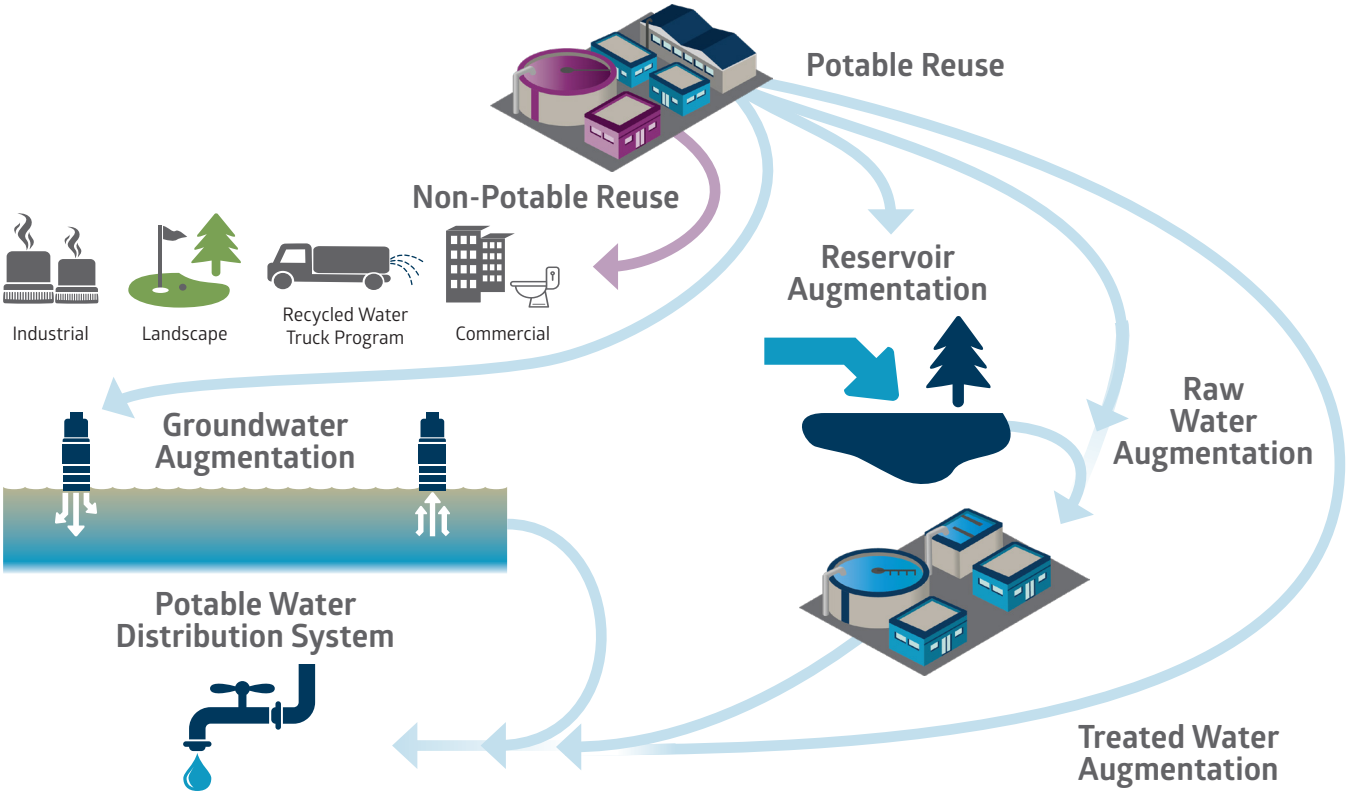
Today, the program is focused on planning, development, and implementation of recycled water projects throughout EBMUD's water service area in order to reduce the demand on drinking water supplies. Currently planned expansions of the San Ramon Valley recycled water project, the East Bayshore recycled water project, and a satellite recycled water project at the Diablo Country Club are expected to add about 1 MGD of production capacity over the next 5 years.



Allowable Uses and Regulatory Status of Recycled Water in California

This Updated Recycled Water Master Plan is the first to consider the potential for potable reuse in EBMUD's water service area. When EBMUD last updated the Recycled Water Master Plan in 2012, there were no uniform statewide criteria for potable reuse, although several groundwater augmentation projects were operating in southern California. Since then, potable reuse regulations for groundwater augmentation were adopted in 2014, and potable reuse regulations for reservoir augmentation were adopted in 2018. The Division of Drinking Water is currently working on regulations for raw water augmentation (for supply to aqueducts upstream of drinking water treatment plants), aiming for completion by 2023. There is no timeline for treated water augmentation regulations.

Regulations for potable reuse are being developed using a risk management approach for pathogens and chemicals, with the goal of ensuring effective and reliable engineered treatment. Minimum treatment requirements for direct potable reuse will likely include Full Advanced Treatment, similar to the regulations currently in place for groundwater augmentation via injection and reservoir augmentation. The SWRCB will continue to convene an expert panel every 5 years to review risks of constituents like pharmaceuticals and chemicals that may not be completely removed by Full Advanced Treatment, and to determine what additional actions may be needed. Treatment trains developed for the potable reuse alternatives in the Updated Recycled Water Master Plan all include Full Advanced Treatment, consisting of reverse osmosis and advanced oxidation processes, to ensure sufficient removal of pathogens and known chemical constituents.



NON-POTABLE REUSE

Treated domestic wastewater (recycled water) that is not used for drinking, but is safe to use for irrigation, industrial uses, or other non-drinking water purposes. Regulations for non-potable reuse were codified in Title 22 decades ago. This is the only type of reuse currently practiced by EBMUD.

POTABLE REUSE

Recycled water that is further treated through advanced processes and purified sufficiently so that it is safe for human consumption. When the purified water is used to augment a groundwater aquifer (**groundwater augmentation**) or surface water body (**reservoir augmentation**) before being withdrawn, treated, and blended with other water supplies for potable distribution, that is known as **indirect potable reuse (IPR). Direct potable reuse (DPR)** is the term used for purified water introduced directly to the potable water system and blended with other treated water supplies (**treated water augmentation**) or blended with the raw water supply immediately upstream of a water treatment plant (**raw water augmentation**).

