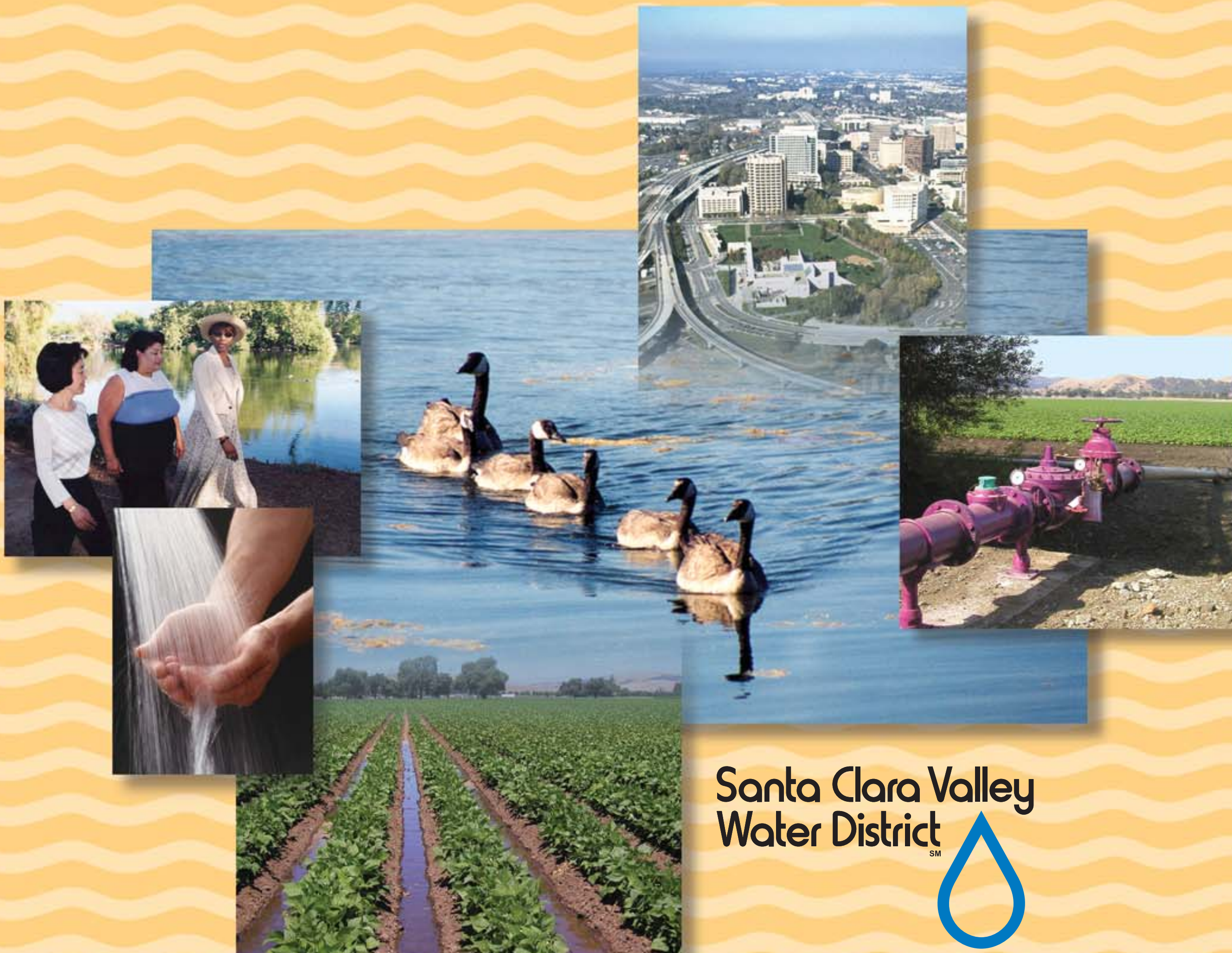
IWRP 2003

Integrated Water Resources Planning Study 2003



Santa Clara Valley Water District

Integrated Water Resources Planning Study 2003

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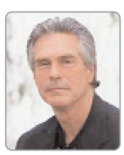
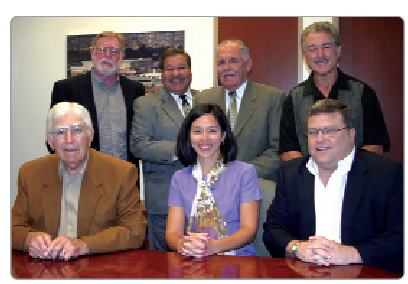


Santa Clara Valley Water District

December 2005



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Acronyms and Abbreviations

ABAG	Association of Bay Area Governments
af	acre-foot
Ag	agricultural
BAWAC	Bay Area Water Agencies Coalition
CEO	Chief Executive Officer
CEQA	California Environmental Quality Act
CIP	Capital Improvement Plan
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DOF	Department of Finance
DHS	Department of Health Services
DBP	disinfection by-products
DWR	Department of Water Resources
DWSAP	Drinking Water Source Assessment and Protection
ESA	Endangered Species Act
ET	Evapotranspiration
EWA	Environmental Water Account
FAHCE	Fisheries and Aquatic Habitat Collaborative Effort
HCP/NCCP	Habitat Conservation Plan/Natural Communities Conservation Plan
IWRP	Integrated Water Resources Planning
O&M	operations and maintenance
MCL	maximum contaminant level
mgd	million gallons per day
M&I	municipal and industrial
MOU	Memorandum of Understanding
MTBE	methyl tertiary butyl ether
NEPA	National Environmental Policy Act
PARWQCP	Palo Alto Regional Water Quality Control Plant
PV	present value
R&D	research and development
SBA	South Bay Aqueduct
SBWRP	South Bay Water Recycling Program
SCRWA	South County Regional Wastewater Authority
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
SJ/SCWPCP	San Jose/Santa Clara Water Pollution Control Plant
SJWC	San Jose Water Company
SWP	State Water Project
SWPCP	Sunnyvale Water Pollution Control Plant
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TWIP	Treated Water Improvement Project
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
UV	ultraviolet
UWMP	Urban Water Management Plan
WMI	Watershed Management Initiative
WTP	water treatment plant

Glossary of Terms

all-weather supplies	Water that is available in dry, normal, and wet years: includes conservation, recycling, and desalination.
banking	The storing, for later use, of water that might otherwise be lost.
baseline	Existing and adopted supplies, infrastructure, programs, and agreements.
Bay-Delta	The region of the Sacramento River and San Joaquin River Delta confluence. A watershed drainage that supplies about 55% of the fresh water used in California.
building blocks	Feasible projects and programs for meeting future water demands.
CALFED	A partnership of state and federal agencies working with stakeholders to restore the ecosystem of the Sacramento-San Joaquin Bay-Delta and improve the reliability and quality of water supplies for over 20 million Californians.
CALSIM II	Department of Water Resources water simulation model.
conjunctive use	A water management strategy for the coordinated use of groundwater and surface water resources.
constructed scale	A range of qualitative values converted into a range of quantitative values (e.g., best, good, fair, poor could become 100%, 75%, 50%, and 25%).
County	Santa Clara County
CVPIA	Central Valley Project Improvement Act; legislation signed into law in 1992 that mandated changes in management of the Central Valley Project, particularly for the protection, restoration, and enhancement of fish and wildlife.
dry-year yield	The average annual supply that could be expected if the 1987–1992 hydrology were repeated.
Ends Policy	A category of District Board policies, with qualitative yet specific outcomes or expectations.
EWA	Environmental Water Account; CALFED strategy to reduce conflicts between environmental needs and water project operations by providing water and flexibility through the strategically timed acquisition, storage, transfer, and release of water.
Extend	The District's water simulation model used in the IWRP analysis.

Hetch-Hetchy supply	Water conveyed by the San Francisco Public Utilities Commission from the Hetch-Hetchy Valley in the Sierra Mountains.
nonpotable	Not suitable for drinking.
portfolio	A combination of building blocks that complement each other to meet water needs with a high degree of reliability.
predictive indicators	Measures of performance that can be used to evaluate whether building blocks and water resource portfolios achieve IWRP planning objectives.
present-value dollars	The current value of one or more future cash payments, discounted at an interest rate that accounts for the time value of money.
real dollar costs	Costs that do not include the effect of general price inflation.
San Luis Reservoir	A 2 million acre-feet facility southeast of Santa Clara County, jointly owned and operated by the federal Bureau of Reclamation and the state Department of Water Resources.
scalability	Modular; able to be built in phases.
Semitropic	Semitropic Water Storage District, in southern San Joaquin Valley
spot market	Water agreements to purchase or transfer water within a one to two year period
stakeholder	Any individual or interest who will be affected by, or has an interest in, the County's long-term water supply.
transfers	An agreement to purchase water from another water user.
yield	The amount of water deliverable from a facility in a specific interval (e.g., year).

Executive Summary

For 75 years, the Santa Clara Valley Water District has provided a safe, reliable, and affordable water supply. Ensuring an adequate, reliable supply of high-quality water now and in the future is a top priority for the District.

Thanks to the District's continuous investments to diversify its water supply, many different types of water resources are available to meet the County's long-term water needs. Choosing wisely among future options, however, is getting increasingly difficult, as multiple water supply issues, risks, and financial challenges complicate the water supply picture.

Integrated Water Resources Planning Study (IWRP) 2003 is designed to help the District as it navigates these challenges and makes the difficult decisions needed to ensure water supply reliability in the years ahead.

What Is the IWRP?

Integrated water resources planning is a process and evaluation framework to enable the District to make sound investment decisions on long-term water supply management. The IWRP approaches water supply issues broadly and inclusively, incorporating community involvement and flexibility to respond to changing and uncertain future conditions. Although IWRP 2003 builds on the initial 1996 IWRP and updates the water supply outlook, it is more than a routine update as called for in the 1996 plan.

The basic work of IWRP 2003 has been to develop a ***planning framework*** and supporting modeling tools that enable the District to fairly compare investment options in an environment of continual change and emerging opportunities. The framework is designed to provide a consistent and thorough process to help the District identify and select specific water resource investments.

IWRP 2003 was developed with input from the District's management team, technical staff, and community stakeholders. Over a 2-year period, IWRP participants developed the planning framework and utilized it to characterize the District's water outlook, assess risks to the water supply, identify and analyze new water resource options, and develop near-term (to year 2010) and long-term (to year 2020 and 2040) water supply recommendations.

