FINAL

Recycled Water Supply Management Plan

Prepared for

DSRSD-EBMUD Recycled Water Authority

Dublin, CA

March 6, 2024

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The project team also recognizes the valuable input provided by Central Contra Costa Sanitary District, the City of Livermore, and Zone 7 Water Agency related to potential supply alternatives.

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

AF	acre-feet
AFY	acre-feet per year
Central San	Central Contra Costa Sanitary District
DERWA	DSRSD-EBMUD Recycled Water Authority
DSRSD	Dublin San Ramon Services District
EBDA	East Bay Dischargers Authority
EBMUD	East Bay Municipal Utility District
gpm	gallons per minute
GPQ	groundwater pumping quota
LAVWMA	Livermore-Amador Valley Water Management Agency
M	million
MG	million gallons
mgd	million gallons per day
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substances
RO	reverse osmosis
SRVRWP	San Ramon Valley Recycled Water Program
WWTP	wastewater treatment plant
Zone 7	Zone 7 Water Agency

Executive Summary

In 1995, the Dublin San Ramon Services District (DSRSD) and East Bay Municipal Utility District (EBMUD) formed a joint powers authority, DSRSD-EBMUD Recycled Water Authority (DERWA). DERWA manages the San Ramon Valley Recycled Water Program, which is supplied by wastewater treated at DSRSD's wastewater treatment plant (WWTP). DERWA provides recycled water to landscape irrigation customers within DSRSD's and EBMUD's service areas. As of 2014, DERWA also provides recycled water to the City of Pleasanton under contract.

DSRSD, EBMUD, and Pleasanton each have plans to expand their respective recycled water systems; however, wastewater flows at the DSRSD WWTP have been much lower than projected, prompting a moratorium on new recycled water connections. Without additional sources of supply, the amount of wastewater available will be insufficient to meet buildout demands.

DERWA initiated the Recycled Water Supply and Operations Plan Update to develop a roadmap for expanding the DERWA program, among other objectives. Although summertime demands vary year-to-year and short-term gaps between supply and demand can be managed through operational storage, prolonged shortages require additional supply to meet demand. Based on updated supply and demand projections, it is possible that DERWA would need to add the following amount of supply in the peak season (note: amounts shown are based on the maximum projected shortage).

- Up to 1 mgd by 2025
- Up to 2 mgd by 2030
- Up to 6 mgd by 2045

While demand management cannot fully eliminate the projected supply shortfall at buildout, it can reduce the amount of supplemental supply needed. Demand management can also help mitigate the need for rationing and/or addition of potable water in the near term. The following strategies were identified as potential ways to reduce recycled water use.

- Improved water efficiency
- Recycled water budgets for the cities of Dublin and San Ramon
- Rebates (e.g., for turf replacement or irrigation controllers)
- Water loss control

Potential supply alternatives underwent an initial screening process, and seven alternatives were carried forward. As shown in Table ES-1, the estimated supply available differs by alternative.

Table ES-1. Summary of Supply Alternatives	
Alternative	**Estimated Supply Available (mgd)**
Raw wastewater from Central Contra Costa Sanitary District (Central San)	2.7
Secondary effluent from Livermore	2 to 3
Secondary effluent from East Bay Discharges Authority (EBDA)	Up to 6 (i.e., the maximum shortage at buildout)
Recycled water from Livermore to Pleasanton	1
Fringe basin wells (higher yield)	2.3 (assumes 2 wells)
Fringe basin wells (lower yield)	2.3 (assumes 7 wells)
Peak season potable water supplementation	3 (with infrastructure improvements)

The study included evaluation of relative benefits and costs to aid in prioritizing alternatives to include in the roadmap. Based on results of the evaluation and feedback from the DERWA Board, a combination of demand management, wastewater from neighboring agencies (Central San or Livermore), and potable water are the most feasible options for mitigating shortage. Although the DERWA Board is not interested in supplementing the system with potable water during drought years, potable water could serve as a backstop when demand exceeds supply in non-drought years.

While a long-term arrangement with a neighboring agency would be the most preferred option due to high benefit and low cost, both Central San and Livermore are planning to reserve their wastewater for other future reuse projects, which makes the long-term feasibility of these alternatives uncertain. Central San discharges notably more effluent than Livermore; therefore, while not guaranteed, there is greater potential to divert flow from Central San, and it is assumed any agreement with Livermore would be on an interim basis.

While groundwater from the Fringe Basin remains an option, it is not preferred due to its operational implications. Between the groundwater alternatives, DERWA's preference would be for fewer, higher-yield wells, with a wellfield of lower-yield wells as a backup option.

Lastly, while EBDA is the only alternative that could meet the full shortage at buildout, it is also the most expensive. The EBDA alternative is more expensive than most potable water supply projects that EBMUD and DSRSD are considering, which makes it an unrealistic option in the near term. The EBDA alternative would only be considered if all other options are exhausted.

The proposed roadmap incorporates supplemental supply alternatives and demand management measures and identifies triggers for lifting the moratorium, which are summarized in Table ES-2. Securing 1 mgd of peak season supply by 2025 is feasible with minimal policy changes and extending DERWA's current temporary agreement with Central San. Securing 2 mgd by 2030 is dependent on external triggers and requires Central San's commitment to a long-term agreement or DERWA's commitment to proceed with installing new non-potable wells in the Fringe Basin. Most of the future demand expected by 2030 is driven by EBMUD's next phase of expansion, which will not be initiated unless a long-term supply is secured (preferably through a long-term agreement with Central San, though Fringe Basin groundwater could serve as a secondary option). Although DERWA could need up to 6 mgd by 2045, it is recommended that DERWA pause and re-evaluate supplies and demands in 2030. Given uncertainty in future conditions, DERWA's supply need could shift substantially, which would affect the unit cost and marginal benefit of remaining alternatives.

Table ES-2. Recommended Roadmap		
Supply Goal	Triggers for Lifting Moratorium	
	By 2025	By 2030
1 mgd by 2025	• Establish recycled water budgets for cities. • Update policies for rationing and potable supplementation. • Extend temporary agreement with Central San.	
2 mgd by 2030	• Secure long-term agreement with Central San or commit to construction of new well. • If new wells, need temporary agreement with Central San or Livermore to bridge the gap (2026-2030).	• Divert 2.7 mgd from Central San or • Bring new wells online (2.3 mgd).
6 mgd by 2045		• Re-evaluate supplies, demands, and cost-effectiveness of remaining alternatives.

In the near term, next steps for DERWA and its member agencies include:

- Considering policy changes to enable rationing in drought years and potable supplementation in non-drought years.
- Developing recycled water budgets for Dublin and San Ramon and exploring the potential to extend rebates to recycled water customers.
- Reviewing DERWA's water loss accounting to determine real versus apparent water losses.
- Continuing discussions with Central San and Livermore regarding potential alternatives.
- Coordinating with Zone 7 on groundwater exploration, including planning for a possible test well in the Fringe Basin.

Recommended activities should be considered in development of DERWA's fiscal year 2025 budget.

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Section 1

Introduction

In 1995, the Dublin San Ramon Services District (DSRSD) and East Bay Municipal Utility District (EBMUD) formed a joint powers authority, DSRSD-EBMUD Recycled Water Authority (DERWA), to produce and distribute recycled water through the San Ramon Valley Recycled Water Program (SRVRWP). The SRVRWP is supplied by wastewater treated at DSRSD's wastewater treatment plant (WWTP) and provides recycled water to landscape irrigation customers within DSRSD's and EBMUD's service areas, including parts of the cities of Dublin and San Ramon, with plans to supply areas within Blackhawk and the Town of Danville in future phases. In 2014, DERWA executed agreements to extend recycled water service to the City of Pleasanton.

DSRSD, EBMUD, and Pleasanton each have plans to expand their respective recycled water systems; however, wastewater flows at the DSRSD WWTP have been much lower than projected due to increased water use efficiency and conservation. Recently, peak season demand exceeded supply, which prompted a moratorium on new recycled water connections. Without additional sources of supply and/or other significant changes, the amount of wastewater available will be insufficient to meet the buildout demands for the SRVRWP.

1.1 Purpose

DERWA initiated the Recycled Water Supply and Operations Plan Update to achieve the following objectives:

- Update supply and demand projections to reflect changed conditions
- Evaluate supplemental supply alternatives and demand management strategies
- Develop an implementation roadmap for meeting future demands
- Use updated hydraulic model to optimize operations

This report documents work supporting the study's first three objectives, which culminates in a proposed roadmap for SRVRWP expansion. The fourth objective is supported by the Recycled Water Operations Plan, developed separately as part of this study (DERWA, 2024).

1.2 Approach

Since DERWA was formed, the DERWA members agencies (DSRSD and EBMUD) have been studying the issue of supply and evaluating various alternatives. Throughout this study, the project team worked with DERWA, DSRSD, and EBMUD to review and update past information, refine and evaluate alternatives, and prepare recommendations. The project team held multiple meetings and workshops with staff and presented draft findings from these efforts to the DERWA Board of Directors on September 25, 2023. Feedback from the DERWA Board informed development of the proposed roadmap (Section 5), which was presented to the Board on December 11, 2023.

The project team also met with staff from Pleasanton and other potential partner agencies. While the roadmap presented in this report reflects preliminary input from potential partner agencies, any alternative involving an external partner would require approval from the respective agency's governing body. Next steps will be advanced at the DERWA Board's direction and in coordination with the appropriate agencies.

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Section 2

Recycled Water Needs

The section summarizes DERWA's projected recycled water supply, demand, and anticipated shortage risk to inform the need for supply augmentation and/or demand management measures.

2.1 Projected Supply

DERWA's supply comes from wastewater treated at the DSRSD WWTP. Wastewater influent (and therefore recycled water supply) is expected to increase with population growth until buildout is reached; however, the increase is not as great as previously projected due to indoor water use efficiency and conservation efforts. Wastewater flows in the service area have remained relatively constant (fluctuating between 9 and 11 million gallons per day [mgd]) since 2005, even with increasing population.

To evaluate the ability of DERWA to meet future recycled water demands, supply projections were updated based on the latest assumptions around population growth and indoor water use, as further described in Appendix A. To account for uncertainty in future conditions, a range of future supply (bound by a high and low projection curve) was estimated. These projections, which represent DERWA's "baseline supply" absent any supplemental sources, are shown relative to historical supply and DERWA's original projections (from the 2003 agreement) in Figure 2-1.

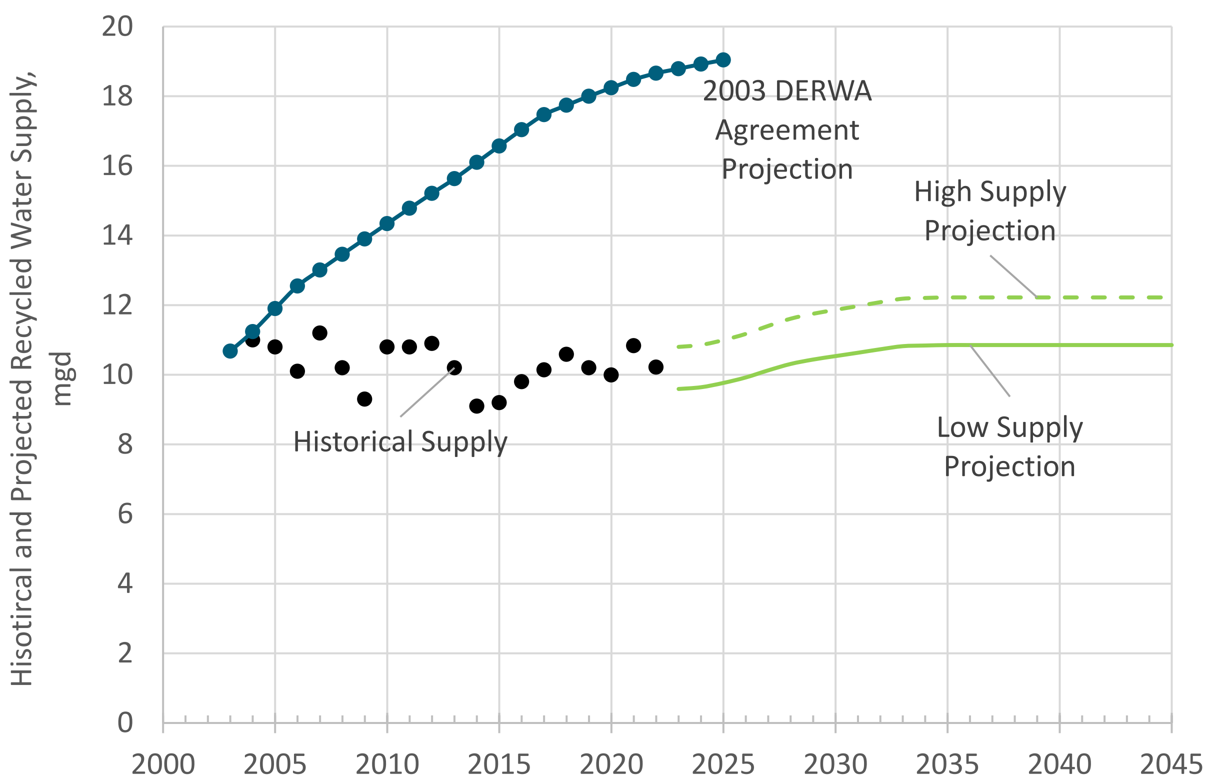

Figure 2-1. Historical and projected supply compared to the 2003 DERWA agreement projection

2.2 Projected Demand

Recycled water demand varies significantly throughout the year due to the seasonality of irrigation. Additionally, demand varies year to year based on weather and other factors. Figure 2-2 demonstrates the variability in demand, with summer 2021 demands being the greatest on record due to severe drought conditions. (Note: EBMUD's Crow Canyon and Canyon Lakes golf courses were not yet connected to the system in 2021; had they been connected, demands would have been even higher.)

Although demands were lower in 2022 and 2023 (with sufficient supply to meet demand), the 2021 demand profile (with the addition of Crow Canyon and Canyon Lakes golf courses) was used as the baseline condition for this study to represent the "worst case" scenario.

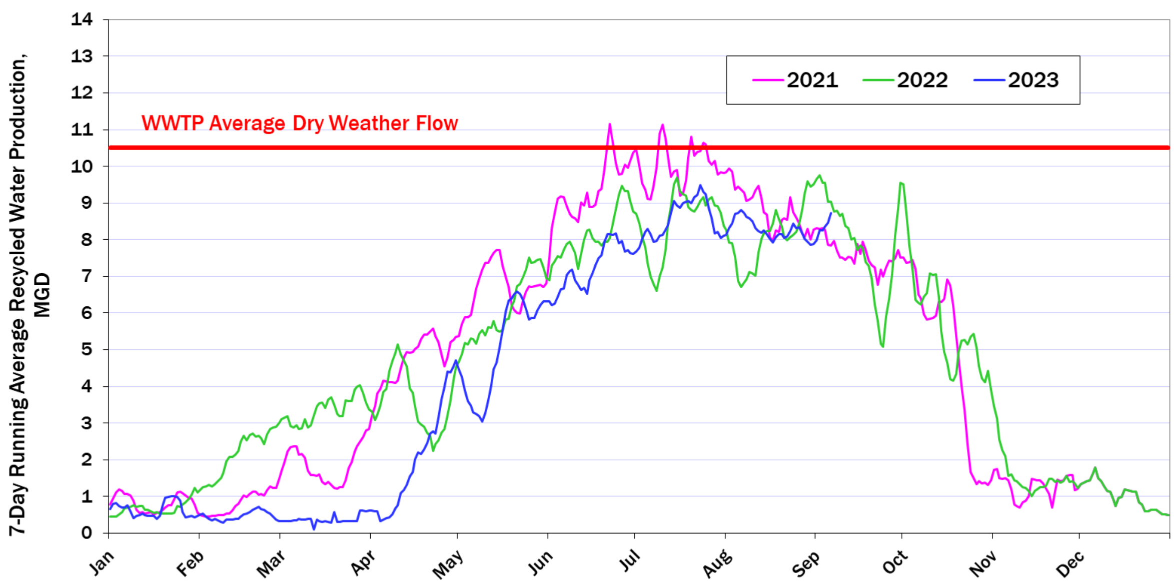

Figure 2-2. DERWA recycled water production, 2021 through September 2023 (7-day running average)

Note: 2021 demands do not include Crow Canyon and Canyon Lakes golf courses.

Future demand on the DERWA system was estimated based on information provided by DSRSD, EBMUD, and Pleasanton. Projected average day demand (assuming no moratorium) is shown in Figure 2-3 in both mgd and acre-feet per year (AFY). Demand projections assume 10 percent water loss within DERWA's distribution system (calculated based on DSRSD and EBMUD demand). Water loss within the Pleasanton system is included in Pleasanton's demand.

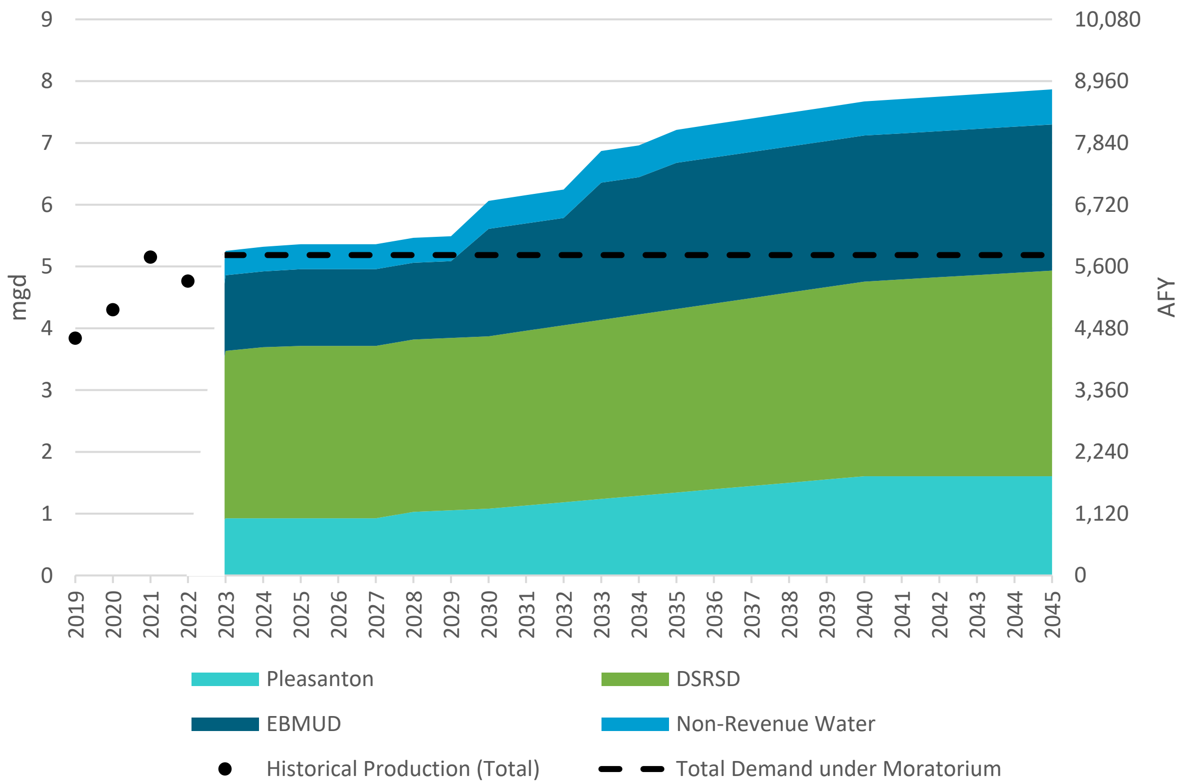

Figure 2-3. Total projected average day demand (mgd and AFY)

Even if the moratorium were lifted, demands are expected to remain relatively constant until 2030 due to the lead time required for constructing the infrastructure needed to connect new customers. Only a handful of customers are ready to connect to the existing recycled water system; beyond these, new infrastructure is needed to expand the service area.

Figure 2-4 shows the locations of new customers that would be ready to connect to the DERWA system by 2025 if supply were available, meaning that the recycled water infrastructure is already in place. The estimated demand from each of these customers is summarized in Table 2-1 (EBMUD's service area) and Table 2-2 (DSRSD's service area). The customers within EBMUD's service area include two new private developments and one redevelopment (City Village). Because City Village is being redeveloped with lower demands than before, EBMUD has agreed to serve this site under the moratorium. The sites within DSRSD's service area are generally city-owned sites (Dublin or San Ramon), some of which are currently irrigated with potable water and others that are new sites expected by 2025. Combined, these "ready to connect" customers would add about 0.1 mgd of average demand and 0.25 mgd maximum day demand to the DERWA system, with most of this demand coming from city-owned sites within DSRSD's service area.

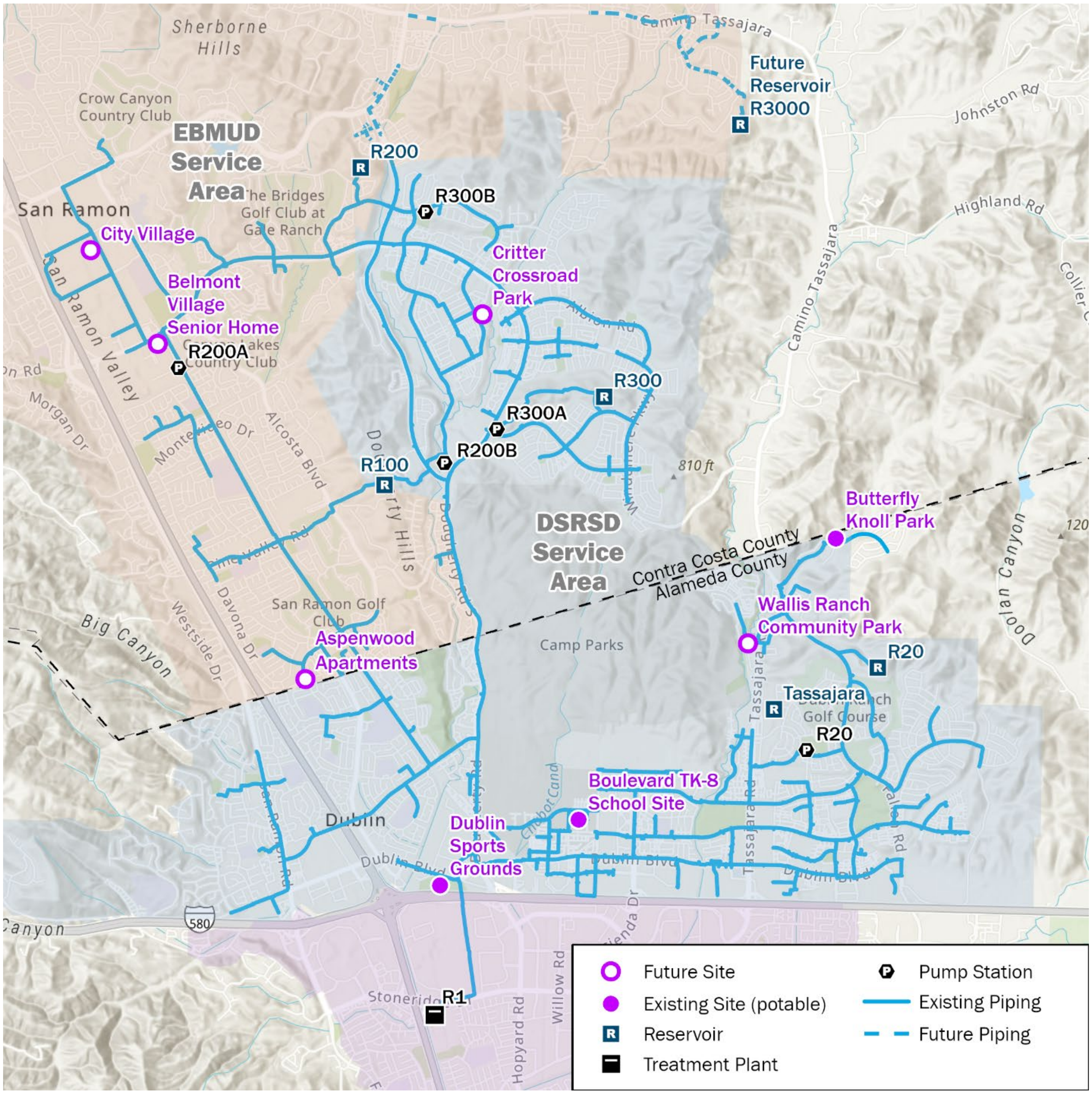

Figure 2-4. Locations of "ready to connect" customers

Table 2-1. Summary of "Ready to Connect" Customers – EBMUD Service Area				
Name	Owner	Feasible Timing for Connection	Estimated Demand, Average (mgd)	Estimated Demand, Maximum Day (mgd)
Aspenwood Apartments	Private	2025	0.000	0.001
Belmont Village Senior Home	Private	2025	0.001	0.002
City Village (redevelopment)[a]	Private	2025	0.015	0.038
Total Demand			**0.016**	**0.041**

a. *Because City Village is being redeveloped with lower demands than the former site (which has been offline since late 2021), EBMUD has agreed to serve this new site under the moratorium.*

Table 2-2. Summary of "Ready to Connect" Customers – DSRSD Service Area				
Name	**Owner**	**Feasible Timing for Connection**	**Estimated Demand, Average (mgd)**	**Estimated Demand, Maximum Day (mgd)**
Dublin Sports Grounds	City of Dublin	2024	0.043	0.11
Butterfly Knoll Park	City of Dublin	2024	0.004	0.01
Boulevard TK-8 School Site	Dublin Unified School District	2024	0.015	0.04
Wallis Ranch Community Park	City of Dublin	2025	0.008	0.02
Critter Crossroad Park	City of San Ramon	2025	0.013	0.03
Total Demand			**0.082**	**0.21**

2.3 Shortage Risk

Baseline supply and demand conditions were analyzed to understand DERWA's ability to meet current and future demands with existing supplies. Total supply and demand for the system were simulated on a daily timestep over 1 year to track the frequency and total volume of shortage over the year. The simulation evaluated a range of current and future conditions (based on the "worst case" demand profile described in Section 2.2) and included 5 million gallons (MG) of on-site storage at the recycled water plant.[1] Further details on the methodology and assumptions of the shortage analysis are included in Appendix A.

In summary, DERWA may not experience a shortage in the near term under normal conditions. However, the system could experience a shortage of approximately 1 mgd by 2025 under "worst case" demands. By 2045 (buildout), DERWA could experience a shortage as high as 6 mgd.[2] Figure 2-5 and Figure 2-6 show how adding varying amounts of supplemental supply during the peak season (April-September) would help mitigate the shortage.

Section 3 presents the supply, demand, and storage options that were considered to address the shortage.