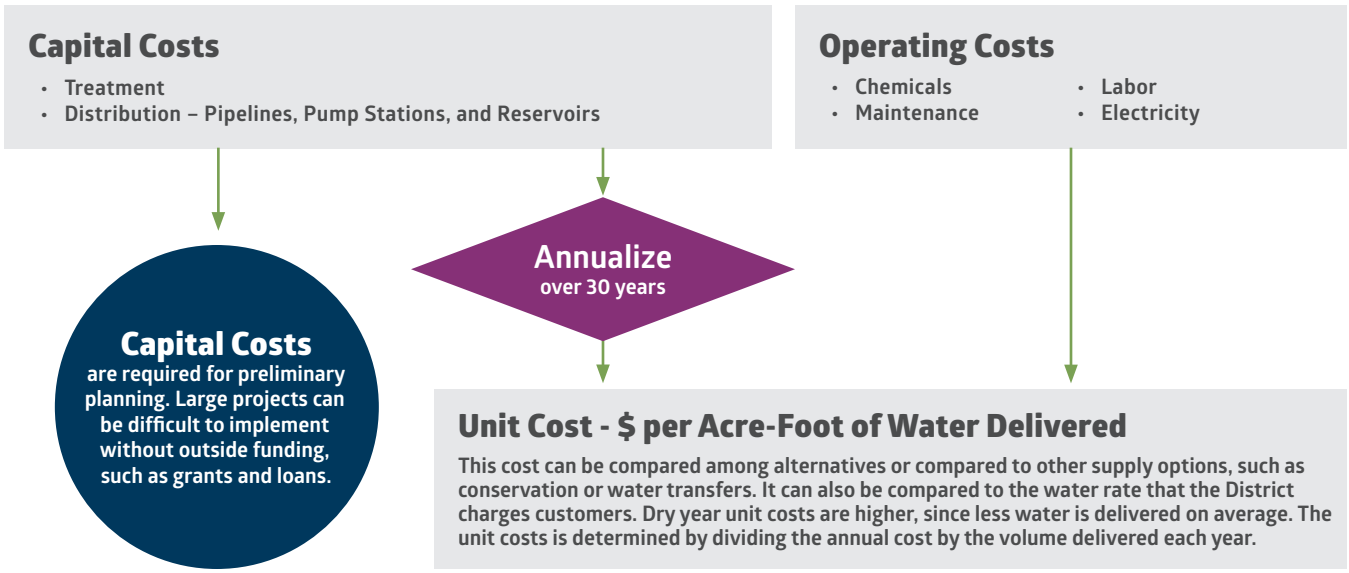
Master Planning Update Process

To prepare the Updated Recycled Water Master Plan, EBMUD evaluated more than 60 non-potable and potable reuse opportunities throughout EBMUD's water service area. For non-potable reuse, a full range of projects were considered, including well-established alternatives previously identified as part of the WSMP 2040, as well as new opportunities that have been identified by EBMUD staff and customers over the last few years – particularly those that arose as a response to the 2012-2015 drought. For non-potable reuse, the core of the planning process for each alternative is to identify a list of specific customers that can be served by a nearby wastewater treatment plant or wastewater collection system. Given the relatively low yield and high cost of constructing and operating small treatment facilities, some small projects (those serving less than 150 AFY) were not considered as alternatives for inclusion in the Master Plan for implementation by EBMUD – although such projects could be implemented and operated by other entities (such as a golf course, cemetery, or industrial user) under agreement with EBMUD.

For potable reuse, a supply assessment was conducted to identify all possible sources of treated municipal wastewater within or adjacent to EBMUD's water service area. Each potable reuse alternative is associated with specific targets: groundwater basins, surface water reservoirs, surface water treatment plants or aqueducts, and large pipelines or tanks within EBMUD's treated water distribution system. Three dozen alternatives were evaluated, covering a variety of advanced water treatment processes and ranging in size from 1 MGD from the San Leandro Water Pollution Control Plant on up to 30 MGD available from EBMUD's Main Wastewater Treatment Plant.

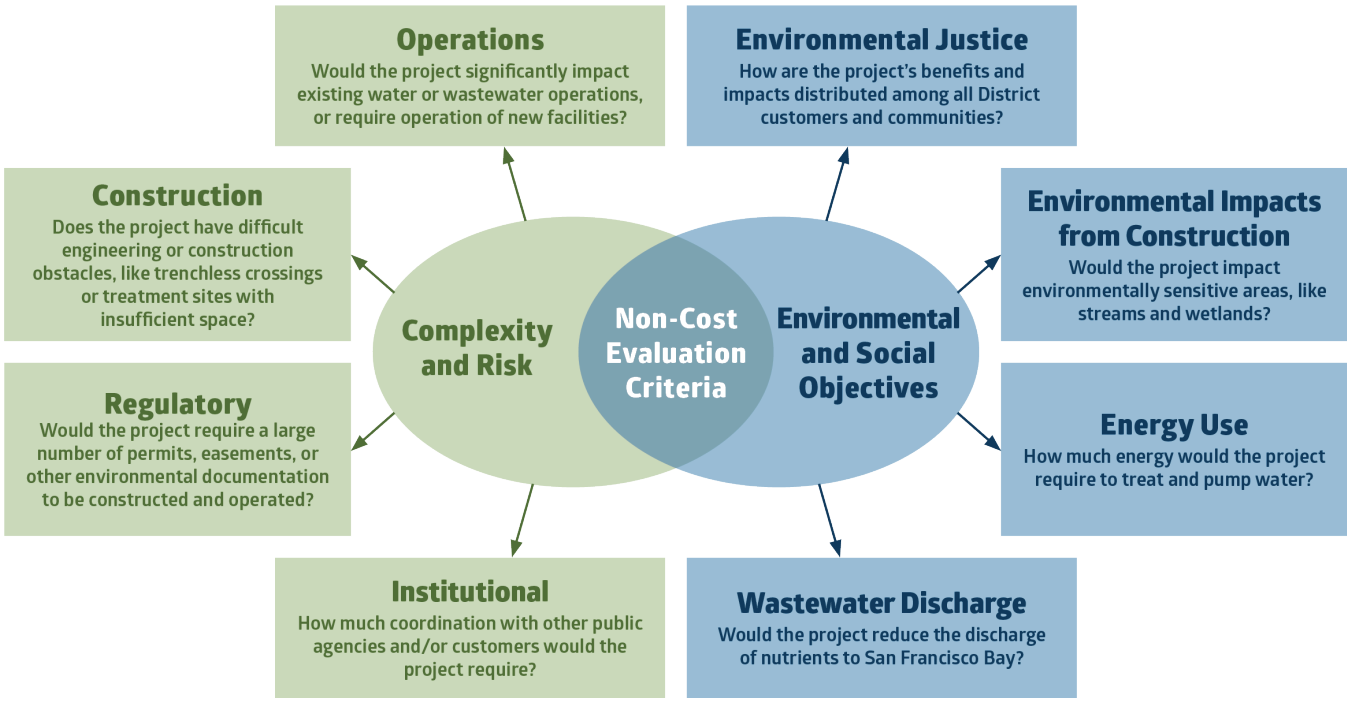
Non-potable and potable reuse alternatives were each evaluated two ways, based on cost and non-cost factors. The non-cost evaluation considered qualitative factors such as social, environmental, complexity, and risk considerations. The cost evaluation considered both capital costs and unit costs, which reflect both construction costs and operating costs over the project's 30-year service life. Unit costs presented here assume that recycled water is produced in all years. Additionally, to provide a comparison to dry year supplemental supply costs, dry year unit costs are presented for each alternative. Dry year unit costs are calculated by assuming that recycled water is produced only in drought years when the need is greatest (about 3 out of 10 years). Since less recycled water is delivered, dry year unit costs are proportionately higher.