Fundamental to the IWRP 2003 process is the identification of ***planning objectives*** that reflect the District's mission (see sidebar) and the Board's Ends Policies. These objectives are used as evaluation criteria by which to rate and compare water resource options. (See Figure ES-1).

Why Is IWRP 2003 Needed?

The mission of the District is a healthy, safe, and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective, and environmentally-sensitive manner.

The IWRP 2003 framework and tools do not provide a static water supply blueprint. Rather, they are designed to assist in ongoing analyses of the water supply alternatives and challenges that face the District in the 21st century. Water resources in California are becoming increasingly limited, with growing competition among urban, agricultural, and environmental uses. Multiple-year droughts, which we experience periodically, further stress the water system and make balancing among these needs even more difficult. Risks and uncertainties such as possible earthquakes, more stringent water quality standards, global warming, and other factors further complicate the picture.

The District must make a number of decisions within this decade that will impact investment choices and future water supplies. Tightening budgets and greater financial constraints make it critical to pursue the best investments possible with the limited dollars available while maintaining the District's diverse assets. IWRP 2003 allows these upcoming choices to be evaluated in the context of the planning framework.

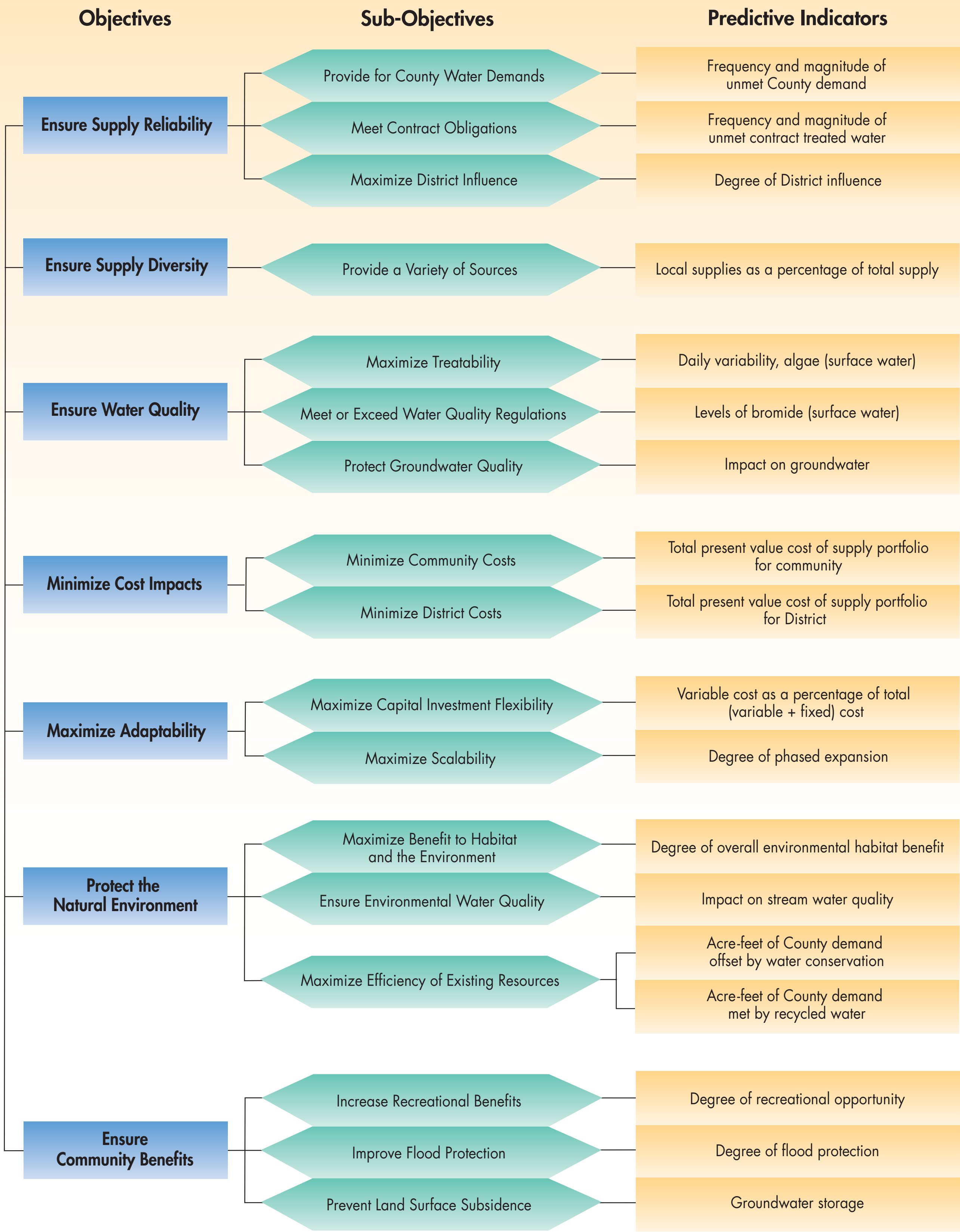
Key Findings

The following insights emerged through the IWRP analysis.

1. It pays to be reliable.

The IWRP looked at the cost of shortages to the community, and determined that through the planning horizon, the cost of the available options to meet needs is less than the cost of not meeting water demand.

IWRP Planning Objectives *Figure ES-1*



2. Securing the baseline is the top priority for ensuring reliability.

The majority of water for meeting future needs will come from the District's baseline water resources and infrastructure. Thus, the single most important component in meeting future needs is ensuring the long-term viability of the District's existing supplies, infrastructure, and programs.

3. A mix of investments in all-weather supplies, storage, and dry-year response best meets planning objectives.

Although supply reliability can be achieved in many different ways, the IWRP analysis showed that new investments in a combination of the following three elements will meet the District's multiple planning objectives in an efficient and flexible manner:

- ***All-weather supplies:*** conservation, recycling, and desalination are available in every year, regardless of weather.
- ***Water storage:*** local groundwater storage, surface storage, or water banking programs such as the Semitropic Water Bank allow surplus water in wet years to be carried over to years when it is needed.
- ***Dry-year response:*** spot market transfers, dry year options transfers, and drought response actions can efficiently supplement supply in critically short years.

4. Local supply development decreases vulnerability to risk.

Local water supplies minimize dry-year dependence on the Bay-Delta estuary, which is susceptible to the impacts of global warming, earthquake in the region, more stringent water quality standards, and limits on Delta pumping.

Recommendations

Staff recommends the District utilize the IWRP process and stakeholder involvement for future analysis of water supply alternatives. In addition, staff recommends the following actions to ensure reliability through 2040.

1. Secure the Baseline

The District's baseline water supply will serve as the foundation for future water resource investments. IWRP 2003 recommends the District take steps now to secure this baseline. Some of these steps are summarized below.

Rinconada Water Treatment Plant

- ***Improve infrastructure reliability.*** A key assumption of IWRP 2003 is that local infrastructure will be reliable throughout the planning horizon. The District is currently evaluating the condition of the District's water treatment plants and distribution system. Improving local infrastructure will be vital to ensuring reliability of the treatment and conveyance systems during emergencies.

- ***Expand groundwater management.*** The local groundwater basins supply nearly half of the water used annually in the County and also provides emergency reserve for droughts or outages. The District should develop facilities to utilize this resource during emergencies, particularly outages to the treated water system, and to further conjunctive use.

- ***Sustain existing supplies.*** The District must also protect imported water supplies by resolving contract and policy issues, supporting Bay-Delta system improvements, resolving the San Luis Reservoir low-point problem, and supporting San Francisco Public Utilities Commission (SFPUC) efforts to implement a Capital Improvement Program and to secure the long-term reliability of SFPUC supplies in the County. Local water supplies can be sustained by maintaining local water rights and protecting the local groundwater basins.

- ***Reaffirm commitments to water conservation and recycling.*** IWRP 2003 assumes the District will continue its commitments to conservation and recycling, resulting in 64,000 af per year savings from conservation by year 2020, and 16,000 af per year of recycled water by the year 2010.

- ***Continue to provide clean, safe drinking water*** and to meet and exceed water quality standards through aggressive source water protection, ongoing improvements to treatment facilities, and re-operations for blending.

2. Implement the "No Regrets" Portfolio for Near-Term Reliability (Phase I)

The technical team created a "No Regrets" portfolio to help ensure reliability through 2010 and perhaps 2020, depending on how risk factors unfold. This portfolio was nicknamed "No Regrets" because its implementation is unlikely to cause anyone to regret it later. The elements are cost-effective, environment-friendly, and flexible, with no major capital construction.

IWRP stakeholders endorsed the No Regrets portfolio, which calls for the following new near-term investments:

- 28,000 af of additional annual savings from agricultural and M&I conservation.
- 20,000 af of additional groundwater recharge capacity.
- 60,000 af of additional capacity in the Semitropic Water Bank.

Water Wise house call

With the No Regrets portfolio in place, potential shortages through 2010 are reduced to levels that presumably could be managed through contingency planning and response, including spot market transfers or demand reduction. The District costs for this improved supply reliability are expected to total $42 million (in real dollars), which includes improved capital infrastructure, operations and maintenance (O&M) expenditures, and program implementation.

As the No Regrets portfolio is implemented, the District must continuously monitor for trends, risks, and opportunities that could trigger the need for longer-term supply investments.

3. Prepare for the Long Term

The District must prepare now to make the hard decisions that will be needed to meet dry-year water demands beyond 2010. When planning for uncertainties more than a decade away, there is not a single, simple solution to managing risk and ensuring water supply reliability. IWRP recommends the following approach to keep water supply options open.

- ***2011 to 2020 (Phase II):*** IWRP 2003 projects a variety of likely risk scenarios and outlines possible response strategies to meet future demand through the year 2020. Figure ES-2 shows the six different scenarios analyzed in the

IWRP process, and the response strategies that would be required to achieve a high level of reliability for each scenario to the year 2020. Which strategies the District pursues will reflect how risks actually unfold.

- ***2021 to 2040 (Phase III):*** Because the impacts of risks 20 to 40 years out are uncertain, and because actions and decisions in the near term can significantly affect the future water supply outlook, IWRP 2003 does not present specific recommendations for investments beyond the year 2020. Rather, it presents general descriptions of the types of investments that may be needed to manage these risks in the more distant future. (See Figure ES-2).