[1] *Although the holding basins at the DSRSD WWTP have a total capacity of 20 MG, this analysis assumes that only Holding Basin 4 (capacity of 5 MG) is available to DERWA due to odor, maintenance, and other operational challenges.*

[2] *6 mgd is the maximum projected shortage at buildout, considering the "worst case" demand profile and low future supply projection. Due to uncertainty in future supply and demand, actual shortages may be less severe.*

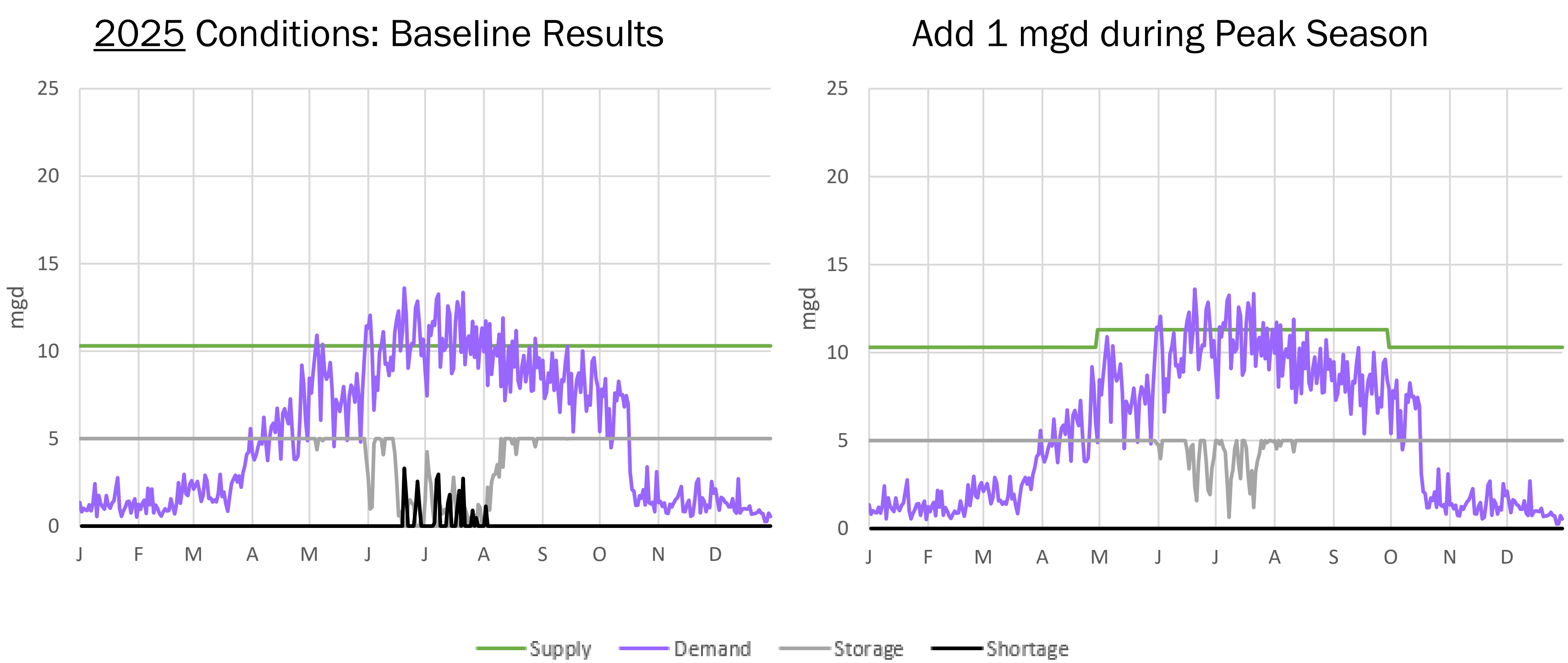

Figure 2-5. Simulated 2025 conditions ("worst case" demand profile and current average supply), with and without 1 mgd of supplemental supply

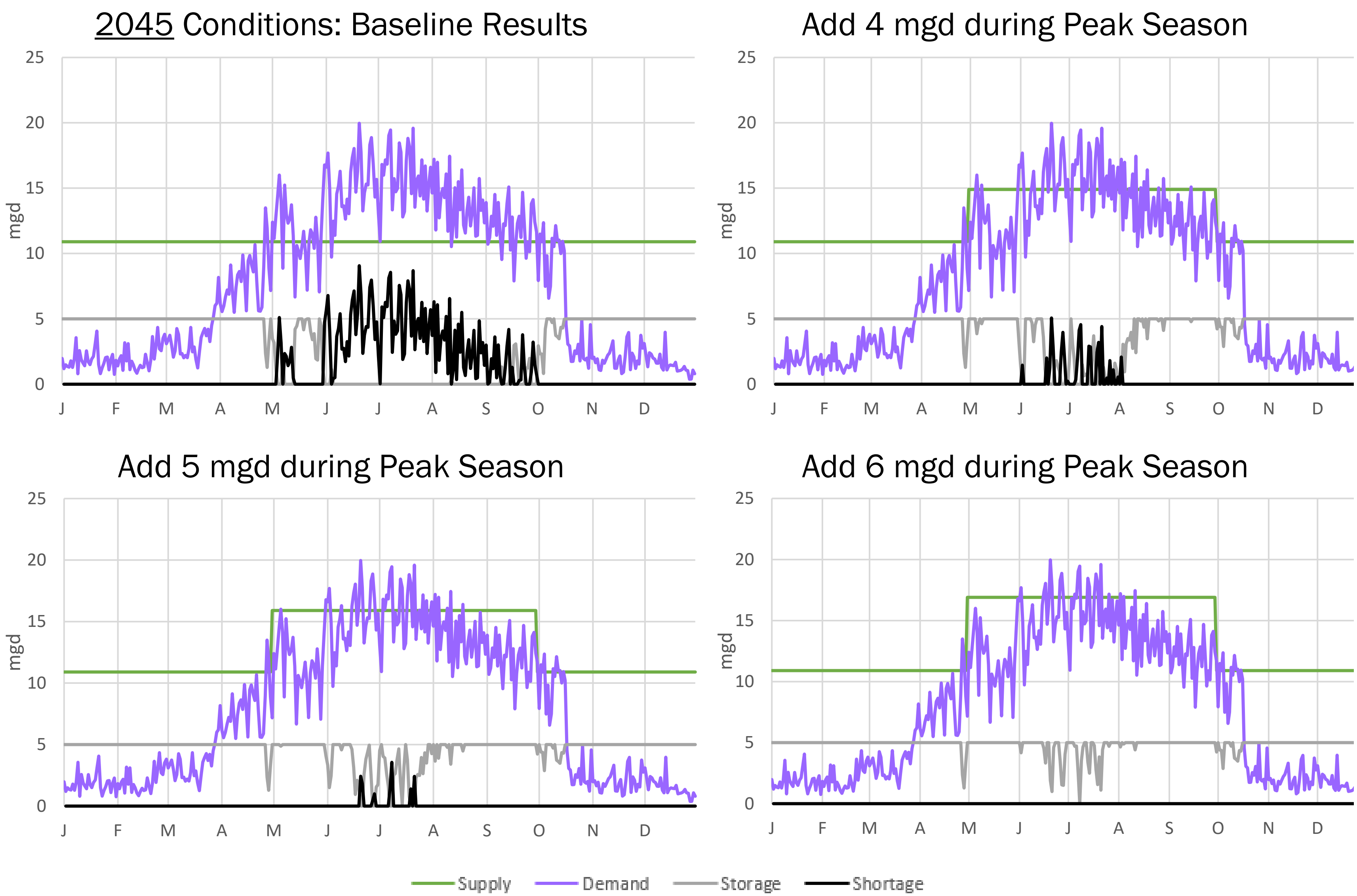

Figure 2-6. Simulated 2045 conditions ("worst case" demand profile and low supply projection), with and without supplemental supply

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Section 3

Potential Alternatives

This section describes the various options considered for filling the gap between DERWA's supply and demand, including demand management measures, storage, and supplemental supply alternatives.

3.1 Demand Management

While demand management cannot fully eliminate the projected supply shortfall at buildout, it can reduce the amount of supplemental supply needed. Demand management can also help mitigate the need for rationing and/or addition of potable water in the near term.

Initially, DERWA considered shifting irrigation days as a demand management strategy; however, this approach would not reduce overall water use since the system already has sufficient equalization storage to manage daily variation in demand. The following strategies were identified as potential ways to reduce recycled water use and are discussed further below.

- Improved water efficiency
- City recycled water budgets
- Rebates
- Water loss control

3.1.1 Improved Water Efficiency

DERWA and its member agencies already have many efforts underway to promote efficient water use. For example, advanced metering infrastructure (AMI) is installed for all DSRSD customers and the largest EBMUD customers. AMI captures real-time data and allows DERWA member agencies to send leak alerts if a customer's water use suddenly increases.

DERWA's Demand Management Working Group, which includes representatives from each of the member agencies, convenes to identify and implement new demand management measures. Many of DERWA's efforts involve coordination with customers, including the cities of Dublin and San Ramon. For example, DERWA supported Dublin in applying for and receiving grant funding to install irrigation controllers at recycled water sites.

Many of DERWA's customers already use water efficiently, as large customers have incentive to closely monitor their water use to keep their recycled water bills as low as possible. However, it is more challenging to monitor and enforce water use across many small sites, such as median strips scattered throughout Dublin and San Ramon. As discussed in the following section, establishing recycled water budgets for Dublin and San Ramon would address some of these challenges by incentivizing water use efficiency at city-owned sites.

3.1.2 City Recycled Water Budgets

Dublin and San Ramon make up about 40 percent of DERWA member agency demand. Both cities own many irrigation sites, such as parks and medians, and have expressed interest in converting additional sites to recycled water. Some city sites are "ready to connect," meaning the recycled water infrastructure is already in place and these sites could easily be switched from potable to recycled water once supply is available.

The recycled water budget concept would incentivize water use efficiency and enable connection of more city-owned sites. DERWA would assign a total amount of recycled water for each city, and water savings at existing sites could be reallocated to new sites. The cities would have flexibility in how they reduce demand to stay within the overall budget. Options include installing irrigation controllers, conducting additional site inspections (beyond DSRSD's and EBMUD's existing scheduled inspections), or implementing other best management practices.

Details of the recycled water budgets, including policies around monitoring and enforcement, would be developed by DSRSD and EBMUD in coordination with Dublin and San Ramon.

3.1.3 Rebates

DSRSD and EBMUD currently offer rebates to their potable water customers for landscape retrofits (i.e., turf replacement), irrigation controllers, and other water efficiency measures. DSRSD's rebate programs are administered by Zone 7 Water Agency (Zone 7), DSRSD's wholesale water supplier. This concept would extend the existing rebate programs to recycled water customers.

Governor Newsom recently signed Assembly Bill 1572, which prohibits the use of potable water to irrigate grass that is primarily ornamental (i.e., "non-functional turf") and not used for recreation or other functional purposes on commercial, industrial, municipal, and institutional properties. Although this ban excludes areas irrigated with recycled water, encouraging drought-tolerant landscape regardless of how a site is irrigated would provide more consistency in public messaging. Coupling rebates for turf replacement with education on how to care for drought-tolerant plants would help ensure that landscapes are well-maintained and set a positive example for other customers considering turf replacement.

DERWA member agencies would fund and administer the rebate programs within their respective service area.

3.1.4 Water Loss Control

DERWA currently observes about 10 percent water loss in the distribution system, which is a notable amount for a relatively new system. For comparison, DSRSD's potable water system typically sees losses of about 5 to 7 percent. (Note: EBMUD's potable system experiences higher losses due to the generally older pipe age.)

DERWA suspects that much of the non-revenue water is apparent water loss (e.g., due to how losses are calculated) versus real water loss. DSRSD staff are reviewing the water loss accounting to better understand the amount of real water loss and inform next steps. Once the water loss accounting is confirmed, DERWA can investigate other potential causes, such as meter accuracy, unauthorized consumption, or leakage, to determine appropriate interventions. DERWA member agencies already have water loss control programs for their potable systems and could extend best practices to reduce losses in the recycled water system, such as detecting and repairing leaks or installing equipment on hydrants to monitor unauthorized usage.

3.2 Storage

This study analyzed operational storage to equalize flow and the potential for seasonal storage to address longer-term gaps in supply and demand. The operational storage analysis is included in DERWA's Recycled Water Operations Plan (DERWA, 2024). Managing prolonged, seasonal shortages would require a substantial amount of storage—estimated at about 80 MG in the near term and 450 MG at buildout. For comparison, the existing holding basins at DSRSD's WWTP can hold about 20 MG. A 2004 memorandum of understanding between DSRSD and Zone 7 includes collaborative efforts to try to identify up to 1,200 acre-feet (AF), or about 390 MG, of recycled water storage. However, due to location constraints, options for seasonal storage are limited. DERWA considered the following above- and below-ground storage options, though ultimately screened them out for reasons described below.

- **Recycled water storage in Chain of Lakes.** The Chain of Lakes is a series of current and former gravel quarry pits that will ultimately be converted to surface water storage facilities under Zone 7 management. Zone 7 currently owns some of the lakes; however, Lakes F and G (which have been identified as suitable for recycled water storage) are still active quarry pits and may not be transitioned to Zone 7 until 2060. Early acquisition of the lakes would require negotiating with the quarry owners and operators. This alternative was not further evaluated, since the timing of converting these lakes to recycled water storage is too far off to meet DERWA's needs, and early acquisition would be costly.
- **Recycled water storage in aquifer.** An early DSRSD study evaluated various sites for groundwater injection and recovery and identified the Bernal and Amador subbasins (within the Main Basin) as most suitable. However, given that the Main Basin is used for drinking water supply, advanced treatment would be required to inject recycled water into the groundwater basin (compliant with California's regulations for groundwater replenishment using recycled water). Therefore, this is a not a feasible option for DERWA's tertiary treated supply. DSRSD, Zone 7, and other Tri-Valley agencies are separately studying the potential of groundwater recharge (for indirect potable reuse) as part of the Joint Tri-Valley Potable Reuse efforts.

3.3 Supplemental Supply

In collaboration with DERWA and its member agencies, the project team developed a comprehensive list of potential sources of supplemental supply. Several options were eliminated through an initial screening process, as summarized in Table 3-1, and confirmed by the DERWA Board at its meeting on September 25, 2023. The alternatives carried forward for evaluation are highlighted in blue and include supply from a neighboring agency, groundwater from the Fringe Basin (which is outside the bounds of the Main Basin and not used for drinking water due to its generally poorer water quality), and supplementation with potable water. Each evaluated alternative is discussed further below.

Table 3-1. Supply Alternatives Initial Screening		
Type of Supply	**Alternative**	**Screening Results and Explanation**
Raw wastewater from neighboring agency	Supply from Central Contra Costa Sanitary District	Included in evaluation (Section 4)
	Supply from Pleasanton's Ruby Hill development	**Screened out** since this alternative would provide no net supply increase to DERWA. Wastewater from Ruby Hill (treated by Livermore) is the basis for Livermore providing recycled water to Pleasanton.
Secondary effluent from neighboring agency	Supply from Livermore	Included in evaluation (Section 4)
	Supply from East Bay Dischargers Authority	Included in evaluation (Section 4)
Recycled water from neighboring agency	Supply from Livermore (to Pleasanton)	Included in evaluation (Section 4)
Stormwater	Stormwater capture and reuse	**Screened out** due to seasonality of rainfall and lack of year-to-year availability (would require substantial storage volume).
Groundwater (new or existing wells)	Drilling two new higher-yield wells in the Fringe Basin	Included in evaluation (Section 4)
	Drilling a wellfield of lower-yield wells in the Fringe Basin	Included in evaluation (Section 4)
	Drilling new wells in the Main Basin	**Screened out** due to water rights and groundwater pumping quota (GPQ) limitations and concerns around per- and polyfluoroalkyl substances (PFAS).
	Using Zone 7's existing Hopyard 7 well	**Screened out** due to water quality concerns (e.g., arsenic, PFAS) and GPQ limitations.
Potable water	Peak season potable water supplementation	Included in evaluation (Section 4)
Reverse osmosis (RO) concentrate	Treating RO concentrate from Zone 7's groundwater demineralization facility	**Screened out** due to PFAS concerns, expensive re-treatment, and unpredictable flow quantity and patterns.

3.3.1 Raw Wastewater from Central San

In 2019, DERWA and Central Contra Costa Sanitary District (Central San) executed a temporary agreement to divert a portion of Central San's raw wastewater upstream of the San Ramon Pumping Station. Under the agreement, approximately 0.7 mgd of Central San's wastewater can be diverted to DSRSD's collection system, treated at DSRSD's WWTP, and used to supplement DERWA recycled water supplies during the summer months. Construction of the diversion project was completed in 2020, and the project was successfully used during the 2021 peak irrigation season.

The initial term of the agreement is 3 years (beginning when the diversion was initiated) with the option for two 1-year extensions (i.e., through 2025). Extending the diversion beyond 2025 would require negotiating a new agreement. As summarized in Table 3-2 and shown in Figure 3-1, this alternative would explore the option for a longer-term partnership with Central San, including the potential to increase the diversion quantity to 2.7 mgd, which is the estimated flow to the San Ramon Pumping Station. Based on current operations, DERWA would need to divert either 0.7 mgd (from one pipeline, as allowed under the temporary agreement) or 2.7 mgd (the full amount from the San Ramon Pumping Station) to maintain minimum velocities in Central San's system and avoid operational disruptions. If the amount of supply diverted from Central San exceeds the quantity DERWA needs to meet recycled water demands, DERWA would be responsible for the costs associated with conveying the additional secondary effluent via the Livermore-Amador Valley Water Management Agency (LAVWMA) and disposal via East Bay Dischargers Authority (EBDA). Based on these constraints, DERWA and Central San may want to evaluate the potential to modify the diversion to allow for intermittent and/or variable flows in the future.

Table 3-2. Alternative Overview: Raw Wastewater from Central San

Raw Wastewater from Central San Longer-term diversion of wastewater from Central San's collection system (beyond current temporary agreement)	**Daily Flow:** 2.7 mgd **Peak Season Volume:** 1,200 AF[a] **Total Additional Demand Met:** 1,400 AFY at buildout (2045)[b] **Capital Cost:** <$1M[c] **O&M Cost:** $1.8M/year[c] **Total Annual Cost:** $1.8M/year[c] **Unit Cost:** $1,300/AF[c]	**BENEFITS:** Reuses wastewater otherwise discharged to San Francisco Bay and reduces nutrient loading during summer months when the risk of algal blooms in the Bay are highest. **CHALLENGES/CONSIDERATIONS:** Long-term availability is uncertain—Central San is currently exploring options to use its wastewater for other future reuse projects, including potential partnership opportunities with EBMUD. To minimize operational disruptions, diversion is intended to be consistent throughout the peak season (not variable or intermittent).

a. *"Peak season volume" is calculated as the daily flow over 150 days, assuming a constant yield. This value represents the volume theoretically available from the supplemental supply source and does not factor in recycled water demand.*

b. *"Total additional demand met" is the estimated additional recycled water demand that could be met at buildout with the addition of the supplemental supply. This includes demand met from the supplemental supply source (in peak season) plus the additional recycled water DERWA can produce in shoulder months.*

c. *Capital cost rounded up to the nearest $1M; O&M and annual cost rounded up to the nearest $100,000; unit costs rounded up to the nearest $100.*

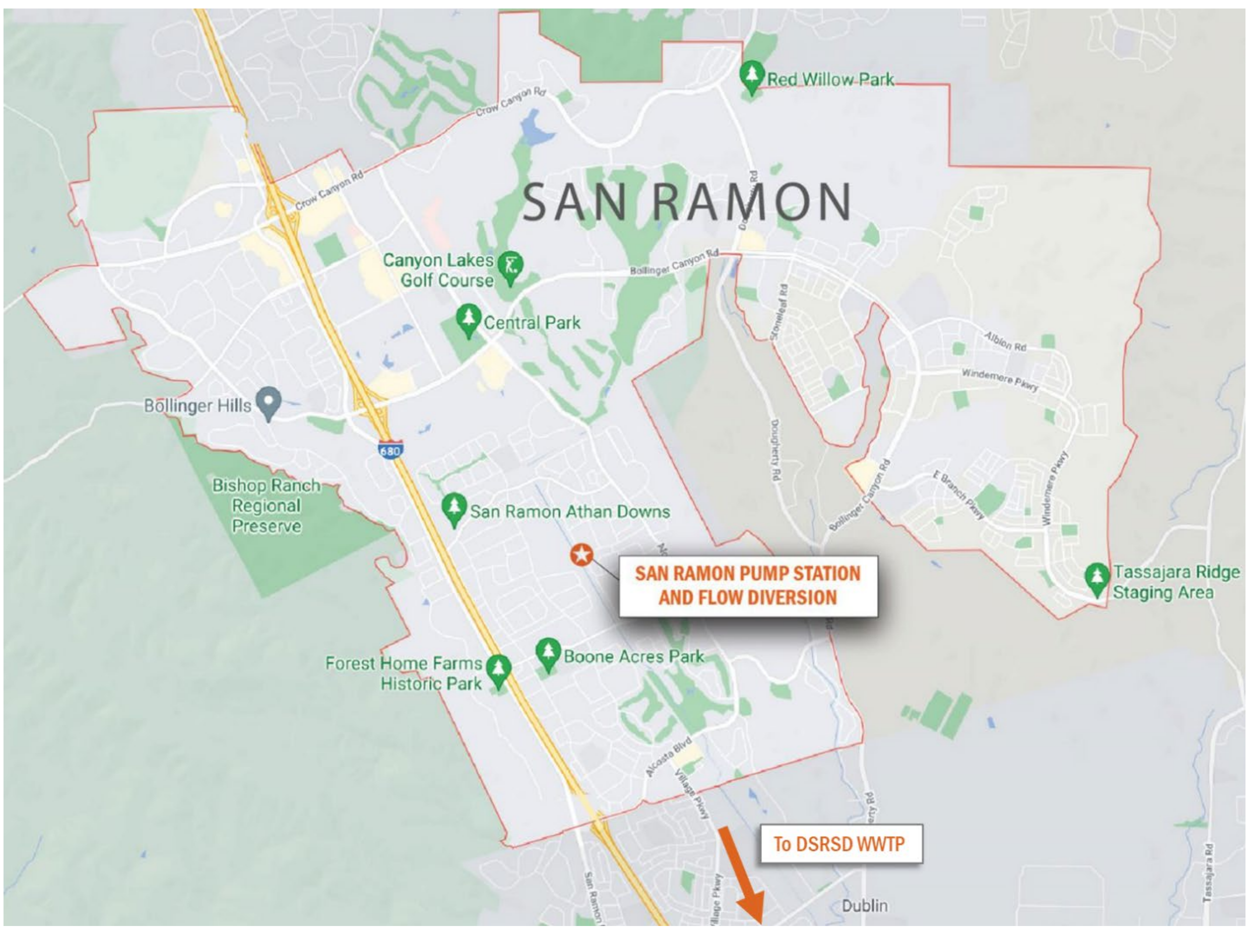

Figure 3-1. Location of raw wastewater diversion from Central San

3.3.2 Secondary Effluent from Livermore

Secondary effluent from the Livermore Water Reclamation Plant flows by gravity to the LAVWMA Export Pump Station for discharge to San Francisco Bay (via EBDA). As summarized in Table 3-3 and shown in Figure 3-2, this alternative would intercept Livermore's flow at the LAVWMA junction box and divert it to DSRSD's Holding Basin 4 for recycled water treatment. This alternative would require relatively minimal new infrastructure and not significantly impact DERWA's operations; however, long-term availability of Livermore's effluent is uncertain due to Livermore's interest in using its wastewater for other future reuse projects, such as the potential Joint Tri-Valley Potable Reuse Project. Use of Livermore effluent for DERWA would require an agreement with Livermore and would likely be on an interim basis.

Table 3-3. Alternative Overview: Secondary Effluent from Livermore

Secondary Effluent from Livermore Diversion of Livermore's secondary effluent from the LAVWMA junction box to DSRSD's WWTP	**Daily Flow:** 3 mgd **Peak Season Volume:** 1,400 AF **Total Additional Demand Met:** 1,500 AFY at buildout (2045) **Capital Cost:** $2M **O&M Cost:** $1.8M/year **Total Annual Cost:** $1.9M/year **Unit Cost:** $1,300/AF	**BENEFITS:** Requires relatively minimal infrastructure. Reduces wastewater discharges and nutrient loading to San Francisco Bay when risk of algal blooms are highest. Reduces LAVWMA pumping costs and EBDA discharge costs (for Livermore). **CHALLENGES/CONSIDERATIONS:** Long-term availability is uncertain, and any agreement would likely be on an interim basis. Livermore flows have declined due to conservation, and Livermore is currently exploring other recycled water projects that would use its wastewater effluent long term. Further evaluation of Livermore effluent water quality would also be needed.

Figure 3-2. Overview of potential diversion of Livermore's secondary effluent to DERWA

3.3.3 Secondary Effluent from EBDA

EBDA is a joint powers authority comprised of five member agencies that discharge treated wastewater effluent to the San Francisco Bay. EBDA also provides service by contract to LAVWMA to discharge effluent originating from DSRSD's WWTP and the Livermore Water Reclamation Plant.

As summarized in Table 3-4 and shown in Figure 3-3, this alternative would involve diverting secondary effluent from EBDA's Marina Dechlorination Facility and pumping it back inland to DSRSD's WWTP for recycled water treatment. This alternative would only be considered if Livermore's effluent is fully reused and therefore no longer exported. Diverting effluent from EBDA would require a new pump station and 15-mile pipeline (parallel to the existing LAVWMA pipeline) to convey the flow eastward to the crest of the hill. DERWA could explore using LAVWMA's existing pipeline to convey the effluent via gravity from the crest of the hill back to the LAVWMA export facilities. However, bidirectional use of the existing LAVWMA line would present significant operational challenges and require close coordination with LAVWMA.

Table 3-4. Alternative Overview: Secondary Effluent from EBDA

Secondary Effluent from EBDA Pumping secondary effluent from EBDA's Marina Dechlorination Facility inland to DSRSD's WWTP	**Daily Flow:** Up to 6 mgd (sufficient volume to address shortage) **Peak Season Volume:** Up to 2,800 AF **Total Additional Demand Met:** 3,000 AFY at buildout (2045) **Capital Cost:** $112M **O&M Cost:** $5.0M/year **Total Annual Cost:** $12.2M/year **Unit Cost:** $4,100/AF at 6 mgd ($5,600 at 3 mgd)	BENEFITS: Uses treated wastewater effluent otherwise discharged to San Francisco Bay. This is the only alternative that could provide enough supply to address the full shortage. CHALLENGES/CONSIDERATIONS: Most expensive alternative by a wide margin (capital cost of $110M+, with unit cost greater than most potable water supply projects that EBMUD and DSRSD are considering). This alternative also poses significant institutional issues and potential constructability challenges, as the new pipeline would pass through developed areas.

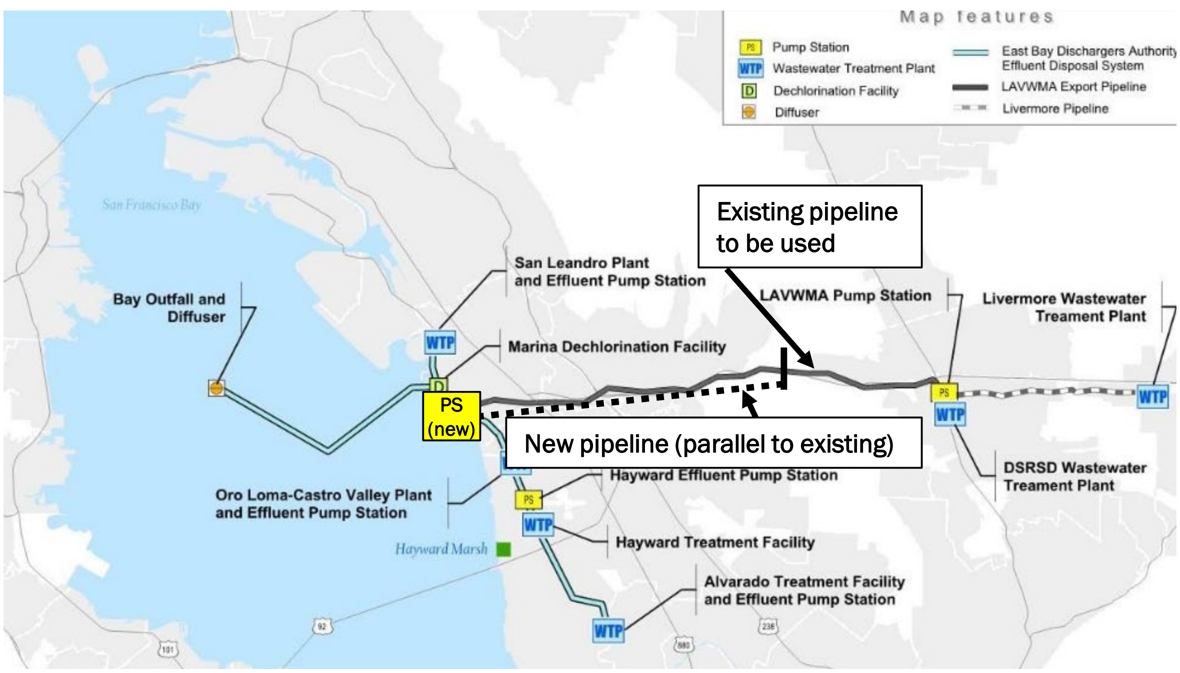

Figure 3-3. Overview of new infrastructure required for EBDA alternative

3.3.4 Recycled Water from Livermore to Pleasanton

Livermore and Pleasanton currently have an agreement under which Livermore provides recycled water to Pleasanton in the El Charro vicinity in an amount corresponding to the Ruby Hill development's projected wastewater discharges at buildout. As summarized in Table 3-5 and shown in Figure 3-4, this alternative would involve increasing the amount of recycled water that Livermore provides Pleasanton, thus reducing Pleasanton's supply from DERWA. The offset DERWA recycled water supply could be used to serve new DERWA customers. Livermore's recycled water charges are currently higher than DERWA's recycled water rate; therefore, any arrangement would also need to account for the difference in recycled water rates.

Table 3-5. Alternative Overview: Recycled Water from Livermore to Pleasanton		
Recycled Water from Livermore to Pleasanton Increased delivery of recycled water from Livermore to Pleasanton to reduce Pleasanton's use of DERWA supply	**Daily Flow:** 1 mgd **Peak Season Volume:** 500 AF **Total Additional Demand Met:** 600 AFY at buildout (2045) **Capital Cost:** <$1M **O&M Cost:** $0.7M/year **Total Annual Cost:** $0.8M/year **Unit Cost:** $1,300/AF	**BENEFITS:** Alternative could be implemented in the near term with minimal system modifications. Reduces wastewater discharges and nutrient loading to San Francisco Bay. **CHALLENGES/CONSIDERATIONS:** Long-term availability is uncertain, as Livermore is exploring other recycled water projects that would use its wastewater effluent. Near-term, expanded delivery to Pleasanton may be limited by Livermore's current treatment capacity, staff availability, and size of the turnout.