After each alternative was evaluated based on quantified cost and qualitative non-cost factors, an economic evaluation was conducted to determine whether any recycled water project alternatives would cost less than other EBMUD supply alternatives, like water transfers or conservation. This evaluation determined that all potable and non-potable alternatives are costlier than EBMUD's existing water supply portfolio, which relies upon the Mokelumne River, Central Valley Project contract supply routed through the Freeport Project, and water transfers in dry years. Only a small number of alternatives are less costly than an economic metric called "willingness-to-pay," an estimate of the maximum dollar amount that water users would be willing to pay for an additional increment of water supply. The economic analysis confirmed that EBMUD's Recycled Water program is driven primarily by the need to meet water supply resiliency and environmental goals, rather than by economic considerations.



Several potable reuse options were identified with comparable unit costs to non-potable reuse, but the total capital investment needed up front is significantly greater. Therefore, EBMUD will maintain a recycled water supply goal of 20 MGD by 2040 to be met through non-potable reuse.

Potable reuse will become more promising when EBMUD's need for water supply increases, wastewater treatment plants within EBMUD's water service area have completed upgrades to remove nutrients in wastewater discharged to San Francisco Bay (which is not expected before 2024), statewide regulations are adopted for raw and treated water augmentation, and other agencies have demonstrated successful potable reuse projects. Therefore, potable reuse opportunities should be re-evaluated in five years (around 2024) to determine if any projects should be incorporated into the EBMUD water supply portfolio. To guide these future efforts, a discussion of the most promising potable reuse projects is included after the descriptions of the currently recommended projects.



Updated Recycled Water Master Plan

The four recommended non-potable reuse projects include continued expansion and implementation of the DERWA/San Ramon Valley Recycled Water Project, pending adequate supply, and the East Bayshore Recycled Water Project, development of a new recycled water supply for the Phillips 66 refinery in Rodeo using effluent from the Pinole-Hercules and Rodeo wastewater treatment plants, and expansion of the recycled water supply to the Chevron refinery in Richmond potentially using the City of Richmond's wastewater treatment plant. The estimated total capital cost of these four projects is $340 million by 2040. Most of the capital cost for construction is planned to occur after 2030.

In addition to implementing the recommended non-potable reuse projects, EBMUD will continue to encourage development of non-potable reuse projects self-financed and implemented by EBMUD water customers. Although EBMUD will not provide financing for construction of these projects, staff will be available to help with programmatic aspects of implementation. An example of this type of customer self-financed project is Diablo Country Club, which is exploring the feasibility of constructing a recycled water facility using raw wastewater from Central Contra Costa Sanitary District's collection system, offsetting about 250 AFY of potable water currently used for golf course irrigation. Customer self-financed satellite treatment projects – even small ones -- would contribute to EBMUD's 20-MGD recycled water goal.

Each of the four recommended projects is featured on the following pages.

RECOMMENDED NON-POTABLE REUSE PROJECT

San Ramon Valley Recycled Water Program

Landscape Irrigation | Danville, Blackhawk, and San Ramon

The San Ramon Valley Recycled Water Program is a partnership with EBMUD and Dublin San Ramon Services District (DSRSD) to provide recycled water to both agencies' customers for large landscape irrigation over multiple phases. Phase 1 and 2 of the program are near completion, and portions of the Phase 3 recycled water pipeline and the R3000 recycled water reservoir are already constructed. Phases 3-5 would build upon EBMUD's successful partnership with DSRSD, extending distribution system infrastructure and securing additional supplies to serve landscape irrigation customers in San Ramon, Danville, and the Blackhawk Country Club. Although each phase is a relatively small project, this well-established landscape irrigation program should continue to be a high priority as long as funding and source supply are available. Phase 4 has the highest unit cost of the three phases, and is therefore planned for implementation after Phase 3 and 5.

POTENTIAL FUTURE PROJECT COMPONENTS

Pipelines – 7 miles of new pipelines along the Dougherty Road, Camino Tassajara, and Blackhawk Drive corridors.

Pump Station – R3000 Pump Station along Dougherty Road corridor (currently in planning) and R4000 Pump Station serving Blackhawk Drive.

Customer retrofits for landscape irrigation.

