DRAFT

ALAMEDA COUNTY WATER DISTRICT

WATER RESOURCES MASTER PLAN 2050

ALAMEDA COUNTY WATER DISTRICT

April 2026

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ACRONYMS & ABBREVIATIONS

ACWD	Alameda County Water District
AF	acre-feet
AFY	acre-feet per year
AMI	advanced metering infrastructure
ASR	Aquifer Storage & Recovery
CIP	Capital Improvement Plan
Desal	desalination
DPR	direct potable reuse
DSS	Least Cost Planning Decision Support System Model
FIRO	Forecast-Informed Reservoir Operations
FLOWS	Fish Ladder Operations and Water Stewardship
GSP	groundwater sustainability plan
GW	groundwater
IPR	indirect potable reuse
IRP	Integrated Resources Plan
LSW	local surface water
LTA	long-term average
O&M	operations and maintenance
PFAS	per- and polyfluoroalkyl substances
PW	purified water
Semitropic	Semitropic Groundwater Bank
SFPUC	San Francisco Public Utilities Commission
SGMA	Sustainable Groundwater Management Act
SWP	State Water Project
UWMP	Urban Water Management Plan
UWUO	Urban Water Use Objective
WEMP	Water Efficiency Master Plan
WRMP	Water Resources Master Plan
WTP	Water Treatment Plant
WUE	water use efficiency

GLOSSARY OF TERMS

Baseline Supply	Scenario used to represent supply availability, facility capacity, and operations in the future without implementation of any options or strategies.
Goal	The water resources future ACWD wants to achieve by 2050. These are what the plan should achieve.
Level of Service Goal	Performance goal set by the District. In the case of the WRMP, this refers to reliability performance whereby the District meets 90% of customer demands in all years.
Maximum Allowable Shortage	The maximum amount of shortage (10%) allowed in any year based on the District's established level of service goal related to reliability.
Planning Objective	What ACWD wants to accomplish through the planning process. These are what the work should achieve.
Portfolio	Combination of supply options and resource strategies.
Scenario	Future conditions that impact future water demands and supply availability.
Water Resource Strategy	Water management action that may have a cost, but does not generate a volume of water.
Water Supply Option	Water supply project that generates a volume of water.
Water Supply Reliability	The consistent ability of water supplies to meet demand while considering factors such as hydrology, facilities, and operations.

1. A WATER RESOURCES MASTER PLAN FOR 2050 AND BEYOND

Alameda County Water District (ACWD or District) initiated the Water Resources Master Plan (WRMP or Plan) 2050, a document with a 25-year planning horizon that serves as a "north star" for the District by outlining the District's water supply strategy. The planning conducted as part of the WRMP provides valuable information about the District's future resilience in the face of known uncertainties, helping inform critical decision-making on future infrastructure and water supply investments. As the District's water supply strategy roadmap, this document outlines policy decisions that will help the District evaluate and negotiate changing conditions today and in the future. This roadmap serves as a bridge between the known conditions of today and the relatively unknown conditions of the future.

1.1 Water Resources Goals for 2050

The WRMP anchors around five goals that help define ACWD's water resources future. These goals help guide the District as it considers what actions it can take in the 25-year planning horizon of the WRMP. Developed in coordination with the ACWD Board and with input sought from interested parties and members of the public, the WRMP goals are intended to be achieved through an integrated suite of projects and actions, not a single project or isolated efforts.

While, as with any water supply planning effort, the focus is naturally on ensuring sustainable supplies to meet demands, the District also sought to address other Board and community priorities: affordability, equity, resilience, watershed stewardship, and regional leadership. The goals naturally reflect this, with the first goal focused on a sustainable water supply portfolio that leverages local resources and adapts to climate change. While this goal guides the overall planning effort, the other four goals encourage the District to go beyond the basics by including other, more intangible elements not directly tied to a unit of water.

1.2 Planning Objectives and Processes

To guide the WRMP planning effort, District staff articulated eight planning objectives that outline the desired outcomes of the WRMP planning process. Different than the WRMP goals, the planning objectives guide how the planning process was conducted, from technical analysis methods to engagement and collaboration internal to the District and with external parties. **Figure 1** lists each of the WRMP planning objectives developed and confirmed by the District Board and used to guide the planning processes and results described within this WRMP.

1.3 Collaboration and Engagement

As reflected in the planning objectives, both internal coordination and external outreach and engagement were critical components of WRMP development. ACWD structured a process that identified internal roles and responsibilities along with methods to engage the community. Internal coordination involved a Core Team, Extended Team, and the Board of Directors, while external outreach involved interested parties and the public. The District's outreach and engagement activities focused on deepening collaboration, soliciting feedback on water supply options and resource strategies, and fostering transparency around decision-making.

Internal engagement involved consulting with subject matter experts as technical components of the Plan were discussed, evaluated, or proposed. Extended Team meetings allowed for engagement of key departments throughout the District at meaningful milestones. The Board of Directors was also engaged at regular meetings where they received updates and provided direction to staff.

ACWD prioritized robust external outreach and engagement to ensure that the perspectives of customers and a diverse array of interest groups are reflected in the Plan. The District prioritized being adaptable in terms of collaboration and engagement to encourage meaningful conversations. This included asking the right questions to the right audience through an interested parties' workshop process. Through workshops, surveys, meetings, and targeted communications, ACWD worked to educate, inform, and involve the community in shaping a resilient water future. Although the number of participants was low, the insight that was provided was extremely valuable in ensuring the Plan was developed in alignment with community values. **Table 1** summarizes the audiences and the input received through the planning process. More information about the District's outreach and engagement efforts is included in Appendix A.

Figure 1: WRMP Planning Objectives

	Planning Objectives	WRMP Report Sections
1	Examine a **comprehensive list** of all potential supply projects and management strategies to select a **justifiable portfolio** that will best meet Water Resources Goals.	3.1: Water Supply Options 3.2: Water Supply Portfolio Development 3.5: Selected Portfolio 4: Water Resource Strategies
2	Address **future uncertainty and risk** through robust analysis.	2: Forecasting Conditions in 2050 3.4: Portfolio Comparison & Evaluation
3	Facilitate the making of **near-term tough decisions** and document the timing and **drivers for future decisions**.	3.3: Portfolio Evaluation Criteria 3.4: Portfolio Comparison & Evaluation 5: Implementation Plan
4	Create an adaptive, dynamic, and feasible **implementation pathway**	5: Implementation Plan
5	Identify and develop strategies that **align with funding opportunities**.	4: Water Resource Strategies
6	Encourage and facilitate **staff and Board involvement**, as well as diverse **public and potential collaborator engagement**.	1.3: Collaboration & Engagement
7	**Educate public and customers** on ACWD's current and planned management of water resources.	1.3: Collaboration & Engagement
8	**Support development of related planning efforts** such as ACWD's Engineering Report, UWMP, SGMA, and rate studies.	1.3: Collaboration & Engagement

Table 1: Outreach and Engagement Audiences, Involvement, and Input

Participant Group	Involvement	Input
Core Team	Consulting team and key ACWD staff.	Responsible for the detailed development of the WRMP, meeting weekly to integrate input and make recommendations.
Extended Team	Executive staff and subject matter experts from across ACWD departments.	Provided data, reviewed drafts, and offered cross-functional insights through approximately bimonthly workshops and other adhoc meetings
Interested Parties	Entities such as local municipalities, environmental groups, and groundwater users.	Participated in Advisory Workshops focused on specialized topics like water use efficiency, equity, groundwater impacts, and watershed stewardship.
Board of Directors	ACWD's Board of Directors.	Received regular updates on progress, ensuring transparency and accountability through public meetings. Provided direction and feedback at key progress milestones and approved the final WRMP.
Public	Customers and non-customers who make up the general public of ACWD's service area.	Participated in statistically significant polling effort that shaped outreach efforts, including regular information-sharing via the ACWD website, the use of a public input web tool, community presentations, and educational campaigns.

2. FORECASTING CONDITIONS IN 2050

2.1 Building upon Past Successes to Meet Future Challenges

ACWD completed its previous long-range resource planning process in 1995. The Integrated Resources Plan (IRP) was innovative and ahead of its time and has served the District well over the past 30 years. The 1995 IRP reviewed existing resources and operations, forecasted water demand, and considered known and unknown risks, culminating in a document that has been consistently referenced by District staff and decision-makers to this day. As a result of the IRP, several projects and policies have been implemented that have cost-effectively enhanced District supply reliability while incorporating emerging innovations and addressing changing conditions. An important example is the District's prioritization of groundwater storage, which led to increased use and reliability of its own local groundwater resources while securing storage in the Semitropic Groundwater Bank.

IRP Successes

- ✓ **Demand reduced by 3,600 acre-feet per year** (3.2 million gallons per day)
- ✓ **5 million gallons per day operational in 2003**

  10 million gallons per day operational in 2010
- ✓ **150,000 acre-feet secured in the Semitropic Groundwater Bank**
- ✓ **Groundwater table maintained above sea level**

  Quarry Lakes Groundwater Recharge System improved for more efficient operation
- ✓ **Treatment Plant 2 capacity increased to 23 million gallons per day**
- ✓ **1.8 miles of non-potable water mains installed**

Since the adoption of the IRP, the District has experienced many changes that warrant an updated look at the future of its water supply – for instance, the threat climate change presents to the District's water supply is more clear today than it was in 1995.

Reliability of the Sacramento-San Joaquin Delta has increasingly become a concern considering regulatory shifts, sea level rise, and other system stressors. The Sustainable Groundwater Management Act (SGMA) may present regulatory challenges to the District's ability to rely on its Semitropic Groundwater Bank storage as it has in the past. Water quality concerns, such as PFAS (per- and polyfluoroalkyl substances), are increasing. Other concerns, such as invasive species, also bring challenges to water supply reliability.

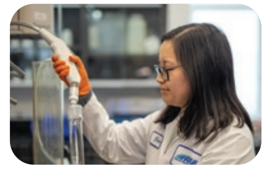
Taking an updated look at the District's water supply future also brings several opportunities to consider new information. Water use efficiency has caused a significant decrease in per capita water use, even despite a growing population. Great improvements have been made in energy efficiency, creating a more level playing field for energy-intensive water supplies. A regulatory framework for advanced purified water now exists. The District's demographics have also changed, bringing new priorities, values, and views on water and water use. As these uncertainties and opportunities unfold in the coming decades, the District needs a framework for decision-making that helps staff efficiently navigate this landscape.

MAJOR FUTURE CHANGES AND CHALLENGES

Urban Water Use Objective

Climate Change

Water Management Regulations



Water Quality

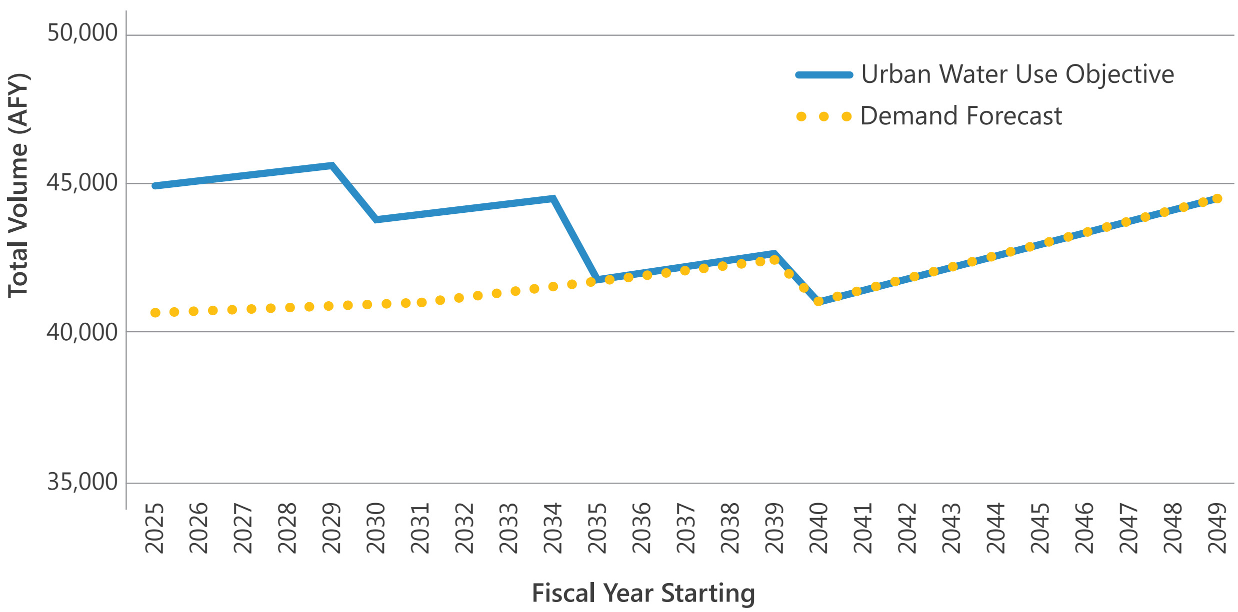
Although 2050 is only 25 years into the future, there are several areas of uncertainty that should be considered when forecasting the availability of current (or baseline) ACWD supply sources to meet forecasted 2050 demands. The WRMP made educated assumptions about the future (demand and baseline supply) to determine potential gaps in meeting District's 2050 goals.

2.2 Demand Forecast for 2050

Future demands in the District's service area have historically been projected using a Least Cost Planning Decision Support System Model (DSS model) developed by Maddaus Water Management and used for the District's Water Efficiency Master Plan (WEMP), which uses inputs of land use information, economic projections, and water use survey data. Modifying the model inputs results in a range of potential demand futures. However, statewide "Making Conservation a California Way of Life" regulations now direct the District to meet calculated Urban Water Use Objectives (UWUO or efficiency standards) starting in 2025. The District's Board has formally committed to meeting these Urban Water Use Objectives. The most efficient and cost-effective path to compliance is expected to be adaptive over time, reflecting changes in customer behavior, technology, and leveraging ACWD's investment in Advanced Metering Infrastructure (AMI). While the specific actions may evolve, the District is committed to achieving and maintaining the resulting demand profile. The feasibility of the recommended water supply strategy and final WRMP depend on successful implementation of the conservation levels assumed in this forecast.

Because the District is already below the mandated 2025 levels, the forecast assumes a fairly flat total demand between 40,000 and 45,000 acre-feet per year (AFY), carrying through 2050, once additional water use efficiency measures and goals are in place. These measures are outlined in the District's WEMP, as amended in 2026. The WEMP is a dynamic plan that will be evaluated and amended, as needed, to ensure water use efficiency goals are met. With this regulatory-driven demand forecast, the District has effectively limited the uncertainty traditionally associated with demand projections. Thus, uncertainty stems from future baseline supply. **Figure 2** shows the demand projection used for the WRMP. More information about the demand forecasting process can be found in Appendix B.