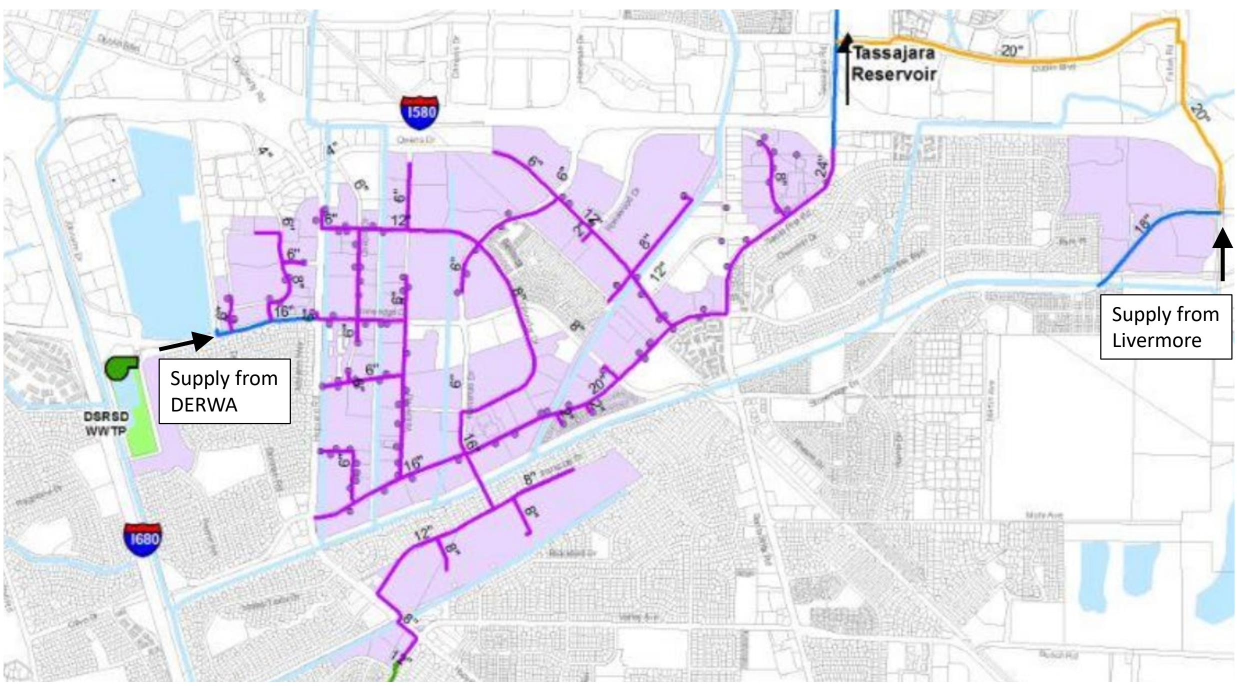

Figure 3-4. Overview of Pleasanton's recycled water system

Source: Pleasanton 2020 Urban Water Management Plan

Based on preliminary hydraulic modeling, Livermore's system has sufficient head to fill Tassajara Reservoir and supply Pleasanton's demands; however, the amount of recycled water that Livermore can supply to Pleasanton may be limited by other factors. Additionally, as discussed in DERWA's Recycled Water Operations Plan, this alternative could result in lower pressures for Pleasanton customers currently served by Livermore (DERWA, 2024). While the reduced pressures would still be acceptable based on standard criteria, this pressure change should be discussed with these customers before implementing this alternative. Water quality will also need to be considered for customers who would be receiving recycled water from a new or blended source.

3.3.5 Fringe Basin Wells (Higher Yield)

Prior to the mid-1960s, DSRSD operated groundwater wells at and around the DSRSD office. These wells were abandoned when DSRSD began purchasing higher-quality water from Zone 7. Although the Fringe Basin is less productive and has lower-quality groundwater than the Main Basin, Fringe Basin groundwater may be sufficient for non-potable uses. DERWA has explored using groundwater from the Fringe Basin to supplement recycled water supply in summer months. Past groundwater studies evaluated multiple potential well locations and indicated that the DSRSD office and WWTP sites have the highest potential yield among the locations evaluated (on DSRSD- or EBMUD-owned property).

As shown in Table 3-6 and Figure 3-5, this alternative would involve constructing two Fringe Basin wells—one 1,000-gallons-per-minute (gpm) well at the DSRSD office and one 600-gpm well at the DSRSD WWTP—to supplement recycled water supply in summer months. Further investigation is needed to confirm feasible yield and water quality at these locations.

Table 3-6. Alternative Overview: Fringe Basin Wells (Higher Yield)		
Fringe Basin Wells (Higher Yield) Installation of two new wells in the Fringe Basin (near DSRSD's Office and WWTP)	**Daily Flow:** 2.3 mgd (one 1,000-gpm well and one 600-gpm well) **Peak Season Volume:** 1,100 AFY **Total Additional Demand Met:** 1,200 AFY at buildout (2045) **Capital Cost:** $12M **O&M Cost:** $1.9M/year **Total Annual Cost:** $2.7M/year **Unit Cost:** $2,300/AF	BENEFITS: Proposed well locations are highest production areas historically found in the Fringe Basin and located on DSRSD-owned land. Wells can be operated to match DERWA's peak summer demands. CHALLENGES/CONSIDERATIONS: Water quality and yield are uncertain. Requires additional investigation and coordination with Zone 7 (the Groundwater Sustainability Agency) to identify and fully understand requirements for operating wells in the Fringe Basin. Additionally, operation and maintenance of new wells would increase staff workload.

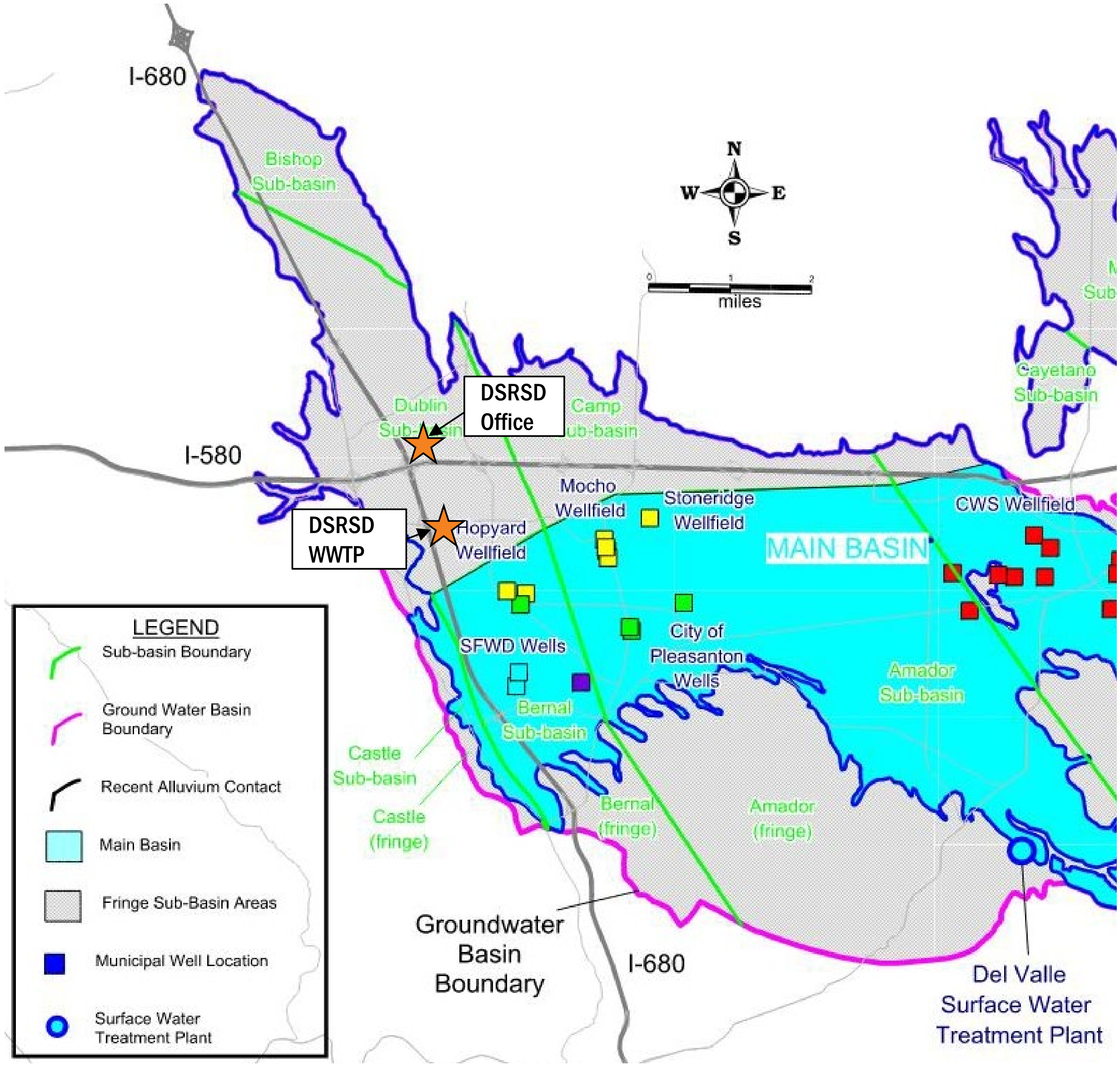

Figure 3-5. Potential DERWA well locations

Source: Zone 7's 2005 Groundwater Management Plan.

3.3.6 Fringe Basin Wells (Lower Yield)

As summarized in Table 3-7, this alternative assumes that DERWA would install additional wells in the Fringe Basin after higher-yield well locations have been exhausted. Based on prior studies, it is assumed that these lower-yield wells could have a production rate of approximately 230 gpm. At this production rate, seven wells would be needed to match the total yield of the higher-yield well alternative (as assumed in the preliminary cost estimates). Further field testing would be needed to confirm actual number, location, and cost of wells.

Table 3-7. Alternative Overview: Fringe Basin Wells (Lower Yield)

Fringe Basin Wells (Lower Yield) Installation of new wellfield in the Fringe Basin (after higher-yield well locations have been exhausted)	**Daily Flow:** 2.3 mgd (assumes 7 wells at 230 gpm) **Peak Season Volume:** 1,100 AFY **Total Additional Demand Met:** 1,200 AFY at buildout (2045) **Capital Cost:** $39M **O&M Cost:** $2.0M/year **Total Annual Cost:** $4.5M/year **Unit Cost:** $3,900/AF	**BENEFITS:** Wells can be operated to match DERWA's peak summer demands. **CHALLENGES/CONSIDERATIONS:** Water quality and yield are uncertain. Would require additional investigation and coordination with Zone 7 (the Groundwater Sustainability Agency) to identify and fully understand requirements for operating wells in the Fringe Basin. Operating and maintaining a wellfield would require significant staffing resources.

3.3.7 Peak Season Potable Water Supplementation

The DERWA system has several potable supply connections that can be used in an emergency condition. Details on these connections, including location, capacity, and limitations, are summarized in DERWA's Recycled Water Operations Plan (DERWA, 2024). Each of these connections is only intended to be used for brief periods and in non-drought conditions.

Use of potable water as a longer-term supply alternative would require a policy change to allow broader use of potable supplementation when demand exceeds supply. Based on feedback from the DERWA Board, it is assumed that potable supplementation would only be allowed in non-drought conditions. Additionally, this alternative would require new infrastructure designed for more sustained use. Assuming that potable water from Pleasanton would be unavailable (due to Pleasanton's potable supply limitations in the peak season), this alternative would supplement the DERWA system with potable water from EBMUD or DSRSD.

Currently, EBMUD can add potable water (from a nearby hydrant) to DERWA's Reservoir R100 via a temporary pipeline and booster pump. As summarized in Table 3-8 and shown in Figure 3-6, costs for this alternative include a new permanent pipeline and pump station to connect EBMUD's hydrant to R100, as well as a new 0.5-mile pipeline to connect DSRSD's potable system to R100. This new infrastructure would allow for potable water to be supplied by either agency, as decided by the DERWA member agencies and considering any potential water rights issues. Further analysis is needed to determine whether both of these permanent connections are needed. If DERWA decides to draw potable water from only one agency (DSRSD or EBMUD), the capital cost would be lower.

Table 3-8. Alternative Overview: Peak Season Potable Water Supplementation

Peak Season Potable Water Supplementation Addition of potable water from EBMUD or DSRSD into DERWA's distribution system during shortage	**Daily Flow:** 3 mgd **Peak Season Volume:** 1,400 AFY **Total Additional Demand Met:** 1,100 AFY at buildout (2045) [a] **Capital Cost:** $4M **O&M Cost:** $2.5M/year **Total Annual Cost:** $2.7M/year **Unit Cost:** $2,500/AF	**BENEFITS:** Offers flexibility to add potable water only as needed to address peak season shortages. **CHALLENGES/CONSIDERATIONS:** Potential challenges with public messaging. Requires determining which agency provides the potable water to address potential water rights issues. Supply is not available during drought conditions.

a. Excludes demand met with potable water.

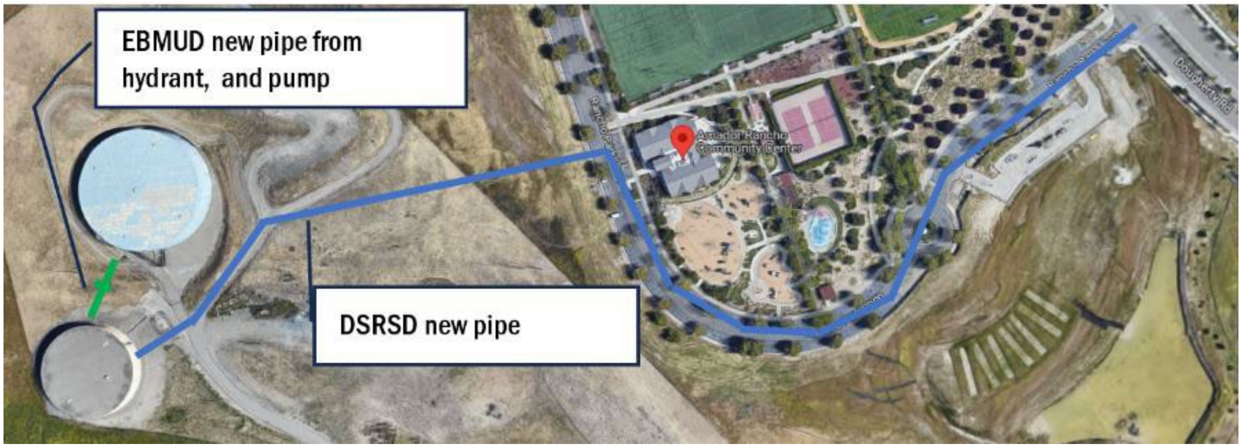

Figure 3-6. Overview of infrastructure required for longer-term addition of potable water at Reservoir R100

With Board approval, DERWA could leverage its existing potable connections to augment supply with potable water for temporary periods if demand exceeds supply in non-drought years. While not a long-term solution, this could provide a near-term backstop without DERWA needing to construct new permanent infrastructure. Use of the existing connections would be limited by the capacity and operational constraints as detailed in DERWA's Recycled Water Operations Plan.

Section 4

Alternatives Evaluation

This section describes the process and outcomes of evaluating the seven supplemental supply alternatives that advanced through the initial screening described in Section 3.3. Further details on the evaluation assumptions and methodology are presented in Appendix B.

Note: The evaluation of benefits and costs described below is focused on supply alternatives with the assumption that DERWA will continue to explore the recommended demand management strategies presented in Section 3.1. Details of specific demand management measures, including cost of implementation and estimated demand reductions, will need to be further defined by DERWA member agencies.

4.1 Evaluation Overview

The approach for evaluating the seven supply alternatives involved a multi-criteria decision support process intended to aid in prioritizing alternatives to include in the roadmap (Section 5). In summary, the evaluation included three steps:

1. **Evaluation of benefits.** Benefits were evaluated using criteria and weightings that were discussed and confirmed with DERWA staff. Evaluation criteria are framed as benefits (i.e., the higher the score, the greater the benefit) and result in an aggregate “relative benefit” score for each alternative.
2. **Development of cost estimates.** Preliminary capital, operations and maintenance (O&M), and unit costs were developed for each alternative. Cost assumptions are included in Appendix C.
3. **Comparison of benefits and costs.** Considering costs and benefits together facilitates decision making and understanding the tradeoffs among alternatives.

4.2 Evaluation Criteria

Eight evaluation criteria were used to differentiate and prioritize the supply alternatives, as shown in Table 4-1. All criteria were evaluated qualitatively, except for “ability to meet demand at buildout,” which was quantified in AFY. Details on criteria weighting and the qualitative and quantitative scores are provided in Appendix B.

Table 4-1. Evaluation Criteria			
Criteria	**Description**	**Quantitative**	**Qualitative**
Ability to Meet Demand at Buildout	Volume of additional demand (in AFY) that can be met in 2045, based on projected supply and demand. Includes estimated supply used from the alternative source (during the peak season) plus additional recycled water that DERWA could produce in the shoulder months. [a]	✓	
Regulatory Feasibility	Complexity of known/anticipated regulatory requirements. Ease of securing permits for construction and ongoing operations.		✓
Technical Feasibility and Supply Certainty	Feasibility of design, construction, and operation from a technical/engineering standpoint.		✓
Institutional Complexity	Ease of implementation and operation from an institutional standpoint (e.g., willingness of external partners).		✓
DERWA Control	Local or regional (non-imported) supply source or conveyance.		✓
Stakeholder Support	Anticipated level of support from local leaders/NGOs and the public.		✓
Water Quality	Ability to improve delivered water quality, reduce odor, maintain residual chlorine, and avoid sources contaminated with CECs (e.g., PFAS).		✓
Impact on Staff	Anticipated changes to workload for DERWA, DSRSD, or EBMUD staff.		✓

a. Augmenting supply in the peak season would enable expansion of the recycled water program year-round; therefore, this criterion reflects the overall expected benefit from the alternative (i.e., total additional demand that can be met in a year).

NGO = non-governmental organization

CEC = contaminants of emerging concern

As reflected in the "ability to meet demand at buildout" criterion, the amount of supply varies for each alternative. Table 4-2 summarizes the estimated flow (in mgd) available from each supply source during the peak season. Secondary effluent from EBDA is the only alternative with sufficient supply to fully address the anticipated shortage at buildout (6 mgd); however, other alternatives could be implemented in tandem to address larger shortages.

While the shortage risk described in Section 2.3 represents the maximum expected shortage under "worst case" conditions, DERWA will likely not experience shortage to this degree every year, or even throughout the full peak season; therefore, DERWA may not need to use the full amount of supply available from each alternative. To minimize waste and the need to discharge excess effluent to the Bay, there is benefit to augmenting supply only as needed.

Table 4-2. Estimated Supply Available from Each Alternative	
Alternative	**Supply (mgd)**
Raw wastewater from Central San	2.7
Secondary effluent from Livermore	2 to 3
Secondary effluent from EBDA	Up to 6 (i.e., the maximum shortage at buildout)
Recycled water from Livermore to Pleasanton	1
Fringe basin wells (higher yield)	2.3 (assumes 2 wells)
Fringe basin wells (lower yield)	2.3 (assumes 7 wells)
Peak season potable water supplementation	3 (with infrastructure improvements)

4.3 Evaluation Results

Results in this section are presented as benefit scores, estimated costs, and combined benefits and costs.

4.3.1 Benefit Scores

Figure 4-1 shows relative benefit of the seven supply alternatives, in ranked order, based on ability to meet demand at buildout and other qualitative benefits combined. Detailed scoring for all criteria is included in Appendix B. Scores are normalized and intended for relative comparison.

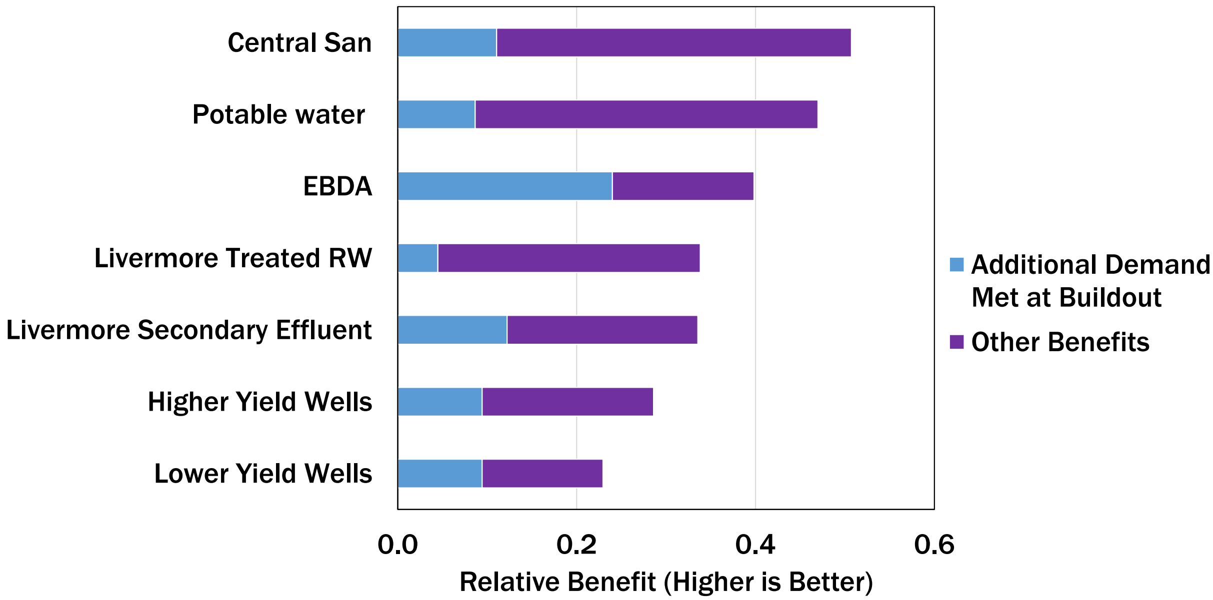

Figure 4-1. Relative benefit scores of each alternative

Note: For the potable water alternative, "additional demand met" refers to additional demand met with recycled (non-potable) water.

4.3.2 Costs

Cost metrics used in the evaluation include capital, annual O&M, and unit costs.

Figure 4-2 shows the estimated capital costs of each alternative and depicts the expected accuracy range associated with Class 5 cost estimates (-50% to +100%). Details on the capital costs and associated markups/contingencies are provided in Appendix C.

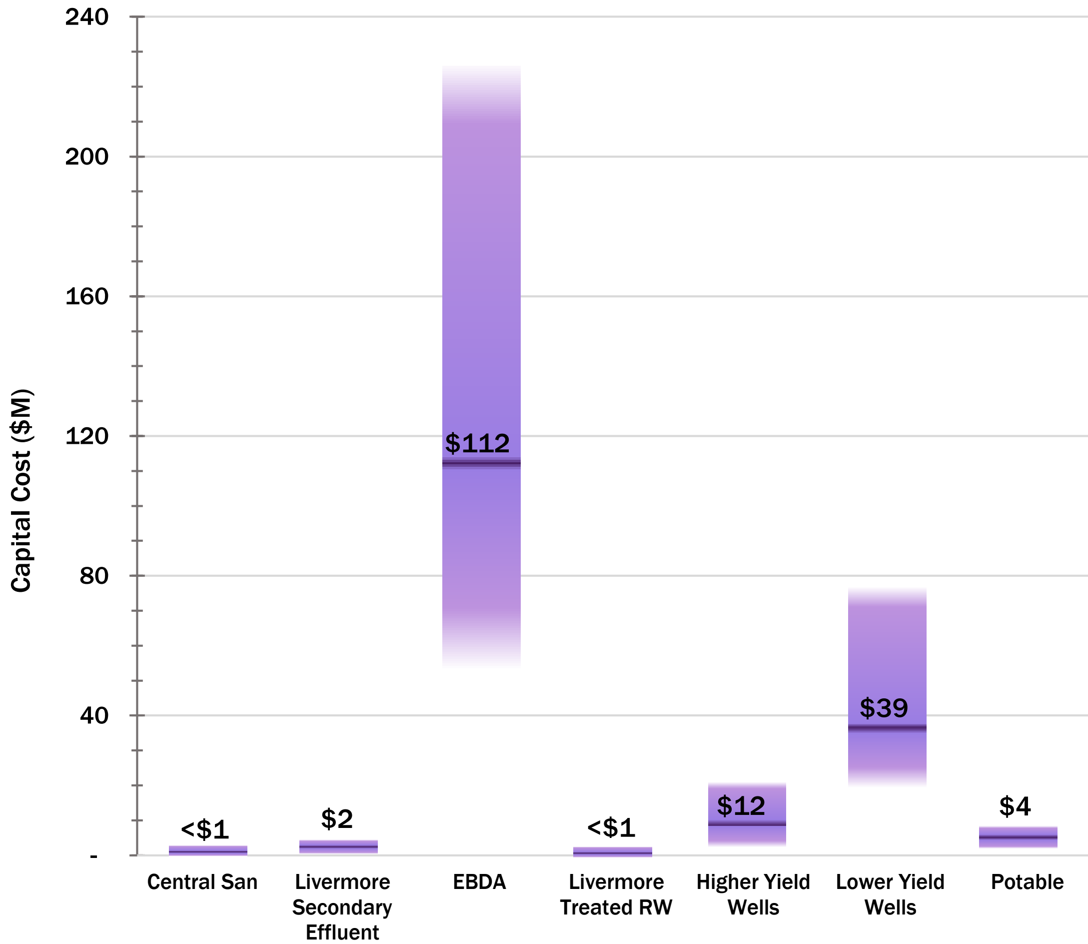

Figure 4-2. Capital cost estimates and ranges for each alternative

Figure 4-3 shows the estimated annual O&M cost of each alternative. Cost assumptions are further detailed in Appendix C.

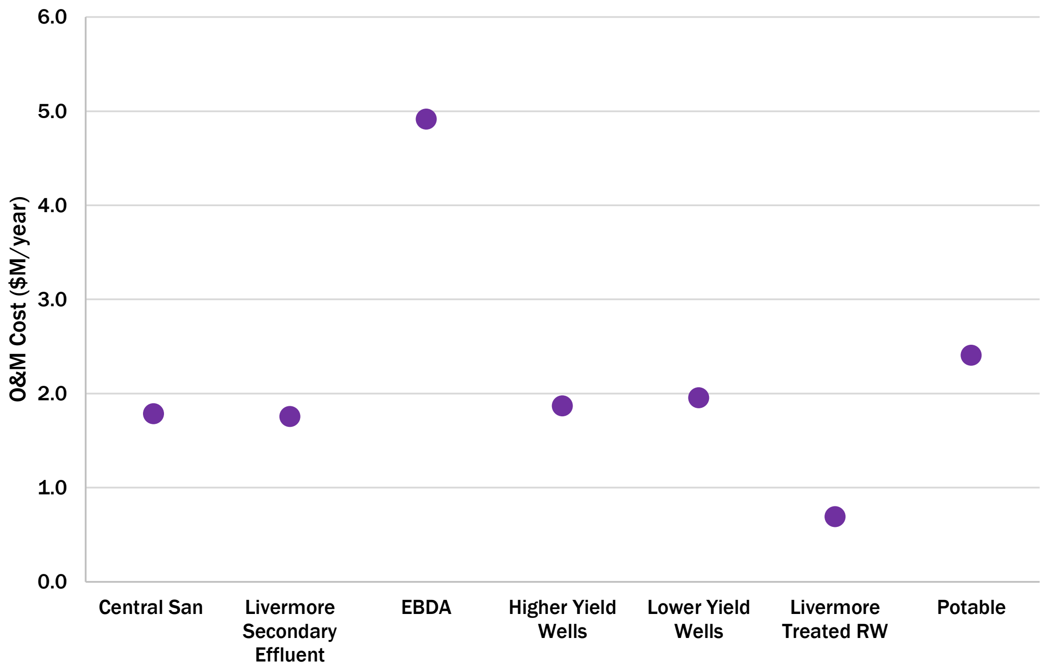

Figure 4-3. Estimated annual O&M costs for each alternative

Table 4-3 presents the total annual cost, additional demand met, and unit cost for each alternative. The total annual cost is the sum of the annualized capital cost (assuming 5 percent interest over 30 years) and the annual O&M cost. "Additional demand met" includes the demand met from the supplemental supply in peak season plus the additional recycled water that can be produced by DERWA in shoulder months. This demand is estimated using future projections (built on the 2021 demand curve as a "worst case" profile) and is only intended to be used for comparative purposes. Though actual demand met would vary based on customer water use and other conditions at the time the supplemental supply is introduced, alternatives with a higher "additional demand met" are generally expected to yield a greater amount of supply.

Table 4-3. Summary of Unit Costs for Additional Demand Met

Alternative	Total Annual Cost ($ millions per year)[a]	Additional Demand Met (AF)	Unit Cost ($/AF)[a]
Raw Wastewater from Central San	$1.8	1,400	$1,300
Secondary Effluent from Livermore	$1.9	1,500	$1,300
Secondary Effluent from EBDA (6 mgd)	$12.2	3,000	$4,100
Treated Recycled Water from Livermore	$0.8	600	$1,300
Non-Potable Water from Fringe Basin Wells (Higher Yield)	$2.7	1,200	$2,300
Non-Potable Water from Fringe Basin Wells (Lower Yield)	$4.5	1,200	$3,900
Peak Season Potable Water Supplementation	$2.7	1,100[b]	$2,500

a. Annual costs rounded up to the nearest $100,000; unit costs rounded up to the nearest $100.

b. Additional demand met with recycled water (excludes potable supply).

4.3.3 Combined Benefits and Costs

Figure 4-4 shows the relative benefit scores versus estimated unit costs for each alternative. Optimal results are closest to the top-left corner of the chart, as indicated by the star (highest benefit and lowest cost). The Central San and Livermore alternatives would add minimal cost beyond DERWA's current treatment cost, which is approximately $1,200/AF.