AT A GLANCE

	PHASE 3	PHASE 4	PHASE 5
WATER SUPPLY BENEFIT	Annual Average Demand of 800 AFY (0.7 MGD)	Annual Average Demand of 300 AFY (0.3 MGD)	Annual Average Demand of 300 AFY (0.3 MGD)
COST	Capital Cost - $25 M Unit Cost - $1,900/AF Dry Year Unit Cost - $6,300/AF	Capital Cost - $17 M Unit Cost - $2,900/AF Dry Year Unit Cost - $9,700/AF	Capital Cost - $8.1 M Unit Cost -$1,600/AF Dry Year Unit Cost - $5,400/AF
TIMING	2025-2027	2033-2034	2028-2029

BENEFITS

The project leverages existing infrastructure, including the recent (2018) expansion of the recycled water production facility in Dublin.

CHALLENGES

Project partners (DSRSD and EBMUD) need to secure additional wastewater or other supplemental supplies to meet peak customer demands in summer. The additional supply could come from groundwater or from diversion of raw wastewater from Central Contra Costa Sanitary District's adjacent sewerage collection system.

FUNDING

To date, EBMUD has received over $19M in state and federal grant assistance to construct Phases 1, 2, and 3 of the San Ramon Valley Recycled Water Program. The multi-agency aspect of the project increases its eligibility for grant funding, and this will continue to be true for future phases.

RECOMMENDED NON-POTABLE REUSE PROJECT

East Bayshore Recycled Water Project

Landscape Irrigation & Industrial Uses | Alameda, Albany, Berkeley, Emeryville, and Oakland

The East Bayshore Recycled Water Project (EBRWP) is a multi-phase project that will provide up to 2.6 MGD of tertiary-treated recycled water from the EBMUD Main Wastewater Treatment Plant to a wide array of landscape irrigation customers, industrial cooling towers, and building ventilation and cooling systems. This represents a significant expansion of the project, which currently delivers an annual average of 0.2 MGD primarily to landscape irrigation customers in the greater downtown Oakland and Emeryville areas.

POTENTIAL FUTURE PROJECT COMPONENTS

Treatment – A new 4.5-MGD membrane bioreactor treatment facility to replace the existing tertiary membrane filters.

Pipelines – 21 miles of new pipelines, mainly in Berkeley, Alameda, and Emeryville.

Pump Station – Serving customers in the UC Berkeley area

Customer retrofits for landscape irrigation, building ventilation, and industrial reuse

AT A GLANCE

WATER SUPPLY BENEFIT
Annual Average Demand of 2,900 AFY (2.6 MGD)

COST
Capital Cost - $130 M
Unit Cost - $3,000/AF

Dry Year Unit Cost - $9,400/AF

TIMING
Small increases in deliveries by 2030; Larger expansion scheduled for construction 2030-2039.

BENEFITS
The project leverages existing infrastructure, particularly distribution system backbone pipelines in Oakland and along the Highway 80 corridor.

CHALLENGES
Existing EBRWP water quality is not ideal for irrigating sensitive species, and is not suitable for industrial use or ventilation and cooling systems. EBMUD is currently evaluating short-term, intermediate-term, and long-term alternatives to improve recycled water quality and determine the recommended path forward for EBRWP.

FUNDING
EBMUD has received over $6M in state grant assistance to construct the existing East Bayshore treatment facilities and distribution pipelines. Future phases of the project would be eligible for grant funding or low-interest loans. This project has no other partner agencies, which reduces grant funding eligibility but simplifies project management.

RECOMMENDED NON-POTABLE REUSE PROJECT

Chevron Richmond Refinery Expansion from Richmond Water Pollution Control Plant

Industrial Use | Richmond

Since 1996, EBMUD has been delivering recycled water to the Chevron refinery in Richmond for use in its cooling towers. Building on that success, in 2010 EBMUD brought online the Richmond Advanced Recycled Expansion (RARE) Water Project to provide high purity recycled water for boilers at the refinery. Both projects currently use effluent from West County Wastewater District. This project could potentially produce additional recycled water to serve the Chevron Richmond refinery using the City of Richmond's Water Pollution Control Plant (WPCP) as a source of wastewater.

POTENTIAL FUTURE PROJECT COMPONENTS

Treatment – New 5-MGD split treatment membrane bioreactor and reverse osmosis at Richmond WPCP, and 1.5 MGD of additional capacity at the RARE facility.

Pump Station and Pipeline – A pump station and about two miles of pipeline connecting the City of Richmond WPCP to the RARE production facility at the Chevron refinery.

AT A GLANCE

WATER SUPPLY BENEFIT
Annual Average Demand of 4,300 AFY

COST
Capital Cost - $110 M
Unit Cost - $2,600/AF

Dry Year Unit Cost - $8,600/AF

TIMING
Construction 2035-2040. This project requires a long lead time to allow upgrades at the City of Richmond WPCP and to convey the water to the RARE facility.

BENEFITS
The project builds on EBMUD's successful partnership with Chevron, and Richmond WPCP upgrades could be designed to meet multiple objectives beyond recycled water.

CHALLENGES
Major upgrades would be needed at the City of Richmond WPCP, which is situated on a constrained site with little additional space for new treatment facilities.

FUNDING
The project may be less competitive for public funding since it serves just one industrial customer, but some portions of the project could be privately funded.

RECOMMENDED NON-POTABLE REUSE PROJECT

Phillips 66 Refinery

Industrial Use | Rodeo

The Phillips 66 Recycled Water Project would deliver up to 3.7 MGD of recycled water to the refinery for use in their boilers and cooling towers. The source of water for this project is the Pinole-Hercules Water Pollution Control Plant (providing most of the supply) and Rodeo Water Pollution Control Facility (providing a fraction of the supply). The combined final disinfected effluent from both treatment plants would be pumped at the Rodeo Pump Station to the refinery for treatment at a new advanced recycled water treatment plant. This project is recommended because it would deliver a large amount of recycled water to a single customer, with comparatively few pipelines required due to the short distance between the sources of wastewater and the Phillips 66 Refinery.

POTENTIAL FUTURE PROJECT COMPONENTS

Treatment – New treatment facilities include membrane filtration, a biological aerated filter, reverse osmosis and ultraviolet disinfection.

Pump Station and Pipeline – A pump station and less than one mile of pipeline connecting the Rodeo WPCF to the Phillips 66 Refinery fence line. An existing pipeline would be used to convey treated effluent beyond the fence line to new treatment facilities on the refinery site.