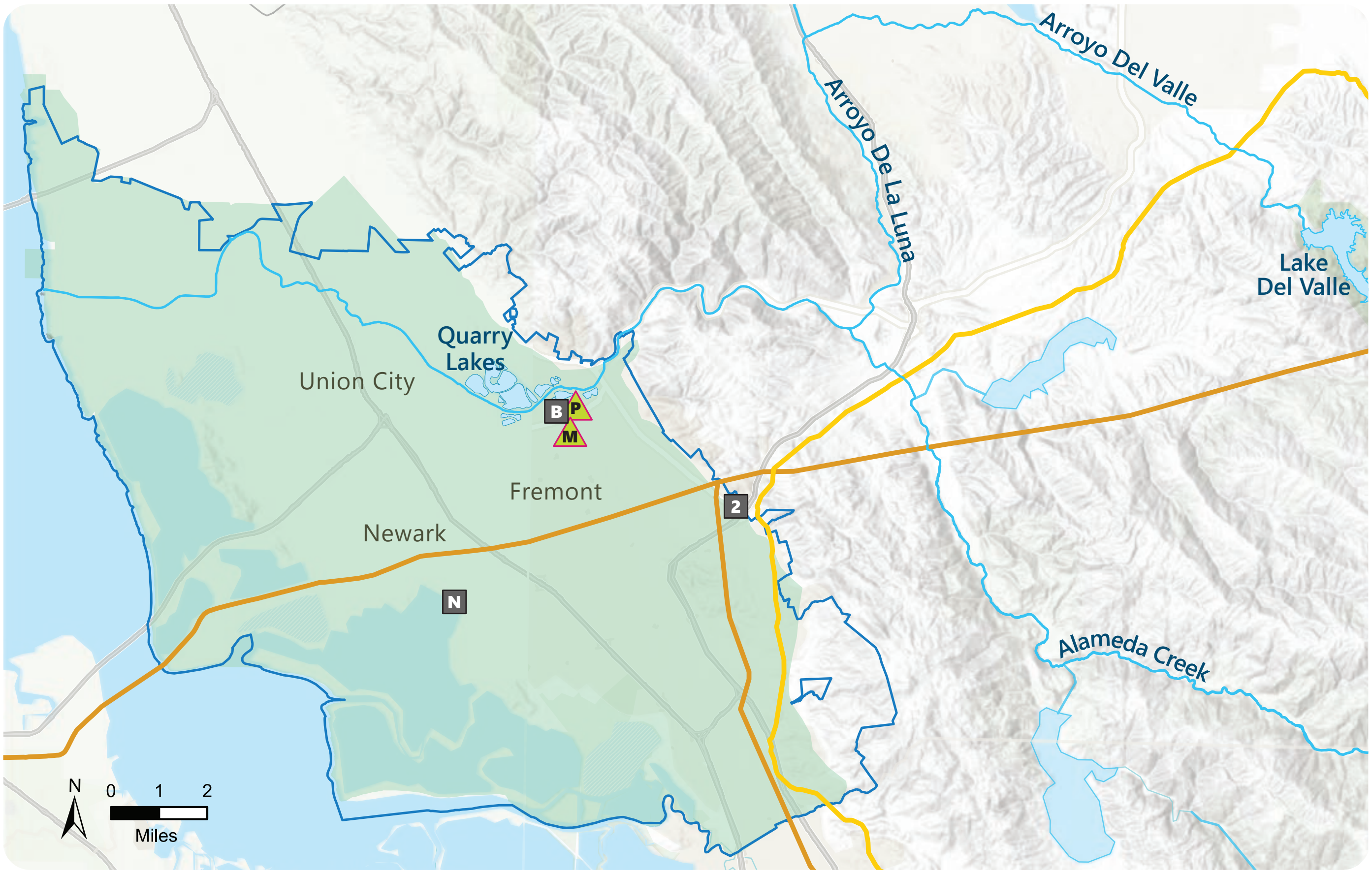
Figure 2: Demand Projection through 2050



2.3 Baseline Supply Reliability in 2050

ACWD currently meets its water demands using supply sources that include imported water from the State Water Project (SWP) and San Francisco Public Utilities Commission (SFPUC), local groundwater from the Niles Cone Groundwater Basin (Niles Cone), and local surface water from the Alameda Creek Watershed. The future baseline supply portfolio assumes that these supplies will continue to be available to meet 2050 demands, which are projected to increase slightly over current demands. Due to these increased demands and declining SWP reliability through 2050, ACWD's 2050 baseline supply portfolio must rely more heavily on SFPUC purchases. Water purchased from the SFPUC is the District's most expensive source of supply, so these additional purchases are anticipated to greatly increase District costs to meet baseline demand. The District's projected 2050 baseline supply portfolio is shown in the pie chart provided below in **Figure 3**.

Figure 3: Baseline Supply Portfolio (2050)



Key ACWD Production Wells

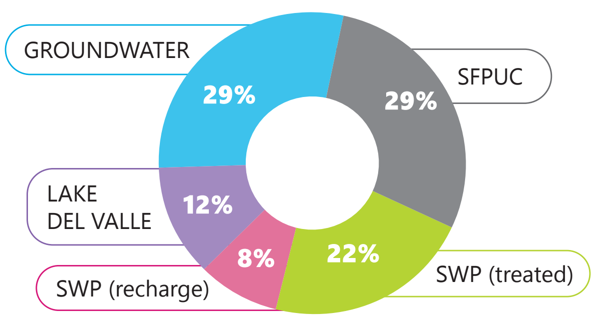
- P Peralta-Tyson Wellfield
- M Mowry Wellfield

Treatment Facilities

- B Blending Facility
- 2 WTP2
- N Newark Desal Facility (brackish groundwater)

- ACWD Boundary
- Niles Cone Groundwater Basin
- Water Body
- Creeks
- SFPUC Regional Water System
- South Bay Aqueduct

2050 Baseline Portfolio
Average Annual Supply Utilization



To forecast the reliability of baseline supplies in 2050, the WRMP considered three possible future scenarios shaped by climate change and regulatory changes, as shown in **Figure 4**. For climate change, these scenarios considered a range of impacts by examining the projected availability of existing surface water and groundwater supplies given changes in quantity, timing, and intensity of precipitation, increasing temperature, and increases in sea level rise. The potential regulatory changes considered would result in decreases in stored supplies and deliveries at the Semitropic Groundwater Bank and availability of San Luis Reservoir carry-over of SWP supply. More information about the scenarios and the underlying assumptions is included in Appendix C.

Public Survey Finding:

ACWD customers are overwhelmingly in support of planning for sustainability, reliability, and resiliency.

The District forecasted supply availability under mild, moderate, and severe future conditions using current ACWD and regional infrastructure capacities and operations to meet the forecasted demand for 2050. Scenarios A and B represent mild to moderate conditions more likely to occur within the planning horizon, with Scenario B most closely aligning with "expected" 2050 conditions. Scenario C reflects more severe conditions that are grounded in realistic future probabilities but are less likely to occur by 2050.

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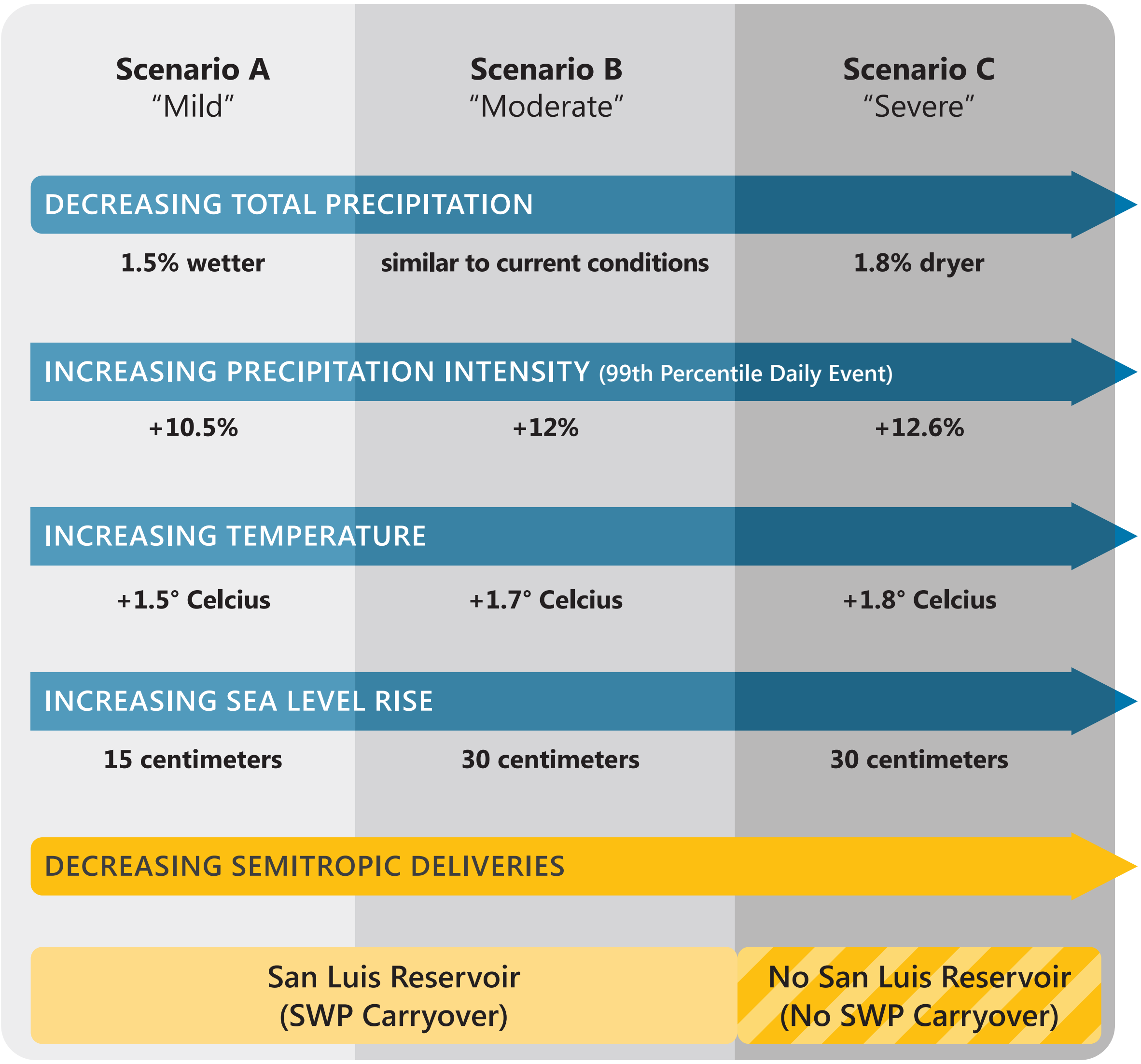
Figure 4: Future Baseline Supply Scenarios



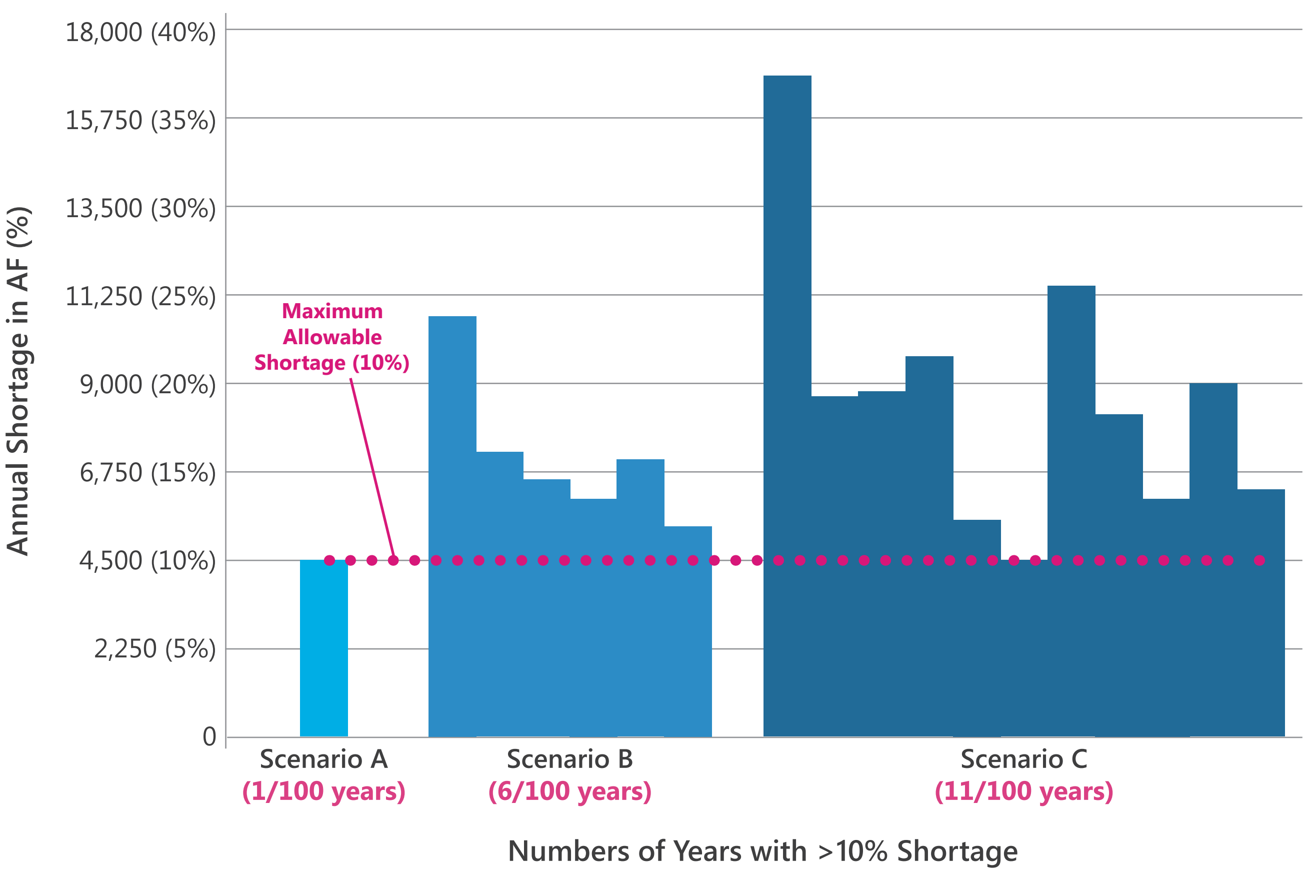
The forecasted baseline supply was compared to forecasted demand under all three future conditions scenarios to estimate the future reliability of the District's baseline supply. Reliability is measured as the number of years out of 100 that supplies meet or exceed 90% of total demand. As shown in **Figure 5**, reliability declines across the three scenarios, reflecting an increasing number of years in which the District exceeds the 10% maximum allowable shortage.