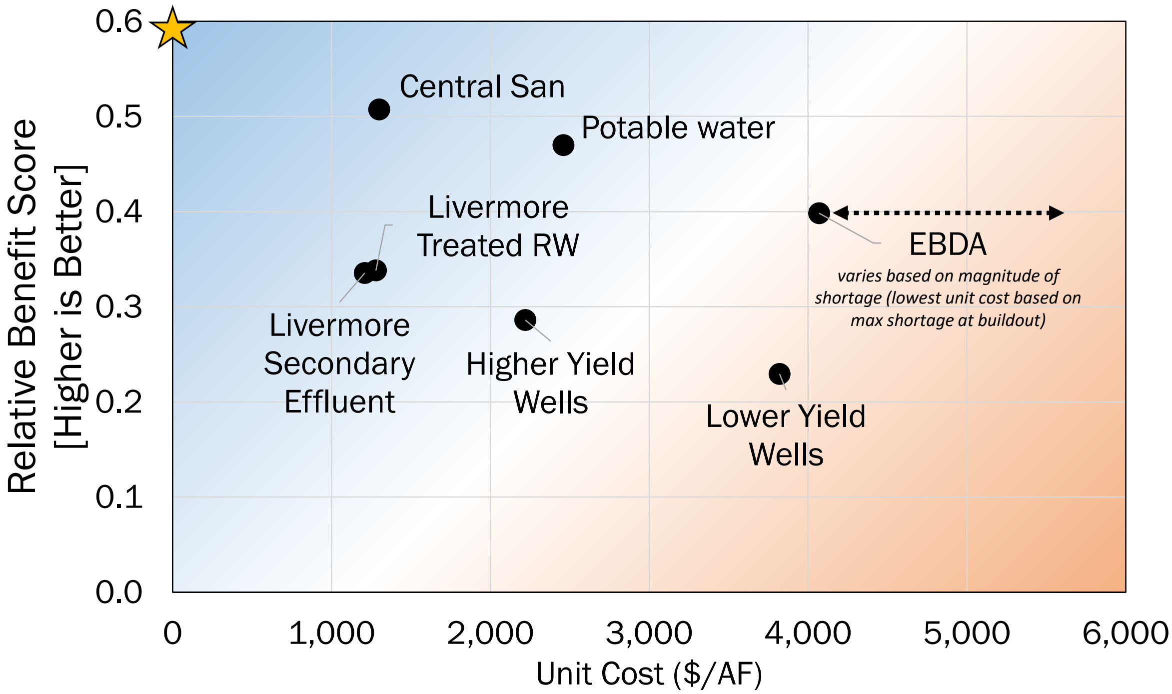

Figure 4-4. Benefit score and unit cost for each alternative

Unit costs are based on the additional demand met at the maximum assumed yield of the supplemental supply. At lower flows, the unit cost will increase. For example, if the EBDA alternative were designed to deliver 3 mgd (instead of 6 mgd) based on DERWA's interim supply need, the unit cost would be higher ($5,600/AF).

4.4 Summary

Based on results of the evaluation and feedback from the DERWA Board provided at its meeting on September 25, 2023, a combination of demand management, wastewater from neighboring agencies (Central San or Livermore), and potable water are the most feasible options for mitigating shortage. Although the DERWA Board is not interested in supplementing the system with potable water during drought years, potable water could serve as a backstop when demand exceeds supply in non-drought years.

While a long-term arrangement with a neighboring agency would be the most preferred option due to high benefit and low cost, both Central San and Livermore are planning to reserve their wastewater for other future reuse projects, which makes the long-term feasibility of these alternatives uncertain. Central San discharges notably more effluent than Livermore; Central San discharges about 35 mgd of effluent on average, while Livermore discharges less than 5 mgd on average. Therefore, while not guaranteed, there is greater potential to divert flow from Central San, and any agreement with Livermore would likely be on an interim basis.

While groundwater remains an option, it is not preferred due to its operational implications. Between the groundwater alternatives, DERWA's preference would be for fewer, higher-yield wells, with a wellfield of lower-yield wells as a backup option.

Lastly, while EBDA is the only alternative that could meet the full shortage at buildout, it is also the most expensive. The EBDA alternative is more expensive than most potable water supply projects that EBMUD and DSRSD are considering, which makes it an unrealistic option in the near term. Although the DERWA Board does not want to fully rule out any alternatives, the EBDA alternative would only be considered if all other options are exhausted.

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Section 5

Roadmap for Expansion

This section presents a roadmap for expanding the DERWA program and incorporating the preferred supply alternatives and demand management measures from Section 4. Based on the timing of future demands and associated potential supply shortfall, the roadmap is divided into three phases, with checkpoints in 2025, 2030, and 2045. Each pathway includes triggers and decision points for connecting new customers, based on DERWA's ability to secure new supply and/or reduce demand to address the following anticipated shortages:

- Up to 1 mgd by 2025
- Up to 2 mgd by 2030
- Up to 6 mgd by 2045

The anticipated shortages are based on projected peak season supply and demand assuming the "worst case" demand profile. While actual supply and demand may vary, the options presented in the roadmap are designed to help DERWA minimize the risk of shortage and confidently connect new customers without impacting existing customers.

5.1 Near-term Actions

Nearly all alternatives presented in the roadmap require some lead time to implement; therefore, it is prudent that DERWA consider near-term policy changes related to shortage response in case a shortage occurs before the proposed supply augmentation and demand management measures are in place. Additionally, planning activities for potential future alternatives can continue in parallel to make progress toward longer-term options as near-term actions are implemented.

5.1.1 Policy Changes

While DERWA may not experience a supply shortfall in an average year, establishing policies for rationing in drought years and potable supplementation in non-drought years would provide a backstop and streamline DERWA's shortage response. Supplementing the system with potable water through existing potable connections (for temporary periods) could enable service continuity without demand cutbacks; however, to avoid sending mixed messages to the public, DERWA would only consider potable supplementation in non-drought years when there are no other restrictions on potable supply.

If demand exceeds supply in a drought year, customer rationing may be needed. Although recycled water has historically been marketed as a "drought-proof" supply, it is not fully drought-proof, and many agencies are now messaging recycled water as "drought-resilient." Having a policy and communication plan in place would enable DERWA and its member agencies to call for rationing if needed without causing confusion for customers.

5.1.2 Planning Efforts

Early planning activities can lay the groundwork for potential future alternatives and inform next steps. The following low-cost activities will help DERWA gather more information needed to make decisions on longer-term alternatives.

- **Continue negotiations for a long-term agreement with Central San.** Although DERWA can divert raw wastewater from Central San through 2025, a longer-term diversion (or diverting a greater amount of wastewater) requires a new agreement. Even if Central San is not able to commit to a permanent agreement at this time, creating a new temporary agreement would keep the Central San alternative as an option past 2025. Additionally, DERWA and Central San may want to evaluate the potential to modify the diversion to allow for intermittent and/or variable flows.
- **Pilot Livermore sending more recycled water to Pleasanton.** This alternative can likely be implemented—at least to some degree—with existing infrastructure. Pilot testing this alternative would inform feasibility and, if successful, provide benefit to both agencies (by freeing up supply for DERWA and reducing Livermore's effluent disposal costs through LAVWMA/EBDA). Although any arrangement with Livermore would likely be on an interim basis due to lack of future supply availability, this alternative could serve as a temporary solution while longer-term alternatives are designed and constructed.
- **Collaborate with Zone 7 on groundwater exploration, including a potential test well.** As the groundwater basin manager, Zone 7 is currently updating its groundwater model and well master plan. While these efforts are focused on the Main Basin, Zone 7 has expressed willingness to collaborate and could work with DERWA to explore use of the Fringe Basin as a non-potable supply, which would offset potable demand and provide regional benefit. Because potential yield and water quality from the Fringe Basin are uncertain, a test well would be necessary to gather more data before a groundwater alternative could move forward.

5.2 Roadmap to 2025 (1 mgd)

Absent the moratorium, DERWA's projected supply shortfall could be up to 1 mgd by 2025. This shortfall accounts for current shortage risk plus the expected additional demand from the "ready to connect" customers described in Section 2.2. Under current conditions, diverting raw wastewater from Central San (~0.7 mgd as allowed under the temporary agreement) would likely eliminate the shortage under "worst case" conditions (e.g., as observed in 2021). However, the "ready to connect" customers could increase DERWA's maximum day demand by about 0.3 mgd. Most of this additional demand would come from city-owned sites within DSRSD's service area. Therefore, by establishing recycled water budgets for Dublin and San Ramon as described in Section 3.1.2, DERWA could connect these new customers without a net increase in demand.

As shown in Figure 5-1, the roadmap to 2025 includes a combination of demand management (0.3 mgd to offset the additional demand from "ready to connect" customers) and raw wastewater from Central San (0.7 mgd to address the remaining supply shortfall). Although these measures are expected to mitigate shortage risk in the near term, it would be prudent for DERWA to develop policies around rationing (drought years) and potable supplementation (non-drought years) as a backstop in case the shortage is greater than anticipated.

Adding the "ready to connect" customers by 2025 is contingent on the following triggers occurring in 2024:

- Establishing recycled water budgets for Dublin and San Ramon
- Approving policies to enable rationing and potable supplementation (if needed)
- Extending the temporary agreement with Central San through 2025

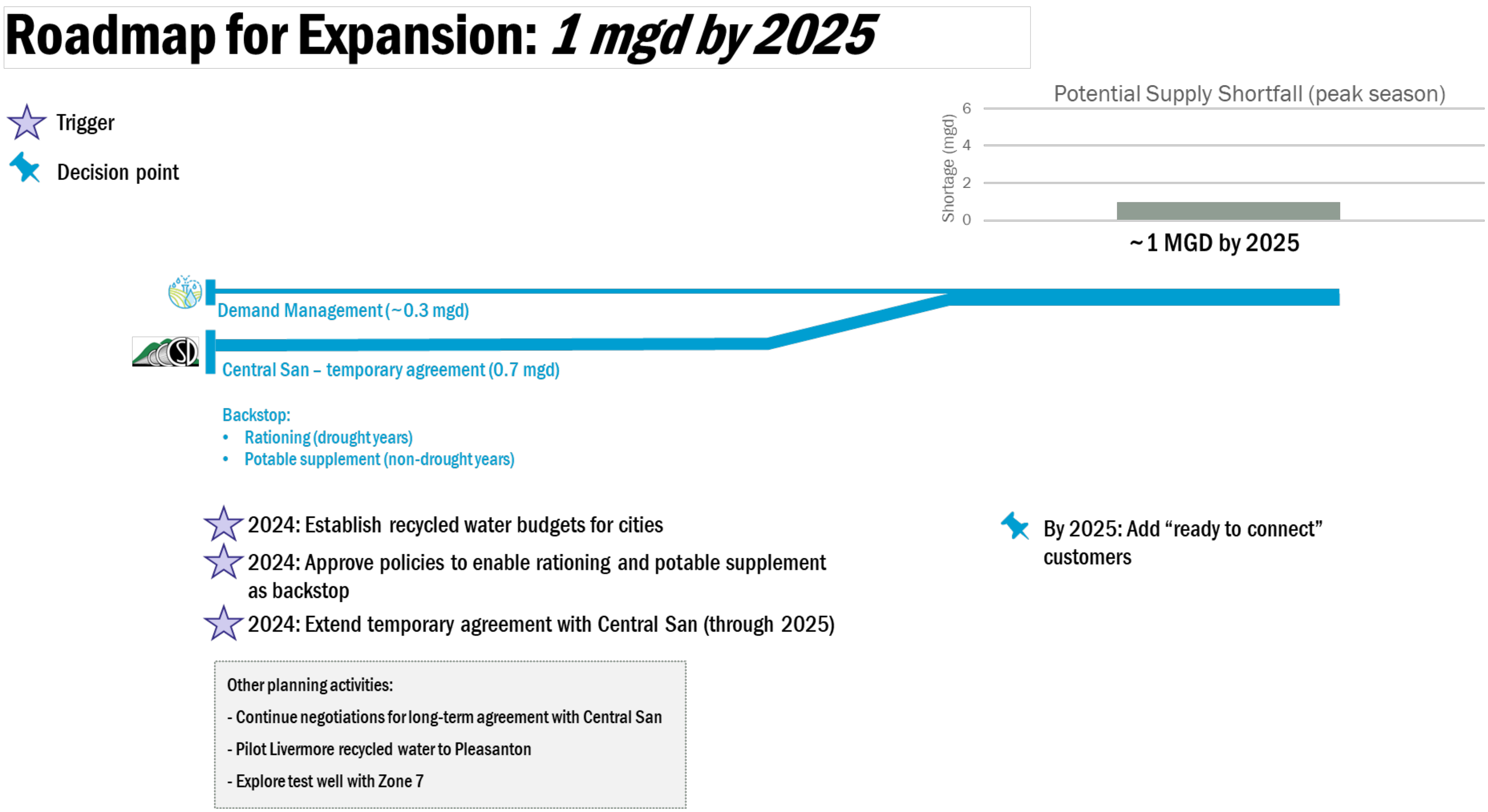

Figure 5-1. Roadmap for expansion: 1 mgd by 2025

5.3 Roadmap to 2030 (2 mgd)

The increase in demand expected by 2030 is largely driven by EBMUD's Phase 3 customers, which are primarily located in Danville and northern San Ramon. With these customers online, DERWA's potential peak season supply shortfall increases to about 2 mgd.

As noted in EBMUD's Capital Improvement Program, design and construction of Phase 3 infrastructure is contingent upon supplemental supply being secured; therefore, for Phase 3 customers to be connected by 2030, supply must be secured by 2025. Figure 5-2 and Figure 5-3 show a preferred and alternate path, respectively, for filling a 2-mgd shortfall by 2030. The preferred path (Figure 5-2) involves establishing a long-term agreement with Central San to divert the full 2.7 mgd of raw wastewater. Although DERWA would not need the full 2.7 mgd in the near term, Central San's commitment to provide the supply when needed would serve as a trigger for EBMUD to initiate design of the Phase 3 infrastructure. In the meantime, DERWA could continue to divert 0.7 mgd from Central San and maintain the city recycled water budgets as a demand management measure.

If Central San cannot commit to a long-term arrangement, DERWA could pursue an alternate path that involves Fringe Basin groundwater (Figure 5-3). If a test well demonstrates adequate groundwater quality and quantity by 2025, DERWA could initiate design and construction of new wells in parallel with EBMUD's design and construction of Phase 3 infrastructure to connect new customers by 2030. Due to the time it takes to design and drill wells, an interim solution would be needed to maintain service continuity after the temporary agreement with Central San expires and before the new wells are online (2026 to 2030). Options for a temporary alternative include:

- A new temporary agreement with Central San (to continue diversion of 0.7 mgd).
- Recycled water from Livermore to Pleasanton.
- Secondary effluent from Livermore.

A delay in the test well would likely extend the timeframe that a temporary alternative is needed (i.e., past 2030); therefore, to stay on schedule, it is recommended that DERWA begin exploration of the Fringe Basin in parallel with Central San negotiations. However, DERWA would not need to commit to design and construction of new wells until the outcomes of Central San discussions are clear.

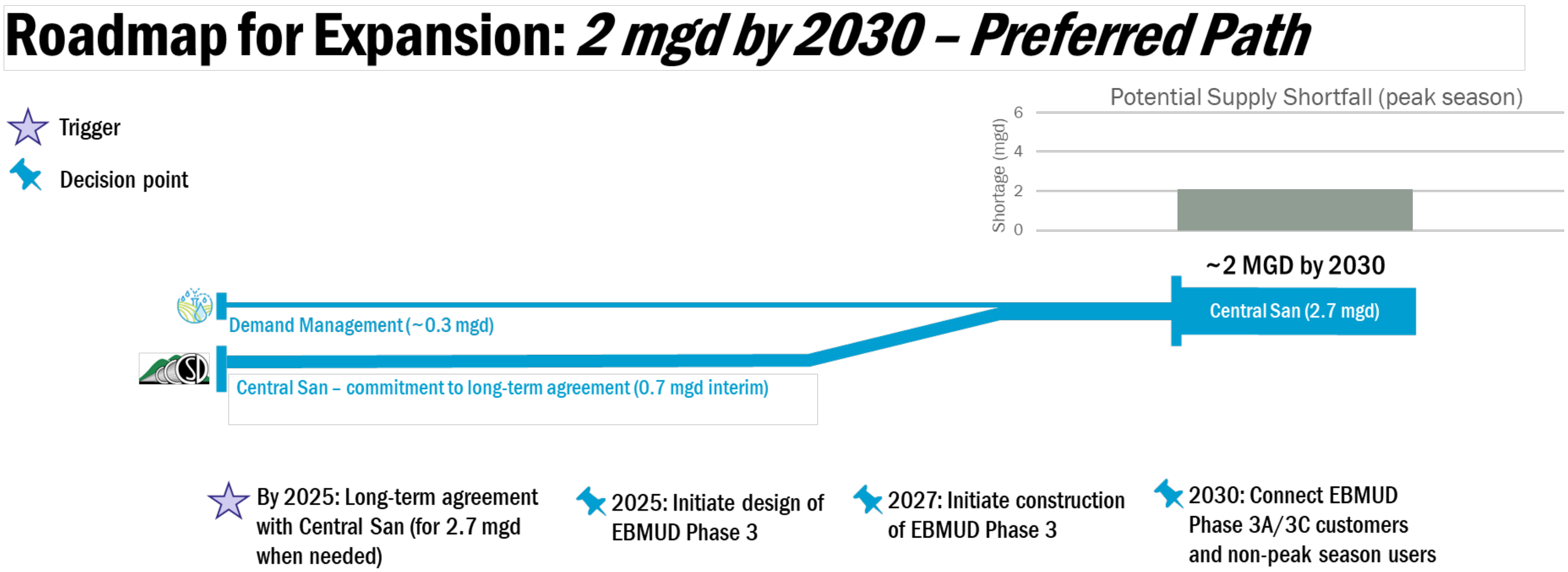

Figure 5-2. Roadmap for expansion: 2 mgd by 2030 (preferred path)

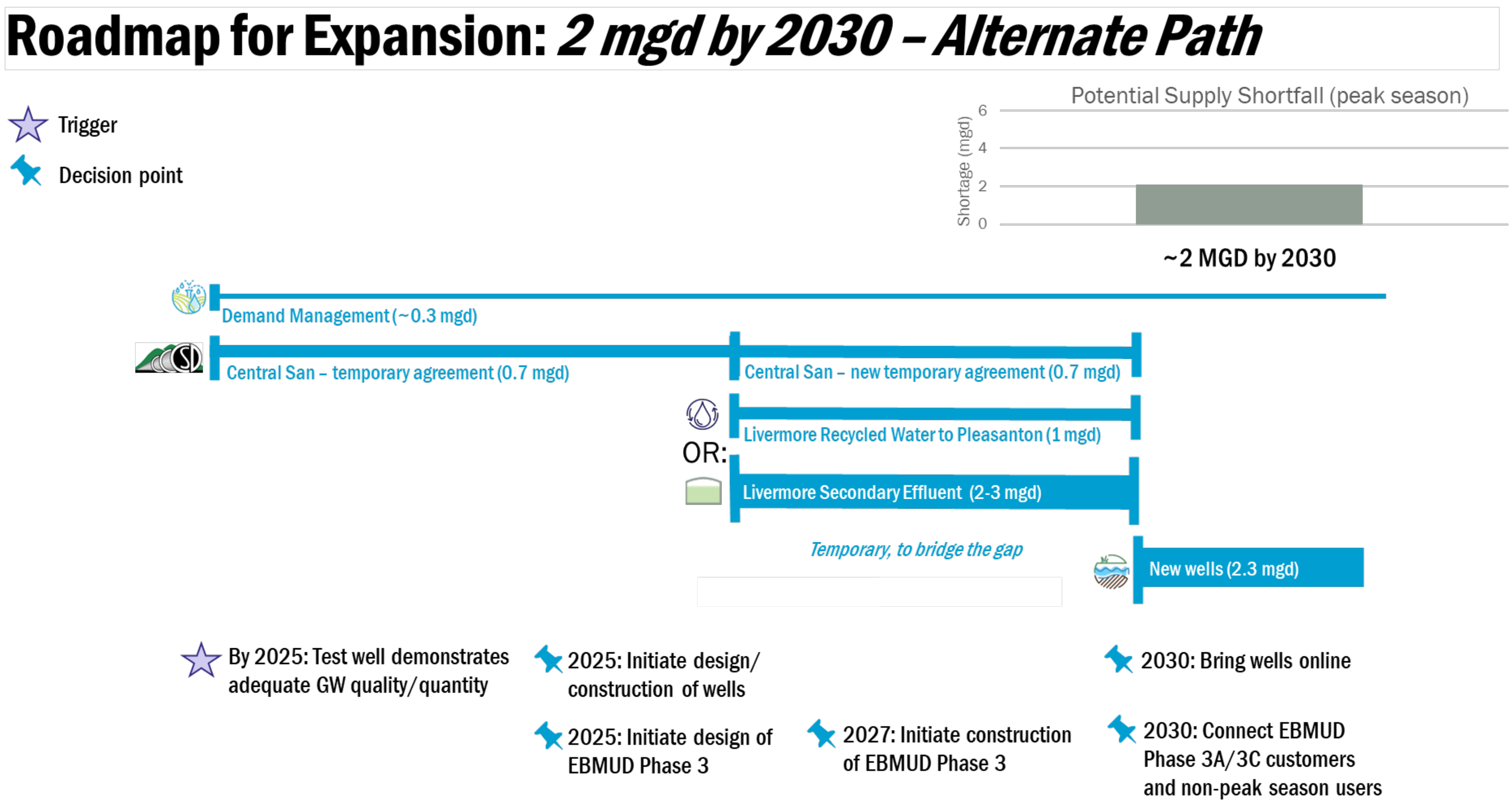

Figure 5-3. Roadmap for expansion: 2 mgd by 2030 (alternate path)

5.4 Roadmap to 2045 (6 mgd)

Based on current buildout projections, DERWA could experience a peak season supply shortfall of up to 6 mgd by 2045. As shown in Figure 5-4, mitigating this shortfall likely requires a combination of alternatives, including diverting the full 2.7 mgd from Central San, drilling new wells in the Fringe Basin, and possibly supplementing with potable water. The only alternative that can fully mitigate the shortage is secondary effluent from EBDA; however, this is the most expensive alternative, and it becomes even less cost effective if the full 6 mgd is not needed.

Given the great amount of uncertainty in future conditions, it is recommended that DERWA re-evaluate supplies, demands, and the cost-effectiveness of remaining alternatives before proceeding with a significant capital project like the EBDA alternative. For example, nearly 2 mgd of the potential 6 mgd shortage is due to the assumed increase in Pleasanton's demand; however, Pleasanton's buildout projections may be revised after its next recycled water master plan update. If less supplemental supply is needed, a large project may not be worth the cost.

Additionally, any remaining alternatives should be considered within the context of EBMUD's and DSRSD's broader water resiliency efforts. Both agencies are exploring a range of potable supply projects to improve water supply reliability and drought resilience. If recycled water projects for non-potable uses start to become more expensive than potable supplies, DERWA may choose to maintain a moratorium on new connections.

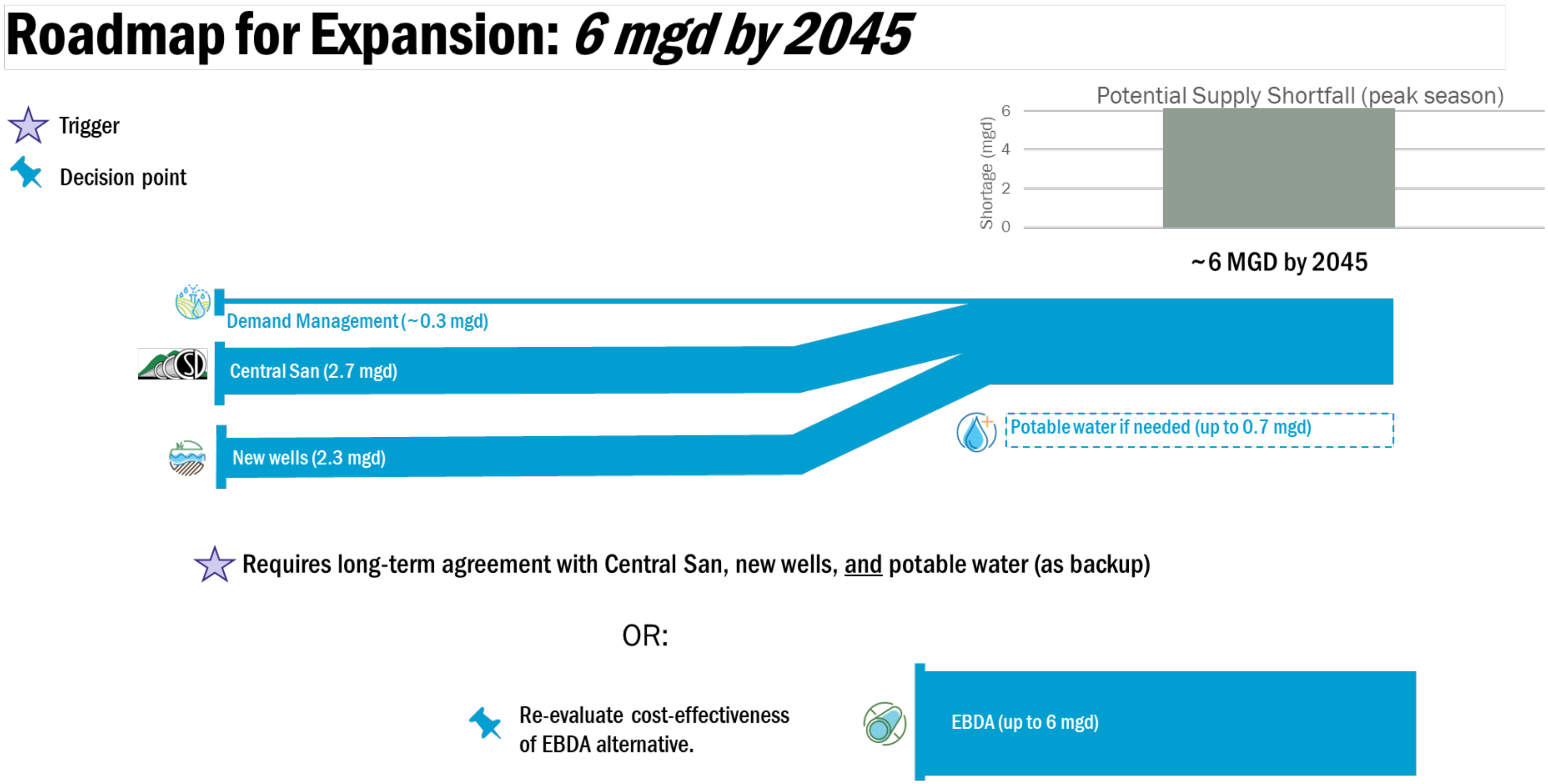

Figure 5-4. Roadmap for expansion: 6 mgd by 2045

Section 6

Conclusions and Next Steps

Table 6-1 summarizes the triggers for lifting the moratorium and securing 1 mgd of peak season supply by 2025, 2 mgd by 2030, and 6 mgd by 2045. Achieving 1 mgd by 2025 is feasible with minimal policy changes and extending DERWA's current agreement with Central San, as allowed through 2025. Achieving 2 mgd by 2030 is dependent on external triggers and requires Central San's commitment to a long-term agreement or DERWA's commitment to proceed with new wells in the Fringe Basin (assuming adequate groundwater quality and quantity). Although DERWA could need up to 6 mgd by 2045, it is recommended that DERWA pause and re-evaluate supplies and demands in 2030. Given uncertainty in future conditions, DERWA's supply need could shift substantially, which would affect the unit cost and marginal benefit of remaining alternatives.

Table 6-1. Recommended Roadmap

Supply Goal	Triggers for Lifting Moratorium	
	By 2025	By 2030
1 mgd by 2025	• Establish recycled water budgets for cities. • Update policies for rationing and potable supplementation. • Extend temporary agreement with Central San.	
2 mgd by 2030	• Secure long-term agreement with Central San or commit to construction of new well. • If new wells, need temporary agreement with Central San or Livermore to bridge the gap (2026-2030).	• Divert 2.7 mgd from Central San or • Bring new wells online (2.3 mgd).
6 mgd by 2045		• Re-evaluate supplies, demands, and cost-effectiveness of remaining alternatives.

In the near term, next steps for DERWA and its member agencies include:

- Considering policy changes to enable rationing in drought years and potable supplementation in non-drought years.
- Developing recycled water budgets for Dublin and San Ramon and exploring the potential to extend rebates to recycled water customers.
- Reviewing DERWA's water loss accounting to determine real versus apparent water losses.
- Continuing discussions with Central San and Livermore regarding potential alternatives.
- Coordinating with Zone 7 on groundwater exploration, including planning for a possible test well in the Fringe Basin.

Recommended activities should be considered in development of DERWA's fiscal year 2025 budget.

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Section 7

Limitations

This document was prepared solely for DERWA in accordance with professional standards at the time the services were performed and in accordance with the contract between DERWA and Brown and Caldwell dated February 6, 2023. This document is governed by the specific scope of work authorized by DERWA; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by DERWA and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Section 8

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Appendix A: Supply and Demand Analysis

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Appendix A: Supply and Demand Analysis

This appendix summarizes the analysis of supply and demand for DSRSD-EBMUD Recycled Water Authority (DERWA)'s recycled water system (system) and documents data sources and assumptions. The project team analyzed historical supply and demand data to understand trends and evaluate risk of shortage now and in the future. This evaluation considered the baseline condition with no supplemental water or improvements to increase recycled water supply. The baseline results presented herein were used to evaluate various alternatives to address projected shortages.

A.1 System Configuration and Data Sources

A.1.1 Recycled Water System

For this evaluation, the system boundary begins with collected wastewater, which is treated to become a recycled water supply, and ends with recycled water demand. The following subsections further describe this system.