AT A GLANCE

WATER SUPPLY BENEFIT
Annual Average Demand of 4,100 AFY (3.7 MGD)

COST
Capital Cost - $53M
Unit Cost – $1,100/AF

Dry Year Unit Cost - $3,700/AF

TIMING
Construction 2025-2029, 2035-2039

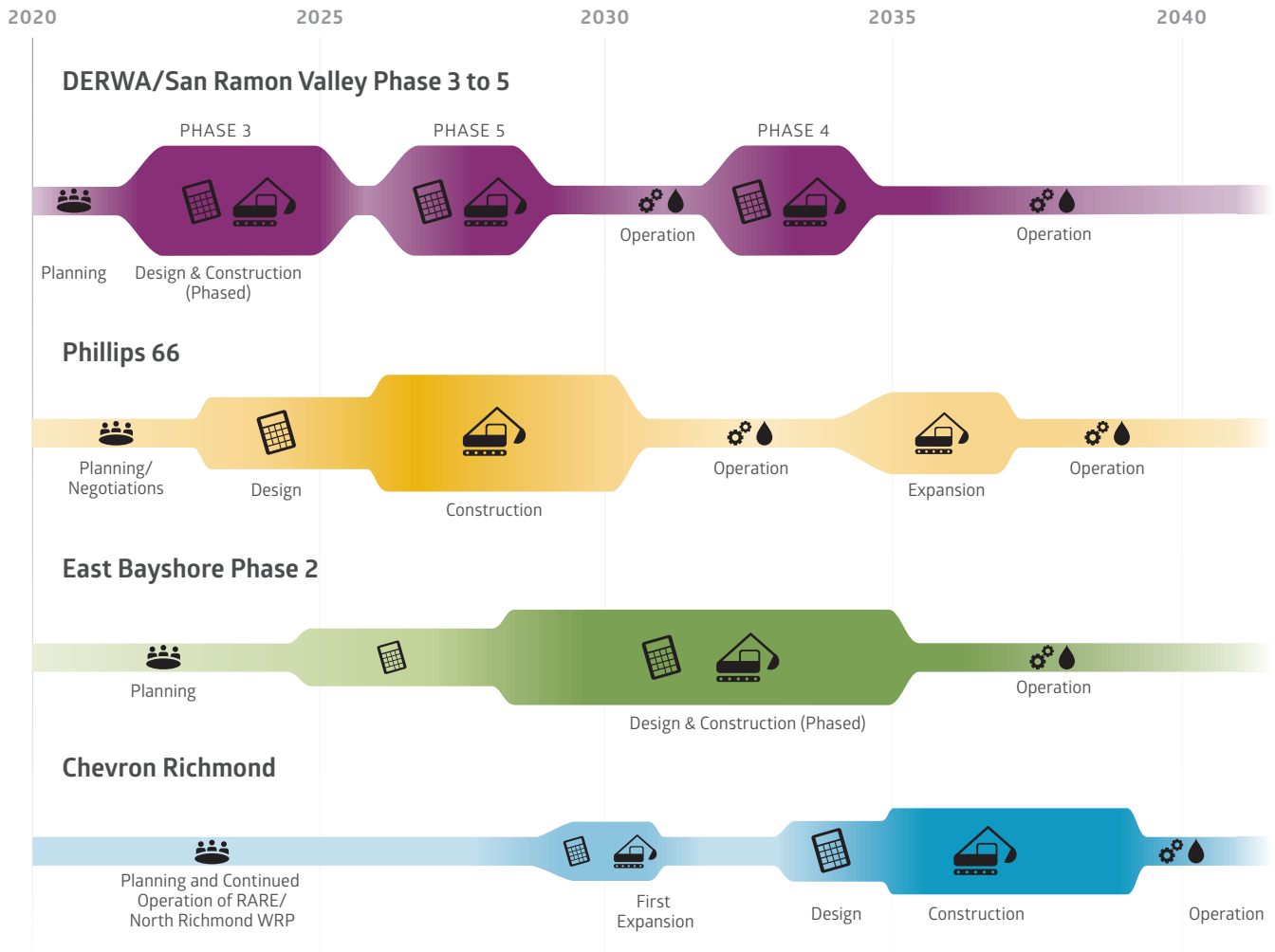
BENEFITS
This alternative is the most cost-effective of the recommended non-potable reuse alternatives because it serves a large amount of recycled water to one customer, only short pipelines are required, and no treatment modifications are required at a municipal wastewater treatment plant.

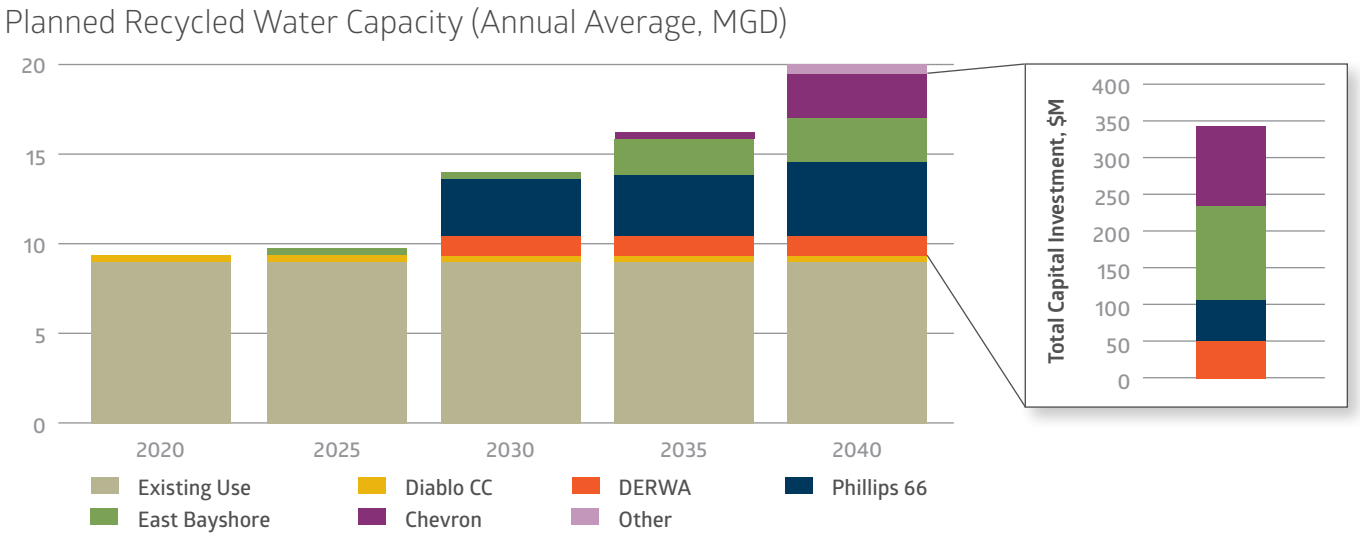
CHALLENGES
The project has institutional challenges due to the involvement of four public agencies and one private entity, with agreements needed to divide responsibilities for operating the pump station, pipeline, and treatment facilities. The treatment plant would be located on Phillips 66 Refinery property.