> The District has established a level of service goal of meeting at least 90% of customer demands in all years, whereby the District is committed to a maximum allowable shortage of 10%. Reliability can then be measured by the frequency in which the District is unable to meet this level of service goal.

Results show that baseline supplies are essentially sufficient to meet demands under the milder Scenario A conditions (only one year exceeding the 10% shortage level goal). Under Scenario B, the District would experience supply shortfalls that exceed the 10% shortage level goal in about 6 out of 100 years. These Scenario B results indicate that the District's current supply deliveries and storage are insufficient to meet future demands within ACWD's level-of-service goal for shortages under moderate future climate and regulatory impacts. Furthermore, results under Scenario C show that supply shortages are more frequent (11 out of 100 years) and have a greater magnitude.

Given these shortage results, the District has an opportunity to focus on near-term optimization of existing supplies – like groundwater – to improve reliability under expected moderate (Scenario B) future conditions. The results also highlight the value of UWUO-driven water use efficiency, which reduces demand and supply stress, thereby extending the time available before more costly actions are needed. This approach allows the District to take additional time to evaluate and prepare new supply options in advance of potential future severe (Scenario C) conditions. In that sense, Scenario C can be used as an important planning tool to represent either an extreme version of 2050 conditions or conditions that may materialize in the longer term (i.e., beyond 2050) when substantial new supplies will be needed. Scenario A is not used for portfolio evaluation because the District's current system can effectively manage mild future conditions.

Figure 5: Baseline Shortage Frequency and Magnitude by Scenario



3. CONSIDERING FUTURE SUPPLY OPTIONS

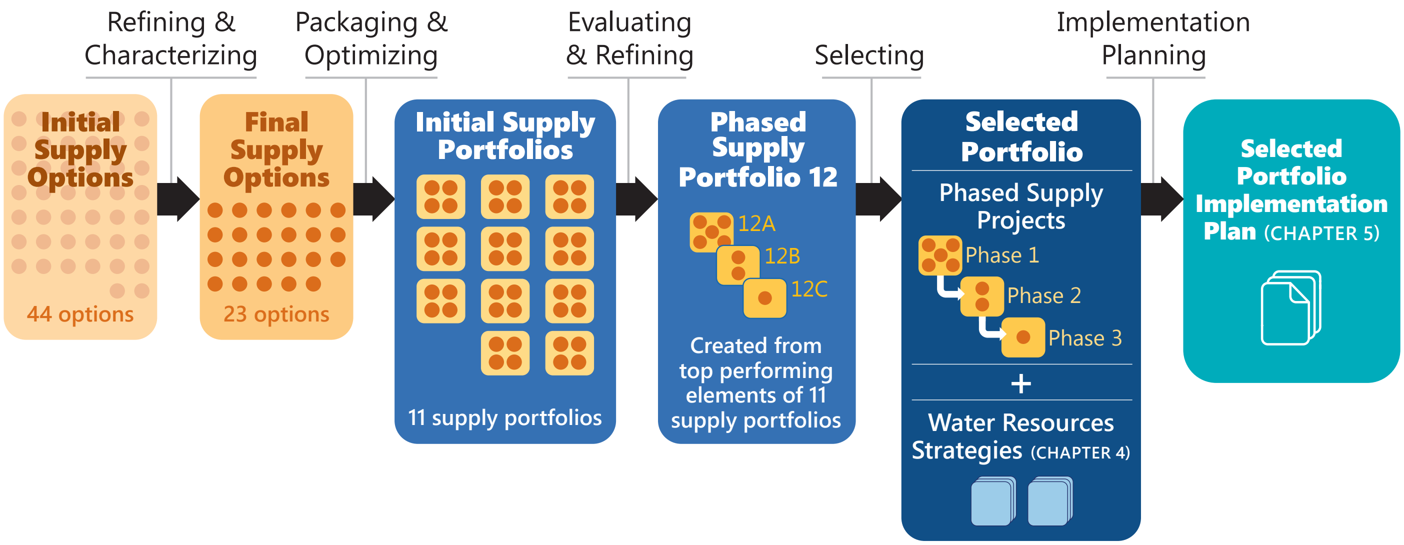
To best meet WRMP Goal 1 ("A sustainable water supply portfolio that leverages local resources and adapts to climate change"), the District explored all potential supply options that could help improve reliability under moderate 2050 conditions (Scenario B) while preparing for the potential to experience more severe conditions between 2050 and beyond (Scenario C). A collection of potential supply options was developed from previous work as well as new input from ACWD and external interested parties. A refinement exercise was completed to streamline variations of similar options. The resulting 23 supply options were characterized by making initial assumptions as to volumetric supply potential, the facilities needed to fully utilize the supply, associated costs, and key implementation considerations.

Public Survey Finding:

Based on polling, the public is willing to explore additional conservation when it's more cost-effective than new supply

These options were then further refined in concert with each other through the creation and systems modeling of 11 different portfolios of options. The results of portfolio modeling were used to evaluate the reliability of each portfolio, as was done under the baseline forecast described in Chapter 2. Portfolios were also assessed relative to nine other criteria, and a comparative analysis was completed to highlight key trade-offs for decision-makers. Through this process, a twelfth portfolio was created and ultimately selected to best meet ACWD supply needs. Ancillary water resources strategies were developed to complement the supply options in order to meet all five WRMP goals. This overall process is shown in **Figure 6**.

Figure 6: Process for Considering Supply Options



3.1 Water Supply Options

A supply option is considered fully characterized when all components necessary to source and produce the water supply for use are included: Supply Source + Conveyance + Storage + Treatment + Distribution. **Table 2** provides a summary of themes of the supply options within each type of supply source, with further details about each standalone option in Appendix D.

Table 2: Supply Option Categories Overview

Supply Source	# of Options	Summary of Themes
Groundwater	6	Groundwater options focus on optimizing ACWD's ability to produce and treat local groundwater, particularly in dry years. Options focus on expanding pumping, improving treatment quality, or adding new facilities to access new supplies. Some of these options work synergistically. Optimization options include revising groundwater rule curves, lowering minimum operating levels, enhancing treatment for PFAS and hardness, and optimizing Newark Desalination Facility operations. A significant option that accesses a new supply involves constructing a new groundwater production facility in the southern region of the service area.
Imported Water	7	Imported water options emphasize expanding ACWD's access to flexible, drought-resilient supplies by optimizing the use of existing imported water sources from the SWP and SFPUC or by adding new sources. Some of the more significant options explore storing excess water in a new groundwater bank, either within the Alameda Creek Watershed or externally. Other options focus on improving conveyance or treatment flexibility.
Local Surface Water	4	Local surface water options focus on making fuller use of ACWD's existing local surface water supplies. Most of these supplies are typically recharged at Quarry Lakes Regional Recreation Area, with the remainder stored in Lake Del Valle. System constraints currently limit full utilization. Addressing distribution and treatment constraints could increase the volume available for recharge, and reoperating Del Valle could enhance local surface water capture.

Table 2: Supply Option Categories Overview (continued)

Supply Source	# of Options	Summary of Themes
Ocean or San Francisco Bay Water	1	A new Bay water desalination facility, potentially sited in the southern portion of the service area.
Purified Water	4	Purified water options include both indirect (IPR) and direct potable reuse (DPR) with water sourced from Union Sanitary District. IPR would be achieved by either recharging local groundwater aquifers or augmenting surface water sent to Water Treatment Plant 2 with purified water for additional treatment prior to distribution. DPR involves construction of an advanced water purification facility that feeds directly into the distribution system via Water Treatment Plant 2.
Demand Management	1	ACWD is already engaging in numerous water use efficiency programs (i.e., incentives, rebates, technical assistance) with enhancements (higher goals for participation and new measures) to meet the State Urban Water Use Objectives (UWUO). This additional water use efficiency supply option sets even higher goals for many existing measures and adds new, and more expensive measures.

3.2 Water Supply Portfolio Development

An initial suite of 11 portfolios was developed following a thematic approach designed to meet future water supply needs and address WRMP goals. Each portfolio represents a distinct strategy, incorporating a unique combination of water supply options tailored to meet specific performance criteria and operational needs, but which must satisfy two minimum conditions:

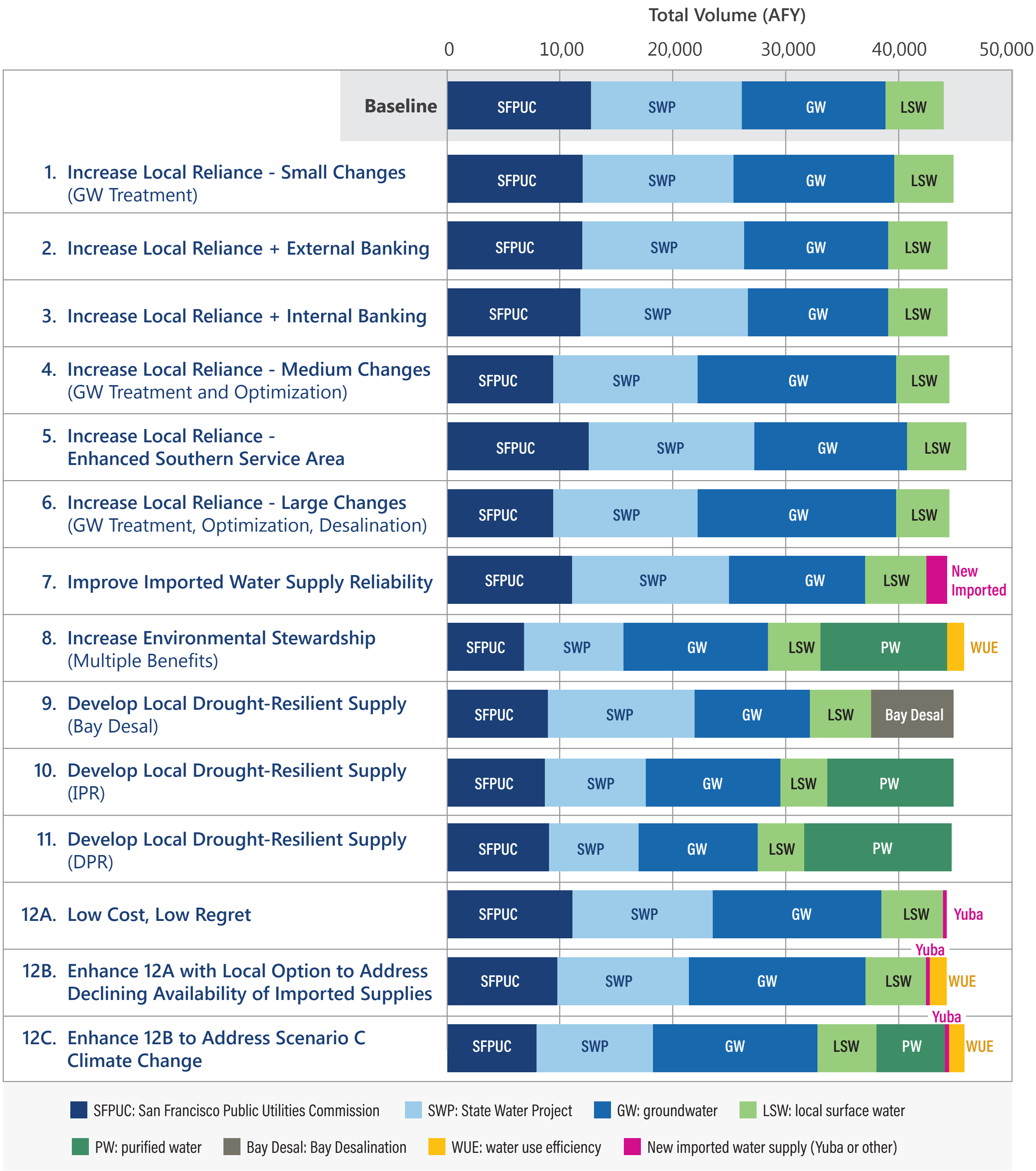
1. Meet projected 2050 (assumed full buildout) demand under Scenario B future conditions
2. Achieve water quality goals

All 11 portfolios were evaluated to examine trade-offs among core portfolio elements. Portfolio 12 was then developed by synthesizing the strongest-performing elements identified through that evaluation and by identifying synergies among elements that perform effectively in combination, including elements selected for their ability to be phased to mitigate risk. A three-phase implementation of Portfolio 12 (12A, 12B, and 12C) was subsequently established to accommodate significant uncertainties as conditions evolve, including climate change, state-level policy, and future growth and water demand. Each phase was subsequently evaluated against the planning criteria to confirm that the phased, risk-informed strategy meets ACWD's needs and goals. The supply composition of all portfolios is compared at a high level in **Figure 7**, but described in more detail in Appendix E.

3.3 Portfolio Evaluation Criteria

Each of the 12 portfolios was evaluated against the ten evaluation criteria listed in **Figure 8**. Some criteria are more directly quantifiable (e.g., cost) while others are more qualitative in nature (e.g., regional leadership). The portfolio development and evaluation process was faciliated using the Integrated Planning Tool, an evaluation platform with an Excel interface to manage supply options, portfolios, performance metrics from modeling, evaluation criteria, and methods. Moving forward, this dynamic planning tool will allow ACWD staff to make as-needed adjustments to project options, portfolio composition, and evaluation criteria as conditions change in the future. More information on the portfolio development and evaluation process is included in Appendix E.

Figure 7: Summary of Portfolios for Evaluation



Note: While the supplies in each portfolio meet 2050 demands under normal conditions, their long-term average volume across all year types (as shown in the chart) varies, reflecting differing long-term reliability. Reliability in terms of shortage frequency of each portfolio is discussed further in the following section.

Figure 8: Portfolio Evaluation Criteria

Long-term Reliability

Ability to consistently meet demand over extended periods, especially under stress conditions like drought or climate change

Local Control

Degree to which supply is owned and operated by ACWD, allowing for greater autonomy in decision-making and responsiveness to community needs

Regulatory Risk

Potential for regulatory uncertainty during construction and operations phases

Cost Efficiency

Reflects the initial capital costs and annual per acre-foot unit costs (operation & maintenance and imported water purchases) to provide the supplies

Drinking Water Equity

Potential for distribution of varying qualities of water across the service area

Environmental Stewardship

Ability to minimize ecological impacts and improve watershed sustainability

Regional Leadership

Contribution to broader regional water goals, such as improving overall water supply reliability, quality, or cost-efficiency within the Bay Area

Leveraging Resources

Ability to utilize existing infrastructure, labor, and institutional capacity

Community Benefits

Potential for social and economic advantages, such as job creation, support for local partnerships, recreational opportunities, and flood mitigation

System Adaptability/ Emergency Resilience

Capacity to respond to emergencies (seismic events, Delta outages) and adjust to future uncertainties (climate change, population growth)

LONG-TERM RELIABILITY

Portfolios that developed new large-scale, regional supplies had the greatest impact in mitigating severe future conditions, but these supplies were not necessary to meet moderate conditions.