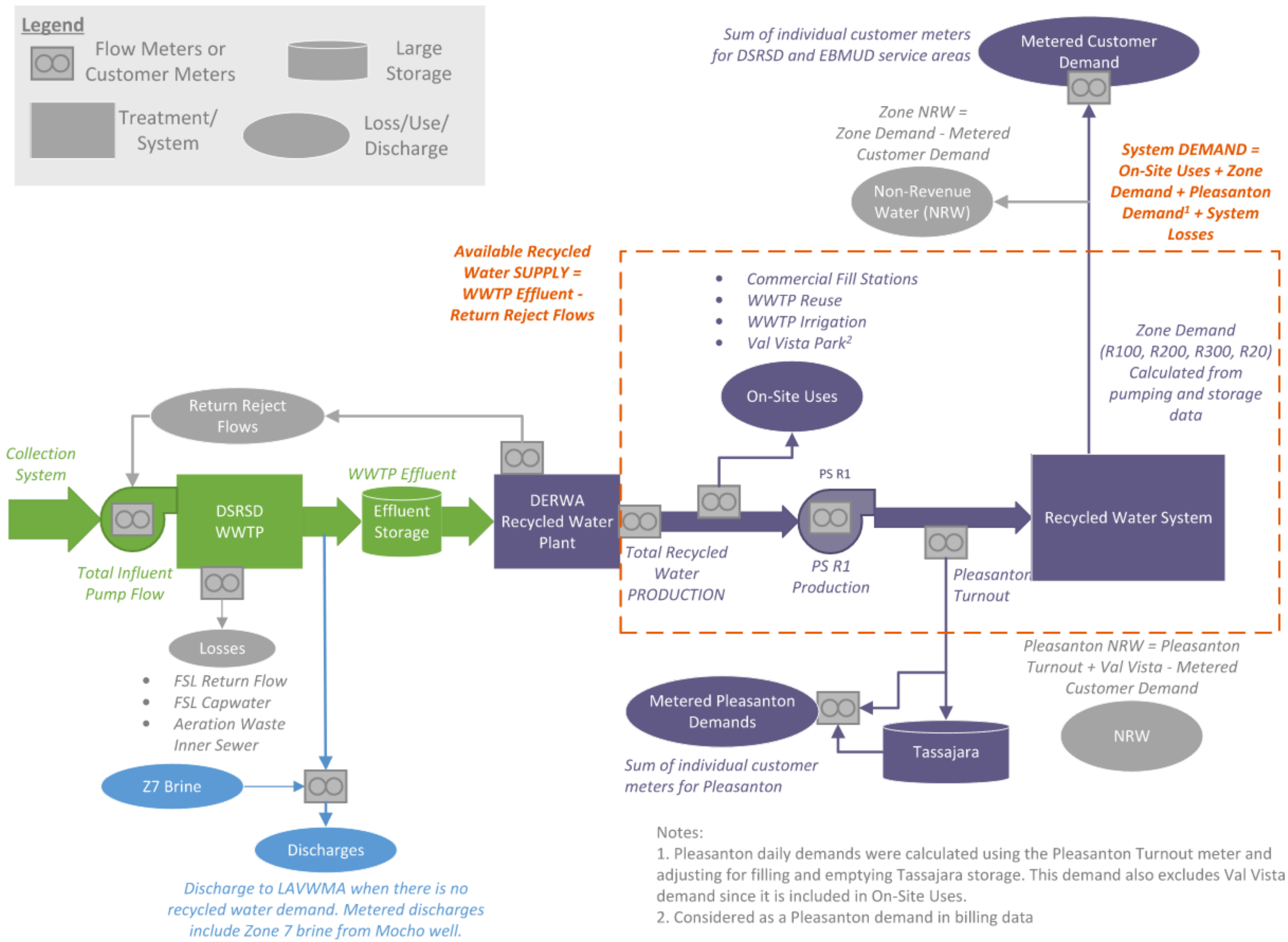
A.1.1.1 Supply Sources and Customers

The system currently receives recycled water supply (supply) from the Dublin San Ramon Services District (DSRSD) wastewater treatment plant (WWTP), which treats wastewater collected from the cities of Pleasanton, Dublin, and a portion of San Ramon. This baseline evaluation only considers the supply available from the DSRSD WWTP's typical service area and not supplemental supply from other sources, such as the temporary diversion from Central Contra Costa Sanitary District (Central San).

Recycled water demand (demand) comes from irrigation customers within the East Bay Municipal Utility District (EBMUD) and DSRSD service areas, as well as the City of Pleasanton. Recycled water customers in the EBMUD and DSRSD service areas are individually metered and billed by those agencies, while Pleasanton receives recycled water under a contract as a wholesale customer of DERWA.

A.1.1.2 System Configuration

Figure A-1 shows a schematic of the DERWA recycled water system and depicts how water flows from the DSRSD wastewater collection system through the WWTP and recycled water facilities and ultimately to recycled water customers. This schematic identifies the metering points and various inflows and outflows pertinent to the supply and demand analyses.



Notes:
1. Pleasanton daily demands were calculated using the Pleasanton Turnout meter and adjusting for filling and emptying Tassajara storage. This demand also excludes Val Vista demand since it is included in On-Site Uses.
2. Considered as a Pleasanton demand in billing data

FSL = facultative sludge lagoon

Figure A-1. Recycled water system schematic

A.1.2 Data Sources

Table A-1 summarizes the data sources used to understand supply and demand and is not an exhaustive list of the data or information used in this study.

Table A-1. Data Sources				
Name	Period Available	Timestep	Measured or Calculated	Description
Total Influent Pump Flow	Jan-2017 through Feb-2023	Daily	Measured	Wastewater pumped from the collection system to the DSRSD WWTP; includes the recycled water plant return reject flows
WWTP Effluent	Jan-2017 through Feb-2023	Daily	Calculated	DSRSD WWTP effluent; total influent minus WWTP losses
Available Recycled Water Supply	Jan-2017 through Feb-2023	Daily	Calculated	WWTP effluent minus return reject flows; supplemental supply from Central San removed
Total Recycled Water Production	Jan-2016 through Dec-2022	Daily	Measured	Water produced by DERWA recycled water plant
On-site Uses	Jan-2016 through Dec-2022	Daily	Measured	Recycled water used on site or near the recycled water plant, including commercial fill stations, WWTP reuse, WWTP irrigation, and Val Vista Park (part of Pleasanton demand)
Pleasanton Turnout	Jan-2016 through Dec-2022	Daily	Measured	Metered Pleasanton demand at the turnout, upstream of Tassajara Reservoir
Pleasanton Demand	Jun-2018 through Dec-2022	Daily	Calculated	Metered demand at Pleasanton Turnout adjusted for Tassajara Reservoir storage and pumping to determine daily fluctuations in Pleasanton demands
Zone Demand	Jan-2016 through Dec-2022	Daily	Calculated	Sum of demands from each recycled water system zone (R100, R200, R300, R20) as calculated by DERWA; includes DSRSD and EBMUD demands.
Weather	Jan-2016 through Dec-2022	Daily	Measured	Mean and max temperature, average humidity, rainfall, average wind speed, and evaporation

A.2 Existing Conditions

To understand existing conditions, the project team analyzed recent historical supply and demand data. Recent trends in supply coupled with state water use efficiency goals provide the basis for supply projections. The project team used existing trends in monthly and daily demand to project future peak demands as DERWA adds customers to the system.

A.2.1 Supply

The recycled water system's supply source is treated wastewater effluent from the separate sanitary sewer collection system, which includes dry and wet weather flows. During wet weather, influent flows are greater due to inflow and infiltration in the collection system; however, recycled water demand is greatest in the dry season. Therefore, supply availability in the peak demand season tends to be less than the annual average.

A.2.1.1 Historical Data Analysis

Available recycled water supply was calculated as the DSRSD WWTP effluent minus reject flows that are returned to the WWTP. The project team used data from 2017 through 2022 to analyze supply trends. These data exclude the additional supply diverted from Central San in 2021. Figure A-2 shows the average monthly supply and rainfall totals. During the dry season (i.e., from about April through September), rainfall totals are lowest, which results in lower average monthly supply because of the lack of inflow and infiltration. This period also coincides with the irrigation season, when recycled water demands are greatest.

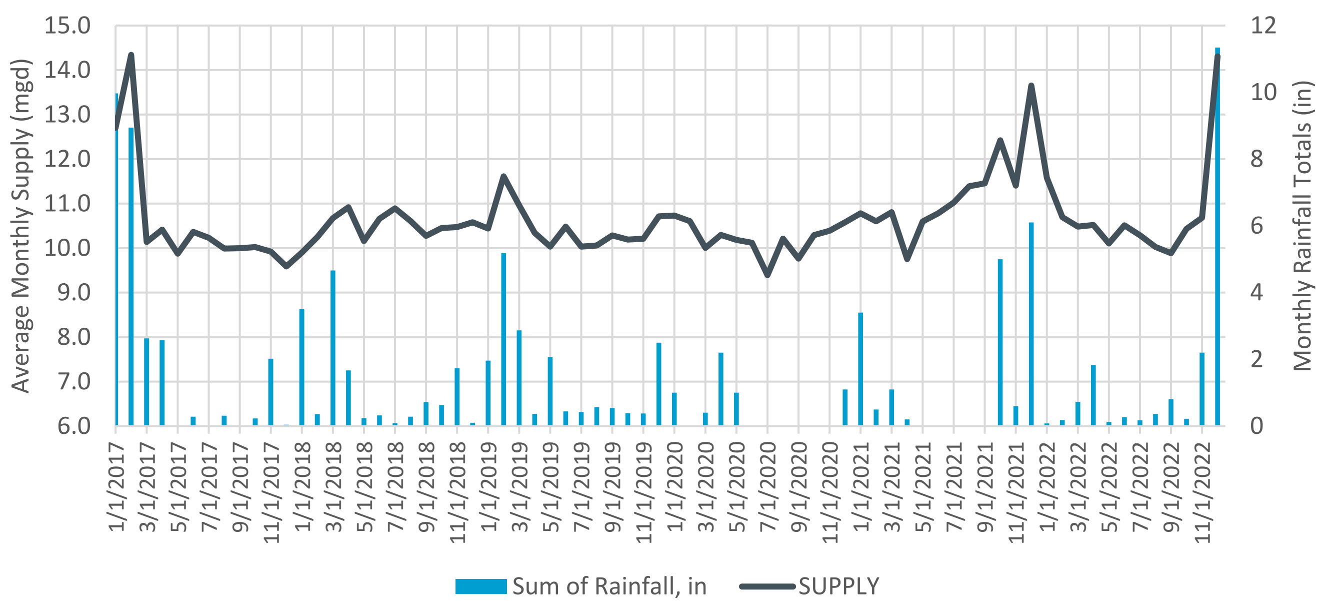


Figure A-2. Monthly supply and rainfall

The analysis of existing supply focused on the peak irrigation season (April through September) to avoid overestimating supply availability. Figure A-3 shows the average monthly supply by year from April to September, which falls mostly between 10 million gallons per day (mgd) and 11 mgd.

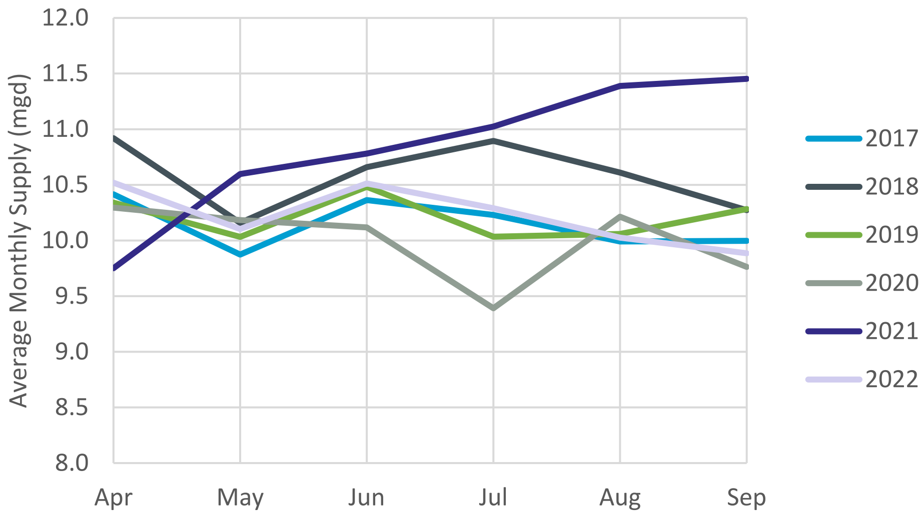


Figure A-3. Average monthly supply (April to September)

Figure A-4 shows daily and weekly supply. Within this period, 2020 and 2021 represent the worst and best supply conditions, respectively. (Note: this dataset excludes the supplemental supply diverted from Central San in 2021).

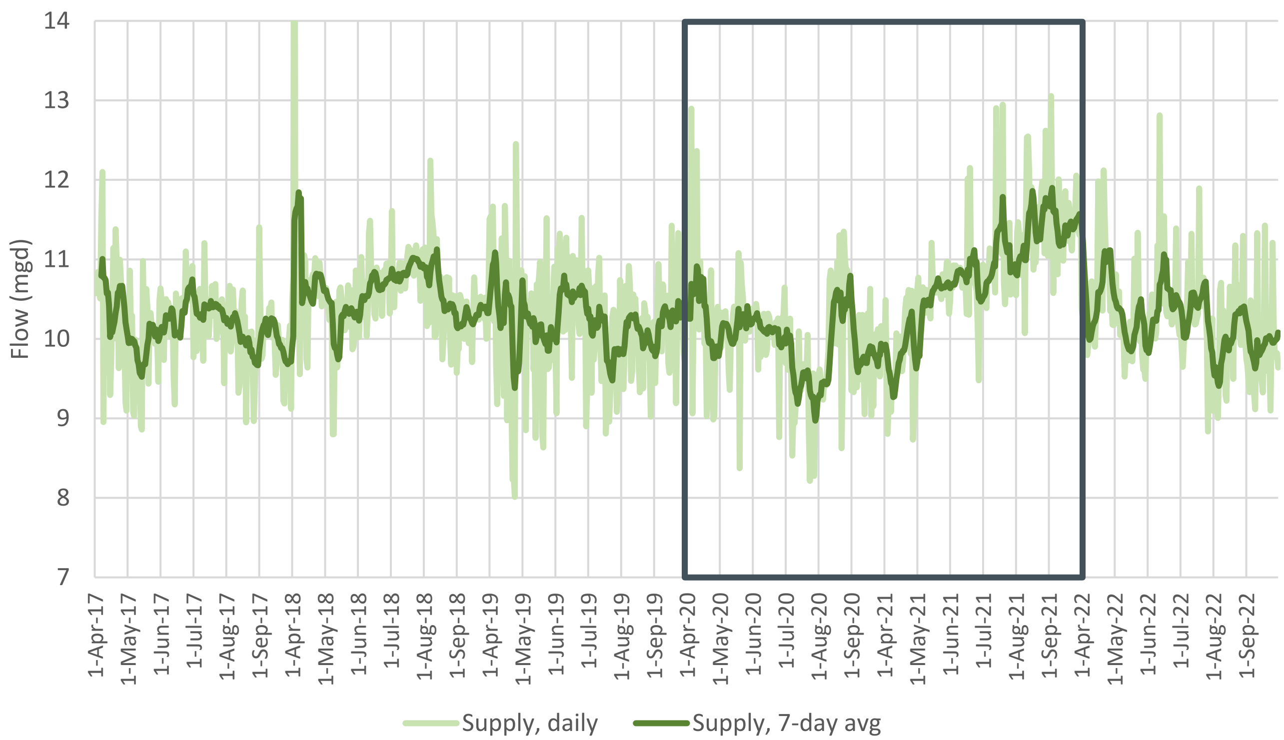


Figure A-4. Daily and weekly average supply (April to September)

A.2.1.2 Estimated Availability

Figure A-5 shows the exceedance frequency of daily and weekly (7-day rolling average) supply from April through September, which indicates the availability of supply during the peak irrigation season. The plot shows the likelihood of supply being greater than a selected value based on data from 2017 to 2022. For example, weekly supply was greater than 9.8 mgd 90 percent of the time. The key supply availability scenarios used based on this analysis are:

- >11.0 mgd 10 percent of the time
- >10.3 mgd 50 percent of the time
- >9.8 mgd 90 percent of the time
- >9.6 mgd 95 percent of the time

Additional weekday versus weekend supply was also analyzed for informational purposes. On average, available supply on the weekends tends to be about 0.3 mgd less compared to weekdays.

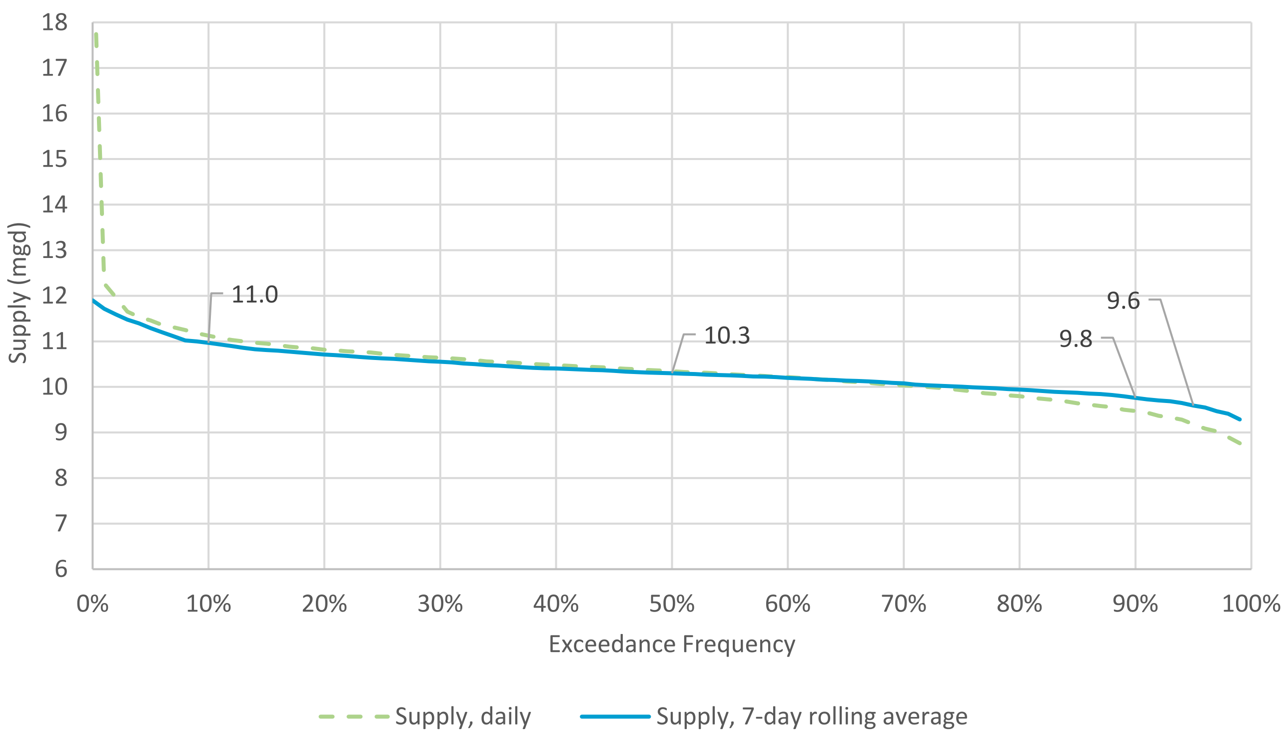


Figure A-5. Existing supply exceedance frequency

A.2.2 Demand

Due to the seasonality of irrigation patterns, recycled water demand is more variable than supply. Demand trends are important for determining the likelihood of a shortage in the near and long term.

Due to limited supply, DERWA requested a moratorium on new recycled water customers. DERWA initialized the moratorium request in March 2019 with an interim agreement formalizing the pause period in 2022. Some EBMUD customers (Crow Canyon and Canyon Lakes golf courses) were approved, though not yet connected, prior to the moratorium. The demands from these customers are not fully reflected in historical data though were considered when establishing the baseline demand condition.

A.2.2.1 Production versus Demand

The project team analyzed recycled water production and demand. Production is the amount that enters the system at the recycled water plant and is inclusive of on-site uses, filling system storage, and non-revenue water (NRW). NRW is the difference between the volume of water produced and the volume of water billed and is inclusive of leaks, flushing, and any other uses that are not billed. Demand is typically measured at the customer meter (i.e., billed usage) and does not account for NRW or daily demand fluctuations given that not all customer meters provide daily data from 2017 to 2022. To understand daily demand, the project team analyzed demand in the system upstream of distribution system tanks using the data from DERWA as described in Table 1-1.

A.2.2.2 Historical Production

Figure A-6 shows the average monthly production from 2017 to 2022. Average annual production has mostly increased from year to year with notable peaks in 2017 and 2021. Peaks after April in 2017 may be attributed to greater-than-typical on-site use at the commercial fill stations and WWTP reuse.

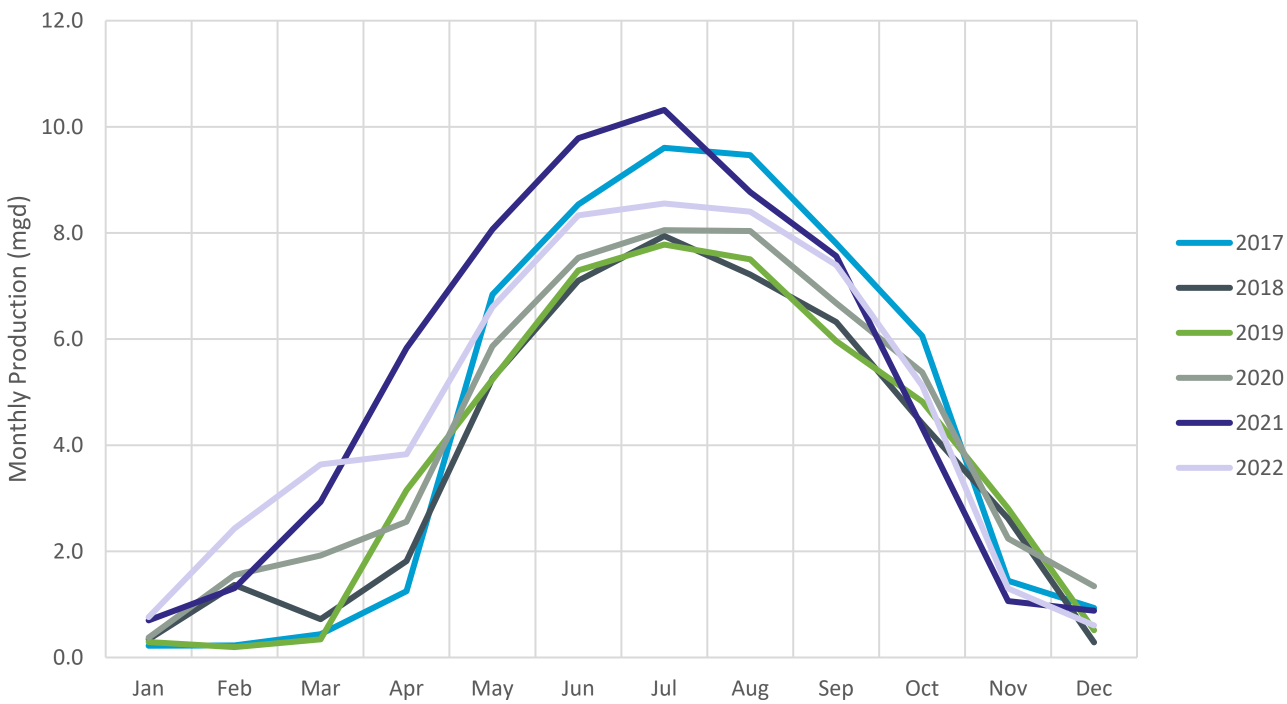


Figure A-6. Monthly recycled water production

A.2.2.3 Historical Demand Statistics

Figure A-7 shows total average annual demand including on-site uses, Pleasanton demand, and zone demand. Zone demand includes EBMUD and DSRSD demand and was further defined in Table 1-1.

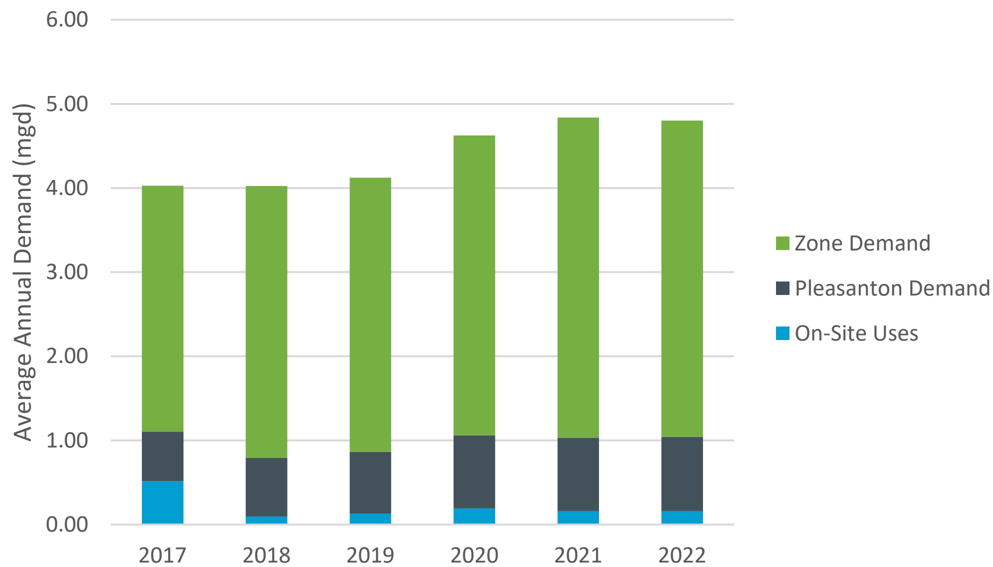


Figure A-7. Average annual demands

As shown in Figure A-8, maximum month and maximum week factors were calculated by taking the respective maximum demand (for the month or week) and dividing by the annual average demand. Although 2017 through 2019 experienced some higher maximum month and week factors, overall demand was lower in those years. Average annual demand was similar in 2021 and 2022, but maximum month and week factors were notably higher in 2021. As shown in Figure A-9, maximum day factors trend similarly to the maximum month and week factors.

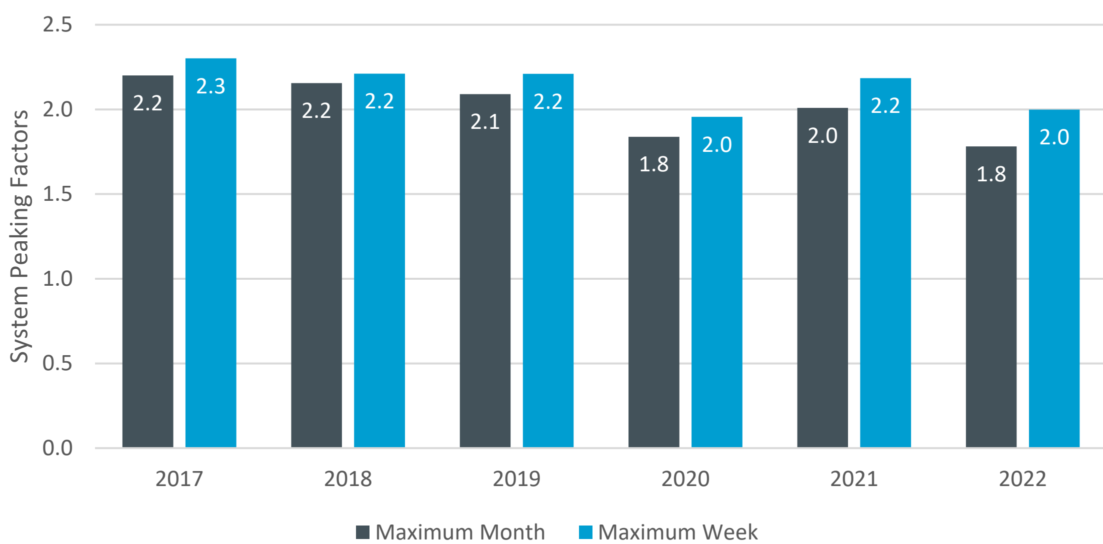


Figure A-8. Maximum month and maximum week peaking factors

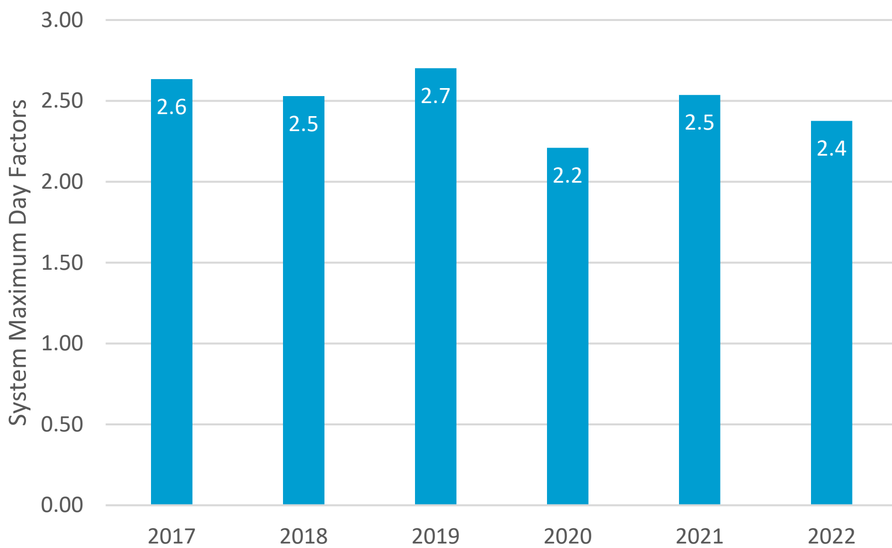


Figure A-9. Maximum day peaking factor

A.2.2.4 Daily Demand

Total system demand is best represented by production because production is inclusive of NRW, but the daily timestep may not truly represent system demand due to the filling of storage tanks throughout the system. Storage in the distribution system is primarily used to address hourly fluctuations in demand, but storage filling may, at times, cause a misrepresentation of daily demand. It is also useful to understand the breakdown of demand between on-site uses, Pleasanton demand, and zone demand. Therefore, daily demand was calculated as the sum of on-site uses, Pleasanton demand, and zone demand.