FUNDING
The project may be less competitive for public funding since it serves just one industrial customer, but some portions of the project could be privately funded.

Implementing The Master Plan

This Updated Recycled Water Master Plan provides a pathway for EBMUD to meet its goal of 20 MGD by 2040. The recommended approach calls for meeting the goal entirely through non-potable reuse projects across EBMUD's water service area, but the projects and opportunities for potable reuse will be periodically re-evaluated as EBMUD's water supply needs and regulatory status for potable reuse are tracked. The timing of the recommended projects will be dependent on wastewater supply availability, institutional agreements, customer outreach, cost effectiveness, and opportunities for funding. If the supply sources are sufficient, San Ramon Valley and Phillips 66 are recommended for implementation first, as they require less up-front capital investment than the East Bayshore and Chevron Richmond projects.





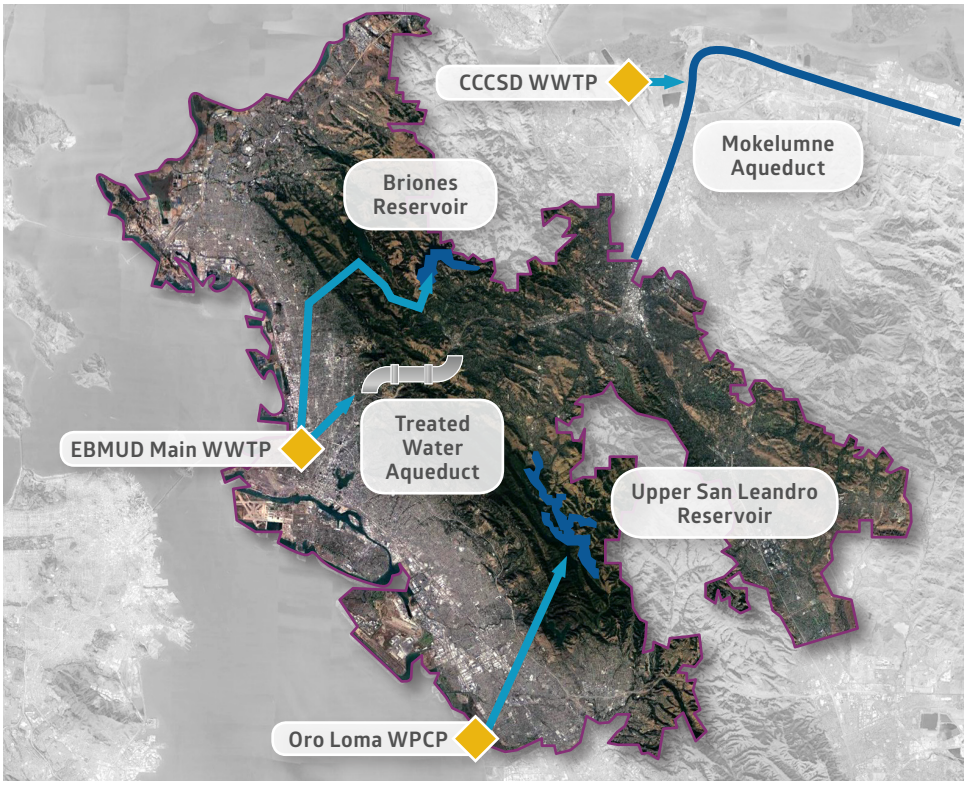
The Possibility of Potable Reuse

The Updated Recycled Water Master Plan identified multiple pathways to incorporate recycled water into EBMUD's potable water supply portfolio via potable reuse. Although none are yet recommended for implementation by 2040, this section provides information on the most promising potential potable reuse alternatives. Public outreach, education, and acceptance are factors of consideration when determining the future potential of potable reuse.

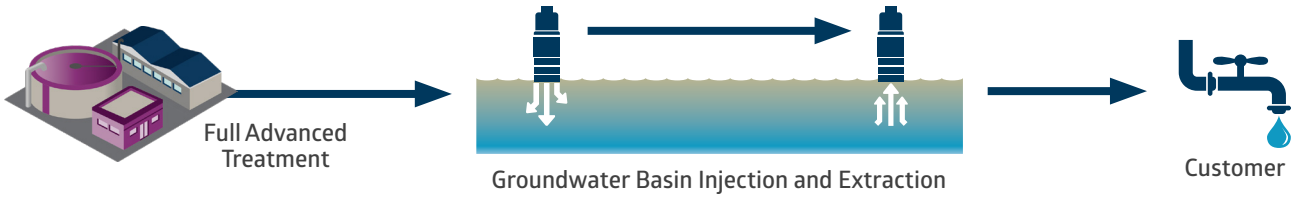
The advantages of potable reuse compared to non-potable reuse include:

- **Flexibility.** Recycled water that meets potable reuse standards can be used for any potable purpose, maximizing flexibility and reliability compared to the more restricted uses of non-potable recycled water.
- **Economy.** There is greater potential for economy of scale, since no small distribution system pipelines, service lines, or customer retrofits are needed. Projects must be fairly large to realize this potential, so potable reuse makes more sense when there is a sizeable need for water in all year types, not just in dry years. The unit costs presented in this report assume that potable reuse projects are operated in all years – if operated only in dry years, then the unit costs are roughly three times higher.
- **Simplicity.** Customers only use one kind of water and there is no need to construct and maintain dual distribution systems.