To test future reliability under moderate, expected conditions, each portfolio was modeled using Scenario B (as was done to the baseline portfolio). To assess portfolio performance under more severe conditions projected for 2050 and beyond, the portfolios were also run under Scenario C. Together, these runs helped identify portfolios capable of maintaining higher levels of reliability over the long term, supporting earlier preparation for more severe conditions, as well as shorter-lived portfolios that may perform well for roughly the next 25 years, but likely not beyond. This comparison helps identify the risk of near-term overinvestment while also avoiding pursuit of strategies that could result in stranded assets.

LOCAL CONTROL

Portfolios that developed the most local and regional supplies to offset baseline imported water purchases scored highest in local control.

In addition to reliability, local control was cited by the Board and during public polling as one of the most important criteria for portfolio selection. In order to quantify local control, each potential source of supply was given a relative factor of local control, with local surface water and groundwater having the highest level, followed by regional multi-agency supplies like purified wastewater and desalinated water from San Francisco Bay, and, lastly, imported waters from SFPUC and SWP having the least level of local control. The ratio of these supplies within each portfolio determined the overall percentage (or level) of local control for each portfolio.

COST EFFICIENCY

Portfolios with new large supply facilities will have larger capital costs but may decrease overall annual costs due to decreases in imported water purchases.

While cost is not the most important criterion, it is important to ensure that the combination of projects within a portfolio are cost-effective. Higher total capital costs are reflected in portfolios that require new large-scale treatment facilities, but these costs can often be offset through external funding and partnerships. Over time, portfolios that result in reduced annual costs (including operations and maintenance (O&M) and purchase of imported water) can make even higher capital portfolios look more cost-effective.

REGULATORY RISK

Portfolios that are dependent upon technologies that are currently novel, have less regulatory precedent, or have complex permitting requirements with multiple entities, scored lower.

While long-term reliability is a measure of responsiveness to mainly climatic conditions, regulatory risk is focused on assessing performance of portfolios relative to uncertainty around future regulations that could impact specific supply options within the portfolios. The existing regulatory landscape was used to make assumptions about future regulatory conditions. As technology and regulations evolve, the assessment will most likely change.

OTHER QUALITATIVE CRITERIA

Several other qualitative criteria were used to examine how well supply portfolios met other WRMP goals relative to each other.

Portfolios that reduce the direct use of SFPUC supply reduce water quality variability across the distribution system; thus, these portfolios had higher **drinking water equity** performance than those that did not reduce direct use of SFPUC supply. **Environmental stewardship** favored portfolios with projects that improved water quality for increased beneficial use (like stormwater and purified water) and included projects which typically have higher unit cost. Portfolios that had strong multi-agency projects like Bay desalination and purified water had higher performance under **regional leadership**. **System adaptability** and **emergency resilience** criteria highlighted portfolios that expanded and diversified supplies closer to ACWD's service area to offset imported supplies that could come offline from seismic events. **Leveraging resources** and **community benefit** criteria did not reflect much distinction between portfolios.

3.4 Portfolio Comparison and Selection

The initial 11 portfolios were first evaluated and compared to determine key criterion trade-offs between portfolios. Each of the three Portfolio 12 phases (12A, 12B, and 12C) were then evaluated across all criteria relative to the other 11 portfolios to confirm that Portfolio 12 would best meet the needs and goals of ACWD.

Public Survey Finding:

Public polling revealed that affordability versus reliability was a critical trade-off

As the primary criterion, reliability was compared against both capital and unit costs as shown in **Figure 9** (under Scenario B) and **Figure 10** (under Scenario C). This initial comparative analysis showed that portfolios 1 - 7 would still result in multiple shortages in excess of 10% under moderate Scenario B conditions, indicating that they would perform even more poorly under Scenario C conditions. However, since Portfolios 2 and 3 have slightly better reliability at similar capital costs, they were kept under consideration for the Scenario C analysis. By comparing the remaining portfolios under Scenario C conditions, a tradeoff could be seen between the increased reliability at increased costs of developing new supplies. Because Portfolio 12 had three phases of implementation, under moderate conditions shown in **Figure 9**, it yielded a similar level of reliability as Portfolios 8, 9, 10, and 11 at a lower cost in its first two phases (12A and 12B) while also providing increased reliability (phase 12C) if and when it is needed to address more severe conditions. Note that both the unit and capital costs for Portfolios 12A, 12B, and 12C are cumulative, where the costs for Portfolio 12B include Portfolio 12A costs and the costs for Portfolio 12C include costs for Portfolios 12A and 12B.

Reliability was also compared against local control to help differentiate between higher reliability Portfolios 3, 8, 9, 10, 11 and 12. As seen in **Figure 11**, Portfolios 8, 10, 11, 12B, and 12C perform best, with most sharing a common factor of purified water. This specific trade-off analysis highlights a key difference between Bay desalination (Portfolio 9) and purified water (Portfolios 8, 10, 11, and 12C), the two supply types that offer higher reliability by providing large volumes of water. While both supply types scored similarly under the local control criterion, portfolios with purified water simultaneously reduce the share of imported water and increase the share of local groundwater, thus increasing the portfolio’s overall score for local control.

Ultimately, Portfolio 12 was selected for implementation because, compared to the other portfolios, it provides a favorable balance between the need for addressing reliability uncertainty and cost while maximizing local control in a phased, adaptable way that also continues ACWD's legacy of regional leadership and partnerships. Portfolio 12 was built to be implemented in three phases, combining supply options that build upon existing resources and facilities to enhance the resiliency of ACWD's water system while adding new supplies that enhance adaptive capacity to respond to more extreme climate change impacts. Climate change will cause more significant declines in SWP reliability due to long-term reduction in snowpack, as contrasted to the local Alameda Creek Watershed which is not snow-driven. This further underscores the favorable performance of Portfolio 12, which emphasizes optimizing local groundwater.

Figure 9: Reliability Relative to Cost (Scenario B)

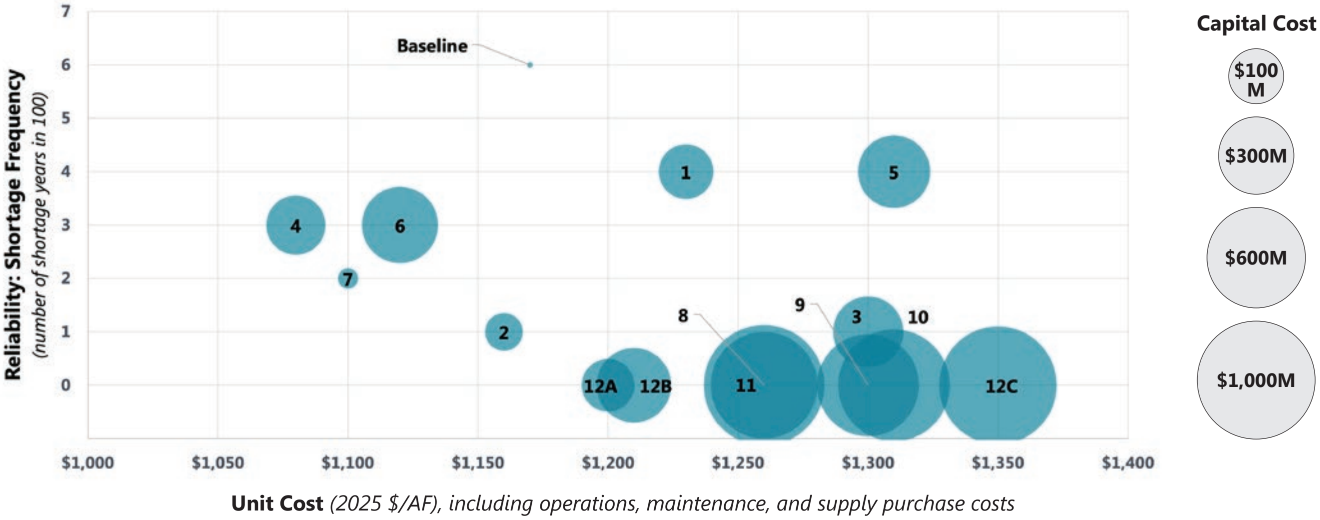


Figure 10: Reliability Relative to Cost (Scenario C)

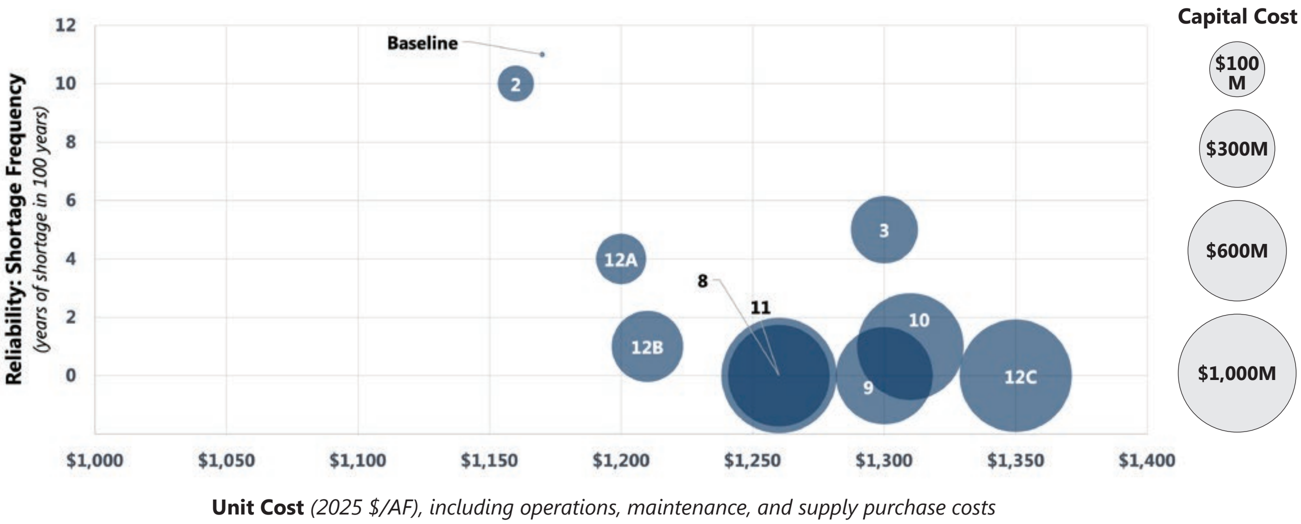
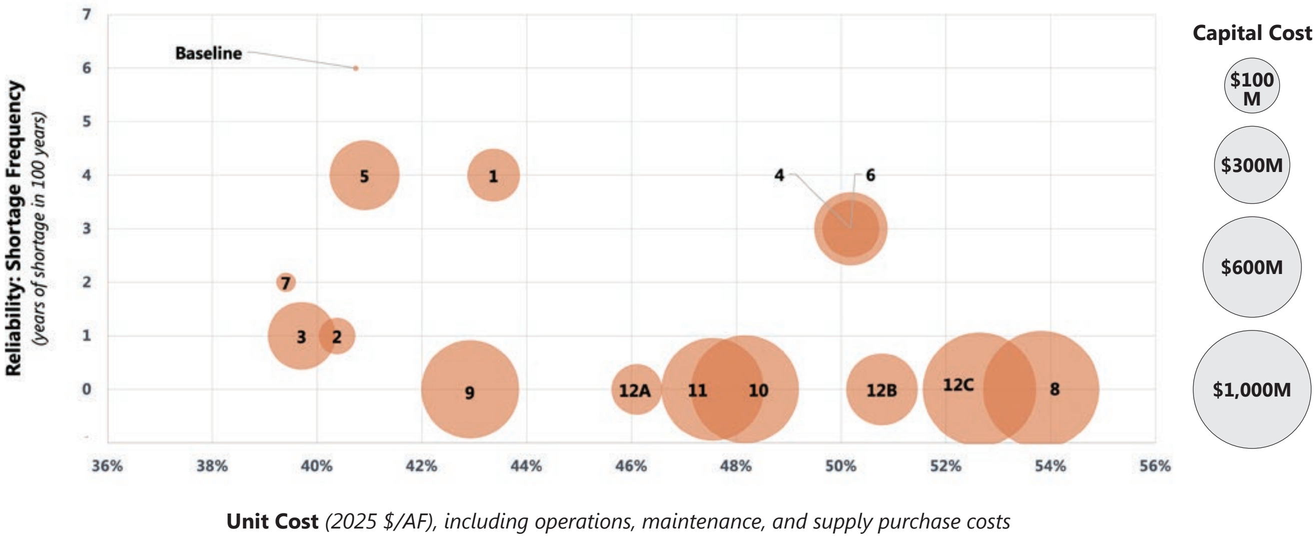


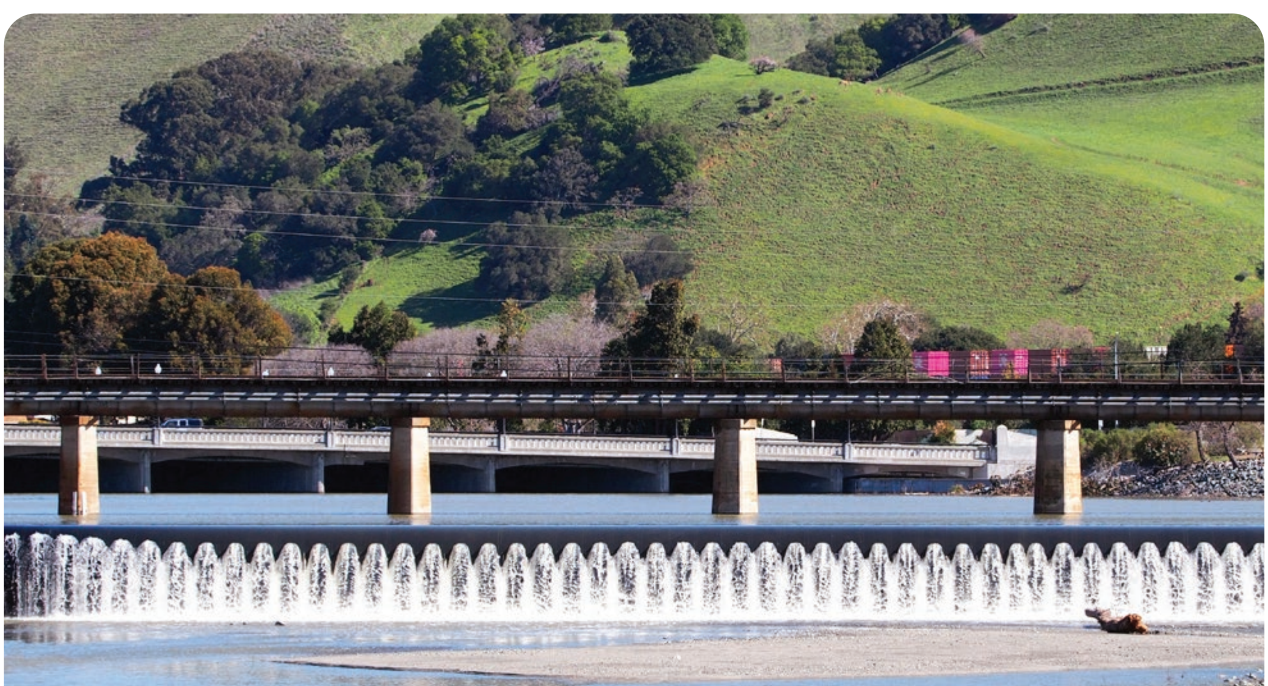
Figure 11: Reliability Relative to Local Control



3.5 Selected Portfolio

The selected portfolio's suite of projects can be developed in three phases, starting with projects that build upon existing resources and facilities to enhance the resiliency of ACWD's water system while adding new supplies to enhance adaptive capacity to respond to more extreme climate change impacts. Phase 1 (previously referred to as Portfolio 12A) begins with no- and low-regret, multi-benefit projects that strengthen resilience today, with later phases introducing higher-cost supplies as triggered by various factors. **This portfolio provides the District with a unique opportunity to optimize the District's current system while making decisions now that can help the District be more adaptive in an uncertain future.** The portfolio and its various phases (12A, 12B, 12C) are illustrated in **Figure 12**.