Daily demand is shown in Figure A-10, which also overlays the average weekly and monthly demands. Showing demand in this way more clearly illustrates that 2021 summer demands were the highest in this period of record, though average annual demand for both 2021 and 2022 were similar. Daily climate data shows similar trends in temperatures for both 2021 and 2022. Total rainfall was also similar; however, the distribution of rainfall differed, with about 3.5 inches of rain from April through September in 2022 compared to 0.2 inches during the same period in 2021. DERWA also theorized that drinking water conservation measures put in place due to drought conditions in both 2021 and 2022 were voluntarily applied by recycled water customers in 2022.

Climate is typically a key variable that can help predict irrigation water demand. This study attempted to correlate climate data with demand. Single- and multi-variable regression were explored; however, correlation was poor. This is likely due to the limited years of data and the changes in customers over time (prior to the moratorium on new connections).

Daily production data is also shown for comparison. While daily production and demand are generally aligned, the production values had some extreme day-to-day variations that could be due to filling storage tanks that did not need to be refilled for multiple days after or for other operational needs. For these reasons, and because the calculated daily demands are slightly more conservative during the irrigation season, the calculated system daily demand was used as the basis for the baseline demand profile.

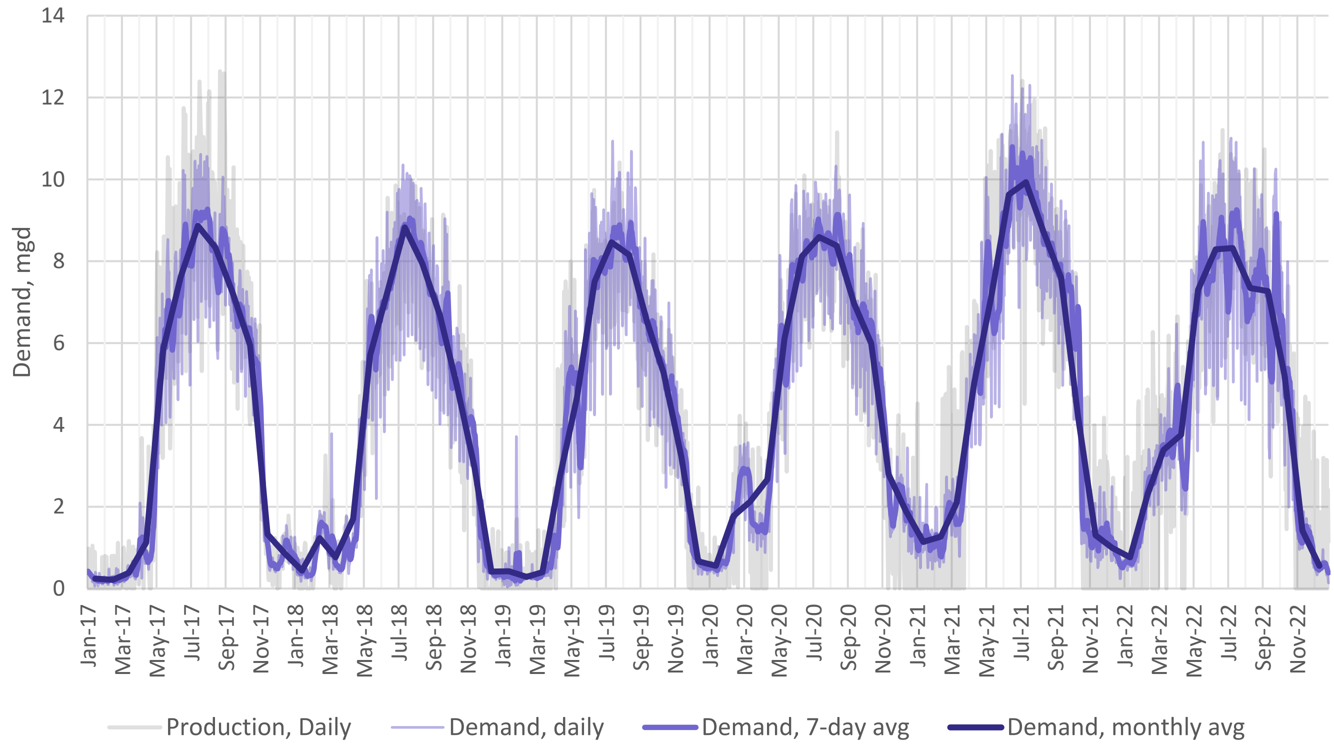


Figure A-10. Daily demand with weekly and monthly averages

A.2.3 Supply and Demand Analysis

The project team analyzed existing supply and demand conditions to assess the ability of DERWA to meet current demands. The metric used for performance was the extent to which shortages are predicted in a simulation of supply and demand.

A.2.3.1 Approach

Total supply and demand for the system were simulated on a daily timestep over 1 year. The simulation considered on-site storage reservoirs (i.e., the holding basins) at the recycled water plant and evaporation from those reservoirs. Note that this does not include storage in the distribution system, which is used for hourly peaking. This is further discussed in the operations plan. The simulation tracked the frequency and total volume of shortage over the year.

DSRSD's holding basins have a total capacity of 20 million gallons (MG); however, only Holding Basin 4 (capacity of 5 MG) is considered available for DERWA due to odor, maintenance, and other operational challenges.

A.2.3.2 Conditions

The supply conditions considered four scenarios ranging from 9.6 mgd to 11.0 mgd, aligned with the exceedance frequency analysis discussed in Section A.2.1.2. The analysis assumed a constant daily supply. Although daily wastewater flows vary by 1 to 2 mgd, this fluctuation can be equalized through on-site storage.

Given variability in demands, the existing demand analysis considered a range of conditions as shown in Table A-2. The analysis included 2021 and 2022 average annual demands plus anticipated demand for two golf courses (Crow Canyon and Canyon Lakes – South Course) within EBMUD's service area. EBMUD had plans to connect these customers prior to DERWA formalizing the moratorium; however, these customers were not yet connected in 2021 so are not reflected in the demand data.

Table A-2. Existing Demand Conditions

Average Annual Demand, mgd	Description
4.80	2022 demand (actual)
5.00	2021 demand (actual)
5.35	2021 demand plus EBMUD's new connection for Crow Canyon Golf Course
5.42	2021 demand plus EBMUD's new connection for Crow Canyon Golf Course and Canyon Lakes Golf Course (South)

Each of the average annual demands were varied on a daily timestep over the year based on a demand pattern. The pattern was developed by normalizing 2021 daily demands to the 2021 annual average. The pattern for 2021 was selected because it represented the worst-case condition in terms of sustained peak demands as confirmed by the data and DERWA staff.

A.2.3.3 Results

The simulation compared supply and demand on a daily timestep while considering on-site storage to also meet demand. An example graphic for one of the conditions simulated is shown in Figure A-11. When demand exceeds available supply and storage, a shortage occurs in the simulation.

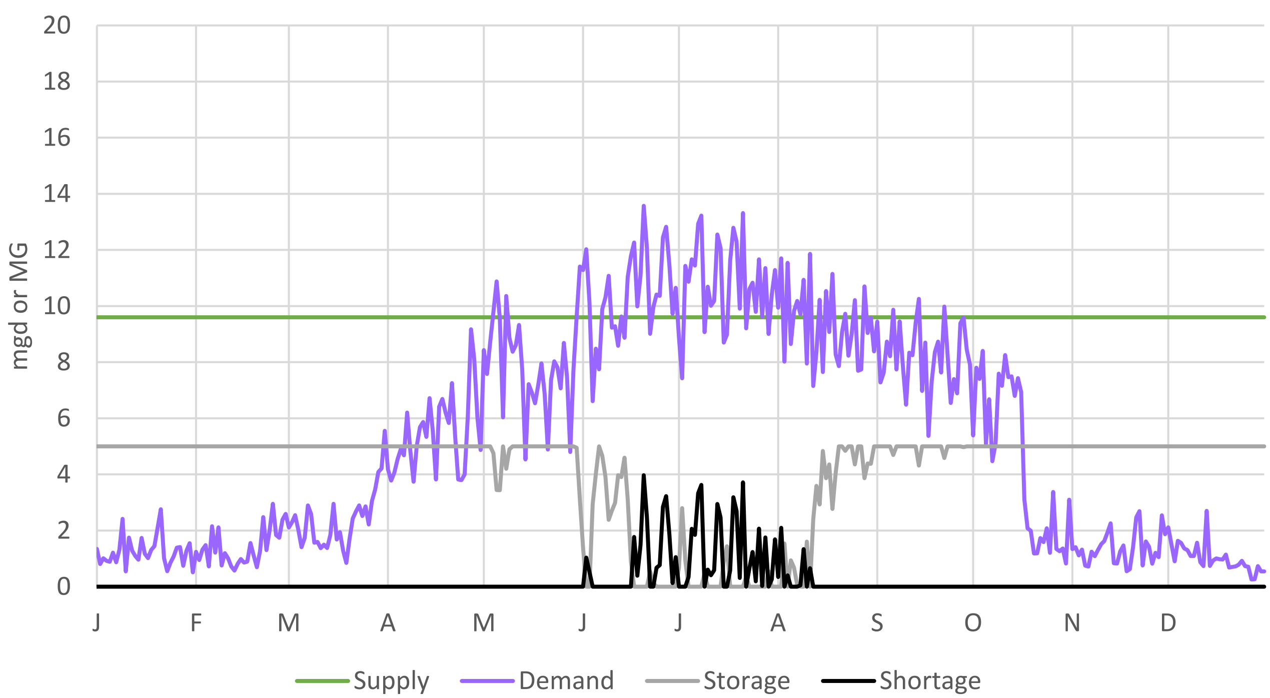


Figure A-11. Example simulation of existing conditions supply and demand

The number of days and total volume of predicted shortage was tracked for each combination of conditions simulated. Table A-3 shows the results for the four supply scenarios across the four annual demand scenarios. The results show that the system cannot always support the level of demands experienced in 2021 without shortages or supplemental supply.

Table A-3. Existing Conditions Supply and Demand Simulation Results

Supply Scenarios		Average Annual Demand Scenarios[a]							
		5.42 mgd		5.35 mgd		5.00 mgd		4.80 mgd	
Exceedance Frequency	Supply, mgd	Shortage Volume, AF	Number of Days with Shortage	Shortage Volume, AF	Number of Days with Shortage	Shortage Volume, AF	Number of Days with Shortage	Shortage Volume, AF	Number of Days with Shortage
10%	11.0	16	5	3	3	0	0	0	0
50%	10.3	100	20	79	15	1	1	0	0
90%	9.8	183	41	157	36	48	12	5	4
95%	9.6	226	46	196	43	77	16	25	8

a. See Table A-2 for demand scenario descriptions
AF = acre-feet

One question DERWA posed was whether they could have met the demands in 2021 without supplemental supply. The available supply in 2021 was higher than normal at around 11 mgd and fell in the 10 percent to 20 percent exceedance frequency range. When simulating the conditions specific to 2021, the results showed that DERWA could have potentially met demands without supplemental supply if on-site storage was fully used (up to 5 MG). This is also illustrated in Figure A-12, which shows the monthly production volumes versus supply volumes for 2019 to 2021. Supplemental supply that was received during 2021 is excluded from the supply, but supply was still greater than production in that year. Note, however, that the supply in 2019 and 2020 would not have been able to meet the demand experienced in 2021.

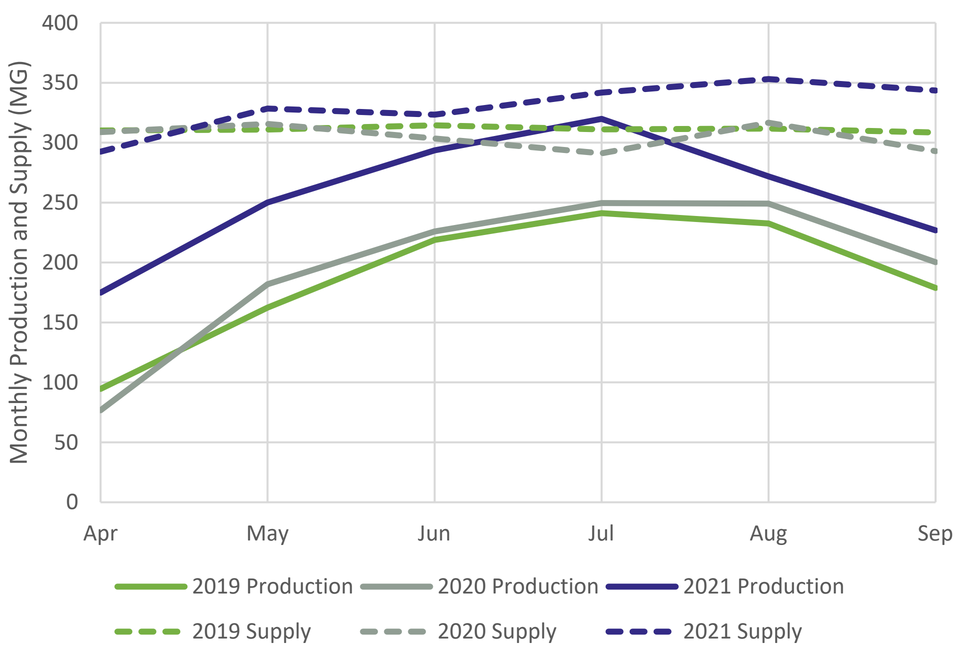


Figure A-12. Monthly production and supply 2019 to 2021

A.3 Future Conditions

Projections of supply and demand were developed and then simulated to evaluate the ability of DERWA to meet future demands.

A.3.1 Baseline Supply Projections

With wastewater flows being the supply to DERWA's recycled water system, supply is expected to increase as the population of the service area increases through buildout. However, the increase is not as great as previously projected due to indoor water use efficiency and conservation efforts. Historical wastewater flows in the service area have remained steady between approximately 9 mgd and 11 mgd since 2005 even with increasing population. To evaluate DERWA's ability to meet future demands, the project team updated supply projections based on the latest information on population growth and indoor water use. These projections represent DERWA's estimated baseline supply for the future based on their current source of supply without improvements or contracts for supplemental supply.

A.3.1.1 Approach

DERWA's baseline supply was projected out to 2045 using population projections, estimates of unit indoor water use, and estimates of losses. Areas of growth within the DSRSD WWTP service area include the cities of Dublin and Pleasanton. While the southern portion of San Ramon is also within the service area, San Ramon is considered mostly built out. For Dublin and Pleasanton, population projections were provided by DERWA in terms of dwelling unit equivalents (DUE). DUE projections for the service area are shown in Figure A-13. The stacked bars show total DUEs made up of existing and those projected for Dublin and Pleasanton. Buildout of the entire service area is expected by about 2035, beyond which supply is not expected to increase.

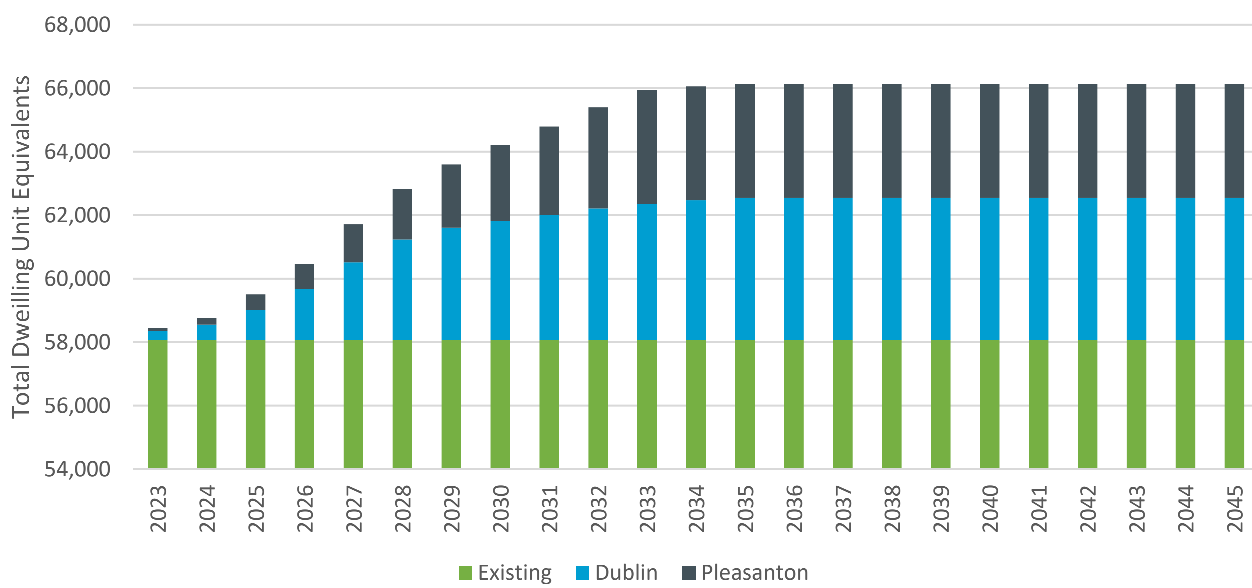


Figure A-13. DUE growth for the DSRSD WWTP service area

Indoor water demand is approximately equivalent to wastewater flow. Current planning for wastewater flows assumes 220 gallons per day per DUE (gpd/DUE). Water efficiency requirements are expected to reduce wastewater flow. The following assumptions were made to derive a low-end gpd/DUE estimate that incorporates the future proposed indoor residential water efficiency standard (42 gallons per capita per day [gpcd] by 2030):

- Indoor water use for existing customers was assumed to decrease by 5 gpcd
- Indoor water use for new connections was assumed at 42 gpcd, per the water efficiency standard
- 2.92 people per DUE (based on census data)[1]

The above assumptions result in an estimated unit flow of 195 gpd/DUE. This unit value and the 220 gpd/DUE value were used to develop a range for future potential supply.

The unit values are used to project wastewater flows; however, there are losses as this flow is converted to a recycled water supply. The DSRSD WWTP influent flow and recycled water data provided since 2017 indicates that approximately 84 percent of the WWTP influent flow is available as supply. The existing supply analysis already accounts for this reduction, and this factor was applied to future wastewater flow projections to estimate the supply available for DERWA.

A.3.1.2 Result

The resulting high and low supply projections are shown in Figure A-14. The results are shown in comparison to historical recycled water supply from 2004 to 2022, and the 2003 DERWA agreement projection. Actual supply fell short of the 2003 DERWA agreement projection by about 45 percent in 2020 due to impacts of water conservation on indoor water use. The high and low projections developed from this study represent current trends and plans for additional water conservation.

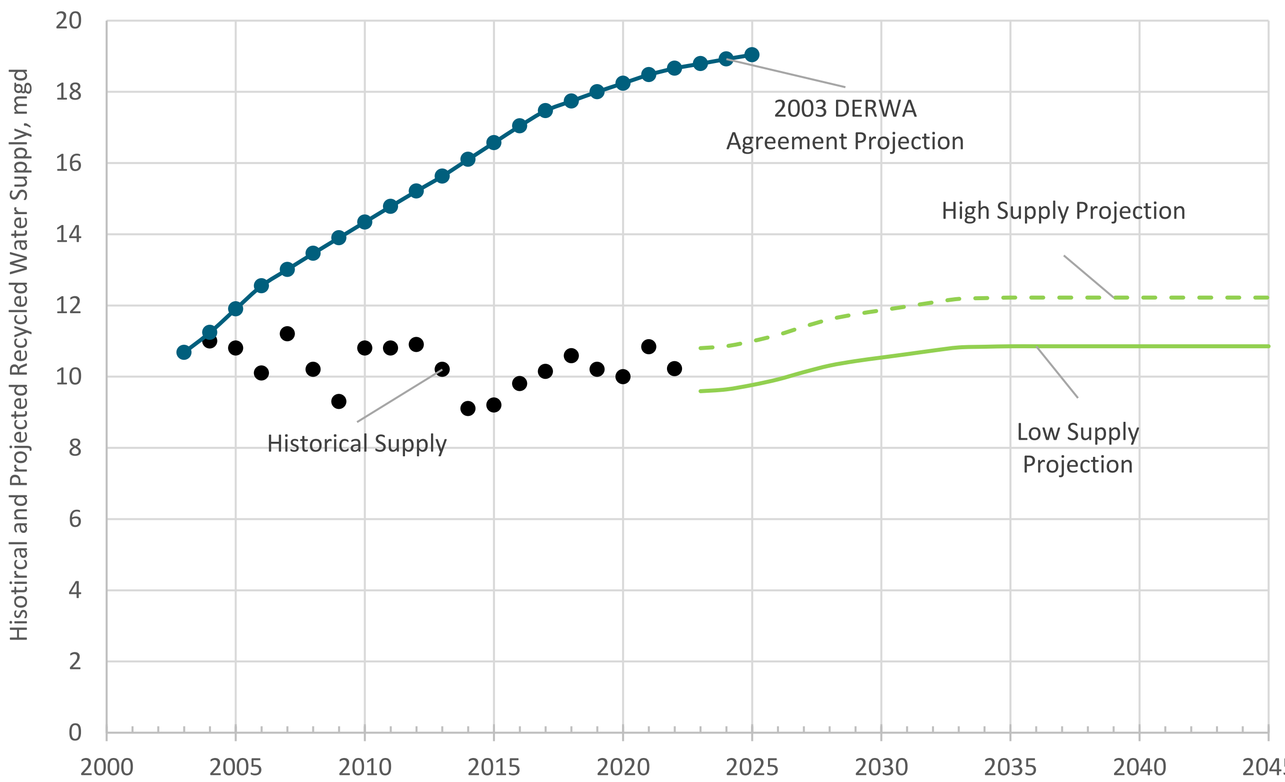


Figure A-14. Historical and projected supply compared to the 2003 DERWA agreement projection

[1] Average persons per household (2018 – 2022) for the cities of Dublin and Pleasanton per United States Census Quick Facts.

Figure A-15 shows a more detailed view of the recent historical supply and the two supply projections. At most, supply is projected to increase by about 2 mgd based on the high projection. With indoor water efficiency requirements, supply will remain near current levels. For both projections, supply flattens out by 2035 due to expected buildout of the service area.

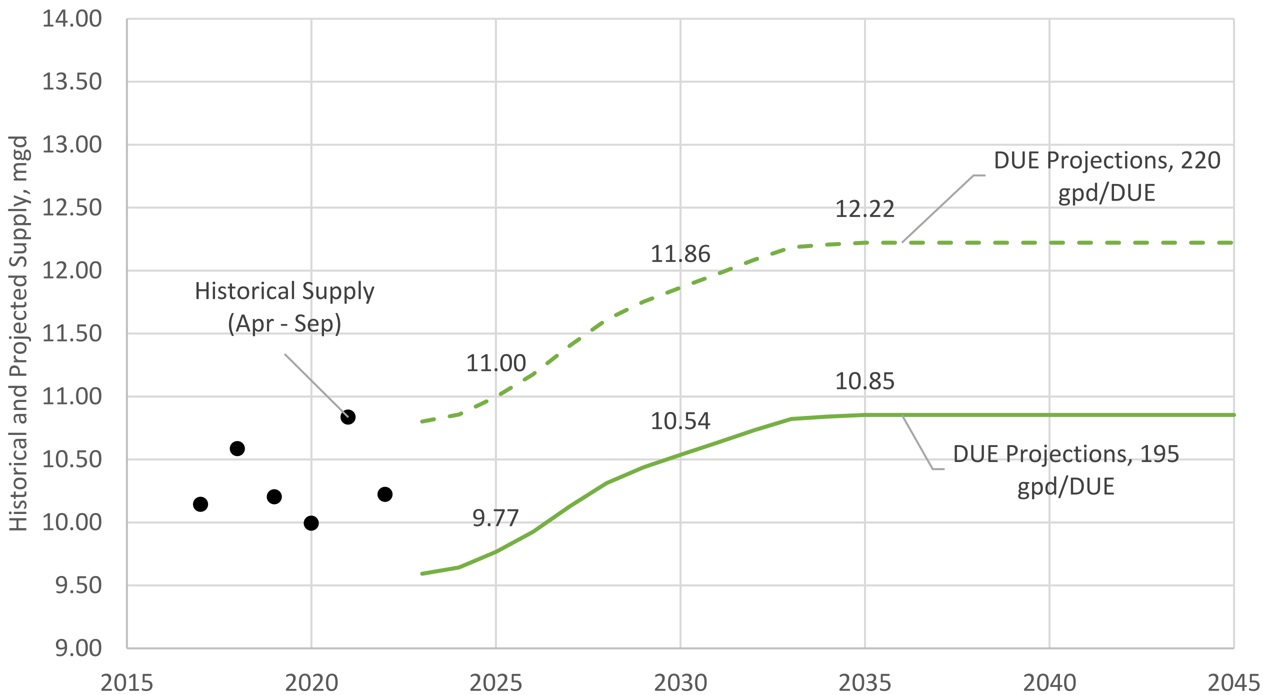


Figure A-15. Range of projected supply

A.3.2 Demand Projections

Future demands are based on projections provided by Pleasanton, DSRSD, and EBMUD. Estimated demand due to NRW within DERWA's system is calculated as 10 percent of the demand projections from DSRSD and EBMUD. Note that NRW is not included in the individual projections for DSRSD and EBMUD. Instead, they are added as a separate demand category in the total recycled water demand. It is assumed that Pleasanton demand projections are inclusive of NRW within Pleasanton's system. Demands on site at the recycled water plant are included in DSRSD's demand projections and are assumed to remain constant.

The demand projections are presented in terms of average annual and maximum day in units of mgd and acre-feet per year (AFY). Maximum day demands are estimated based on a 2.5 peaking factor applied to the average annual demand. DERWA's 2003 contract used a maximum day factor of 2.9; however, demand over the last 6 years shows maximum day factors between 2.2 and 2.7, with a maximum day factor of 2.5 in 2021.

A.3.2.1 Pleasanton

Projections of recycled water demand for Pleasanton, as shown in Figure A-16, are based on an assumed buildout demand of 1,800 AFY, as noted in Pleasanton's 2020 Urban Water Management Plan and discussed with Pleasanton staff. Near-term growth (through 2030) is assumed to be limited by Pleasanton's contractual maximum day demand of 2.7 mgd, based on the recycled water facility's current rated treatment capacity. Demand beyond 2030 was assumed based on linear interpolation from 2030 to 2040 out to a buildout maximum day demand of 4.0 mgd. Pleasanton's buildout projections may change, as the City plans to update its recycled water master plan; however, no significant expansion is planned in the next few years.

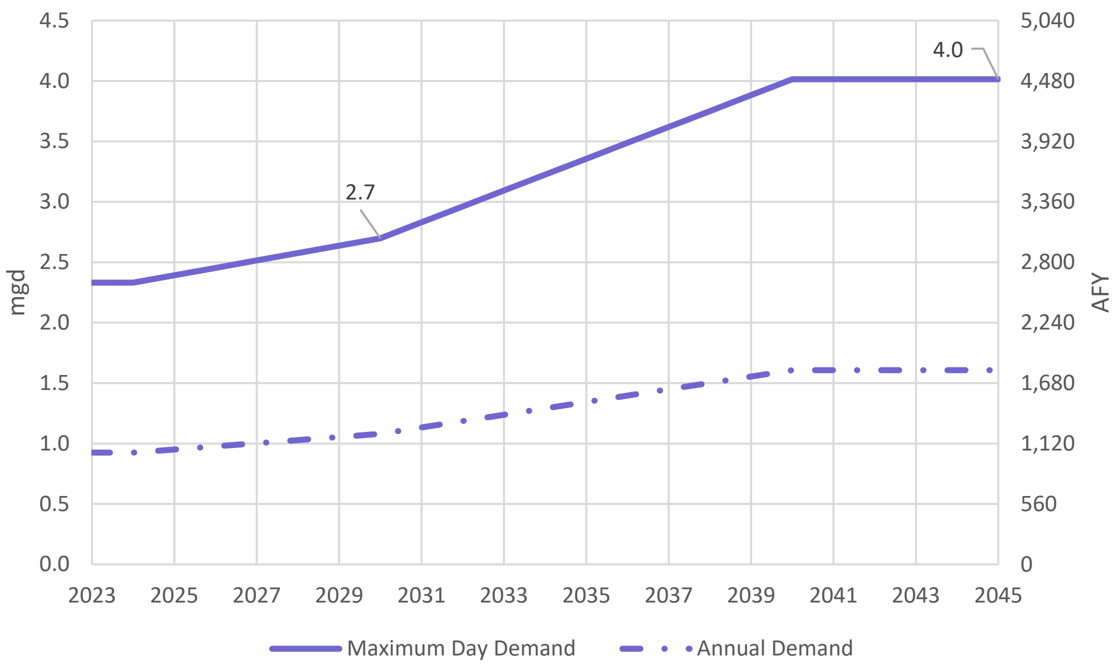


Figure A-16. Pleasanton demand projections

A.3.2.2 DSRSD

Projections of recycled water demand for DSRSD are based on discussions with staff and information provided by DSRSD on expected near-term growth. DSRSD projected average and maximum day demands are shown in Figure A-17. On-site demands at the recycled water plant are included in 2023 DSRSD demand and are assumed to remain constant in the future at 0.15 mgd. As shown in Figure A-17, DSRSD has a small amount of near-term customer demand that could be connected by 2025, but connecting additional customers beyond that would require new infrastructure. Therefore, the projections assume a pause in new connections until 2030. From that point, demand was projected linearly out to 2045 up to the contractual limit of 3,730 AFY (3.3 mgd).