- ***Throughout the planning horizon:*** Other critical steps to ensure long-term water supply reliability include monitoring for risks, new opportunities, and technology improvements; further investigating desalination feasibility and recycled water acceptance and marketability; exploring potential water management and water quality improvement alternatives; and maximizing external funding.

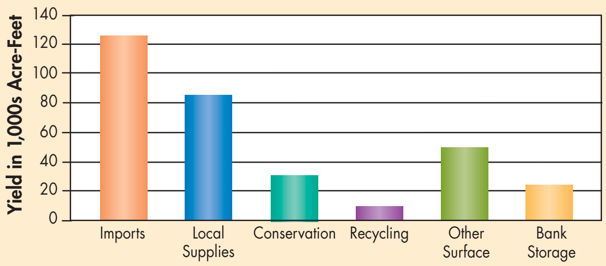
The IWRP framework and evaluation tools allow comparison of new alternatives as they arise, and can be updated for risks and changes to the water supply outlook as they unfold. IWRP 2003 will help the District make the difficult decisions needed to ensure water supply reliability well into the 21st century.

New Investments Needed over Time *Figure ES-2*

Current Baseline Supplies

Securing the Foundation

Current Baseline Supplies—Dry-Year Yield

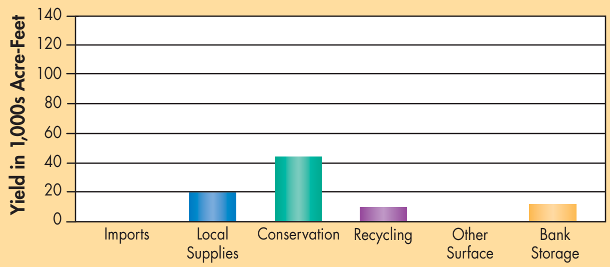


The single most important component of meeting future water needs is ensuring that the District's existing supplies, facilities, and programs perform as intended.

Phase 1 (2004–2010)

Recommended Near-Term Investments

No Regrets Portfolio and Additional Baseline Commitments—Dry-Year Yield



The No Regrets portfolio includes modest additional investments in conservation, groundwater recharge, and water banking. These investments, in addition to the District's baseline recycling and conservation commitments, will help ensure reliability through 2010.

Notes

- *All quantities shown in 1,000s of acre-feet.*
- *Dry-year yield is the average annual supply that could be expected if the 1987–1992 hydrology were repeated.*
- *"Other Surface" supplies include Hetch-Hetchy and non-District water rights.*
- *Investments shown in each phase are in addition to those in the previous phase.*
- *All risk scenarios include random risks.*

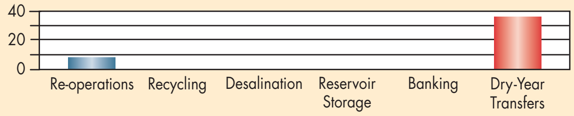
Phase 2 (2011–2020)

Possible Responses to Risk Scenarios

Phase 3 (2021–2040)

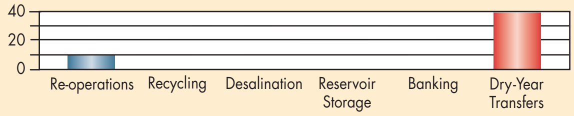
Keeping Options Open

Random Occurrences



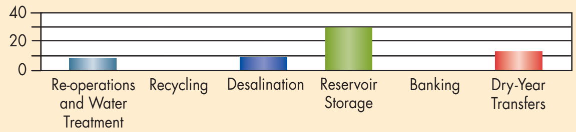
Will need additional storage or all-weather supplies by 2030. An expanded banking participation, a new 100,000 af reservoir, desalination, or recycling could all reduce shortages through 2030 to negligible levels.

Climate Change



Significant impacts from climate change beyond 2020 may require water treatment for salinity. All-weather supplies and storage will also be needed.

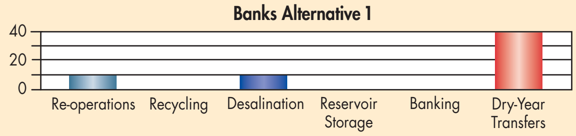
More Stringent Water Quality Standards



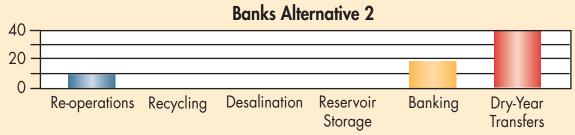
Implementation of CALFED reservoirs would improve water quality. Whether source quality improvements (re-operations, reservoir storage, or blending) are needed will be evaluated after the District's Treated Water Improvement Project is on-line in 2008.

No Expanded Banks Permit

Banks Alternative 1



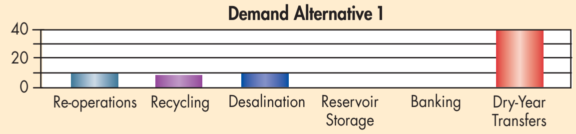
Banks Alternative 2



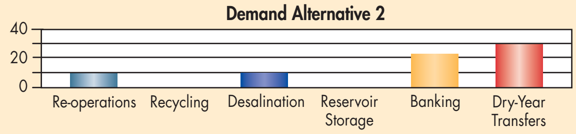
Beyond 2020, alternative 1, which includes desalination, is more effective than alternative 2, which includes water banking. However, even with desalination before 2020, additional all-weather supplies and storage are necessary after 2020. Recycling or other all-weather supplies may substitute for desalination if desalination is not shown to be feasible in further study.

Demand Growth Greater than Projected

Demand Alternative 1



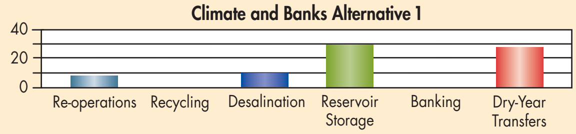
Demand Alternative 2



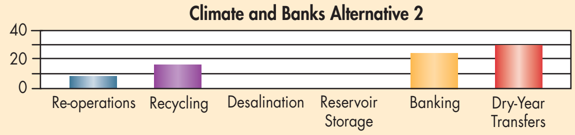
Beyond 2020, additional all-weather supplies will be necessary. This may require additional building blocks above those identified in IWRP 2003, such as advanced treatment of recycled water for groundwater recharge or aggressive desalination. Additional storage will also be needed.

No Expanded Banks Permit and Climate Change

Climate and Banks Alternative 1



Climate and Banks Alternative 2



Impacts from this risk scenario may require water treatment for salinity beyond 2020. Additional all-weather supply will be required before 2030.

Introduction

This chapter describes the Integrated Water Resources Planning Study (IWRP) 2003 process and how IWRP 2003 differs from the Santa Clara Valley Water District's 1996 IWRP. It explains the key product of IWRP 2003, known as the IWRP framework, along with new analytical tools, and details stakeholders' contributions to the IWRP process.

Meeting Santa Clara County's Water Needs

Balancing the three missions of the District—water supply, flood management, and environmental stewardship—is challenging and complex, requiring innovative, flexible, and incremental solutions to adapt to an uncertain and ever changing future.

Will there be enough water in the future? A South County farmer asked this at the first stakeholder meeting of IWRP 2003. The question underscores the fact that water cannot be taken for granted. We depend on it not only for our personal use, but also for business, industry, farming, recreation, the environment, and the scenic beauty of our communities. A sustainable, high-quality water supply is vital for a prosperous economy, the environment, and quality of life in Santa Clara County (County).

District Mission

The mission of the District is a healthy, safe, and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective, and environmentally-sensitive manner.

As the County's water wholesaler, the District's job is to make sure there is enough water for the area's needs. In addition to its water supply mission, the District serves as the flood management agency and environmental steward for the watersheds of the County. Balancing these three missions of water supply, flood protection, and watershed stewardship is challenging and complex.

The IWRP serves as a guide to assist in sound investment decision-making for long-term water supply, looking at current and future trends, challenges, and opportunities. Water supply issues in California are shaped by two major factors—periodic droughts and increasing competition for water. Population growth and competition among urban development, agriculture, and environmental water needs all place increasing demands on this limited resource. Today's challenges revolve around balancing finite and variable water supplies, especially during prolonged drought periods. Now more than ever, water managers like the District must carefully plan for future needs while efficiently managing existing supplies, finding innovative and technical solutions to mounting costs, and protecting the environment.

Integrated Water Resources Planning at the District

To address the complex issues associated with providing a long-term water supply, the District uses a process called integrated resources planning. Integrated resources planning approaches an issue broadly and inclusively, often incorporating community input and flexibility to respond to changing conditions.

The District's first IWRP was finalized in 1997. That IWRP relied heavily on stakeholder participation. Stakeholders helped staff identify several alternative water resource strategies and rate them against planning objectives, ultimately selecting a final preferred strategy. That strategy identified three action programs corresponding to a range of future water shortage levels, with components phased in over time, based on demand. The 1996 IWRP called for periodic updates every 3 to 5 years to monitor and react to changing conditions.

IWRP 2003 Tools *Figure INTRO-1*

The **IWRP framework** is a method to allow fair and consistent comparison of water supply investment alternatives.

The simulation model **Extend** allows different combinations of water resource options, called portfolios, to be tested against repeats of historical hydrology through the 2040 planning horizon. The model tracks portfolio performance as measured by the IWRP planning objectives, including water shortages and costs.

The **Economic Analysis Tool** allows water resource options to be compared on an equal footing economically, even if they have different cost and benefit time streams, different project life expectancies, and different implementation dates.

The **Risk Analysis Tool** uses statistical techniques and estimation of risk probabilities to further test water resource portfolios under different possible futures, called scenarios. This risk tool is the refinement to Extend that tracks how shortages and project costs can change under global warming, earthquakes, and other risks.

Although the IWRP 2003 builds on the initial IWRP and its commitment to stakeholder participation and multi-objective planning, it is more than a routine update as called for in the 1996 Plan. IWRP 2003 does update the water supply outlook for changes since the initial IWRP; however, its main focus is in the development of a new planning framework for evaluating alternatives and challenges as they arise and more

The Scope of the IWRP

The IWRP provides information to assist in long-term investment decision-making in accordance with the District Ends Policy "The water supply is reliable to meet future demands." In contrast, year-to-year decision-making is accomplished through annual operations planning activities, which include evaluating annual transfer opportunities, allocating imported water deliveries, setting carryover storage targets, and scheduling facilities maintenance decisions.

advanced tools such as a risk analysis model and an economic evaluation tool. (See Figure INTRO-1.) While the 1996 IWRP selected a preferred strategy, IWRP 2003 identifies a number of alternative strategies that can be pursued to meet needs depending on how the future unfolds.