PHASE 1 expands the District's current use of local surface and groundwater supplies while increasing banking opportunities. The District has already begun several of these efforts, including optimizing and enhancing yields from Del Valle Reservoir to utilize more local runoff, optimizing wet year recharge of the Niles Cone, and pursuing participation in the Yuba Accord to increase access to wet-year supplies and banking opportunities. This phase includes new or improved groundwater treatment for PFAS and hardness to support the ongoing reliability of the District's existing groundwater supply. While these treatment improvements alone do not increase available yield, they address operational constraints that currently limit the District's ability to more fully utilize available groundwater supply. Accordingly, this phase enhances conjunctive use operations by revising ACWD's groundwater rule curves and lowering minimum operating levels in the Niles Cone, allowing for increased pumping during drought periods to help mitigate shortages and increased capture of surplus runoff in wet years. Optimizing treatment operations at the Newark Desalination Facility supports these efforts and provides benefits extending into subsequent phases.



PHASE 2 (previously referred to as 12B) builds on Phase 1 but introduces elements that carry additional cost compared to those elements included in Phase 1. The two elements in this phase are the addition of new groundwater production in the southern portion of the service area and additional water use efficiency measures. Feasibility studies for new groundwater production are already underway to understand what volume of supply and storage is available, as well as what kind of treatment would be required. Results of these studies will help the District determine appropriate locations for additional groundwater facilities. Utilizing more groundwater in this part of the District's service area will increase resiliency, as it has historically been more reliant on imported water supplies. An alternative approach is to enhance distribution system transmission to convey water from existing groundwater production facilities, with additional analysis needed to compare the trade-offs of this option relative to new local groundwater production if it is deemed feasible. Finally, the District will also evaluate the implementation of additional water use efficiency measures beyond what is planned to meet the UWUO to further strengthen reliability. Phase 2 is designed to further increase reliability at a slightly higher cost than Phase 1, while deferring the substantially greater investments associated with Phase 3 (previously referred to as 12C) until they are warranted.

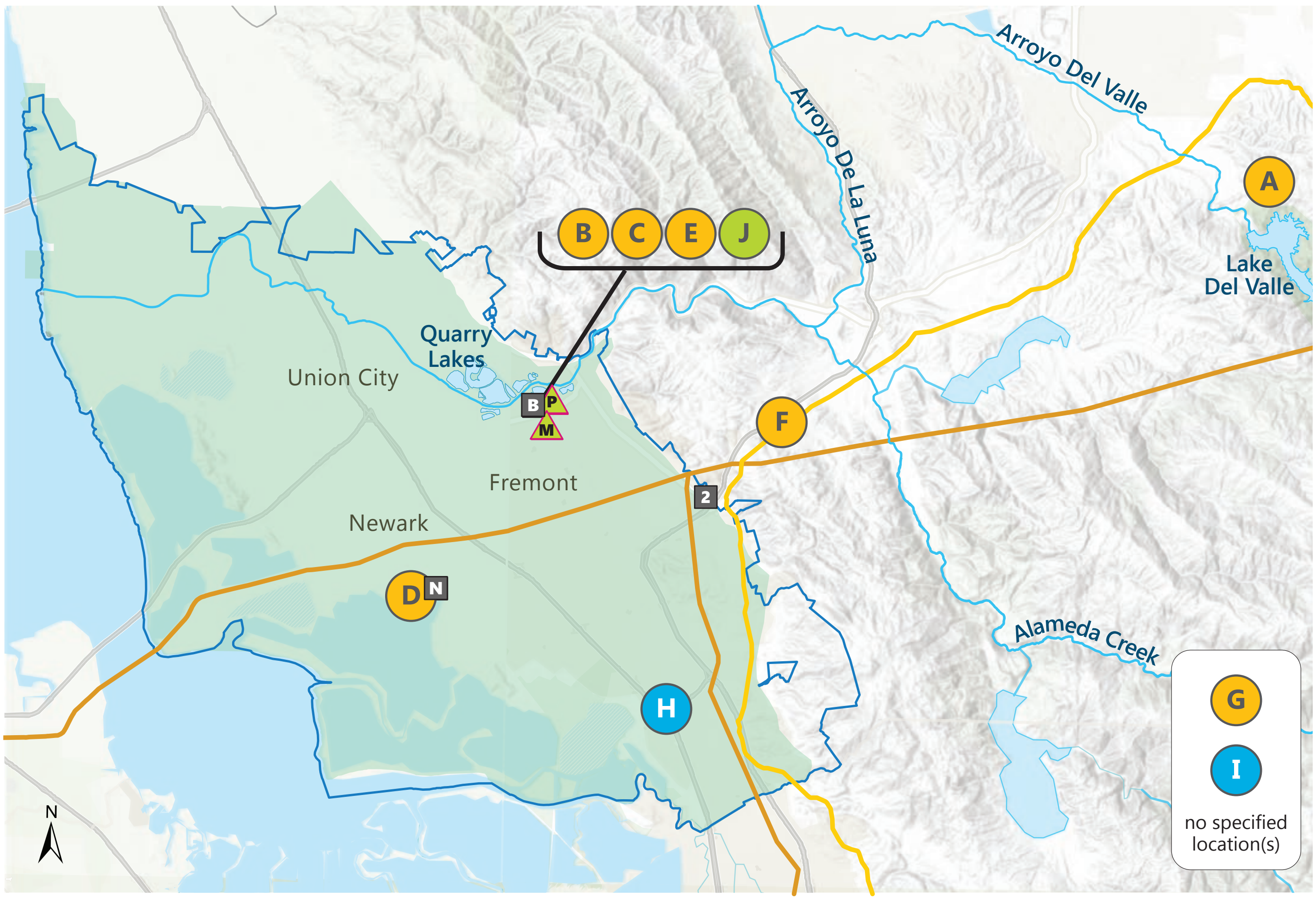
In 2023, a District study concluded that purified water recharge provided limited value given current constraints on the District's ability to pump, treat, and distribute additional groundwater. Phases 1 and 2 of the selected portfolio directly address these constraints by revising ACWD's groundwater rule curves and lowering minimum operating levels in the Niles Cone, augmenting wet year recharge, enhancing groundwater treatment for PFAS and hardness (Phase 1), and adding a new southern groundwater facility (Phase 2). By the end of Phase 2, the District will have increased its groundwater production capability and expanded the portion of distribution system that can be reliably served with local supplies. The final phase of the selected portfolio, **PHASE 3**, builds on these investments by adding purified water for groundwater recharge. This Phase entails a partnership with Union Sanitary District to deliver purified water to the Quarry Lakes area to increase recharge of the Niles Cone. Phase 3 is intended for implementation further in the future, at a time when conditions require a need for such a capital-intensive water supply project to maintain system reliability. Implementation of Phase 3 is largely tied to Scenario C conditions, which are driven by predicted declines in SWP supply due to climate change and changes in Semitropic Groundwater Bank operations. Regardless of its ultimate implementation, it relies on the groundwater enhancements made in Phases 1 and 2.

Figure 12: Selected Portfolio

PHASE 1
Boost existing local supplies through optimization and enhancement projects

PHASE 2
Explore the potential for groundwater supply in the southern Niles Cone

PHASE 3
Implement purified water for recharge in Niles Cone



- A — Optimize/Enhance Del Valle Yields
- B — Revise Groundwater Level Curves
- C — Augment Recharge
- D — Optimize Newark Desalination Facility
- E — Groundwater Treatment for PFAS + Hardness
- F — New Yuba Water Supply
- G — Groundwater Banking
- H — Southern Groundwater Facility
- I — Additional Water Use Efficiency
- J — Purified Water for Recharge

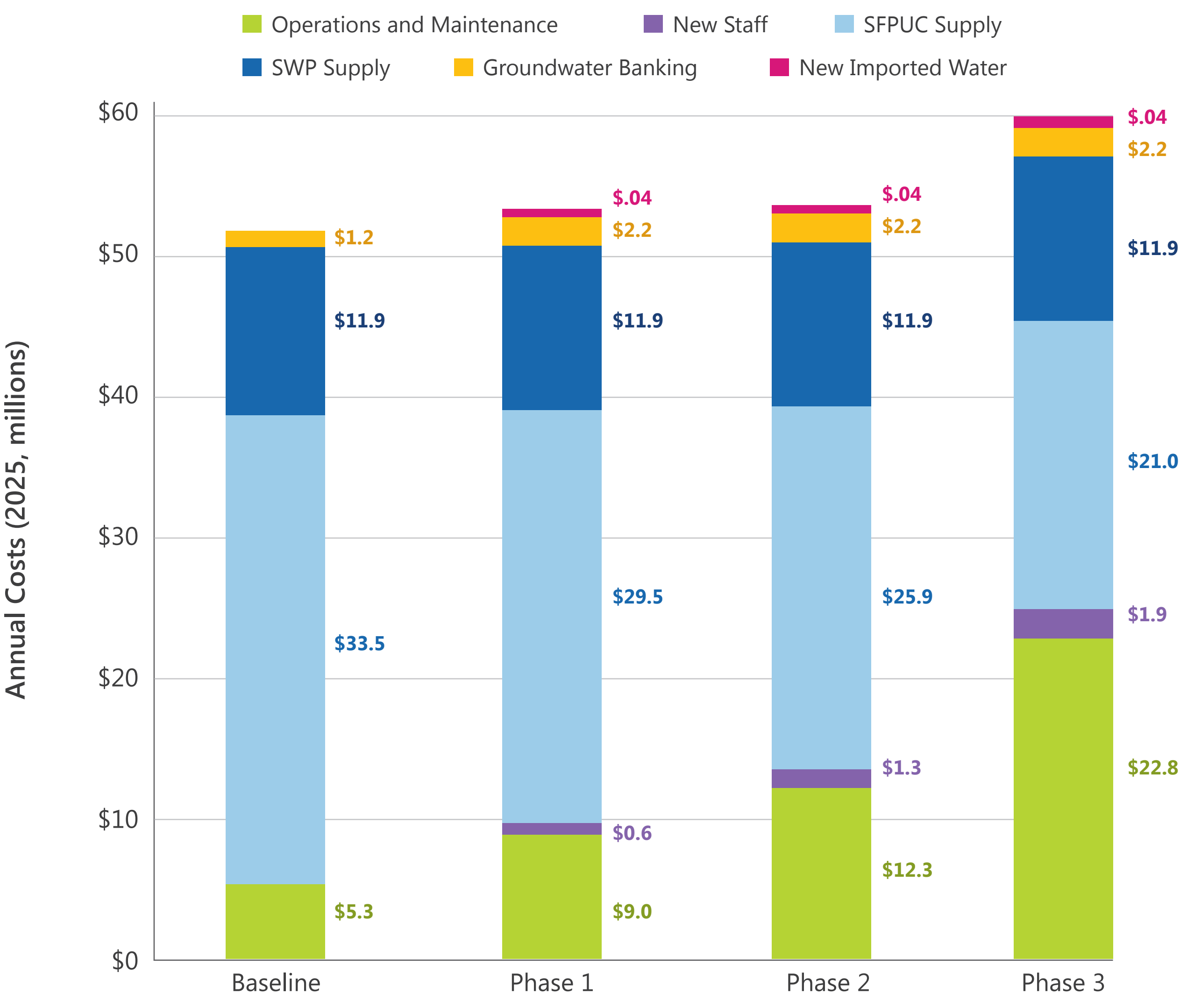
Key ACWD Production Wells
- P — Peralta-Tyson Wellfield
- M — Mowry Wellfield

Treatment Facilities
- B — Blending Facility
- 2 — WTP2
- N — Newark Desal Facility (brackish groundwater)

- ACWD Boundary
- Niles Cone Groundwater Basin
- Water Body
- Creeks
- SFPUC Regional Water System
- South Bay Aqueduct

Figure 13 shows a breakdown of the annual operating costs in 2050 for the baseline condition (no new projects), including supply purchases and O&M, as well as the cost breakdown for Phases 1-3 of the selected portfolio. All costs are shown in 2025 dollars with no escalation. While Phases 1 and 2 result in higher O&M, staffing, and new imported water supply costs relative to baseline, these increases are largely offset by reduced purchases of high-cost SFPUC supplies as the new projects come online. As a result, total annual operating costs in Phases 1 and 2 remain nearly cost-neutral relative to the baseline, while materially increasing system resilience and usable local supply capacity, and adding adaptability to future climate change. Phase 3 further reduces reliance on SFPUC supplies, but includes a comparatively larger increase in O&M and staffing costs.