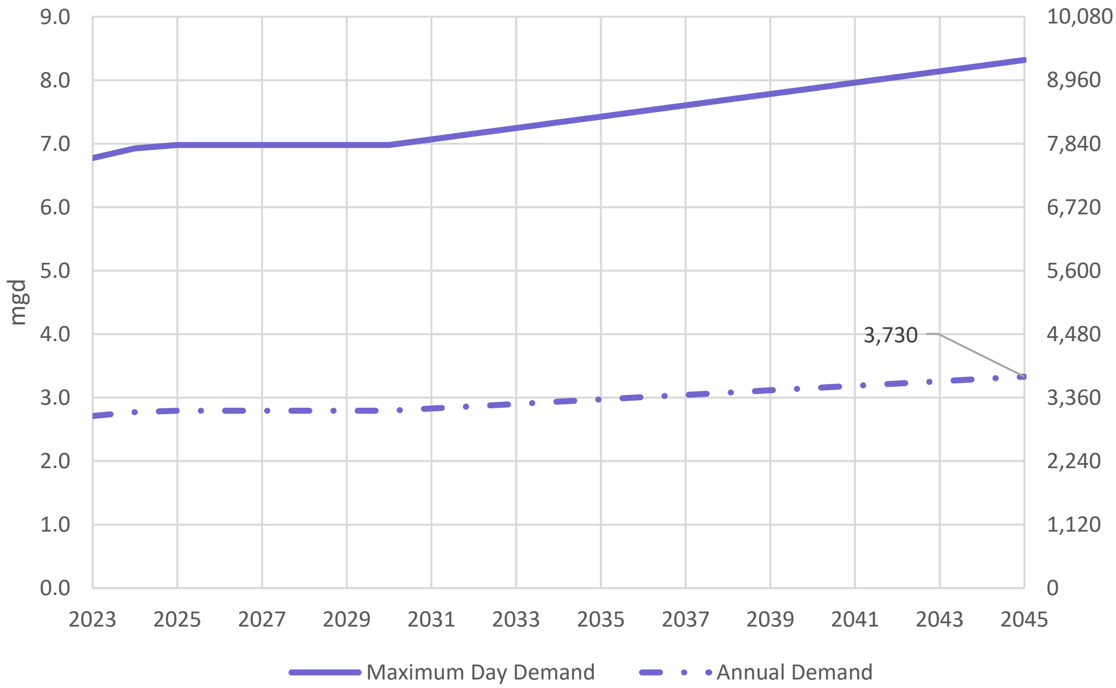


Figure A-17. DSRSD demand projections

A.3.2.3 EBMUD

Projections of recycled water demand for EBMUD are based on specific recycled water customers that they are planning to connect by phase. Table A-4 summarizes the phases and the proposed connection year.

Table A-4. EBMUD Future Customer Demands by Phase

Phase	Description	Average Annual Demand		Maximum Day Demand, mgd	Connection Year
		AFY	mgd		
1 and 2 (Complete)	Existing demand with the addition of Crow Canyon and Canyon Lakes (South) golf courses.	1,373	1.225	3.06	2022
2 (New development)	New development within the Phase 2 area, expected by 2025. Recycled water infrastructure is already in place, making these customers ready to connect.	18	0.016	0.04	2025
3A, 3C	Includes many small customers. These phases require constructing new infrastructure.	557	0.500	1.24	2030
4, 5	Includes two country clubs (larger customers)	540	0.480	1.21	2033
3B	Optional phase	162	0.140	0.36	2035
	TOTAL	2,650	2.361	5.91	

The resulting projections of average and maximum day demands as shown in Figure A-18 are more stepwise compared to Pleasanton and DSRSD. This is due to more detailed plans regarding specific groups of customers and the infrastructure needed to serve them. The projection is less than EBMUD's contractual limit of 2,690 AFY by 40 AFY.

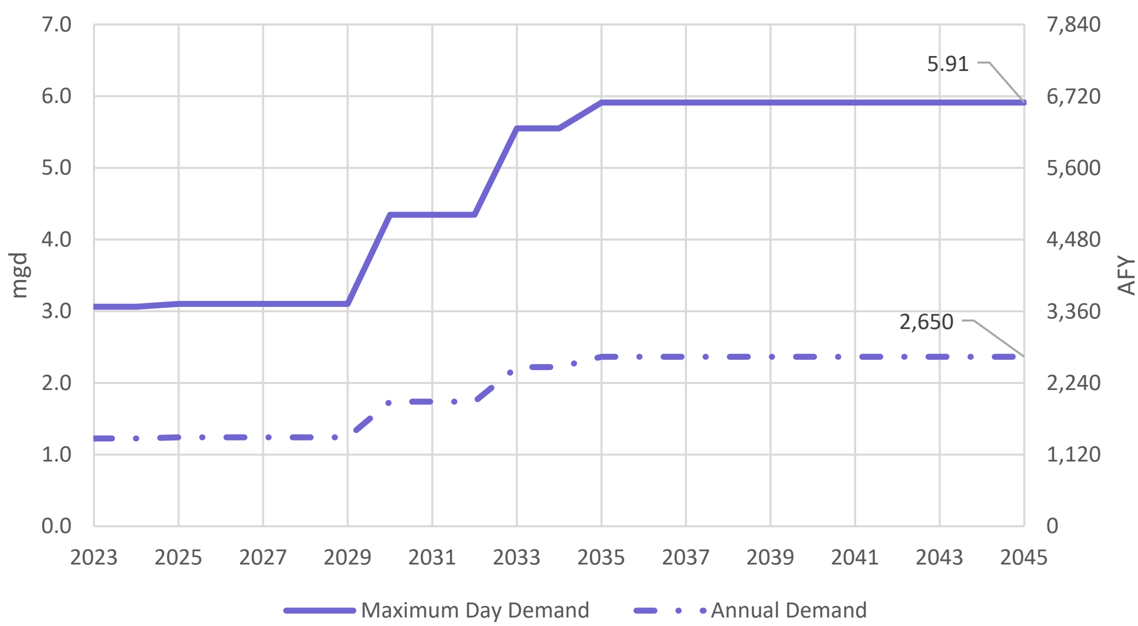


Figure A-18. EBMUD demand projections

A.3.2.4 Total

The total projected demand includes estimated demands from Pleasanton, DSRSD, and EBMUD along with an estimate of NRW based on 10 percent of DSRSD and EBMUD demands. Figure A-19 and Figure A-20 show the total projected demands for average annual and maximum day, respectively. Historical production is shown for 2019 to 2022 with the projections then starting in 2023. A dotted line is also shown to give reference to the demand with the moratorium in place. The projected incremental increase in maximum day demands is shown in Figure A-21 for near-term and buildout conditions.

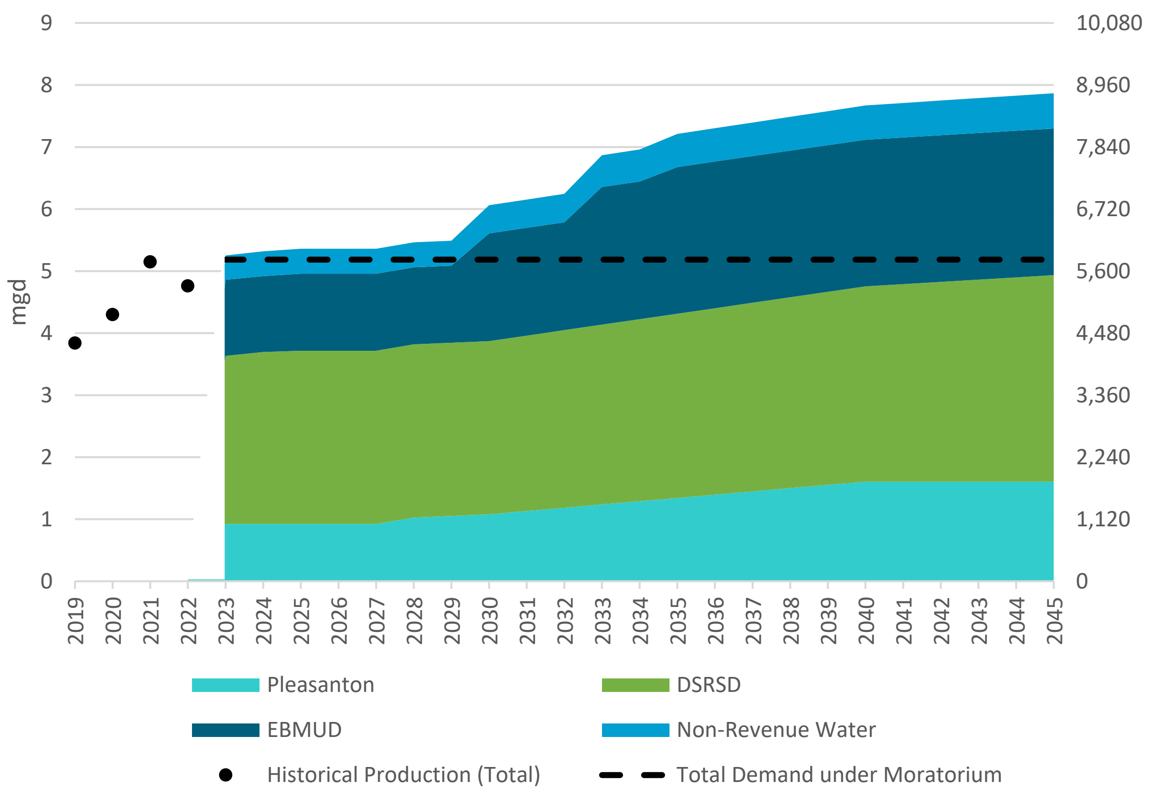


Figure A-19. Total projected average day demand

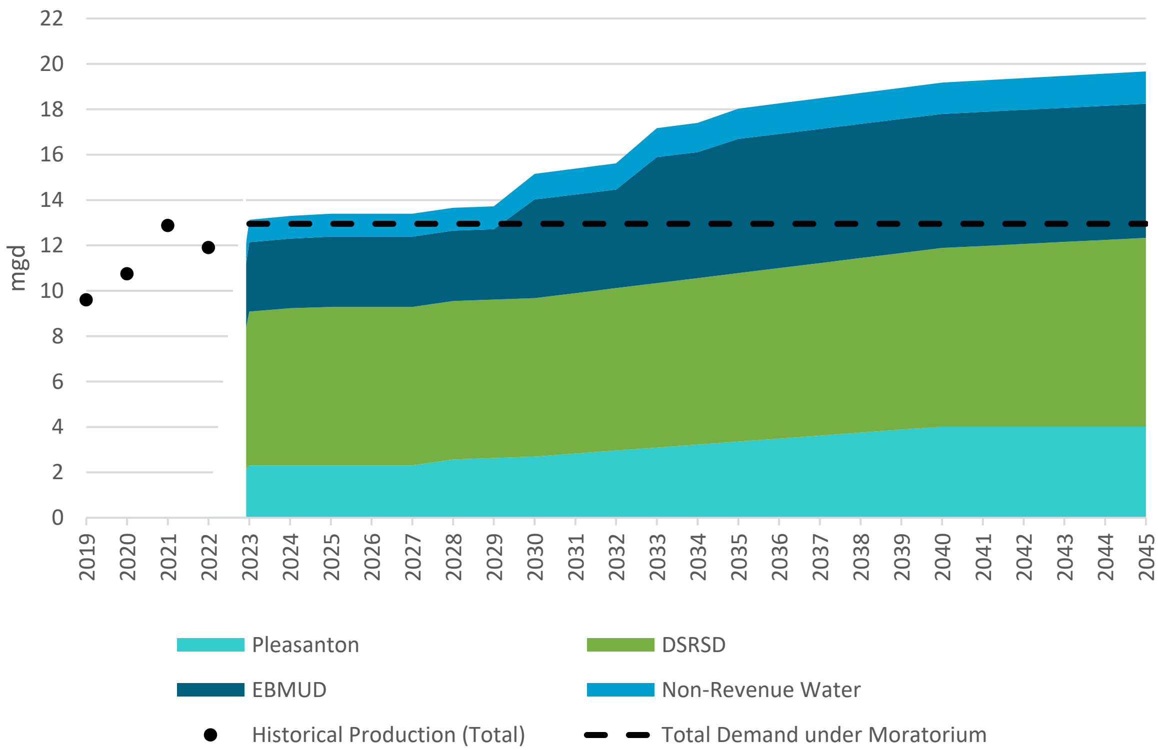


Figure A-20. Total projected maximum day demand

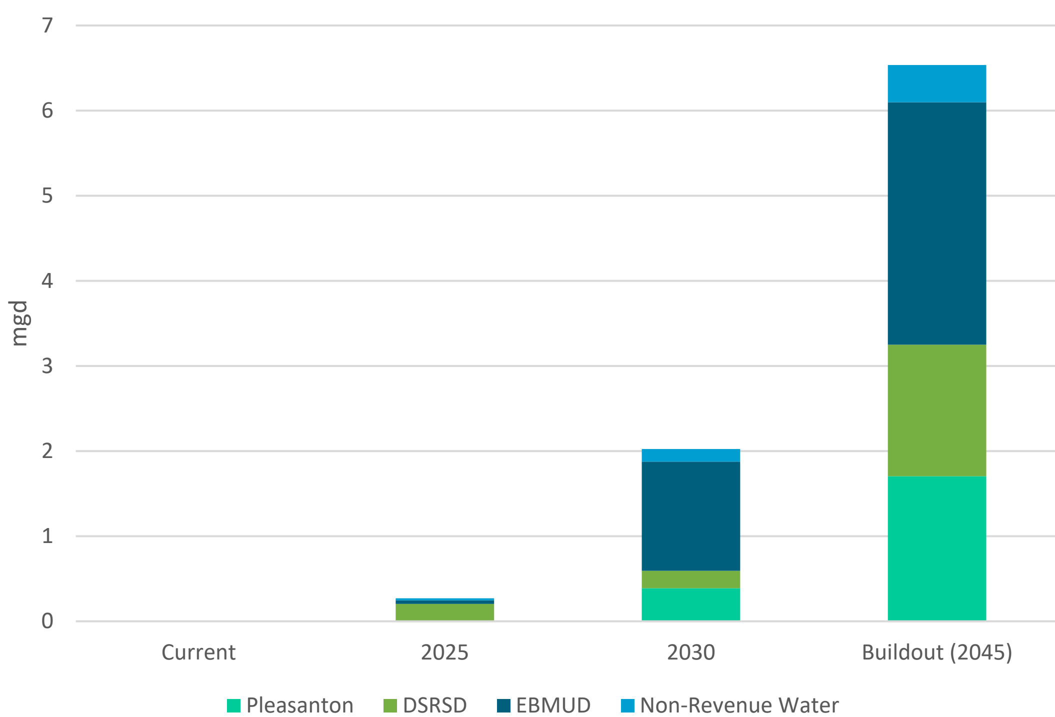


Figure A-21. Incremental demand increase, maximum day demands

A.3.3 Supply and Demand Analysis

The project team analyzed future supply and demand conditions to understand DERWA's ability to meet future demands.

A.3.3.1 Approach

Future supply and demand scenarios were simulated on a daily timestep over 1 year. Similar to the existing conditions evaluation, the simulation considered on-site storage reservoirs at the recycled water plant and evaporation from those reservoirs. The same maximum capacity of 5 MG was assumed for on-site storage. Performance metrics included future system yield, the magnitude of shortages, and the total number of days with shortages over the simulated year.

A.3.3.2 Conditions

The conditions simulated included projections of supply and demand starting in 2025 in 5-year increments out to a buildout condition estimated by 2045. The supply projections considered high and low projections:

- High Supply: projection of DUEs multiplied by 220 gpd/DUE
- Low Supply: projection of DUEs multiplied by 195 gpd/DUE

Future demand was calculated as the sum of individual projections for Pleasanton, DSRSD, EBMUD, and NRW by year. The performance metrics were calculated for the future supply and demand conditions every 5 years out to 2045. For each future condition, demand was varied on a daily timestep over a year based on the 2021 demand pattern that was also used for the existing conditions analysis.

A.3.3.3 Results

The results are presented in terms of system yield and risk of shortages. System yield is defined herein as the average annual demand that can be met with no shortages. A key condition for these results is that they are based on using the 2021 demand pattern. A higher annual demand could be met in a given year if the demand pattern had lower peaks or if the demands were distributed differently over the year. The resulting system yield by year and supply condition is shown in Table A-5. Yield does not increase past 2035 because supply is not projected to increase further after buildout of the wastewater collection system service area is reached.

Table A-5. Projected System Yield

Year	High Supply Condition		Low Supply Condition	
	Yield, AFY	Yield, mgd	Yield, AFY	Yield, mgd
2025	5,941	5.3	5,380	4.8
2030	6,389	5.7	5,717	5.1
2035 to 2045	6,501	5.8	5,829	5.2

Figure A-22 shows the resulting yield over time compared to the average annual demand, which illustrates the supply gap.

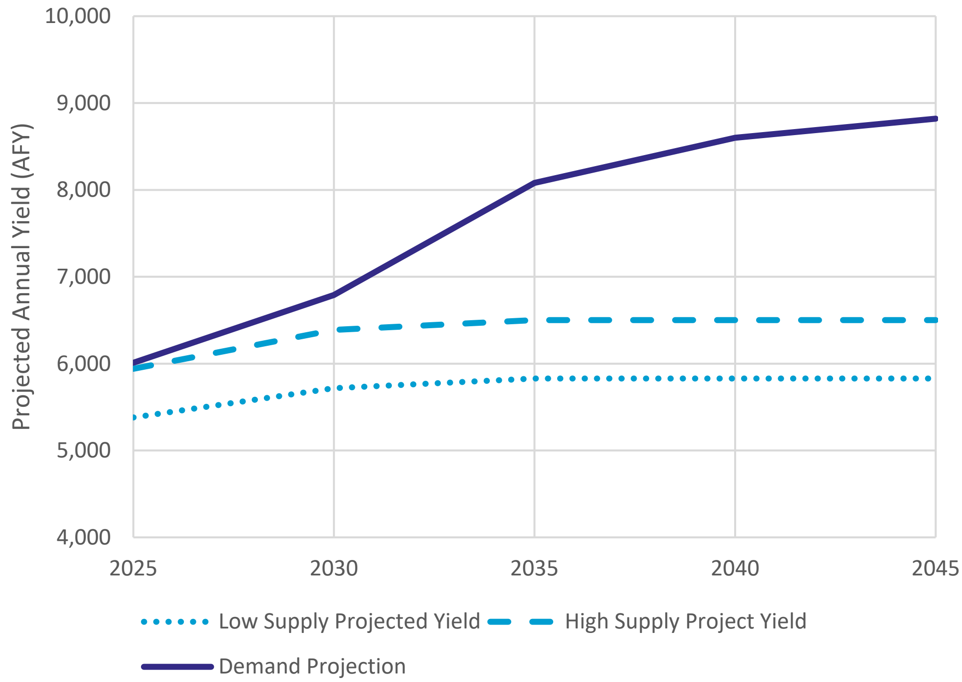


Figure A-22. Projected system yield compared to projected demand

If demand increases with no additional supply beyond the projected baseline conditions, the anticipated shortages are as summarized in Table A-6. The range shown is based on the high and low supply projections.

Table A-6. Simulated Future Shortages[a]

Year	Shortage Volume		Number of Days with Shortages	Maximum Shortage, mgd
	AF	MG		
2025	10 to 160	2 to 50	3 to 40	1.0 to 3.8
2030	60 to 310	20 to 100	10 to 50	3.1 to 4.9
2035	440 to 850	140 to 280	60 to 90	6.1 to 7.4
2040	690 to 1,190	230 to 390	80 to 110	7.3 to 8.6
2045	820 to 1,350	270 to 440	90 to 120	7.8 to 9.1

a. Ranges are based on the high and low supply conditions.

The volume of predicted shortages is shown graphically in Figure A-23. Figure A-23 indicates the average annual demand that can still be met if the extent of shortages predicted is acceptable. The lower and middles lines are the annual demands that can be met under low and high supply conditions, respectively. The top line is the total demand. The difference between the top and the middle and lower lines is the shortage volume in AF, as shown in Table 3-3. Out to 2030, the shortage volume is small compared to the overall demand that can be met. Beyond 2030, the shortage volume is larger and well beyond DERWA's risk tolerance.

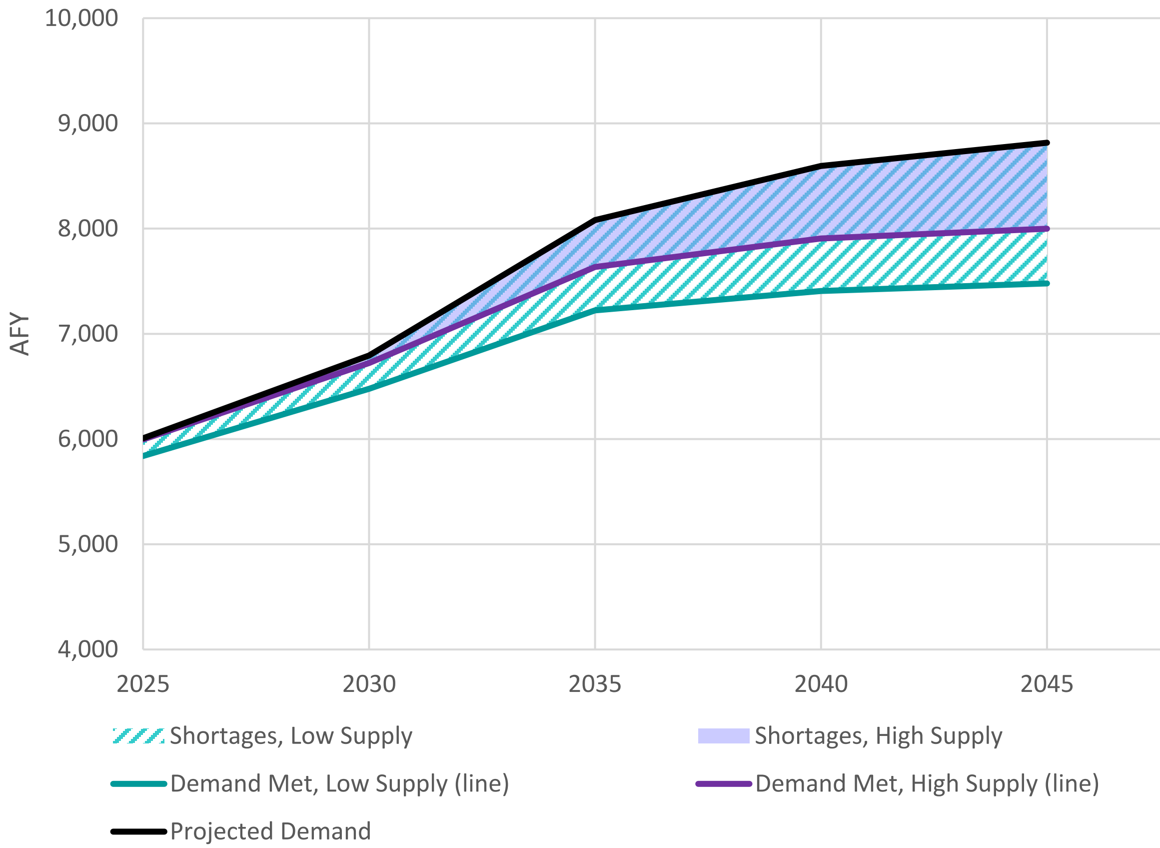


Figure A-23. Shortages and demand met compared to total demand

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Appendix B: Alternatives Evaluation

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Appendix B: Evaluation of Benefits and Costs

The DERWA Recycled Water Supply and Operations Plan Update involved a multi-step process to evaluate and prioritize supplemental supply alternatives based on relative benefit and cost. Many of the alternatives are still conceptual, and therefore the relative benefits and costs may shift as projects are further defined. However, this exercise aided in comparing and prioritizing alternatives to inform next steps. The results of this evaluation informed the roadmap presented in DERWA's Recycled Water Supply Management Plan.

B.1 Evaluation Criteria

The project team identified eight evaluation criteria to differentiate and prioritize seven supply alternatives (Table B-1). These criteria are framed as benefits, where a higher score is better. All criteria were evaluated qualitatively, except for ability to meet demand at buildout, which was quantified in acre-feet per year (AFY). Cost was considered separately, as discussed further below. Non-monetary criteria are critical to project success and require a defensible, repeatable approach that makes use of project information available at the time.

Table B-1. Evaluation Criteria

Criteria	Description	Quantitative	Qualitative
Ability to Meet Demand at Buildout	Volume of additional demand met in 2045 (in AFY), based on projected supply and demand. Includes estimated supply used from the alternative source (during the peak season) plus additional recycled water that DERWA could produce in the shoulder months.[a]	✓	
Regulatory Feasibility	Complexity of known/anticipated regulatory requirements. Ease of securing permits for construction and ongoing operations.		✓
Technical Feasibility and Supply Certainty	Feasibility of design, construction, and operation from a technical/engineering standpoint.		✓
Institutional Complexity	Ease of implementation and operation from an institutional standpoint (e.g., willingness of external partners).		✓
DERWA Control	Local or regional (non-imported) supply source or conveyance.		✓
Stakeholder Support	Anticipated level of support from local leaders/NGOs and the public.		✓
Water Quality	Ability to improve delivered water quality, reduce odor, maintain residual chlorine, and avoid sources contaminated with CECs (e.g., PFAS).		✓
Impact on Staff	Anticipated changes to workload for DERWA, DSRSD, or EBMUD staff.		✓

a. *Augmenting supply in the peak season would enable expansion of the recycled water program year-round; therefore, this criterion reflects the overall expected benefit from the alternative (i.e., total additional demand that can be met in a year).*

NGO = non-governmental organization

CEC = contaminants of emerging concern

B.2 Weighting and Sensitivity

Assigning weights to evaluation criteria allows decision makers to emphasize the relative importance of some criteria over others (higher weight indicates greater relative importance). The weighting scheme presented in Table B-2 was reviewed and confirmed by DERWA staff. This weighting scheme emphasizes the importance of meeting buildout demands, indicating DERWA's desire to secure sufficient supply to lift the moratorium.

Table B-2. Criteria Weighting

Criteria	Weight
Ability to Meet Demand at Buildout	24%
Regulatory Feasibility	11%
Technical Feasibility & Supply Certainty	11%
Institutional Complexity	11%
DERWA Control	12%
Stakeholder Support	11%
Water Quality	8%
Impact on Staff	12%
Total	**100%**

B.3 Scoring Alternatives

Table B-3 presents the scoring guide for evaluating benefits. The quantitative criterion (ability to meet demand at buildout) was scored as the volume of additional demand that could be met in 2045, based on a simulation of future supply and demand. For qualitative criteria, each alternative was scored relative to others using an increasing positive scale (higher score = more benefit).

Table B-3. Scoring Guide for Evaluation					
Quantitative Criteria	**Score**				
Ability to Meet Demand at Buildout	Volume of additional demand (in AFY) that can be met in 2045 (ranges from 0 to 3,000 AFY).				
Qualitative Criteria	**1**	**2**	**3**	**4**	**5**
Regulatory Feasibility	Uncertain if regulations can be met.	Regulatory requirements known/anticipated and complex.	Regulations can be met and straightforward (e.g., proven compliance).	-	-
Technical Feasibility & Supply Certainty	Uncertainty around land availability, operational requirements, or supply consistency. Low likelihood of supply certainty.	Requirements known but challenging/ complex (e.g., requires new facilities or substantial changes in operations). Medium likelihood of supply certainty.	Requirements known and straightforward (e.g., can be achieved with existing facilities; minimal operational changes needed). High likelihood of supply certainty.	-	-
Institutional Complexity	No willing partner.	Willing partners & no existing agreement.	Willing partners with existing agreement.	No partners needed (DERWA can pursue independently).	-
DERWA Control	Imported supply.	Local supply.	-	-	-
Stakeholder Support	Known opposition.	Likely opposition.	Unknown.	Likely support.	Known support.
Water Quality	Documented risk of odor, loss of residual chlorine, or PFAS.	Unknown.	Documented evidence of low risk.	Improved water quality.	-
Impact on Staff	Difficult to implement, significant impact to staff workload (e.g. continuous monitoring needed, need to hire additional staff).	Difficult to implement, some impact to staff workload.	Easier to implement, minimal changes to staff workload.	No changes to staff workload.	-

Project team members independently scored each alternative using Table B-3 as a guide. After compiling and comparing independent scoring results, the project team discussed differences across the results and reached consensus on the scores in Table B-4. Explanations for scores that required further discussion are noted in the below table.