IWRP 2003

In order to get a sense of how the water outlook may change over time, and in recognition of the long lead times necessary for implementing many water projects, IWRP 2003 aims toward a distant horizon, assessing water supply and demand through the year 2040. And while it is critical for water plans to have long planning horizons, much can change over 40 years, and no single plan or set of investments can sufficiently manage the range of possible futures. Therefore, the IWRP recommends a flexible resource mix to be implemented in phases over the planning horizon.

IWRP 2003 is not a traditional rigid water supply blueprint, but a planning tool: a framework for evaluating alternatives and guiding future decisions on resource development and water supply investments.

- Through 2010, IWRP 2003 recommends specific water resource investments and actions to ensure reliability in the near term.
- Through 2020, IWRP presents a detailed analysis of potential water resource projects and possible strategies to meet future demands.
- Through 2040, IWRP evaluates potential risks and opportunities affecting water supply certainty, and presents a general description of the types of investments that may be needed to ensure water quality and reliability in the long term.

As near-term actions are being implemented, the District will continuously monitor for risks as well as opportunities that could trigger the need for longer-term supply investments. The District will also keep a close eye on economic and demographic trends, changes in drinking water quality standards, funding opportunities, new partnerships, new legislation and institutional arrangements, water markets, and advancements in treatment technology that could impact costs.

The IWRP framework was developed by staff and supplemented by major contributions from water retailers and community stakeholders (See Figure INTRO-2). It includes eight steps.

1. Describe Baseline Water Outlook
Describe a baseline future water outlook for the County. This baseline outlook assumes implementation of current and adopted programs.

2. Secure the Baseline
Identify actions needed to safeguard and maintain the existing water supplies, infrastructure, and programs that comprise the baseline supply.

3. Evaluate Risks to the Baseline
Identify likely risks, such as infrastructure failure due to an earthquake and global warming, and evaluate the reliability of the baseline water supply under these risks.

The District, through IWRP 2003 and its other activities, will ensure that the County has a safe, reliable, and cost-effective water supply now and in the future.

4. Define Planning Objectives
Identify measurable and concise planning objectives using District Board policies as a starting point. Develop predictive indicators (similar to performance measures) to quantify how well each planning objective is met.

5. Identify Investment Building Blocks
Identify water resource programs or projects ("building blocks") and rate them using IWRP predictive indicators.

6. Construct and Evaluate Portfolios
Analyze the performance of different portfolios (combinations of building blocks), using the planning objectives and predictive indicators.

7. Evaluate Risks to Portfolios
Evaluate the reliability of the water resource portfolios under the risks identified.

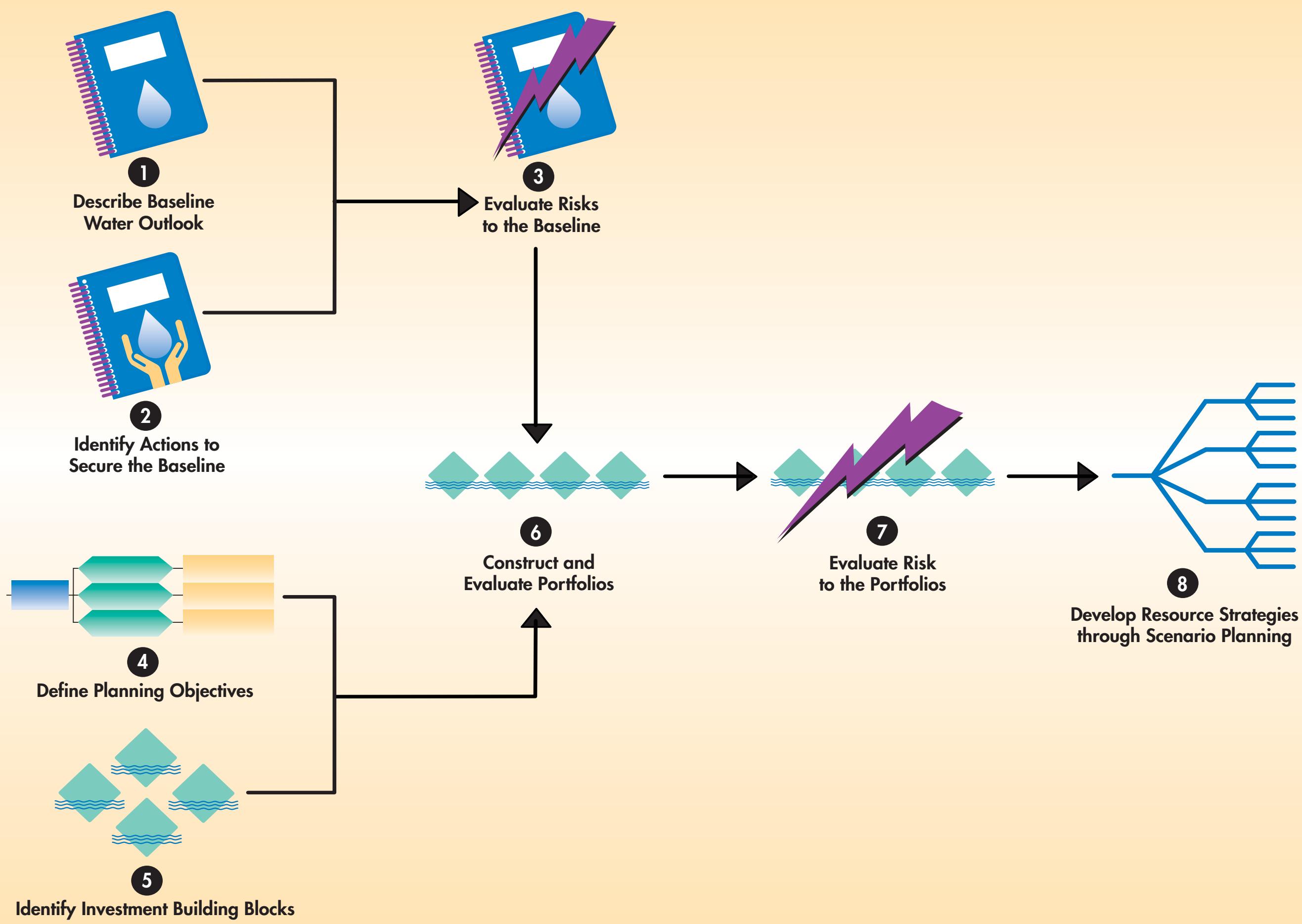
8. Develop Resource Strategies through Scenario Planning
To address the uncertainties associated with predicting the future, map out plausible alternative futures and identify water supply strategies. Recommend actions to manage risk in the future.

The District is using the IWRP 2003 framework to help ensure that the County has a safe, reliable, affordable water supply—now and in the future. The IWRP is never "finished." Ongoing use of the IWRP framework and modeling tools developed for IWRP 2003 will enable the District to evaluate the water supply impacts of specific projects and opportunities as they arise.

IWRP Project Roles

District staff, management, stakeholders, and the Board of Directors (Board) each had distinct roles in the preparation of this staff planning study.

IWRP Framework *Figure INTRO-2*



- **The Board**
  Pursuant to Board Governance, the Board establishes District policy. Policy issues raised during IWRP 2003 were forwarded to Board members for their consideration.

- **The Management Team**
  Consisting of the Chief Executive Officer, Chief Operations Officer, and other senior District managers, this group provided general guidance, set planning objectives, developed predictive indicators, reviewed specific recommendations from the technical team, and considered input from the stakeholders.

- **The Technical Team**
  Composed of individuals from engineering, operations, water quality, environmental and water resource planning, and finance, this group developed the information required for the supporting analyses.

The IWRP incorporated a stakeholder process to capture the broad interests of our community.

- **The Stakeholders**
  This group, which represented other regional and retail water agencies, business, agriculture, and environmental and community interests, reviewed the planning framework and the technical analysis, providing input and feedback.

IWRP Stakeholders

The 1996 IWRP demonstrated the value of public participation in the planning process. Building on the experience of the 1996 stakeholder process, IWRP 2003 convened stakeholders representing a broad cross section of interests, including: businesses, advocacy and environmental groups, public officials, other water agencies, landscape professionals, and agricultural interests. (see Figure INTRO-3). This group included many of those who had participated in the 1996 IWRP.

Over an 18-month period, stakeholders provided valuable input at five in-depth meetings and one informal meeting with District staff (see Figure INTRO-4). At the conclusion of each meeting staff prepared a written summary, including a record of all stakeholder comments and remarks, and forwarded this information to the Board; these can be found in the appendix to this introduction.

IWRP 2003 Stakeholders *Figure INTRO-3*

Academic Community	**Mr. Roger Salstrom**	Professor, Department of Organization & Management, College of Business, San Jose State University
Agricultural Community	**Mr. Joe Gonzales**	Board Director, Santa Clara County Farm Bureau
Business Community	**Ms. Margaret Bruce**	Director of Environmental Programs, Silicon Valley Manufacturing Group
	Mr. James Tucker	Director, Economic Development & Communications, San Jose Metropolitan Chamber of Commerce
County Planning	**Ms. Ann Draper**	Planning Director, Planning Department, Santa Clara County
District Agricultural Water Advisory Committee	**Mr. Jan Garrod**	Member, District Agricultural Water Advisory Committee
District Flood Control Zone Advisory Committees	**Mr. Fred Fowler**	Chair, Guadalupe Flood Control and Watershed Advisory Committee
District Landscape Advisory Committee	**Mr. Doug Nakamura**	Member, Landscape Advisory Committee
District Water Commission	**Ms. Sally Lieber**	Chair, Water Commission
Environmental Advocates	**Mr. Michael Stanley-Jones**	Senior Researcher, Silicon Valley Toxics Coalition
	Mr. Craig Breon	Executive Director, Santa Clara Valley Audubon Society
	Ms. Huali Chai	Attorney
Homeowners	**Ms. Jacqui Carr Gouveia**	Executive Director, United Neighborhoods of Santa Clara County
Other Water Agencies	**Ms. Ellen Levin**	Water Resources and Policy Analyst, San Francisco Public Utilities Commission
	Ms. Nicole Sandkulla	Water Resource Analyst, San Francisco Bay Area Water Supply and Conservation Agency
Public Advocacy Groups	**Ms. Nancy Olson**	Member, League of Women Voters
Wastewater/Water Recycling	**Mr. Randy Shipes**	Deputy Director (Watershed Management), City of San Jose Environmental Services
	Mr. Jim Gasser	Sanitary Sewer Engineer, City of Gilroy
Water Retailers	**Mr. George Belhumeur**	Vice President, Operations, San Jose Water Company
	Mr. Robin Saunders	Director, Water and Sewer Utilities, City of Santa Clara

Stakeholders' Contributions to IWRP 2003

Figure INTRO-4

The primary role of each stakeholder was to represent their constituents' interests and to provide technical advice to staff. Stakeholders also

- Commented extensively on IWRP planning objectives and their relative importance.
- Provided technical feedback on the development of the planning framework and new planning tools, and strongly supported the IWRP decision-making framework as a useful tool to facilitate meaningful discussion and debate of the issues.
- Expressed their views on potential new water supply programs and projects for meeting future water supply reliability and water quality needs.
- Endorsed near-term actions and implementation plans to achieve water supply reliability through 2010.
- Suggested strategies for developing partnerships, overcoming challenges, and identifying opportunities.
- Kept the project team informed of community concerns.