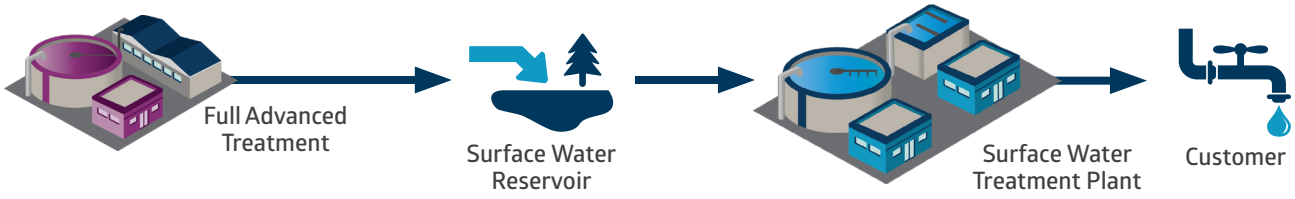
The following pages show example projects for reservoir augmentation, raw water augmentation, and treated water augmentation. Details are not shown for groundwater augmentation because of the difficulty of equitably incorporating a large amount of extracted groundwater from the East Bay Plain aquifer into EBMUD's water distribution system.



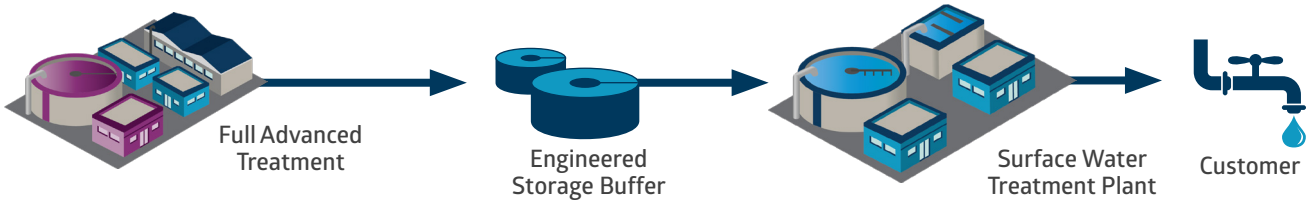
GROUNDWATER AUGMENTATION



RESERVOIR AUGMENTATION



RAW WATER AUGMENTATION

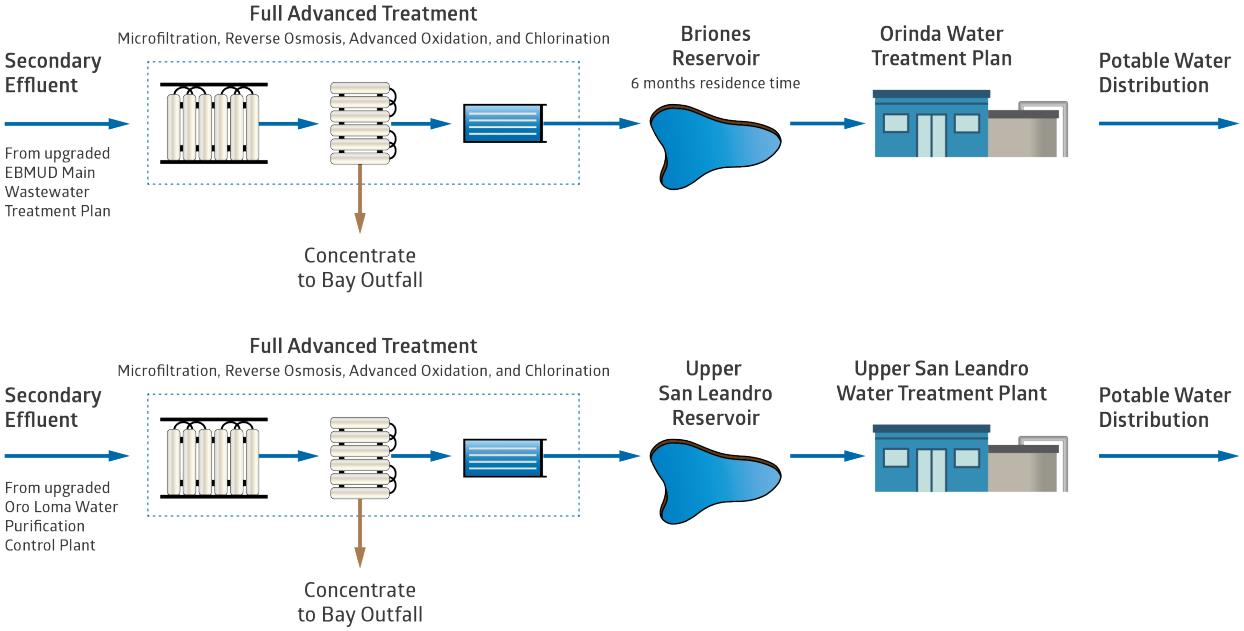


TREATED WATER AUGMENTATION

POTABLE REUSE OPPORTUNITY

Reservoir Augmentation

EBMUD's surface water reservoirs in the East Bay Hills – in particular Briones Reservoir and Upper San Leandro Reservoir – could be used to store advanced-treated water for potable reuse. These reservoirs are large enough to provide more than six months of average residence time for the amount of advanced-treated water that could be feasibly produced at nearby wastewater treatment plants. After storage and mixing in the reservoir, water would be treated at one of EBMUD's existing surface water treatment plants, such as Orinda Water Treatment Plant or Upper San Leandro Treatment Plant, prior to distribution to customers. Example facilities are shown below.



AT A GLANCE

REGULATIONS

Regulations for Reservoir Augmentation became effective in October 2018. The first project in operation is expected to be the City of San Diego's Pure Water project using Miramar Reservoir.

BENEFITS

The water can be used for any potable purpose, and offsets existing supplies. Projects using Briones Reservoir for storage would serve EBMUD's west-of-hills customers. Projects using Upper San Leandro Reservoir would serve a smaller subset of customers in the southern part of EBMUD's water service area.