Table B-4. Scores

Alternatives	Additional Demand Met (AFY)	Regulatory Feasibility	Technical Feasibility & Supply Certainty	Institutional Complexity	DERWA Control	Stakeholder Support	Water Quality	Impact on staff
Maximum Score:	**3,000**	**3**	**3**	**4**	**2**	**5**	**4**	**4**
Raw Wastewater from Central San	1,400	3	3	2[a]	1	4	3	3
Secondary Effluent from Livermore	1,500	2	2	1	1	4	3	3
Secondary Effluent from EBDA	3,000	2	1	1	1	3	3	3
Treated Recycled Water from Livermore	600	2	2	1	1	4	3	4
Non-Potable Water from Fringe Basin Wells (Low Yield)	1,200	1[b]	1[c]	2[d]	2	2[e]	2	1[f]
Non-Potable Water from Fringe Basin Wells (High Yield)	1,200	1[b]	2[c]	2[d]	2	2[e]	2	2[f]
Potable Water Supplementation from DERWA Agencies	1,100[g]	3	2[h]	2	2	2[i]	4	3[j]

a. *DERWA would need to negotiate a longer-term agreement with Central San.*
b. *Uncertain if water quality standards can be met until a test well is drilled.*
c. *Both well alternatives would require new infrastructure, but the higher yield alternative does not require land acquisition since the more productive wells are on DSRSD property. Additionally, the lower yield wells have less reliability and supply uncertainty, and thus are scored lower.*
d. *Permitting and drilling requires approval from Zone 7, the basin's Groundwater Sustainability Agency.*
e. *New wells could have possible local opposition from those already pumping in the area since it could impact their yield (a spacing of 5,000+ feet minimum required).*
f. *Adding groundwater wells to DERWA's supply portfolio would significantly increase staff effort through activities such as permitting, drilling, testing, operating, and monitoring. However, the higher yield option scored higher since there are fewer wells to maintain.*
g. *Additional demand met with recycled water (excludes potable supply).*
h. *While technically feasible, the DERWA Board is not interested in potable water supplementation in drought years from a policy perspective.*
i. *Anticipated opposition around using potable water for non-potable uses.*
j. *Potable water supplementation could require close demand monitoring and frequent valve operation to avoid potable water waste.*

The scores in Table B-4 were normalized (i.e., converted to a scale of 0 to 1 for each criterion to create a comparable basis), multiplied by their weights (Table B-2), and summed to develop an overall relative benefit score for each alternative. This orients the analysis so maximum normalized scores are associated with maximum benefit. Figure B-1 presents the relative benefit scores. Each colored bar represents the benefit score for an individual criterion (shown in legend); alternatives with longer bars (i.e., towards the top of the figure) generally offer greater benefits.

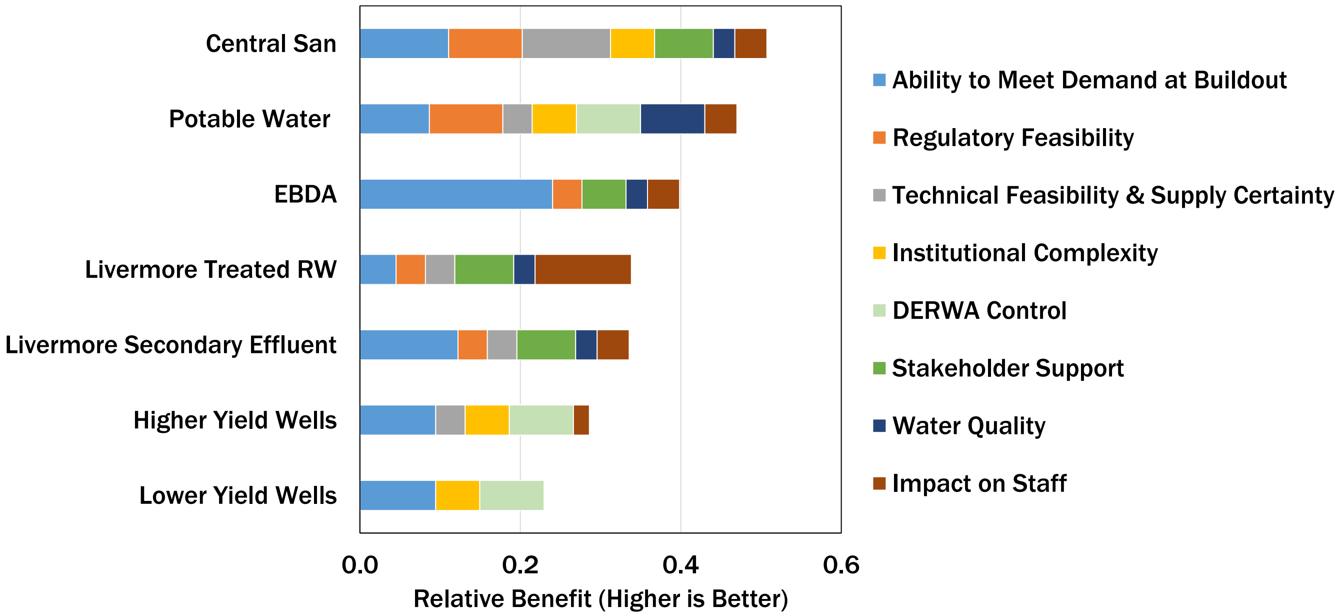

Figure B-1. Relative benefit scores of alternatives

B.4 Benefits Versus Cost

Considering costs in addition to benefits adds another dimension to the evaluation and helps to further distinguish alternatives. Figure B-2 shows the relative benefit scores versus estimated unit costs for each alternative. Optimal results are closest to the top-left corner of the chart (highest benefit and lowest cost).

The Central San and Livermore alternatives would add minimal cost beyond DERWA's current treatment cost, which is approximately $1,200/AF. Conversely, the EBDA alternative is more expensive than most potable water supply projects that EBMUD and DSRSD are considering. Unit costs are based on the additional demand met at the maximum assumed yield of the supplemental supply; therefore, at lower flows, the unit cost will increase. For example, if the EBDA alternative were designed to deliver 3 mgd (instead of 6 mgd) based on DERWA's interim supply need, the unit cost would be higher.

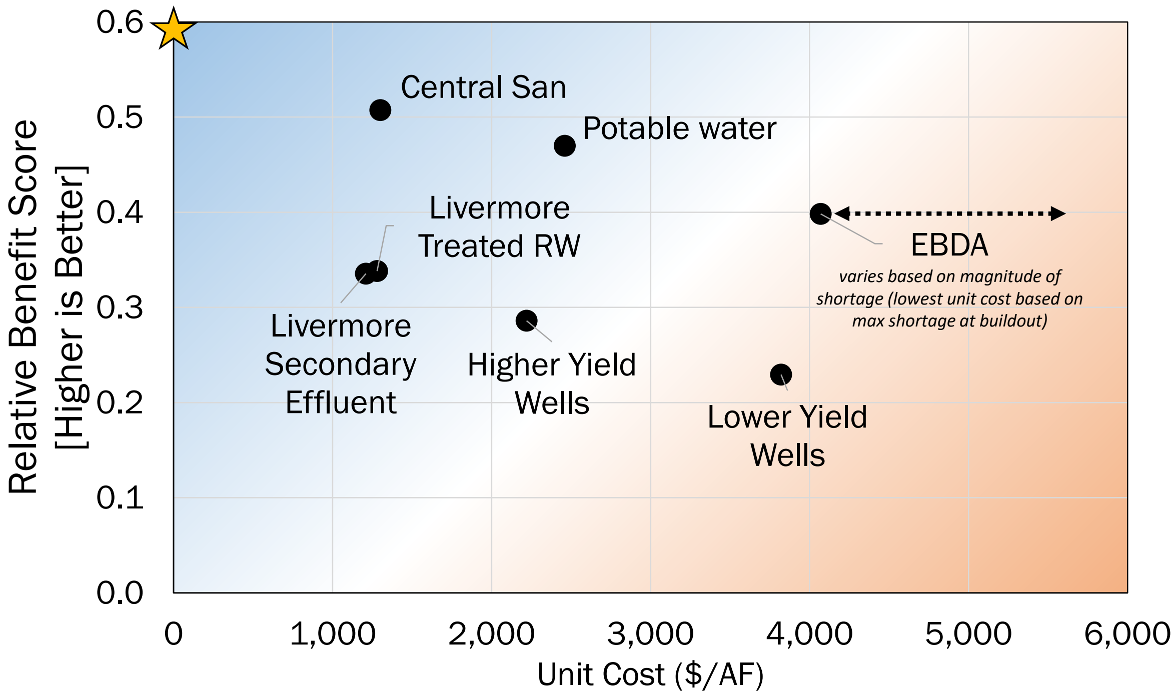

Figure B-2. Alternative benefits vs. unit cost graph

B.5 Summary

The results of the evaluation, along with feedback from the DERWA Board, informed the roadmap for expansion as presented in Section 5 of the Recycled Water Supply Management Plan. While some alternatives are more expensive or less favorable than others, no alternatives are fully ruled out at this time.

For many alternatives, additional studies are needed to further define the benefits and costs, including impacts to ratepayers. In particular, costs and benefits of the Fringe Basin alternatives may shift based on groundwater quality and quantity, which require field testing to confirm. Given that the EBDA alternative is not cost effective in the near-term, benefits and costs should be re-evaluated based on future needs (only if/when other alternatives are exhausted).

Appendix C: Cost Estimates

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Appendix C: Cost Estimates

The DERWA Recycled Water Supply and Operations Plan Update included development of estimated costs for seven water supply alternatives. This document summarizes the basis for costs presented in the Study. Capital costs for the alternatives are estimated at a level consistent with the Association of the Advancement of Cost Engineering's (AACE) definition of Class 5 estimates for screening conceptual projects, which has an accuracy level of -50 percent to +100 percent.

Tables C-1 and C-2 present the estimated capital cost, annual operation and maintenance (O&M) cost, total annual cost, and unit cost for each alternative. Total annual cost is the sum of the annualized capital cost (assuming 5 percent interest over 30 years) and the annual O&M cost. Further details on the capital and O&M cost for each alternative are discussed in each subsection of this appendix. Alternatives are ordered herein based on level of treatment.

Two sets of unit costs were prepared, based on different volumetric assumptions. Table C-1 presents costs based on "Additional Demand Met," which includes the demand met from the supplemental supply (in the peak season) plus the additional recycled water that can be produced by DERWA in the shoulder months. This demand is estimated based on a simulation of projected supply and demand at buildout, using DERWA's 2021 demand profile as a basis. Though actual demand met would vary based on customer water use and other conditions at the time the supplemental supply is introduced, alternatives with a higher "Additional Demand Met" are generally expected to yield a greater amount of supply. Table C-2 presents costs calculated using "Peak Season Volume," which represents the volume theoretically available from the supplemental supply source during the peak season and does not factor in recycled water demand. "Peak Season Volume" is calculated as the assumed daily flow over 150 days.

While capital costs are the same for both approaches, O&M and unit costs differ slightly based on the assumed volume, though generally follow the same ranked order. The costs in Table C-1 (based on "Additional Demand Met") were used for the purpose of evaluating alternatives in this Study. These preliminary cost estimates are intended to be used for comparative purposes only; more detailed costs should be developed as alternatives are further defined.

Table C-1. Alternatives Cost Summary – Based on Additional Demand Met					
Alternative	Total Capital Cost ($ millions)[a]	Annual O&M Cost ($ millions per year)[a]	Total Annual Cost ($ millions per year)[a]	Additional Demand Met (AF)	Unit Cost ($/AF)
Raw Wastewater from Central San	< $1	$1.8	$1.8	1,400	$1,300
Secondary Effluent from Livermore	$2	$1.8	$1.9	1,500	$1,300
Secondary Effluent from EBDA (6 mgd)	$112	$5.0	$12.2	3,000	$4,100
Secondary Effluent from EBDA (3 mgd)[b]	$92	$2.5	$8.5	1,500	$5,600
Treated Recycled Water from Livermore	< $1	$0.7	$0.8	600	$1,300
Non-potable Water from Fringe Basin Wells (Higher Yield)	$12	$1.9	$2.7	1,200	$2,300
Non-potable Water from Fringe Basin Wells (Lower Yield)	$39	$2.0	$4.5	1,200	$3,900
Peak Season Potable Water Supplementation	$4	$2.5	$2.7	1,100[c]	$2,500

a. *Capital costs rounded up to the nearest million.; O&M and total annual cost rounded up to the nearest $100,000; unit cost rounded up to the nearest $100.*

b. *Although the EBDA alternative could produce up to 6 mgd (DERWA's maximum assumed shortage at buildout), costs are also shown for a 3 mgd project for comparison purposes.*

c. *Additional demand met with recycled water (excludes potable supply).*

Table C-2. Alternatives Cost Summary – Based on Peak Season Volume				
Alternative	Annual O&M Cost ($ millions per year)[a]	Total Annual Cost ($ millions per year)[a]	Peak Season Volume (AF)	Unit Cost ($/AF)
Raw Wastewater from Central San	$1.7	$1.7	1,200	$1,300
Secondary Effluent from Livermore	$1.6	$1.7	1,400	$1,300
Secondary Effluent from EBDA (6 mgd)	$4.7	$12	2,800	$4,400
Secondary Effluent from EBDA (3 mgd)[b]	$2.4	$8.3	1,400	$6,000
Treated Recycled Water from Livermore	$0.8	$0.8	500	$1,700
Non-potable Water from Fringe Basin Wells (Higher Yield)	$1.9	$2.6	1,100	$2,500
Non-potable Water from Fringe Basin Wells (Lower Yield)	$2.0	$4.5	1,100	$4,200
Peak Season Potable Water Supplementation	$3.2	$3.5	1,400	$2,500

a. *O&M and total annual cost rounded up to the nearest $100,000. Capital costs are the same as presented in Table C-1.*

b. *Although the EBDA alternative could produce up to 6 mgd (DERWA's maximum assumed shortage at buildout), costs are also shown for a 3 mgd project for comparison purposes.*

C.1 General Assumptions

Table C-3 summarizes the assumed costs for water purchases, treatment, energy, conveyance, and materials used in development of capital and O&M costs.

Table C-3. Cost Assumptions

Item	Unit Cost	Notes/Source
Purchased Water		
Livermore recycled water cost	$4.61/ccf	Applied to the Treated Recycled Water from Livermore alternative. Referenced from 2023 Pleasanton Water and Recycled Water Rate Study for FY23.
DERWA recycled water cost	$1.51/ccf	Applied to the Treated Recycled Water from Livermore alternative. Referenced from 2023 Pleasanton Water and Recycled Water Rate Study for FY23.
EBMUD potable water rate	$2,100/AF	Applied to the Potable Water alternative. Provided by EBMUD staff.
DSRSD potable water rate	$1,800/AF	Applied to the Potable Water alternative. Provided by DSRSD staff, based on the DSRSD FY24 Budget.
Treatment, Energy, and Conveyance		
DSRSD primary and secondary treatment cost	$121/AF	Provided by DSRSD staff.
DERWA treatment cost	$994/AF	FY25 rate from the FY24/25 Proposed DERWA Operations and Capital Budget. Includes labor, maintenance, and chemical costs.
DERWA transmission cost	$156/AF	FY25 rate from the FY24/25 Proposed DERWA Operations and Capital Budget.
LAVWMA discharge cost	$259/AF	FY21/22 rate. Provided by DSRSD staff and consistent with DSRSD's 2021 Alternative Water Supply Study.
Energy rate	$0.28/kWh	Based on the operation of two wells in Pleasanton during FY20/21, which are also presented in the 2023 Pleasanton Water Supply Alternatives Study.
Well pumping rate	463 kWh/AF	Based on the energy and volumetric yield for two wells, which are also presented in the Pleasanton 2023 Pleasanton Water Supply Alternatives Study.
Materials and Installation (estimates provided by Brown and Caldwell)		
8-inch HDPE pipe	$130/LF	Applied to the Secondary Effluent from Livermore and Fringe Basin Wells alternatives.
8-inch trenching	$100/LF	Applied to the Secondary Effluent from Livermore and Fringe Basin Wells alternatives.
12-inch HDPE pipe	$210/LF	Applied to the Potable Water alternative.
12-inch trenching	$120/LF	Applied to the Potable Water alternative.
16-inch HDPE pipe	$270/LF	Applied to the EBDA 3 mgd alternative.
16-inch trenching	$280/LF	Applied to the EBDA 3 mgd alternative. Unit cost is increased to account for 7 miles of dense urban area and steep hilly terrain.
20-inch HDPE pipe	$340/LF	Applied to the EBDA 6 mgd alternative.
20-inch trenching	$320/LF	Applied to the EBDA 6 mgd alternative. Unit cost is increased to account for 7 miles of dense urban area and steep hilly terrain.
Jack-and-bore estimate	$1,000/LF	Applied to major road, railroad, and water crossings in the EBDA alternatives, assumed to be 1 mile between the San Francisco Bay and Castro Valley.

ccf = centum cubic feet

C.2 Raw Wastewater from Central San

Since the infrastructure for diverting raw wastewater from Central San is already in place, it is assumed that this alternative has minimal capital cost (<$1 million). Table C-4 presents the estimated annual O&M costs and staffing requirements for operating this alternative. Labor costs assume the Central San diversion would be opened and closed only once during the peak season (about 10 hours of staff time). However, operating the diversion continuously throughout the peak season may require DERWA to discharge some unused wastewater through the LAVWMA pipeline when demands are low. The preliminary cost estimate assumes 10 percent of the diverted flow is wasted, though actual amount may vary.

Table C-4. Annual O&M Estimate for Central San Raw Wastewater

Category	Item	Cost
Treatment & Conveyance	DSRSD WWTP primary and secondary treatment[a]	$170,000
	DERWA recycled water treatment and transmission[a]	$1,560,000
	Conveyance and disposal of unused wastewater via LAVWMA/EBDA[b]	$30,000
Labor	Turnout operation	$1,000
	Total:	**$1,791,000**

a. *Primary, secondary, and recycled water treatment unit costs were applied to supplemental supply volumes and additional DERWA supply delivered to customers (including shoulder seasons and summer days when demand is less than supply).*

b. *Assumes 10 percent of wastewater flows are discharged through LAVWMA in the Peak Season.*

C.3 Secondary Effluent from Livermore

Capital costs for receiving secondary effluent from Livermore, shown in Table C-5, include a new half-mile pipeline. Flow would be intercepted at the existing LAVWMA junction box across from DSRSD's wastewater treatment plant (WWTP) and diverted to DSRSD Holding Basin No. 4 for recycled water treatment. Pipeline location and specifications were provided by DERWA staff.

Table C-5. Capital Cost for Secondary Effluent from Livermore

Category	Item	Cost
Pipeline	0.5-mile 8" HDPE pipe and trench	$610,000
Markups	3% Material shipping and handling	$20,000
	10.25% Sales tax	$60,000
	10% Contractor general conditions	$90,000
	10% California project	$80,000
	35% Contingency	$300,000
	10% Engineering and SDCs	$90,000
	Total: **AACE Class 5 Range (-50% to +100%)**	**$1,250,000** **($625,000 to $2,500,000)**
	Annualized Capital Cost:	**$81,000**

Table C-6 includes estimated annual O&M costs for receiving secondary effluent from Livermore, assuming about 20 hours of staff time over the peak season to operate this alternative.

Table C-6. Annual O&M Estimate for Secondary Effluent from Livermore		
Category	**Item**	**Cost**
Treatment & Conveyance	DERWA recycled water treatment and transmission[a]	$1,750,000
Labor	Staff operation	$2,000
	Total:	**$1,752,000**

a. Recycled water treatment unit costs were applied to supplemental supply volumes and additional DERWA supply delivered to customers (including shoulder seasons and summer days when demand is less than supply).

C.4 Secondary Effluent from EBDA

Table C-7 presents two sets of capital costs for transporting secondary effluent from the East Bay Dischargers Authority (EBDA) to the DSRSD WWTP. The first estimate is for a 6 million gallons per day (mgd) project, based on DERWA's maximum expected shortage at buildout. However, since DERWA may not need the full 6 mgd—depending on future demands and the status of other supply projects—costs for a 3 mgd project, with a smaller pipeline and pump station, are shown for comparison.

Table C-7. Capital Cost for Secondary Effluent from EBDA		
Category	**Item**	**Cost**
6 mgd project (based on maximum shortage volume at buildout)		
Pipeline	13-mile 20" HDPE pipe and trench	$41,820,000
	Road crossings	$5,280,000
Pump Station	6 mgd pump station	$7,700,000
Markups	3% Material shipping and handling	$1,640,000
	10.25% Sales tax	$5,620,000
	10% Contractor general conditions	$6,210,000
	10% California project	$6,830,000
	35% Contingency	$26,280,000
	10% Engineering and SDCs	$10,140,000
	Total: **AACE Class 5 Range (-50% to +100%)**	**$111,520,000** **($55,760,000 to $223,040,000)**
	Annualized Capital Cost:	**$7,254,000**
3 mgd project		
Pipeline	13-mile 16" HDPE pipe and trench	$34,850,000
	Road crossings	$5,280,000
Pump Station	3 mgd pump station	$4,600,000
Markups	3% Material shipping and handling	$1,340,000
	10.25% Sales tax	$4,580,000
	10% Contractor general conditions	$5,070,000
	10% California project	$5,570,000
	35% Contingency	$21,450,000
	10% Engineering and SDCs	$8,270,000
	Total: **AACE Class 5 Range (-50% to +100%)**	**$91,010,000** **($45,505,000 to $182,020,000)**
	Annualized Capital Cost:	**$5,921,000**

Table C-8 includes estimated O&M costs for the EBDA alternative. Maintenance costs include pump station rehab, which was estimated as 5 percent of the pump station capital cost. Note that there may be additional operational challenges associated with operating the existing LAVWMA pipeline (east of hills) bidirectionally. Furthermore, using the full 6 mgd from EBDA may be constrained by DERWA's available on-site storage. The cost estimates developed for this study are for initial comparative purposes only and will need to be refined if this alternative is further developed.

Table C-8. Annual O&M Estimate for EBDA Secondary Effluent

Category	Item	Cost
6 mgd project (based on maximum shortage volume at buildout)		
Treatment & Conveyance	DERWA recycled water treatment and transmission[a]	$3,440,000
Maintenance	Pump station rehab	$390,000
Energy	Pumping from EBDA to DERWA	$1,090,000
	Total:	**$4,920,000**
3 mgd project		
Treatment & Conveyance	DERWA recycled water treatment and transmission[a]	$1,750,000
Maintenance	Pump station rehab	$230,000
Energy	Pumping from EBDA to DERWA	$520,000
	Total:	**$2,500,000**

a. Recycled water treatment unit costs were applied to supplemental supply volumes and additional DERWA supply delivered to customers (including shoulder seasons and summer days when demand is less than supply).

C.5 Treated Recycled Water from Livermore

Table C-9 shows the system improvements needed for Livermore to increase the amount of recycled water served to Pleasanton, thus reducing Pleasanton's demand from DERWA. Infrastructure needs and costs were provided by DERWA staff and do not necessarily reflect Livermore's constraints, which would need to be further defined in coordination with Livermore staff.

Table C-9. Capital Cost for Treated Recycled Water from Livermore

Category	Item	Cost
PRVs	17 new PRVs	$170,000
SCADA	SCADA upgrades	$200,000
	Total: **AACE Class 5 Range (-50% to +100%)**	**$370,000** **($185,000 to $740,000)**
	Annualized Capital Cost:	**$25,000**

Estimated O&M costs for this alternative are presented in Table C-10, assuming operating this alternative would require about 20 hours of labor over the peak season. Livermore's recycled water rate is currently higher than DERWA's recycled water rate (as noted in Table C-2). Therefore, DERWA would pay the difference (currently $3.1/ccf) on Pleasanton's behalf.

Table C-10. Annual O&M Estimate for Treated Recycled Water from Livermore		
Category	Item	Cost
Treatment & Conveyance	DERWA recycled water treatment and transmission[a]	$530,000
Labor	Staff operation	$2,000
Other Rates	Difference between DERWA wholesale and Livermore recycled water retail rate[b]	$160,000
	Total:	**$692,000**

a. *Since this alternative utilizes in-lieu transfers by reducing Pleasanton's demand from DERWA, the recycled water treatment unit cost is only applied to the "freed up" DERWA supply delivered to customers (including shoulder seasons and summer days when demand is less than supply).*

b. *Includes 20 percent contingency.*

C.6 Non-Potable Water from Fringe Basin Wells

Estimated capital costs for higher- and lower-yield groundwater alternatives, shown in Table C-11, vary based on number of wells and pipeline length. Assuming that wells in the less-productive area of the Fringe Basin could produce 230 gpm, 7 wells would be needed to yield the same amount as two higher-yield wells (assumed at 1,000 gpm and 600 gpm). Groundwater could be pumped to the sewer and conveyed to DSRSD's WWTP or added directly to the DERWA distribution system. For a well located near the DSRSD WWTP, it is equidistant to connect to the sewer or DERWA distribution; however, for a well at DSRSD's office, it is much closer to connect to the sewer. For the purpose of this Study, it is assumed the well water would be pumped to the sewer, and costs for the associated pipelines were derived from the 2019 DERWA Potential Well Sites Evaluation (EBMUD, 2019). Actual costs will depend on location, number, and yield of wells, which are yet to be confirmed.

Table C-11. Capital Cost for Fringe Basin Wells		
Category	Item	Cost
Higher Yield Wells		
Wells	2 wells[a]	$11,000,000
Pipeline	300-foot pipeline to sewer[b]	$260,000
	Total: **AACE Class 5 Range (-50% to +100%)**	**$11,260,000** **($5,630,000 to $ 22,520,000)**
	Annualized Capital Cost:	**$733,000**
Lower Yield Wells		
Wells	7 wells[a]	$38,500,000
Pipeline	500-foot pipeline to sewer[b]	$440,000
	Total: **AACE Class 5 Range (-50% to +100%)**	**$38,940,000** **($19,470,000 to $77,880,000)**
	Annualized Capital Cost:	**$2,533,000**

a. *Non-potable wells are preliminarily estimated at $5.5M per well, including markups; actual cost will depend on site-specific factors once well location and depth are confirmed.*

b. *Based on EBMUD's 2019 estimate and escalated to 2023 dollars. Pipeline lengths and associated costs will depend on well location.*

Table C-12 presents the estimated annual O&M costs for the Fringe Basin groundwater alternatives. Assuming both alternatives yield the same amount of supply, pumping and DERWA treatment/conveyance costs are comparable; however, it is assumed the lower-yield wells have higher maintenance costs due to the greater number of wells. Since DERWA currently does not operate any groundwater wells, it is assumed they would need to hire staff equivalent to 1.5 full-time employees (FTEs).

Table C-12. Annual O&M Estimate for Fringe Basin Wells

Category	Item	Cost
Higher Yield Wells		
Treatment & Conveyance	DSRSD WWTP primary and secondary treatment[a]	$140,000
	DERWA recycled water treatment and transmission[a]	$1,350,000
Maintenance	Well and SCADA rehab and repair	$30,000
Energy	Well pumping	$40,000
Labor	1.5 FTE to operate wells	$300,000
	Total:	**$1,860,000**
Lower Yield Wells		
Treatment & Conveyance	DSRSD WWTP primary and secondary treatment[a]	$140,000
	DERWA recycled water treatment and transmission[a]	$1,350,000
Maintenance	Well and SCADA rehab and repair	$120,000
Energy	Well pumping	$40,000
Labor	1.5 FTE to operate wells	$300,000
	Total:	**$1,950,000**

a. *Primary, secondary, and recycled water treatment costs were applied to supplemental supply volumes and additional DERWA supply delivered to customers (including shoulder seasons and summer days when demand is less than supply).*

C.7 Potable Water Supplementation from DERWA Agencies

Although DERWA currently has several potable connections, the existing connections are for emergency purposes and not intended to be used for sustained periods. Therefore, the estimated capital costs for potable water supplementation, presented in Table C-13, include new permanent infrastructure that would allow for potable water from either DSRSD or EBMUD to be added to Reservoir R100 for more prolonged periods. Further analysis is needed to determine whether it is more appropriate for potable water to come from DSRSD or EBMUD, based on water rights considerations and potential hydraulic limitations. To keep the option open for water to be supplied by either agency, the cost estimate includes a new 0.5-mile DSRSD pipeline and an EBMUD pump station and pipeline. Actual costs may be lower if DERWA decides to build a permanent connection to only one of the member agencies.

Table C-13. Capital Cost for Potable Water Supplementation		
Category	**Item**	**Cost**
Pipeline	EBMUD pipeline and pump station[a]	$2,000,000
	DSRSD 0.5-mile 12" HDPE pipe and trench	$830,000
Markups	3% Material shipping and handling	$20,000
	10.25% Sales tax	$80,000
	10% Contractor general conditions	$120,000
	10% California project	$120,000
	35% Contingency	$420,000
	10% Engineering and SDCs	$120,000
	Total:	**$3,710,000**
	AACE Class 5 Range (-50% to +100%)	**($1,855,000 to $7,420,000)**
	Annualized Capital Cost:	**$242,000**

a. *Estimate provided by EBMUD staff.*

As shown in Table C-14, the estimated annual O&M cost for potable water supplementation includes DERWA transmission, maintenance, energy, labor, and purchased water rates. Since potable water would be added directly to the distribution system, DERWA treatment costs are not applied to the potable supply; however, treatment costs are applied to the additional recycled water that DERWA could produce and deliver in the shoulder months. Maintenance of EBMUD's new pump station is assumed to be 5 percent of the pump station capital cost. The DSRSD connection would be gravity fed, but the EBMUD potable tie-in requires pumping. Labor costs include an estimated 100 hours of labor (assuming the connection is opened/closed 10 times during the peak season). EBMUD and DSRSD potable water rates reflect the average retail water rate; actual cost could vary depending on the portion of water brought in from DSRSD versus EBMUD (to be determined).

Table C-14. Annual O&M Estimate for Potable Water Supplementation		
Category	**Item**	**Cost**
Treatment & Conveyance	DERWA recycled water treatment and transmission[a]	$1,310,000
Maintenance	Pump station rehab	$100,000
Energy	Pumping from EBMUD[b]	$90,000
Labor	Staff operation (about 100 hours per year)	$10,000
Other Rates	DSRSD and EBMUD retail water rates	$890,000
	Total:	**$2,400,000**

a. *The DERWA treatment cost is only applied to additional recycled water delivered to customers (e.g., in the shoulder months). The DERWA transmission cost is applied to the potable supply added in the peak season plus the additional recycled water delivered to customers.*

b. *The energy to pump from EBMUD to the R100 tank assumes a flow rate of 3 mgd over a 0.5-mile pipeline.*

References

City of Pleasanton. *Receive Overview of Water and Sewer Rates and Authorize Mailing Of Proposition 218 Notice of Public Hearing to be Held September 19, 2023 Regarding Proposed Rate Increases*. City Council Agenda Report. July 2023.

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