At the close of the final meeting, stakeholders expressed a strong desire for continuing participation in the IWRP process as new and potential projects arise. For future updates the District will involve stakeholders and use the IWRP framework to evaluate and discuss future plans.

Report Overview

This introduction summarizes the history of integrated water resources planning at the District and explains the planning framework developed for IWRP 2003. Chapters 1 through 8 correspond to the numbered steps of the planning framework and document the IWRP team's process at each of these steps. Chapter 9 summarizes the recommendations of IWRP 2003. A glossary and list of acronyms and abbreviations can be found at the beginning of this report.

Technical information pertinent to each chapter may be found in the Appendixes.

1. The Baseline Water Outlook

The water outlook for Santa Clara County begins with a baseline projection—the District's best estimate of future water supply and demand, assuming that existing and adopted programs and policies continue through the planning horizon.

The first step in crafting a long-term water resources strategy is to define the water outlook over the planning horizon. This chapter describes the baseline water outlook for the County through 2040, including projected water demands, an assessment of water supplies, and estimated water shortages.

The IWRP 2003 Baseline Projection

The IWRP baseline projection is the District's best estimate of future water supply and demand, assuming existing and adopted programs and policies continue through the planning horizon.

The baseline projection is a snapshot of what the future may look like, given our understanding today. It is not a true "no action" scenario in that it assumes that projects currently adopted or in development will occur, programs with sunsets (such as contracts and MOUs) will be extended, and some programs with a high probability of implementation by other agencies will be completed. These projects and programs are described below. Although it can be considered a most likely scenario, the baseline projection is definitely not the only scenario that may occur, given the uncertainties inherent in any projection.

Water Demand

Economic, Demographic, and Land Use Trends

Santa Clara County is home to a very dynamic economy and 1.7 million people. The northern part of the Valley, north of the Coyote Narrows, is extensively urbanized and houses over 90 percent of the County's residents and 13 of the County's 15 cities. In the 1980s, the County economy grew extensively with the success of electronics companies and local defense contractors. Slowing in the electronics industry, the end of the defense buildup, and the conversion of military bases all contributed to the recession of the early 1990s. By the end of that decade, however, Silicon Valley

Downtown San Jose

IWRP 2003 Water Demand Assumptions

- Water demand is projected using data provided by the Association of Bay Area Governments (ABAG) through 2020 and the California Department of Finance (DOF) from 2021 through 2040.
- The District and its retailers will continue their commitment to water conservation throughout the planning horizon. By 2020, annual water conservation savings are estimated to reach 64,000 af. By 2040, conservation will shave 78,000 af from demand.
- The IWRP baseline projection assumes development of Coyote Valley as called for in the City of San Jose Coyote Valley Urban Reserve Vision document.

became the embodiment of a new economy driven by efficiencies from computers, communications, and the Internet. The County has seen a shift from manufacturing jobs to business service jobs, with job growth continuing in some sectors even with the recent economic downturn.

Agriculture is all but gone in North County, with only pockets remaining where there once were numerous orchards. South County remains agricultural and rural residential, with the exception of the cities of Gilroy and Morgan Hill. Both cities are expected to grow in the future, but that growth is tempered by slow-growth ordinances in both jurisdictions and constraints on the existing wastewater system.

Another large part of South County, the San Martin area, remains unincorporated. The Santa Clara County General Plan recognizes the value of this area and the desire of its residents for the area to retain its current nature. As such, the General Plan calls for San Martin to remain rural residential and agricultural, outside urban service area boundaries.

The largest land use change planned within the County is in the area of Coyote Valley. Coyote Valley lies at the northern part of South County and comprises the southern extent of the City of San Jose. The City of San Jose is currently developing a Coyote Valley Specific Plan. The City has developed a Vision document for this area (the Coyote Valley Urban Reserve Vision) that calls for the addition of at least 25,000 households and over 50,000 jobs in this area. This level of development is more than twice the size of its nearest neighbor, the City of Morgan Hill. The IWRP baseline projection assumes development of Coyote Valley as called for in the Vision document.

Influences on Water Demand

The Association of Bay Area Governments (ABAG) is the regional planning agency for the San Francisco Bay Area. Among its other functions, ABAG projects demographic trends for the region. The IWRP 2003 baseline projection relies on ABAG Projections 98, the most current available at the time of the last water demand update. The California Department of Finance (DOF) also prepares demographic projections by city and by county. Although not as detailed as the ABAG projections, the DOF projections go through 2040 and thus are used to extend the demographic projections from 2020, the last year in ABAG Projections 98.

The estimated population in Santa Clara County in 2000 was 1,683,000. The DOF projects that this will rise to 2,595,000 by the year 2040. This represents a 54 percent increase over 2000. According to ABAG, the County will continue to grow, its businesses serving as a driver for Bay Area prosperity. Job growth is expected to outpace population growth, with an increasing number of those employed here living elsewhere in the Bay Area, the San Joaquin Valley, and the Central Coast counties.

Population growth has a major influence on water use and is often stated in terms of water use per capita. But a number of other factors also influence water use, including changes in housing density, shifts from manufacturing jobs to lower water-using research and development (R&D) and service jobs, and the net in-migration of commuters for work in Santa Clara County. Lastly, water use behaviors and weather impacts can effect dramatic changes in overall water use, complicating the usage of trends due to population growth.

Water use for the last three years has been relatively constant, and lower than the IWRP projections would suggest, due to the current recession and mild spring weather. The IWRP projections are focused on the long-term, projecting water demand assuming a rebound of the local economy and average weather conditions.

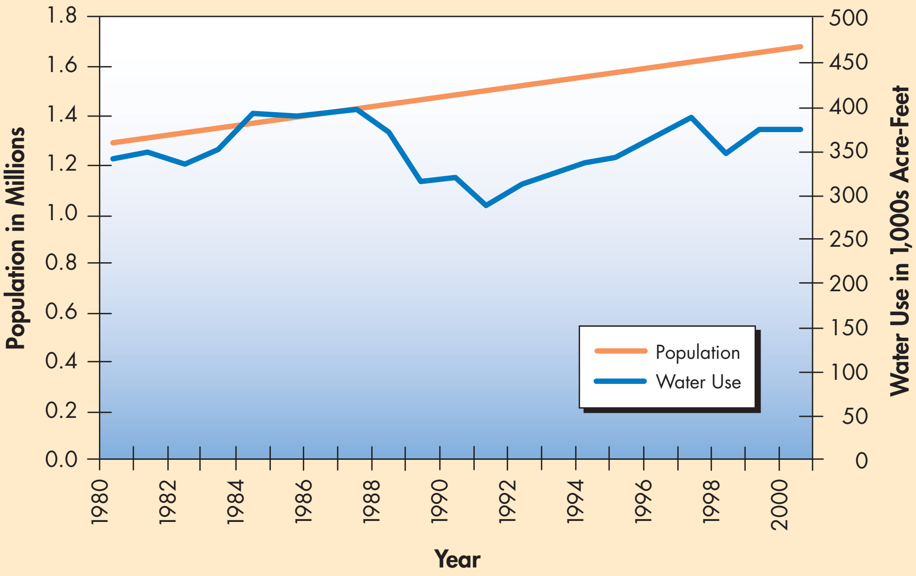
Water Conservation Programs

The District administers over a dozen conservation programs, saving an estimated 29,000 af in 2002. These programs use a mix of incentives and rebates, free device installation, one-on-one home visits, site surveys, and educational outreach to reduce water consumption by homes, businesses, and agriculture.

Accounting for Water Conservation

Increasing water conservation savings (from District water conservation programs and plumbing standards that require more efficient fixtures) are also reflected in the water demand projections. The District and its retailers have implemented numerous conservation programs, reducing water use significantly from what would have been observed without those programs in place. The

Historical Water Use and Population *Figure 1-1*



Conservation helps keep water use down.

implementation of conservation programs, along with economic and demographic changes, have resulted in a current water use below that observed in 1987, in spite of a 21 percent population increase in the County and significant economic expansion over the same time period, as shown in Figure 1-1.

The IWRP 2003 baseline projection assumes the District and its retailers will continue their commitment to conservation throughout the planning horizon. Based on yearly savings achieved since 1992 (the first year of the District's conservation program), year 2020 water demand in Santa Clara County is estimated to be approximately 64,000 af per year less than it would have been in the absence of water conservation activity. By year 2040, it is anticipated that water conservation will reduce demand by 15 percent, or 78,000 af per year.

By 2040, the IWRP baseline projection assumes Santa Clara County's water use will grow much more slowly than its population. This is due in large part to extensive water conservation efforts by the District and its water retailers. However, conservation alone cannot meet the County's future water needs.

Over the planning horizon, the baseline projection calls for Countywide water demand to grow from approximately 382,000 af per year to approximately 475,000 af per year in year 2040, an increase of about 24 percent. Over this same period, Countywide population is expected to grow by 54 percent, from 1.7 million people to 2.6 million. Are the District's existing water supplies adequate to meet future needs? The District's water supply baseline is discussed below.

Water Supply

The District manages water resources and wholesales treated water to retailers in Santa Clara County. In order to maintain maximum efficiency and flexibility, the water supply comes from a variety of sources. Nearly half is from the local groundwater basins, one of the County's greatest natural resources. The basins are managed by the District for the benefit of local retailers, agricultural users, and independent groundwater pumpers. More than half the County's water supply is imported through pumping stations in the Sacramento-San Joaquin Delta. Figure 1-2 shows the sources of supply for 2003.