Figure 13: 2050 Annual Operating and Supply Purchase Costs by Selected Portfolio Phase



ON PURIFIED WATER & BAY DESALINATION

After implementing Phases 1 and 2 of the selected portfolio, analysis indicates that the District is not expected to face a significant supply shortage until 2050 or later. Meeting supply needs beyond that timeframe will require development of a large-volume water supply project, which is typically costly and requires many years of planning and coordination. While the purchase of additional imported water may be considered, Scenario C analyses show a long-term decline in the reliability of SWP supplies due primarily to climate change. Given the high capital costs, long lead times, and substantial uncertainty of large-volume supply projects, the District seeks to preserve flexibility and avoid committing to a single solution prematurely. The question is therefore not whether additional supply will be needed, but when. The two most promising supply options currently available to address this future challenge are Bay desalination and purified water.

Since adoption of the 1995 IRP, recycled water has been identified as the District's next major source of supply. Subsequent planning efforts found that indirect potable reuse offers a more effective long-term solution than traditional non-potable recycled water. The selected portfolio builds on this past work by advancing near-term actions in Phases 1 and 2 that benefit the District today and also better position the District for a future large-scale supply project, **if and when** it is needed. Phase 3 includes a purified water recharge project that leverages existing infrastructure and programs implemented since the 1960's and builds directly on groundwater production, treatment, and operational enhancements implemented in Phases 1 and 2, enabling more effective utilization of the Niles Cone.

In contrast, Bay desalination would require a large upfront capital commitment and early coordination to be cost-effective, shifting spending away from the incremental, lower-cost projects in Phases 1 and 2 that optimize existing assets and local supply sources. Bay desalination also presents higher implementation risks. To be cost-effective, it would likely need to be developed at a scale larger than the District's projected needs, requiring one or more partners and introducing additional operational and governance complexities. While both supply options involve long lead times and early planning investments – despite uncertainty in the timing of the future need – purified water offers a more incremental and flexible implementation pathway, allowing investments to be better aligned with demonstrated need.

In addition, purified water benefits from a clear and established regulatory framework in California, whereas Bay desalination faces greater regulatory uncertainty and heightened permitting and litigation risks associated with intake and discharge impacts. Purified water also typically receives stronger support from environmental and community stakeholders and aligns with the State's direction to expand recycling and reduce wastewater discharges through beneficial reuse. The State's commitment to expanding recycled water is reinforced in the funding landscape – there are currently more external funding opportunities for water recycling than for desalination projects. Taken together, purified water was found to provide greater implementability, preserve flexibility, support continued optimization of local supplies, and allow major capital investment to be deferred until a clear need for additional drought-proof supply is demonstrated through a defined monitoring and trigger framework.

The selected portfolio's phased approach continues ACWD's long tradition of investing in local supplies by leveraging them to the maximum extent sustainable while continuing to adaptively plan for new facilities. The selected portfolio allows ACWD to make smart investments now that both address today's needs and provide valuable incremental progress for decisions that will need to be made in the future. Specifically, this suite of phased projects provides four opportunities for ACWD described below.

OPPORTUNITY 1: Prioritizes low- and no-regret investments that provide multiple benefits under today's conditions

Initial efforts in the selected portfolio are focused on measures that perform well across a wide range of future scenarios while addressing multiple current needs. One overarching theme in Phase 1 is related to optimizing existing groundwater operations through **enhancing groundwater treatment** for PFAS and hardness, **optimizing recharge operations** and **groundwater operating rules**, and **lowering minimum operating levels** in the Niles Cone. These projects leverage existing facilities – like Newark Desalination Facility, Quarry Lakes, and past investments in local fisheries and the FLOWS (Fish Ladder Operations and Water Stewardship) Program – and contribute to offsetting more expensive imported water now, while also preparing the District to use more local groundwater in the future.

Another example is a **new groundwater bank**. While the District's share of the Semitropic Groundwater Bank has historically provided great resilience and buffered some of the worst effects of drought, climate change and regulatory impacts may lessen those benefits in the future. A second groundwater bank would offset these future risks by providing operational redundancy and increasing net return capacity of water during droughts, enhancing overall system resilience. Initiating a second groundwater bank is relatively inexpensive, providing the District with a low-risk investment that offers benefits today and under a range of future conditions.

OPPORTUNITY 2: Layers in future interventions to address uncertainty while avoiding stranded assets

The selected portfolio considers what infrastructure and facilities the District already has, and addresses uncertain future conditions by building on these earlier investments rather than abandoning them. For instance, implementation of the 1995 IRP resulted in construction of the Newark Desalination Facility and improvements to Quarry Lakes, but the District's ability to fully utilize these facilities is limited because of constraints in the District's ability to pump and distribute groundwater. **Optimizing Newark Desalination operations, enhancing groundwater treatment** for PFAS and hardness, and **optimizing groundwater rule curves** and **operating levels** in the Niles Cone will increase the District's ability to pump existing groundwater and take advantage of additional water for recharge that will be available through other parts of Phase 1. Combined, these projects use existing facilities to prepare for a more uncertain future, while reducing the costs of imported supply now and increasing local resilience in case of a drought or Delta disruption.

OPPORTUNITY 3: Establishes a monitoring and trigger framework to guide costly future investments

After implementing Phases 1 and 2, analysis under Scenarios A and B indicates that the District is not expected to face a significant supply shortage until 2050 or later. Phase 3 builds on prior planning and the operational enhancements implemented in Phases 1 and 2 by implementing a **purified water for recharge** project. This project directly leverages existing infrastructure and the earlier phases of the selected portfolio to recharge the Niles Cone when its sustainable yield would otherwise be fully utilized absent the project.

The implementation plan for Phase 3, discussed more at the end of the WRMP, provides additional operational detail and defines future implementation triggers for further stages of purified water implementation. Due to the scale of this project, the District will undergo many years of incremental planning and development decision points, guided by a monitoring and trigger framework implemented through ACWD's existing Water Supply Portfolio Optimization process, before major capital costs are incurred. While purified water for recharge will not be implemented until there is a demonstrated need to maintain system reliability, the District can prepare now by making more modest planning and design investments so that it is ready when the project is needed - or sooner if beneficial funding opportunities arise.

OPPORTUNITY 4: Includes flexible, adaptive pathways

The District is currently evaluating the feasibility of a **new groundwater production facility in the southern portion of the service area**. The evaluation will help to understand what volume of supply and storage is available as well as what kind of treatment would be required. If the studies indicate that supply is not sufficient, the implementation plan includes alternative strategies for shifting gears to evaluate the feasibility of an Aquifer Storage and Recovery project and/or distribution system improvements, and/or adjustment of timelines on other related projects. This type of implementation planning is critical to the long-term success of the District and its ability to adaptively manage to uncertain future conditions. Identifying critical decision points during a project's development life-cycle helps the District prepare the necessary information to inform those decisions. The District's implementation plan for the selected portfolio highlights some of these decision points and offers various pathways that support the District's decision-making process.

4. WATER RESOURCE STRATEGIES

All five WRMP goals represent a holistic commitment by the District to support a water resources future that goes beyond a sole focus on supply development; no single project, policy, or program can be expected to successfully meet every WRMP goal. Accordingly, in addition to the suite of water supply projects that have been selected by ACWD for implementation, the WRMP process identified several water resources strategies that have been recommended for future consideration and implementation. Water resource strategies are projects or policies that support WRMP goals without directly producing a specific volume of water. Water resource strategies range from improving operational reliability to enhancing stewardship to ensuring equity and affordability of water supply.

Public Survey Finding:

Regional collaboration and environmental stewardship are important to ACWD's customers

As with the water supply options, an initial list of water resource strategies was developed by compiling previously identified concepts and incorporating new ideas gathered through engagement with ACWD staff, the ACWD Board of Directors, and external interested parties. More information about this initial list of strategies can be found in Appendix D.

After the selected portfolio of supply projects was chosen, the initial list of strategies was reviewed and refined. Water resource strategies are conceptualized at a higher level than water supply options due to their more subjective nature and level of development. Costs were estimated where possible or relevant (described further in Appendix D). The initial list was organized into several high-level groupings for WRMP implementation as shown in **Table 3,** with further implementation considerations included in the final section of the WRMP.

Table 3: Potential Water Resources Strategies

Strategy Grouping	Summary of Themes
Implement Updated Water Efficiency Master Plan	ACWD is already implementing its Water Efficiency Master Plan (WEMP) to meet Urban Water Use Objectives (UWUOs). Without implementation of this strategy, projected demands are expected to exceed UWUOs beginning in around 2040
Develop Resilience/ Emergency Response Plan	This plan would be a District-wide initiative to identify and document risks affecting ACWD's infrastructure, operations, and services, and to establish coordinated response plans to address those risks. It would also evaluate how future planned water supply projects could be developed in such a way to mitigate or reduce that identified risk.
Establish Multi-Benefit Land Trust	Purchase land in the Upper Alameda Creek Watershed with the intent of establishing a land trust that protects both the quality of Alameda Creek's headwaters as well as species and habitats of concern, and potentially generate habitat credits and/or revenue for the District.
Maintain and Enhance Quarry Lakes Water Quality	Encapsulates several projects to protect and improve water quality at Quarry Lakes through measures that reduce pollutants, manage ecological risks, and strengthen existing monitoring efforts. Together, these projects support the WRMP goal of healthy watersheds and aquifers that are managed to provide multiple benefits.
Support Monitoring, Studies, and Restoration Work in the Watershed	Includes several supporting actions that would maintain existing water quality monitoring in the watershed, continue support of organizations studying ecosystem benefits, and maintain support for ecological and fisheries restoration programs in the Lower Alameda Creek Watershed.
Maximize Local Surface Water Supplies	Continue to monitor data as fishery matures to determine the optimal times and volumes for scheduling bypass flows, as well as advocate for Forecast-Informed Reservoir Operations (FIRO) and reoperation at Lake Del Valle.
Implement Affordability Plan	Complete ongoing efforts to develop and implement an Affordability Plan that formulates policies designed to enhance the affordability of water for all direct and indirect customers.
Establish Water Trading Partnerships	Expand water market participation beyond dry-year needs by making opportunistic, cost-effective purchases in average and wet years to supplement groundwater bank storage and offset declining imported supplies, as well as selling surpluses to generate revenue (through either Bay Area partnerships or among SWP partners).
Build Public Outreach and Partnerships	Expand partnerships with schools, cities, community groups, and the public to educate about water efficiency and drinking water quality. Partnerships may also bolster workforce pipelines and provide insights into new water use efficiency technologies, implementation strategies, and outreach avenues to support the WRMP's Phase 2 supply project that involves evaluating additional water efficiency.

5. IMPLEMENTATION PLAN

The supply portfolio ACWD selected will maximize local supply reliability, improve groundwater basin performance, and maintain operational flexibility across surface water, groundwater, and imported supplies. Collectively, these actions form an integrated portfolio where groundwater improvements, surface water optimization, imported supply diversification, demand management, and resource strategies work in concert to strengthen ACWD's overall water supply reliability.

ACWD will implement this portfolio and the associated water resources strategies over the next 25+ years through dynamic decision-based planning. This implementation plan maps out how each supply and resource component of the WRMP can be advanced relative to their current stage of development, inter-component relationships, and future cost and resource balancing.

The implementation plan is designed to be adaptive, with monitoring and decision triggers linked to external conditions such as changes in water supply reliability, climate change impacts, and evolving regulatory requirements. Some actions, such as optimizing the Newark Desalination Facility or developing a southern groundwater facility, represent longer-term efforts that could be advanced earlier than a demonstrated need as they also improve current operations; in these cases, the recommended trigger is the availability of grant funding opportunities. The implementation plan reflects consideration of these factors, as well as current staff capacity and financial resources, but should be considered a draft outline subject to refinement as conditions, priorities, and resources evolve. In addition to providing an initial framework for capital and financial planning, its purpose is to ensure that the overall WRMP is implementable within real-world staffing and budget constraints. ACWD plans to revisit progress on achieving WRMP goals as part of WRMP implementation at least every five years.

5.1 Supply Project Implementation

The supply projects that comprise the selected portfolio were developed as three main phases, with Phase 1 projects considered to be low- and no-regret actions that primarily work to further enhance and leverage existing supply sources and infrastructure. Many of these projects are already moving forward or are expected to do so in the near term based on decisions made prior to or during development of the WRMP. Projects within Phase 2 are not assumed to come online before 2036, or after 2050 for Phase 3, and will need to respond to several internal and external drivers and triggers that will necessitate future decision points at each stage of implementation. Regardless of the timing for project completion, these projects will continue to be developed so the District can make an informed assessment of how well they can meet future needs under changing conditions and priorities.

The schedule in **Figure 14** reflects a future in which all of the projects are implemented and brought online by 2050, with the exception of Indirect Potable Reuse for Groundwater Recharge which, if needed, would likely be constructed after 2050. There are, however, several project-specific stages, project interdependencies (expressed in **Figure 15**), and drivers, triggers, and decision points that may result in modifying, delaying, or off-ramping projects.

5.1.1 Supply Project Stages and Schedules

Each of the 10 individual projects has a unique suite of implementation stages and a schedule that has been mapped across the WRMP's 25-year planning horizon (2026-2050). The timeline in **Figure 14** shows each project implementation pathway as a series of work stages, including technical planning and studies, solidifying agreements between regulators or partners, preliminary and final design of infrastructure, and finally the procurement and construction stages in order to bring the supply online. The project pathways also indicate periods of inactivity to allow other projects or drivers to take place. The duration of each stage was estimated to reflect a reasonable amount of time considering current ACWD resources and priorities.

Low- or no-regret projects that do not require additional infrastructure design and construction – such as optimizing Lake Del Valle yields, revising groundwater level rule curves, and augmenting recharge – are expected to be completed (or implemented in an ongoing fashion) within the first five years of WRMP implementation. Additional groundwater banking and treatment enhancement projects are anticipated to be completed within the first ten years. Larger new groundwater and purified water projects require many stages of development and decision points to determine how best to meet future District needs, taking into account customer demand responses to ongoing water use efficiency efforts, changes in imported supply reliability, and numerous other factors being monitored as described in later sections.

Greater detail on specific project implementation considerations can be found in Appendix E.

5.1.2 Supply Project Interdependencies

Many decisions to advance individual project stages, or even projects as a whole, will be dependent on the outcomes of other project pathways. **Figure 15** highlights projects that have these critical interdependencies and describes their connection. While not every potential pathway can be envisioned today, some project synergies can clearly be seen to influence overall portfolio implementation.

Several critical interdependencies relate to groundwater. For example, the viability of a new groundwater supply and/or storage in the southern Niles Cone would affect the desired groundwater production and PFAS/hardness treatment capacity at the Blending Facility. Hydraulic modeling will inform distribution system improvement aspects of both the groundwater treatment project and new southern groundwater facility.