CHALLENGES

Secondary upgrades to treatment plants are needed. Oro Loma is pursing these upgrades, but EBMUD has not determined whether or when such upgrades would be implemented at EBMUD's Main WWTP. A smaller project of about 10 MGD could be set up using split treatment with a membrane bioreactor at EBMUD's Main WWTP.

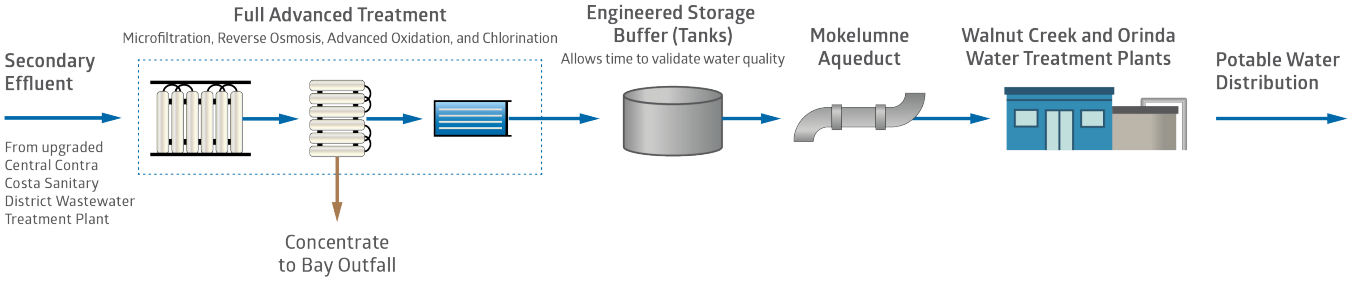
COST

8 MGD from Oro Loma WPCP to Upper San Leandro Reservoir	10 MGD from EBMUD Main WWTP to Briones Reservoir
Capital Cost - $230 M Unit Cost - $2,800/AF	Capital Cost - $510 M Unit Cost - $3,900/AF
Dry Year Unit Cost - $8,600/AF	Dry Year Unit Cost - $12,000/AF

POTABLE REUSE OPPORTUNITY

Raw Water Augmentation

The most promising raw water augmentation alternative would route advanced-treated water from the CCCSD Wastewater Treatment Plant to the Mokelumne Aqueduct, which passes near the plant in North Concord. The water would then be treated in a surface water treatment plant, such as Walnut Creek Water Treatment Plant or Orinda Water Treatment Plant, prior to distribution to customers.



AT A GLANCE

REGULATIONS

The State Water Resources Control Board plans to establish uniform water recycling criteria for raw water augmentation by the end of 2023.

BENEFITS

The water would reach all EBMUD water customers, making this the most equitable alternative among the potable reuse options. Very little infrastructure beyond treatment would be needed, since the Mokelumne Aqueduct is located so close to the CCCSD plant.

CHALLENGES

Secondary upgrades to the CCCSD treatment plant would be needed, although costs for those upgrades are not included below. There are also competing uses for the water, such as serving non-potable water to two petroleum refineries in Martinez.

COST

10 MGD from CCCSD to the Mokelumne Aqueduct

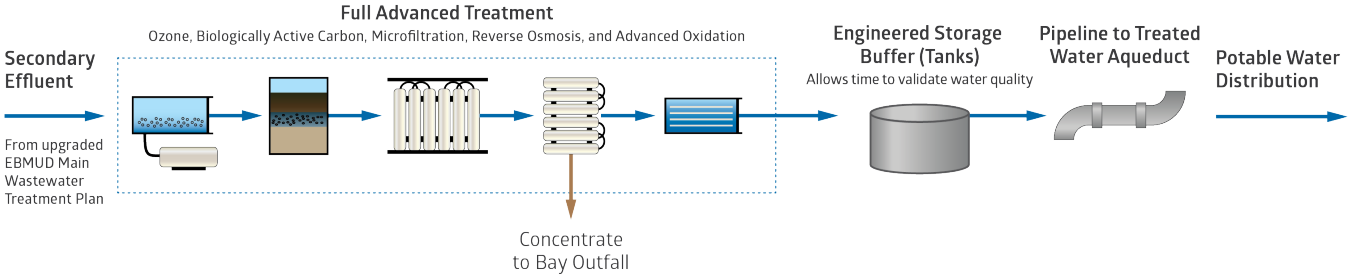
Capital Cost - $180M
Unit Cost - $2,300/AF

Dry Year Unit Cost - $6,500/AF

POTABLE REUSE OPPORTUNITY

Treated Water Augmentation

The most promising treated water augmentation alternative would route advanced-treated water from the EBMUD Main Wastewater Treatment Plant to a large treated water aqueduct in the West-of-Hills transmission system. Claremont Center, an EBMUD facility near the Rockridge BART station, is an example of the type of location where advanced-treated water could be routed for blending prior to distribution. Example facilities are shown below.



AT A GLANCE

REGULATIONS

The State Water Resources Control Board has no immediate plans to establish uniform water recycling criteria for treated water augmentation. As a result, regulations are not expected until 2030 or beyond.

BENEFITS

The water would reach most of EBMUD west-of-hills customers.

CHALLENGES

Site constraints at the Main WWTP make it difficult to construct the needed treatment and storage components. Major secondary treatment upgrades or a new split treatment membrane bioreactor at the Main WWTP would be needed; the cost estimate below assumes split treatment.

COST

10 MGD from the Main WWTP to Claremont Center

Capital Cost - $360M
Unit Cost - $3,400/AF

Dry Year Unit Cost - $9,800/AF

ACRONYMS

AFY	Acre-feet per year
CCCSD	Central Contra Costa Sanitary District
DDW	Division of Drinking Water
DERWA	DSRSD-EBMUD Recycled Water Authority
DSRSD	Dublin San Ramon Services District
EBMUD	East Bay Municipal Utility District
EBRWF	East Bayshore Recycled Water Facility
MGD	Million gallons per day
RARE	Richmond Advanced Recycled Expansion
SWRCB	State Water Resources Control Board
TITLE 22	California Recycled Water Regulations found in Title 22, California Code of Regulations
WCWD	West County Water District
WPCP	Water Pollution Control Plant
WSMP	Water Supply Management Program
WWTP	Wastewater treatment plant

CONVERSION FACTORS

1 MGD = 1,120 AFY

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