IWRP 2003 Baseline Assumptions

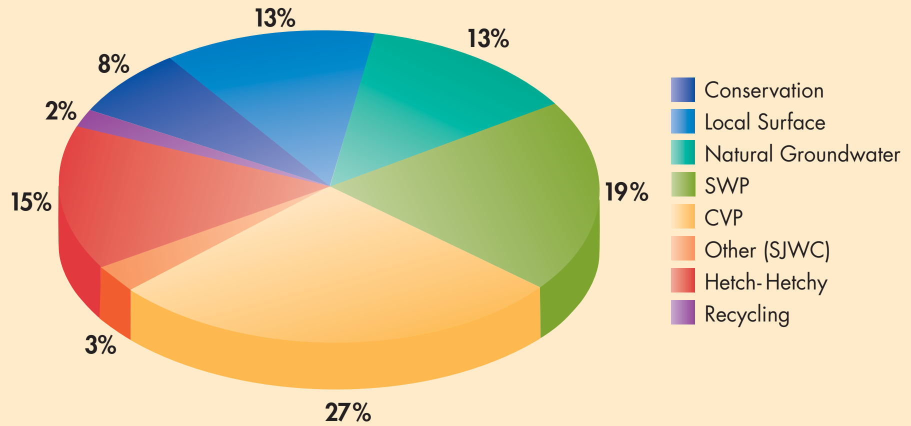
The baseline projection was developed using the following water supply assumptions:

- Local infrastructure will be reliable.
- The Treated Water Improvement Project will be completed.
- Usable reservoir storage will decrease over time to reflect observed siltation rates.
- Existing water supply wells will be able to provide emergency backup supply when sufficient groundwater is available.
- The Fisheries and Aquatic Habitat Collaborative Effort settlement will be implemented.
- Local recharge facilities and creeks will be maintained at their current capacity.
- The long-term viability of the groundwater basins will be protected through groundwater management programs.
- Local surface water rights will be maintained.
- Contracts for imported water supplies will continue in the future.
- The San Luis Reservoir low-point issue will be resolved.
- The Department of Water Resources' efforts to increase pumping permitted from the H.O. Banks Pumping Plant will be successful.
- CALFED Stage 1 programs will be implemented.
- The District's banking capacity of 140,000 af in the Semitropic Water Storage District will be maintained.
- The Hetch-Hetchy infrastructure project will be completed and available Hetch-Hetchy supplies in the future will be similar to historical availability.
- Countywide recycling will expand to 16,000 af by 2010.

District water supply operations include raw water conveyance, storage, water treatment, and treated water distribution. The District operates several local pipelines to transport imported raw water and locally captured water for treatment and distribution or for groundwater recharge. The raw water conveyance system meets the demands of the District's three water treatment plants and then delivers the remaining water to groundwater recharge systems. The three water treatment plants distribute treated water to local water retailers. Major facilities are shown in Figure 1-3. The IWRP assumes the local infrastructure for these facilities will remain reliable and that process and capacity improvements planned for the District's water treatment plants will be completed.

The District's local water supply, imported water supply, and other sources of water included in the baseline projection are described in detail on the following pages.

Year 2003 Water Supply *Figure 1-2*



District water supplies come from a variety of sources. Groundwater pumping accounts for about half of the County's water use, including supplies from natural groundwater recharge and the managed recharge of imported and local surface supplies.

Local Water Supply

Local rainfall contributes to the local water supply when it is captured, used, or stored by reservoirs and streams, and through infiltration (percolation) into the groundwater basins. The District uses ten reservoirs to capture local supplies for treatment or groundwater recharge. The IWRP baseline projection assumes usable reservoir storage decreases over time to reflect observed siltation rates.

The groundwater basins managed by the District perform multiple functions: transmission, treatment, and storage. Water enters the basins through recharge areas and undergoes natural filtration as it is transmitted into deeper aquifers. Sources of natural groundwater recharge include rainfall, leakage from pipelines, seepage from surrounding hills, and net irrigation return flows.

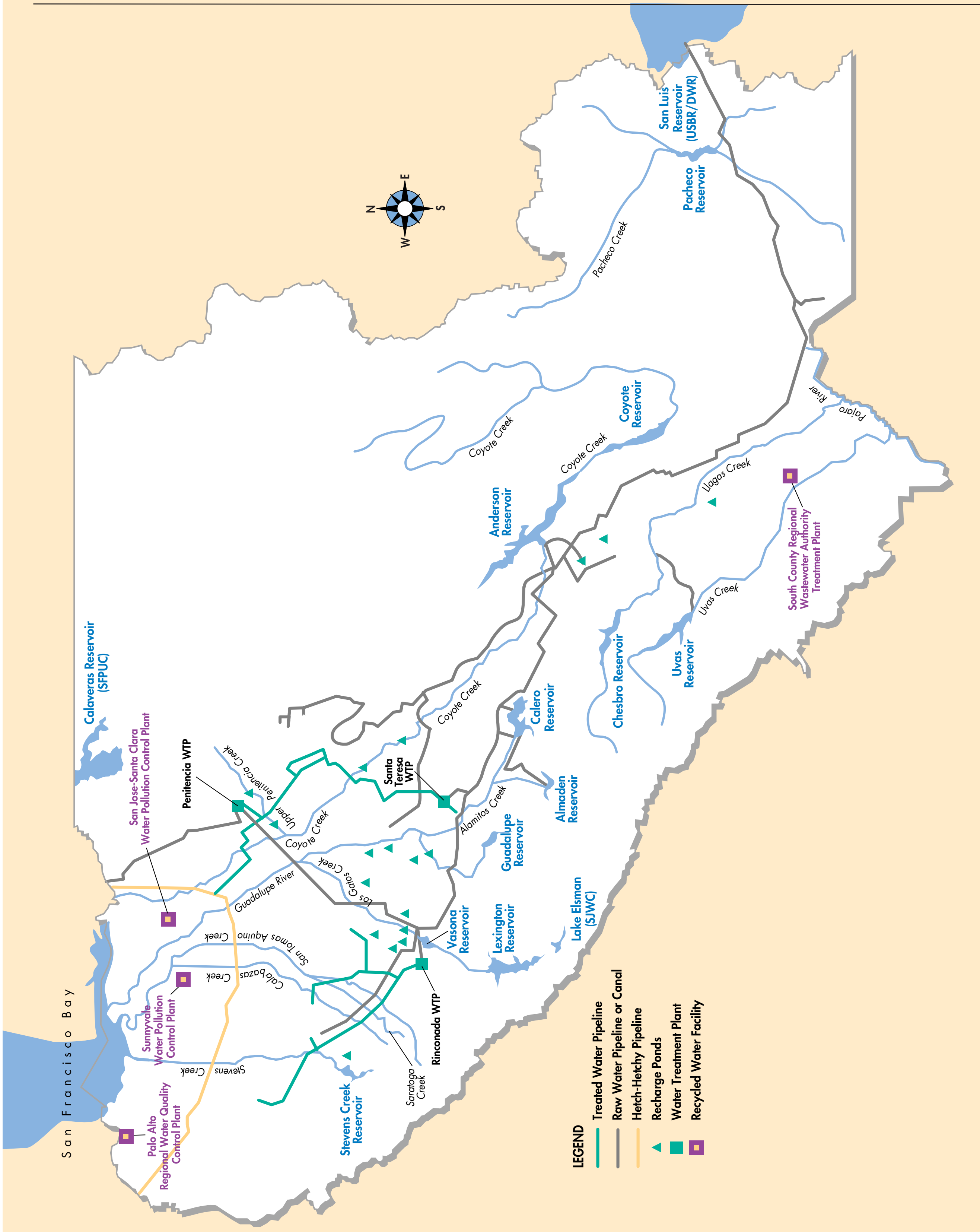
Calero Reservoir

The District has been a leader in conjunctive use in California for decades, utilizing imported and local surface water to supplement groundwater and maintain reliability in dry years. The District augments natural recharge with a managed recharge program to offset groundwater pumping, sustain storage reserves, and minimize the risk of land subsidence. Historical overpumping and significant land surface subsidence (totaling approximately 13 feet in San Jose) led to the formation of the District as the County's groundwater management agency in 1929. Today, the District's managed recharge program uses both runoff captured in local reservoirs and imported water delivered by the raw water conveyance system to recharge the basins through more than 300 acres of off-stream ponds and 30 creeks. Through its rigorous groundwater recharge activities, the District works to keep the groundwater basins "full," banking water locally to protect against drought or emergency outages. The IWRP baseline projection assumes local recharge facilities and creeks will be maintained at their current capacity.

In addition to providing water for municipal and industrial (M&I) and agricultural uses, the groundwater basins have vast storage capacity. Storing surplus water in the groundwater basins enables part of the County's supply to be carried over from wet years to dry years.

Water Conveyance, Treatment, and Distribution System in Santa Clara County

(Selected Facilities) *Figure 1-3*



Map for illustrative purposes only.

Overall groundwater quality in Santa Clara County is very good, and water quality objectives are achieved in almost all wells. The most significant exceptions are nitrate and perchlorate, which have impacted groundwater quality in South County. The District continues to implement a comprehensive nitrate management program, with the goal of reducing nitrate concentrations so that all wells meet the drinking water standard for nitrate. (IWRP modeling assumes continuation of this and other District programs to sustain and protect groundwater resources, which are described in detail in the District's Groundwater Management Plan of 2001.) The District is working to address community needs with regard to perchlorate by actively participating in the Perchlorate Working Group (with the cities of Morgan Hill and Gilroy and the County), by working with the Regional Water Quality Control Board, and supporting the community through the Perchlorate Community Advisory Group.

Imported Water Supply

State Water Project and Central Valley Project

Imported water comes to the County via the Sacramento-San Joaquin Delta. This water is delivered by the California Department of Water Resources' State Water Project (SWP) and by the U.S. Bureau of Reclamation's Central Valley Project (CVP). Imported water is conveyed to the District through two main pipelines: the South Bay Aqueduct (SBA), which carries water from the SWP, and the Santa Clara Conduit and Pacheco Conduit, which brings water from the CVP.

The District has a contract for 100,000 af per year from the SWP, although actual deliveries vary significantly depending on hydrology and other factors. The District's contract for CVP supply is 152,500 af per year, of which 130,000 af is for municipal and industrial (M&I) needs and 22,500 af is for agricultural needs. The IWRP assumes both of these contracts will continue in the future.