Figure 14: Supply Project Stages and Key Decision Points

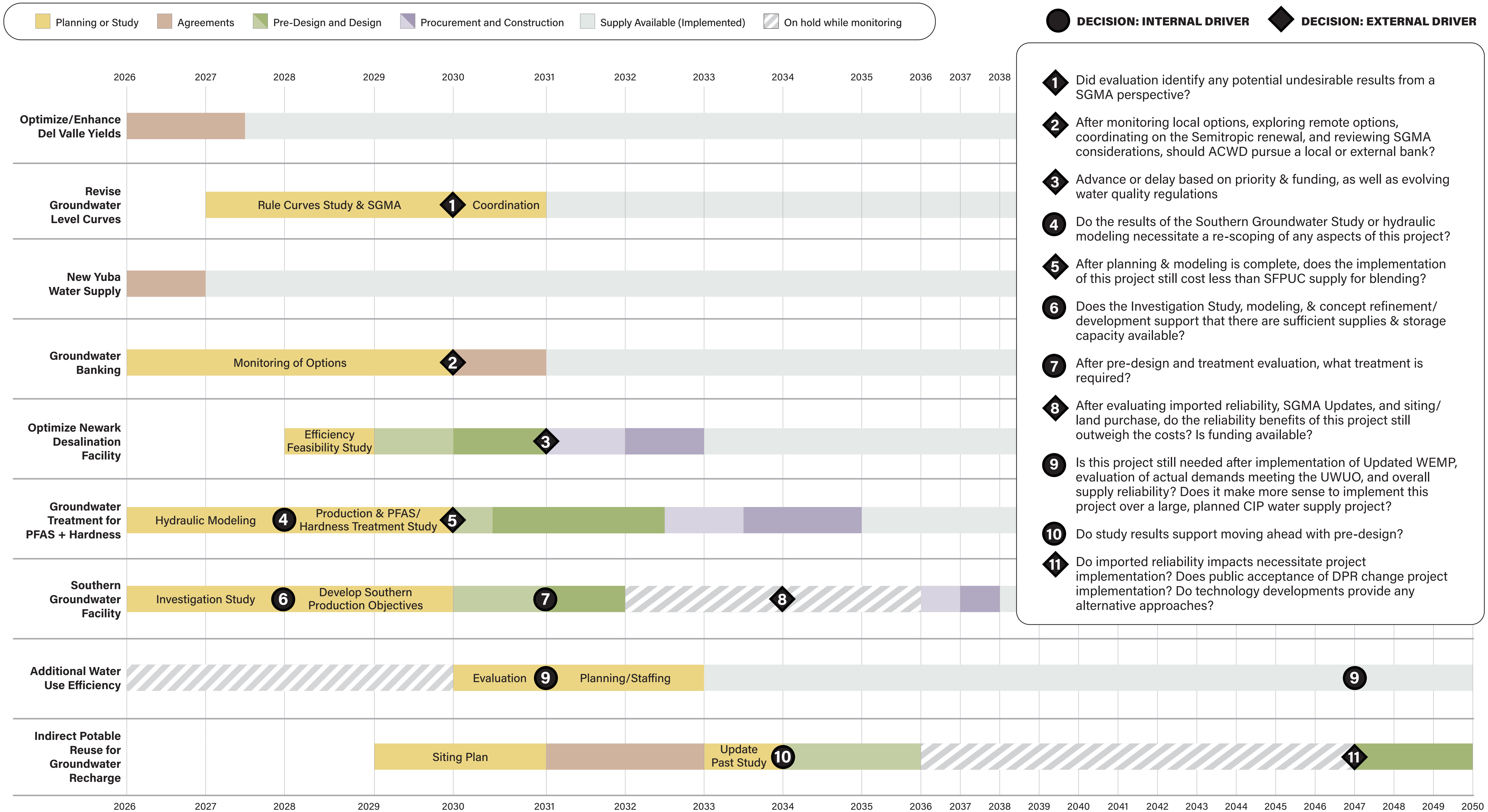
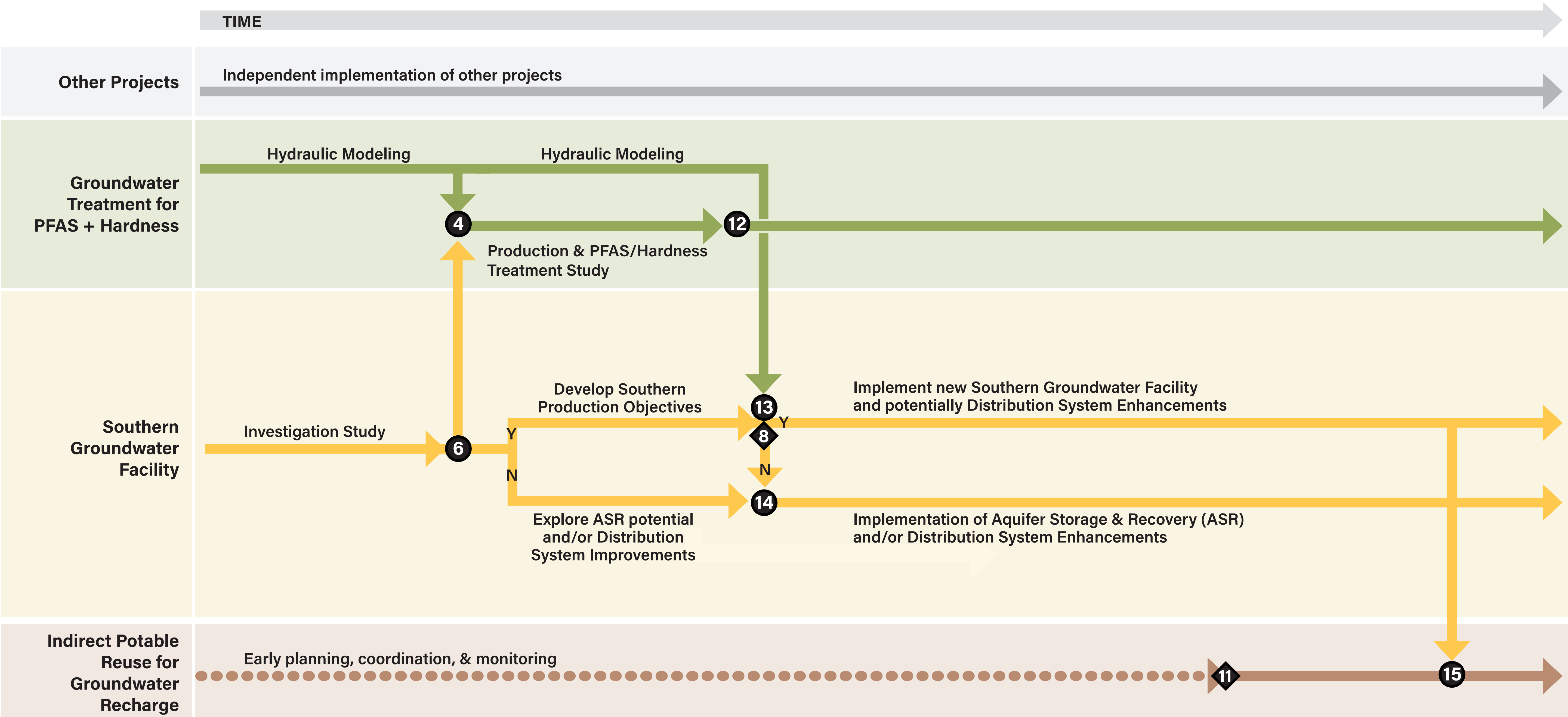


Figure 15: Supply Project Interdependencies



● DECISION: INTERNAL DRIVER ◆ DECISION: EXTERNAL DRIVER

- **4** Do the results of the Southern Groundwater Study, SFPUC MPR amendments, or hydraulic monitoring necessitate a re-scoping of any aspects of this project?
- **6** Does the Investigation Study, modeling, & concept refinement/development support that there are sufficient supplies & storage capacity available?
- **8** After evaluating imported reliability, SGMA Updates, and siting/land purchase, do the reliability benefits of this project still outweigh the costs? Is funding available?
- **11** Do imported reliability impacts necessitate project implementation? Does public acceptance of DPR change project implementation? Do technology developments provide any alternative approaches?
- **12** What are the refined treatment and distribution system needs to deliver increased Blender production to southern service areas?
- **13** To what scale will ACWD develop a new southern groundwater facility to meet objectives of increased annual groundwater production and increased resilience?
- **14** Is Aquifer Storage & Recovery (ASR) feasible, AND/OR are distribution system improvements needed to deliver increased groundwater production to the southern service area?
- **15** Has net groundwater production increased through the successful implementation of one of a series of possible projects in phase 2? (required for construction of purified water for recharge)

5.2 Water Resource Strategy Implementation

Figure 16 provides implementation considerations for the various categories of water resource strategies, color-coded to distinguish projects (shown in blue ovals) and programmatic policies (shown in green squares). Many of these are ongoing or just beginning. For others, the implementation plan is less formalized, allowing flexibility for ACWD to determine if and when implementation is most appropriate in response to opportunities – such as partnerships and funding – as they arise. During its periodic WRMP implementation progress reviews, ACWD will also review its water resource strategies.

Figure 16: Water Resource Strategy Implementation Considerations

Implement Updated Water Efficiency Master Plan	Ongoing with full implementation by 2035-2040 to keep unconstrained demands below UWUO
Support Monitoring, Studies, and Restoration Work in the Watershed	Ongoing
Maximize Local Surface Water Supplies	Ongoing
Establish Water Trading Partnerships	Ongoing; or if accelerated, may continue exploring willing partners, consider long-term agreements with existing partners, or expand with contract services to find new opportunities
Build Public Outreach and Partnerships	Ongoing
Implement Affordability Plan	Plan development ongoing; implement plan elements
Maintain & Enhance Quarry Lakes Water Quality	Continue and expand nutrient sampling; expand other aspects of water quality programs as partnerships and funding are identified
Develop Resilience/ Emergency Response Plan	Begin development within 5 years; estimated to take 2 years to develop
Establish Multi-Benefit Land Trust	Three-phased approach: (1) establish goals, (2) siting study and purchase strategy within 5 years, (3) trust establishment within 10 years

5.3 Implementing the Selected Portfolio

The stages of implementation and interdependence between supply projects (shown in **Figure 14** and **Figure 15**) reflect several specific internal decision points and external triggers. Although the water resources strategies do not have equally detailed implementation schedules, there are some key drivers and triggers that will impact future decisions about if and when to implement them. By pairing potential future internal and external drivers with key decision points now, ACWD will be prepared to manage uncertainty and adapt portfolio implementation to changing conditions. The following sections discuss some of these drivers and decision points based on when they are anticipated to occur.

5.3.1 Near-Term Drivers & Decision Points

During the first five years of WRMP implementation, there are numerous studies and actions that will take place, many of which are already underway. Some are shorter-term steps needed to implement a component of Phase 1, while others are initial steps toward eventual implementation of projects in subsequent phases. Results of these initial studies and other actions will prompt decision-making along the adaptive pathway of the implementation plan. Key near-term drivers are summarized below with the numbers corresponding to the decision points noted in **Figure 14** as appropriate.

NILES CONE GROUNDWATER QUALITY

4 7	Currently, ACWD's ability to utilize local groundwater is limited by water quality constraints such as PFAS and hardness targets and system bottlenecks, such as hydraulic constraints. To fully utilize local groundwater resources, ACWD must consider enhancing PFAS and hardness treatment capacity at the existing Blending Facility. ACWD should continue to study potential treatment options and integrate findings into the Capital Improvement Planning (CIP) budget. The need for PFAS and hardness treatment will also be influenced by the results of ACWD's study of the southern Niles Cone, which may prompt consideration of a southern groundwater production facility which may need PFAS, chloride, hardness, or other treatment technology.

SOUTHERN BASIN GROUNDWATER PRODUCTION VIABILITY

6
8
10
13

If the current investigation study indicates potential groundwater yield in the southern portion of the Niles Cone, ACWD will conduct further analyses to develop and refine concepts for a southern groundwater facility, which could be implemented in different forms depending on ACWD's objectives for producing additional supplies and/or providing additional SWP outage resilience. If there is not sufficient available supply, ACWD will consider additional studies to determine if there is potential for aquifer storage and recovery, and/or distribution system improvements to remove hydraulic constraints on the ability to send existing water supplies to the southern portion of the service area. In either case, the results of the current Southern Basin investigation study will inform the groundwater production and PFAS/hardness treatment study to refine treatment needs at the Blending Facility.

ESTABLISH GOALS & DETERMINE SITING POTENTIAL FOR LAND TRUST

Creating a multi-benefit land trust within the Alameda Creek Watershed first requires establishing clear goals to define desired outcomes. Once goals are established, implementation will depend on the ability to purchase land that is suitable for improving watershed function and quality. By conducting a siting study early, including consideration of benefits and costs, ACWD can be well-positioned and financially prepared to acquire and manage meaningful parcels as they become available in future years.

EXTERNAL GROUNDWATER BANKING

2

ACWD currently banks excess SWP supplies with Semitropic in the Kern County Subbasin, but storage and pump-back capacity are limited during dry years. This, along with regulatory uncertainty of state intervention (which could further restrict pump-back capacity), underscores the need for ACWD to monitor developments and prioritize pump-back flexibility and conveyance capacity in future negotiations – whether through extending its Semitropic agreement beyond 2035 or pursuing alternative groundwater banking partnerships.

5.3.2 Post-2030 Decisions

After 2030, there are additional drivers that can be expected to play a larger role in the District's decision-making process for projects in Phase 2 and Phase 3. Key post-2030 drivers are summarized below with the numbers corresponding to the decision points noted in **Figure 14** as appropriate.

NILES CONE SALTWATER INTRUSION

8

While saltwater intrusion from San Francisco Bay remains a risk, ACWD has reduced this threat through managed aquifer recharge and its Aquifer Reclamation Program. ACWD's Climate Adaptation Plan defines qualitative triggers for operational adaptive actions to address sea level rise impacts on Niles Cone water quality; however, ACWD has not yet identified specific quantitative thresholds (e.g., a defined increase in mean sea level). Establishing refined thresholds, triggers, and a supporting monitoring program will require additional data and further groundwater modeling to evaluate sea level rise-driven impacts; this is planned in the next several years under the District's Groundwater SGMA Enhancement efforts.

The WRMP proposes projects to optimize pumping in the Niles Cone during dry years, paired with enhanced recharge in wet years. ACWD will study the feasibility of these projects and, if pursued, closely monitor basin conditions to ensure long-term sustainability and continued compliance with SGMA.