As with the SWP, the ability of the CVP to meet contract deliveries is dependent on hydrology and environmental regulations. The District negotiated a Water Reallocation Agreement in 1997 with the Bureau of Reclamation and San Luis & Delta-Mendota Water Authority, establishing a basic delivery level of no less than 75 percent of the M&I contract amount for the District. Although the reallocation agreement expires in 2022, IWRP modeling assumes its provisions continue throughout the planning horizon.

The Department of Water Resources (DWR) and the U.S. Bureau of Reclamation have jointly developed an operations model, CALSIM II, to simulate the SWP and CVP systems under different conditions. The IWRP looks to output from CALSIM II for information on future contract deliveries. The CALSIM II run used by the IWRP assumes that the proposed pumping increase from DWR's H.O. Banks Pumping Plant will be successfully permitted by 2008.

Central Valley Project

IWRP modeling assumes that regulations and programs to protect, restore, and enhance the Bay-Delta ecosystem will continue to be implemented. In the last ten years, major changes have been made in operating the SWP and CVP as a result of State Water Resources Control Board regulations to protect Bay-Delta water quality, and as a result of Biological Opinions to protect endangered species. These regulations have required substantial increases in Sacramento Valley stream flows and Delta outflow, as well as reduced Delta exports at certain times of the year. More than $1 billion in environmental restoration has been invested through the CALFED Bay-Delta Program, and under the authority of the 1992 Central Valley Project Improvement Act. As a contractor of both the SWP and the CVP, the District contributes both water and restoration funds to safeguarding the Bay-Delta.

Water diverted from the Bay Delta contains relatively high concentrations of salts (bromide) and organic compounds. These constituents are precursors to the formation of disinfection by-products, a major concern for the District. Delta water will only be able to meet current and anticipated drinking water standards through advanced treatment technologies and source water quality improvements.

Semitropic Water Storage District

In addition to its supply contracts, the District currently has a long-term agreement with the Semitropic Water Storage District to bank, or store, water in Semitropic's groundwater basin for future use. Although this agreement does not provide additional water yield, it does allow the District to divert some of its excess imported supplies in wet years and store them for use in years when they are needed, such as during a multi-year drought.

This agreement with the Semitropic Water Storage District gives the District until 2006 to decide its ultimate participation level in the program, up to 350,000 af of storage capacity. The District has invested in 140,000 af storage capacity, and has 110,000 af of water currently stored in the program. The IWRP baseline assumes the current 140,000 af storage capacity commitment is maintained in the future. Various levels of participation beyond 140,000 af were evaluated as IWRP water resource options (i.e., building blocks), as described in Chapter 5. The Semitropic Water Bank is an "in lieu" storage program, meaning that the District does not take groundwater directly from the groundwater basin at Semitropic. Rather, the District receives its water from Semitropic's SWP contract deliveries from the Delta, while Semitropic meets its water needs by increased ground-water pumping. The District's ability to put water into or take it from the Semitropic Water Bank is, by contract, proportional to SWP allocation percentages for the year. During drought years, this can significantly limit how much of its water bank balance the District can withdraw. The quality of water delivered to the District is the same as the District's SWP contract water, diverted from the Delta and conveyed through the SBA.

Other Sources of Water

Hetch-Hetchy Project

Several of the municipalities in the County have contracts with the City and County of San Francisco for water from the Hetch-Hetchy Project. Hetch-Hetchy imported deliveries originate in the Tuolumne River watershed high in the Sierra Nevada mountains and are transported by closed conduit to the Bay Area. The District does not control or administer Hetch-Hetchy deliveries to the County; however, this supply reduces the demands on District-supplied water. Major capital investments were recently approved to preserve the integrity of the Hetch-Hetchy system. The IWRP baseline projection assumes that this system infrastructure project is completed and that available water supply in the future under different hydrologic conditions will be similar to historical availability.

Hetch-Hetchy water meets all state and federal criteria for watershed protection disinfection treatment and bacteriological quality and operational standards. It has been granted a filtration exemption by the U.S. Environmental Protection Agency (EPA) and the California Department of Health Services (DHS).

Other Local Surface Water

In addition to the local and imported water supplies that the District manages, there are other sources of water serving the customers of Santa Clara County. For example, the San Jose Water Company and Stanford University both hold surface water rights that they use to meet some of their water needs. The IWRP baseline assumes that future diversions under these water rights will be the same as those observed historically, and will vary with hydrology.

Recycled Water

The District continues to work with the wastewater authorities in the County on partnerships to promote water recycling for nonpotable uses such as irrigation and industry. IWRP 2003 includes 16,000 af of recycled water by 2010 as part of the baseline projection. Expansions of water recycling above this 16,000 af were evaluated as building blocks, as described in Chapter 5. In the past, the water quality constituent of primary concern was salts, or total dissolved solids (TDS). Advanced treatment of the recycled water can reduce TDS to levels that are not of a concern. Trace constituents have also been found in recycled water that have raised water quality questions; the District and others are studying the impacts of these newly identified trace constituents, and increasing outreach to inform the public about the safe uses of recycled water.

Recycled Water Targets

The District encourages recycled water development in the County through partnerships with the local wastewater agencies and through financial incentives and technical assistance. The District's Board of Directors has set targets that 5 percent and 10 percent of water use be met through recycled water by 2010 and 2020, respectively.

Water Supply and Demand under Different Hydrology

Water supply availability depends on the timing of precipitation and runoff, which provide water to streams, reservoirs, and groundwater basins. California's hydrology varies greatly from year to year, with multi-year runs of above or below-average rainfall possible, and very few years with hydrology close to the long-term average.

While no model or tool can predict what actual water supplies will be in future years, the record of past water supplies can be used to characterize future water supply. In its water supply planning, the District uses a computer model that simulates the water supply system. The model looks at historical hydrology from 1922 through 2000 and estimates what water supply could be expected from various resources if that hydrology were to be repeated in the future. In this way, the performance of different water supply options, and how they can handle the historically observed hydrologic record, can be compared. (A description of the Extend model can be found in Appendix 1.)

Multi-year drought challenges the District's ability to meet future water demand. Through year 2020, the chance of a water shortage due to drought is about 5 percent. By 2040, shortages averaging about 70,000 af can be expected almost 1 year in 5 if the District takes no additional action.

Historically observed hydrology is typically described as very wet, average, or dry:

- ***Very Wet Supply.*** Wet-year rainfall can be twice that of an average year, but not all of that water can be captured as usable supply. For local supplies, the hydrology of 1983 probably represents the most that can be captured by local facilities.

- ***Average Supply.*** This is the average supply available over the historical record, given currently existing facilities and institutional arrangements. No single year's hydrology is equivalent to the average for all sources; however, 1926 was a near-average year for both local rainfall and imported water hydrology.

- ***Dry Supply.*** The hydrology of 1977 is the driest supply that has been observed in the historical record. It is not just the constraints of a single dry year that are important, but also how the system can respond to successive dry years such as those that occurred in 1928–1934 and 1987–1992. The County's water supply system is more vulnerable to these droughts of long duration, which deplete water storage reserves in local and state reservoirs and in the groundwater basins.

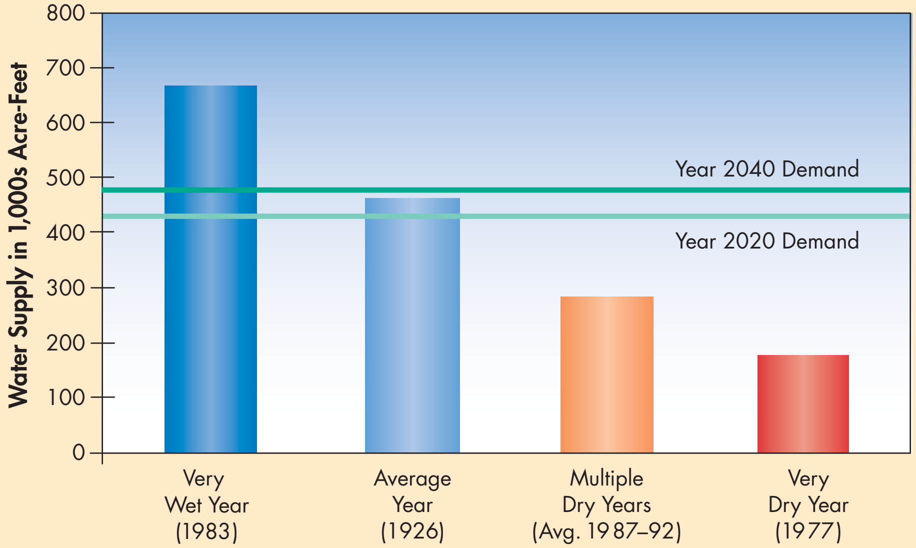
Annual Usable Water Supply under Different Hydrology, in Acre-Feet

(Without Carryover Storage) *Figure 1-4*

	Very Wet 1983	Average 1926	Multiple Dry 1987-92	Very Dry 1977
Local Supplies				
Natural Groundwater Recharge	231,000	99,000	52,000	38,000
Managed Recharge	90,000	90,000	34,000	8,000
Imported Supplies				
SWP	100,000	70,000	49,000	35,000
CVP	148,000	109,000	77,000	32,500
Other Supplies				
Other Local Surface	15,000	11,000	6,300	1,400
Hetch-Hetchy	72,000	54,000	42,000	36,000
Recycling	7,800	7,800	7,800	7,800
Total	**663,800**	**440,800**	**268,100**	**158,700**

Supplies reflect existing facilities and 2002 actual recycled water deliveries. Usable water supply varies greatly with hydrology.

Water Supply and Demand *Figure 1-5*



Supplies are adequate to meet needs in wet and average years, but inadequate in dry years. Supplies in this chart do not reflect water that may be available from storage.

Figure 1-4 summarizes the estimated water supplies with existing facilities and agreements for the very wet, average, and dry hydrologic conditions. This figure shows the water supply that could be captured and put to use in a given hydrologic year, given today's baseline facilities and institutional arrangements. The values do not reflect the ability of surface reservoirs or the groundwater basins to carry over water supply from one year to the next.

Figure 1-5 summarizes the water supply and demand projections presented earlier in this chapter, for different year types. If we only experienced very wet and average weather (and no other risks) our water supply would be reliable now and through 2020, even if we didn't carry over water from one year to the next.