STATE WATER PROJECT RELIABILITY

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Climate change and seismic risks create significant uncertainty in the SWP's ability to provide reliable supplies, with potential disruptions from variable hydrology, saltwater intrusion, and Delta infrastructure vulnerabilities. ACWD's modeling indicates that an SWP long-term average availability of approximately 35-40% of Table A[1] contract amount represents a threshold below which a new supply would likely be needed, triggering Phase 3 of the WRMP. Below this threshold, Phase 1 and Phase 2 can no longer maintain the District's offsite storage target[2], even with maximized SFPUC purchases, indicating that long-term reliability objectives can no longer be met.

ACWD will monitor SWP reliability and progress of the Delta Conveyance Project as key indicators for advancing WRMP projects, particularly indirect potable reuse. Implementation of the Bay Delta Plan could increase environmental flow requirements, further reducing SWP deliveries during dry years and accelerating the need for alternative supply strategies.

1 This analysis assumes no additional loss of system performance, such as reduced stored-water recovery or declines in SFPUC or local supplies beyond those currently assumed. Periodic updates to this analysis should be conducted to reassess and refine the identified critical thresholds.

2 ACWD currently uses approximately 100,000 AF as a target volume to maintain in groundwater banks or other offsite storage to support recovery during a multi-year drought.

CUSTOMER DEMANDS & WATER USE EFFICIENCY

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ACWD will regularly monitor annual customer water use to track progress toward meeting Urban Water Use Objectives (UWUOs) and to better inform future Urban Water Management Plan (UWMP) updates and Water Efficiency Master Plan (WEMP) implementation. This ongoing monitoring will allow ACWD to identify trends, evaluate the effects of regulatory changes and other factors influencing demand, and assess how statewide updates to UWUOs may affect program implementation. Based on these findings, ACWD will determine whether to implement additional water use efficiency measures to further enhance demand management or to evaluate facility and supply needs if water use increases.

PUBLIC ACCEPTANCE

11

ACWD should continue to gauge the public's level of acceptability for purified water projects, particularly DPR. The WRMP includes plans for potential implementation of an IPR project in case of more severe climate change or insufficient supplies from other prior planned projects. Implementation of purified water projects by other agencies and a shifting regulatory landscape may result in changes in public acceptance around DPR and thus result in an updated evaluation of the scope of ACWD's IPR project.

5.3.3 Ongoing Monitoring

Throughout WRMP implementation, the District will monitor numerous factors that may affect the timing, scope, or sequencing of specific projects or strategies. Key areas of ongoing monitoring are summarized below. Monitoring areas that influence specific decision points in **Figure 14** are identified below as appropriate..

WATERSHED & QUARRY LAKES WATER QUALITY

Maintaining acceptable environmental and recreational water quality within Quarry Lakes is critical to ACWD's ability to meet regulations and manage surface flows and recharge into the Niles Cone. Ongoing and expanded water quality monitoring implementation will help to inform future ACWD staff on what, if any, additional projects or programs will be needed to maintain water quality and flows.

PERMIT & REGULATORY COORDINATION

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Some projects proposed in the WRMP will require close coordination with state and federal environmental regulatory agencies regarding the modification of existing permits or acquisition of new permits. Once studies have been completed and project descriptions have been developed, ACWD should begin early communications with the State Water Resources Control Board and others as appropriate to determine permitting needs and develop proposed WRMP projects in a manner that assure successful permitting.

FUNDING AVAILABILITY

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External funding opportunities may lead to prioritization of one type of project over another or accelerate the timing of project implementation.

TECHNOLOGY ADVANCEMENTS

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ACWD should monitor advancements in treatment technologies, specifically for PFAS and advanced water purification; improvements in desalination energy efficiency; the proliferation of new clean energy sources; and the continued development of artificial intelligence. These advancements could accelerate or modify project implementation.

PROJECT PARTNERSHIPS & COORDINATION

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Some of the capital-intensive WRMP projects could be adapted to incorporate regional partners or even abandoned if ACWD were invited to join a partner's existing project. ACWD's ongoing coordination with regional agencies could provide insight into potential issues for planned project implementation by acquiring important lessons learned from other agencies, or benchmarking of project operations.

5.4 WRMP Implementation Support

Implementation of the WRMP will require dedicated financial and staff resources, along with continued internal coordination and external collaboration.

5.4.1 Financing and Funding

Figure 17 shows a cost-loaded schedule that forecasts the timing of capital and annual (O&M and supply purchase) cost expenditures required to meet the water supply project implementation schedule shown in **Figure 14**. Costs associated with implementing water resources strategies have not been included because they are anticipated to be implemented on a more opportunistic basis in response to funding and partnerships, with a less-defined implementation schedule. Additionally, many strategies have either no cost, an undetermined cost, or an estimated low cost relative to the capital costs of supply projects.

The solid light blue bars in **Figure 17** represent the annual costs required to produce the supply mix needed to meet buildout (2050) demands under Scenario B conditions. Combined, the solid dark blue bars and the hatched dark blue bars represent the total expected capital costs for WRMP supply projects. Alone, the solid dark blue bars represent WRMP supply project capital costs that are already accounted for in ACWD's existing CIP; alone, the hatched dark blue bars represent the additional capital costs required to implement WRMP supply projects. Approximately 23% of the total capital needed for Phases 1 and 2 is already covered by elements in the existing CIP.

Implementing any of the projects outlined in the WRMP will require varying levels of funding, both in capital and annual costs. The funding strategies available to ACWD may include connection fees, water rates, grants or low-interest loans, and bonds. As the WRMP implementation period progresses, ACWD staff should also begin integrating planned WRMP projects into ACWD's CIP budget windows. This will aid ACWD in assessing the fiscal impacts of proposed WRMP projects and help determine financing strategy for implementation.

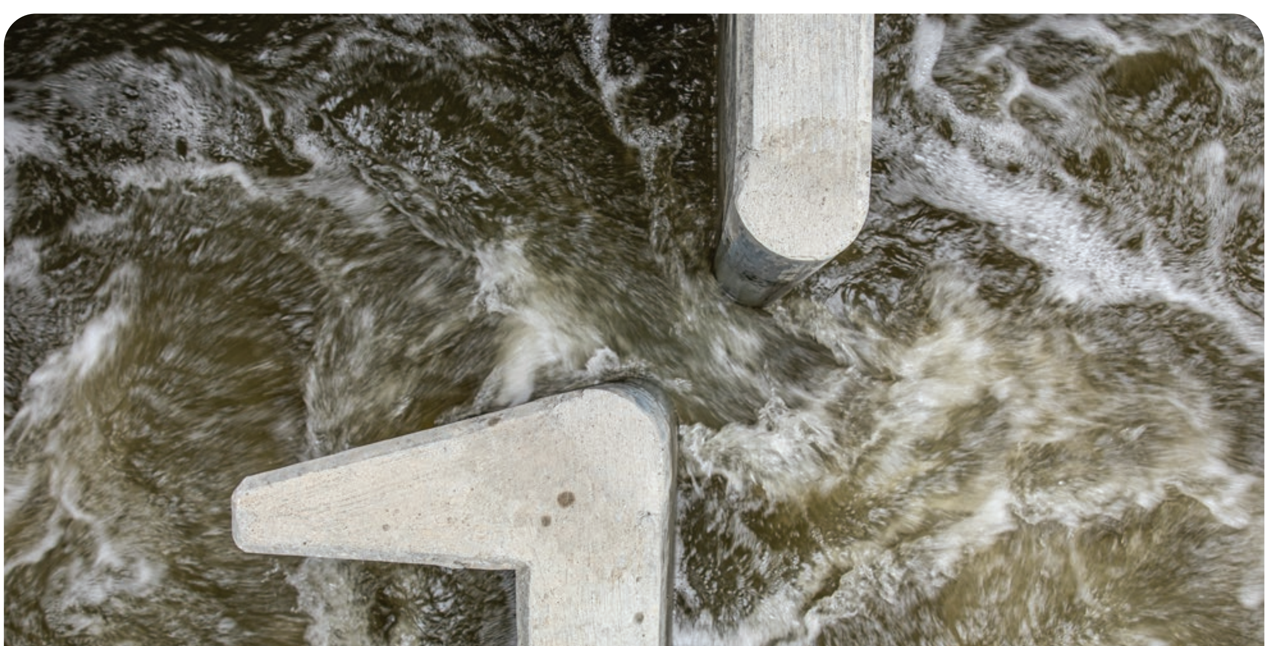
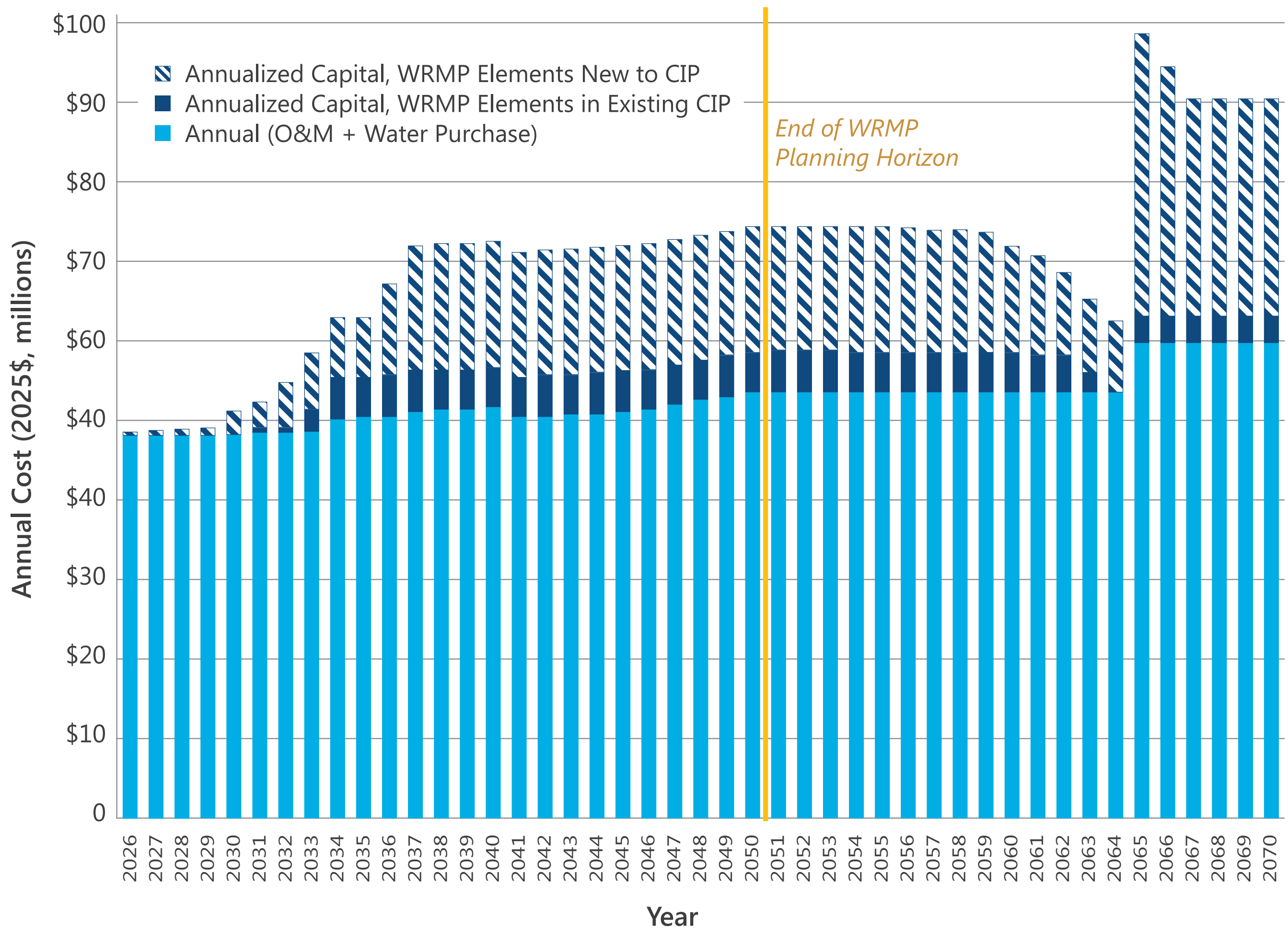


Figure 17: Cost-Loaded Schedule



Notes:

1. "Annual (O&M + Water Purchase)" represents the annual costs required to produce the supply mix needed to meet buildout (2050) demands under Scenario B conditions, which assume a greater share of SFPUC deliveries compared to 2025 conditions. These costs are scaled to reflect the modest increase in total demands between 2026-2050.
2. "Annual (O&M + Water Purchase)" costs shift over time as the major phases of the WRMP come online. Net changes in total annual cost between Baseline, Phase 1, and Phase 2 are projected to be minimal, with a more noticeable increase occurring when Phase 3 is implemented.
3. The "Annualized Capital" bars represent the total expected capital costs for WRMP supply projects. For high-level planning purposes, the chart assumes that capital costs incurred in a particular year are financed through 30-year bonds beginning in the year in which the cost is incurred. In reality, some capital investments may be financed through other mechanisms or bundled into multi-year bond issuances. The chart is intended to illustrate the relative increase in capital-related costs over time.
4. Some WRMP supply project capital costs are already accounted in ACWD's existing CIP, shown as "Annualized Capital, WRMP Elements in Existing CIP." The remaining portion, "Annualized Capital, WRMP Elements New to CIP," reflects additional capital costs required to implement WRMP supply projects. Approximately 23% of the total capital needed for Phases 1 and 2 is covered by elements in the existing CIP.
5. The timing of Phase 3 (Indirect Potable Reuse for Groundwater Recharge) implementation is highly uncertain and depends on several factors described elsewhere in the WRMP. It is unlikely to be needed before 2050. Modeling under Scenario C suggests a significant supply project may be required under expected 2075 climate change conditions. For conservative planning and illustrative purposes only, this chart assumes Phase 3 implementation occurring in 2065.

5.4.2 Staffing Resources

Implementation of the WRMP will require substantial effort from ACWD staff across the entire organization, both for existing staff in the planning and design, as well as new staff to operate new facilities and implement new or expanded resource strategies. The planning-level costs described for capital programs are intended to capture the cost of existing staff effort and consultants in planning and design. As shown earlier in **Figure 13**, costs for new staff to operate new facilities has been included as well.

5.4.3 Outreach and Engagement

The WRMP process was led by ACWD's Water Resources Division in service of their mandate to provide a pathway for future water reliability in keeping with the goals and objectives established by the ACWD Board. The success of the WRMP planning process and the usefulness of this document are the result of purposeful and consistent internal collaborative input across ACWD departments as well as engagement with external interested parties and ACWD customers. Implementation of the WRMP will similarly be reliant upon the continued public outreach through existing ACWD programs as well as ongoing engagement with regulators, potential partners, and ACWD staff and the Board of Directors.