But the District has developed effective ways to extend the usefulness of its existing supplies, through surface and groundwater storage, both in-County and elsewhere in the state. With 530,000 af potential operational water storage, the local groundwater basins serve as the District's best protection against drought and emergency outage.

Although very dry years may appear dramatic in the figure, the District will be able to meet the water needs of the County during single dry years even with increasing demand. Multiple dry years (such as the 1987–1992 drought) pose the greatest challenge to the District's water supply. Although the supply in each year is greater than in a single very dry year, as drought lingers storage reserves are relied on more and more.

Water Shortages

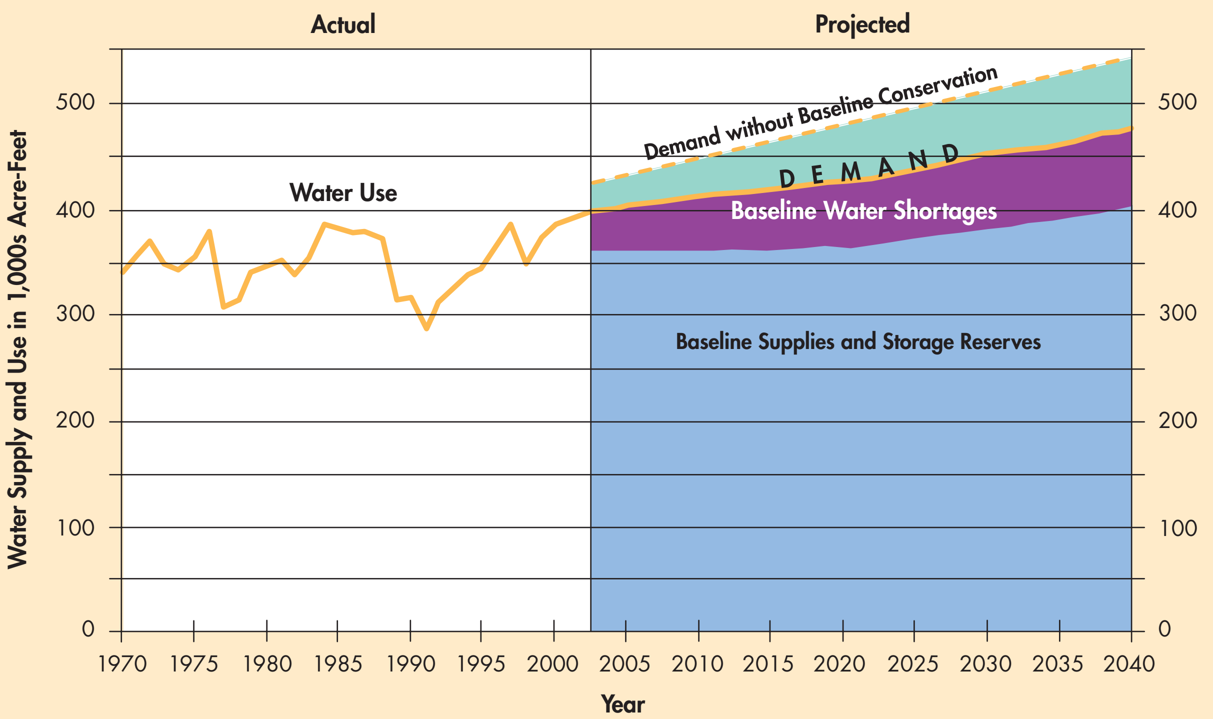
Shortage was defined in the IWRP as demand that cannot be met from available supplies and storage without risking land surface subsidence due to overpumping the groundwater basins. Stakeholders and the technical team agreed that as a baseline assumption, the District could manage a water shortage up to 20,000 af in any given year (roughly 5 percent of demand) through demand reduction programs and voluntary cutbacks without significant economic losses to the community.

IWRP 2003 Baseline Projected Water Shortages

Determining shortage requires bringing all the pieces of the puzzle together: supply, demand, infrastructure constraints, and storage. Figure 1-6 illustrates actual historic water use from 1970 to the present, and future projected water demand, available baseline supplies and storage reserves, assumed baseline water conservation, and resulting dry-year shortages. Although supplies are adequate to meet needs in wet and average years, the expected dry-year shortages grow over time from approximately 50,000 af in 2010 to 75,000 af by 2040. Without the District's aggressive water conservation and supply management programs, water shortages would be even greater and more frequent.

Baseline supplies and storage reserves show a slight increase over time due to the growth of baseline programs, like recycling, that are implemented after 2004. Recycling stretches existing supplies and helps dry-year reliability because

Baseline Water Shortages *Figure 1-6*



Baseline water shortages call for new IWRP investments.

water available but not used in wetter years can be saved in reservoirs, in out-of-County groundwater banking, and in the local groundwater basins for drier times. This is an interesting reversal of the old expression “saving for a rainy day!”

Figure 1-6 shows the importance of maintaining the District’s baseline supplies and storage reserves, the value of present water conservation programs, and the need for future supply investments to meet dry-year shortages.

Next Steps

Defining the baseline water outlook is the first step in the IWRP planning framework. Chapter 2 presents the second step: identifying actions needed to secure the foundation of the baseline water supply. Later chapters will discuss the steps needed to fill in the need identified in this chapter.

2. Securing the Baseline

Later chapters in IWRP 2003 focus on the investments that are needed to ensure long-term water supply reliability. These new investments are built upon a foundation of the District's baseline water supply, which by far makes up the largest share of future supplies. This chapter describes actions needed to safeguard and maintain this vital water supply baseline. These actions will help ensure that the assumptions made in the baseline analysis remain valid throughout the 2040 planning horizon.

Safeguarding and maintaining existing supplies, infrastructure, and programs is a vital component of meeting future water needs.

Protect Imported Water Supplies

Imported water provides over half the supplies used annually in the County, and therefore it is critical that imported water supplies be maintained. Major objectives include resolving imported water contract and policy issues, supporting Bay-Delta system improvements, and resolving the San Luis Reservoir low-point problem.

Resolve Contract and Policy Issues

The District monitors a wide range of administrative, legislative, regulatory, operational, and other issues that could impact the reliability of imported water supplies. The District's SWP and CVP water service contracts require ongoing interpretation and occasional amendments or letter agreements to resolve operational and financial issues. The District is currently negotiating a long-term renewal of its CVP water service contract, including basic reliability and cost provisions. The District is also resolving point-of-delivery issues with DWR related to banking water at Semitropic. As a contractor of the SWP and CVP, the District promotes efficient, coordinated operations of these two projects, under both existing and expanded permitted pumping limits at Banks Pumping Plant.

The California Aqueduct

Support Bay-Delta System Improvements

The District is an active participant in resolving Bay-Delta issues through the CALFED Program and implementation of the Central Valley Project Improvement Act (CVPIA). Under its contract, the

The CALFED Bay-Delta Program

The CALFED Bay-Delta Program is a partnership of state and federal agencies working with stakeholders to restore the ecosystem of the Sacramento-San Joaquin Bay-Delta and improve the reliability and quality of water supplies for over 20 million Californians. Santa Clara County relies on the Bay-Delta to meet, on average, about 40 percent of its annual water needs.

The District supports and participates in the CALFED Bay-Delta Program to help maintain the imported water baseline. Key elements of the Bay-Delta Program include the following:

- Develop Bay-Delta science.
- Restore the Bay-Delta ecosystem.
- Improve the integrity of Delta levees.
- Improve South Delta water quality and water levels.
- Expand the State Water Project's Delta pumping to 8,500 cfs.
- Construct an Intertie between the California Aqueduct and Delta-Mendota Canal.
- Resolve the San Luis Reservoir low-point delivery constraint.
- Develop water-use efficiency programs.

In addition, certain CALFED projects may directly or indirectly affect IWRP investments in water quality or reliability improvements. These potential projects include modification of the levee system around Frank's Tract in the Delta, expansion of Los Vaqueros Reservoir, enlargement of Shasta Reservoir, and construction of a new reservoir in the Sacramento Valley.

District pays $1 to $2 million annually to the CVPIA Restoration Fund. The District also participates in State Water Resources Control Board (SWRCB) Bay-Delta Hearings and related water rights settlement negotiations.

Resolve San Luis Reservoir Low-Point Problem

As the water level in San Luis Reservoir is drawn down at the end of summer, algal growth may begin to degrade water quality for the District and other San Felipe Division contractors so much that the water becomes very difficult to treat. If water levels continue to drop below the lowest intake, San Felipe Division deliveries would be interrupted. In coming years, growing demands of other CVP and SWP contractors will increase pressure to fully utilize all available storage in San Luis Reservoir. Through the San Luis Reservoir Low-Point Improvement Project, the District and other CVP and SWP contractors are working to increase the operational flexibility of storage in San Luis Reservoir, and to ensure a high-quality, reliable water supply for San Felipe Division contractors.

Secure Hetch-Hetchy Supplies

In recognition of its aging infrastructure, the San Francisco Public Utilities Commission (SFPUC) is currently working to implement a Capital Improvement Plan (CIP) in coordination with its contractors. As eight retailers within Santa Clara County receive a significant portion or all of their water from the Hetch-Hetchy system, this is an important issue for the District in terms of water supply reliability. Therefore, it is recommended that the District continue to support and be involved in the SFPUC efforts to implement a CIP. The master sales contract expires in 2009. It is in the District's interest to ensure that the quantity of Hetch-Hetchy supplies in Santa Clara County does not diminish.

Sustain Local Surface Water Supplies

The District has numerous water rights to divert and store water from local creeks and streams. Most of this local supply is recharged into the groundwater basin, either through natural stream channels, through canals, or through instream and offstream ponds.

Beneficial Use of Surface Water

Several factors that can impact the District's reservoir operations and its use of surface water rights include maintaining storage levels for environmental or recreation purposes, dam safety requirements, and managing total District supplies for reliability. Existing recharge capability can also be a limiting factor in the District's ability to fully utilize its surface water supplies. Some of the factors that can impact pond operations and cleaning include fisheries and habitat concerns, aesthetics, recreation, and local residents' concerns. District staff takes these sometimes competing factors into consideration when developing facility operations plans.

Fisheries and Aquatic Habitat Collaborative Effort

Since 1996, the District has been working to address a legal challenge to its water rights. The challenge, filed before the State Water Resources Control Board, claimed that District water supply operations harmed local fisheries in violation

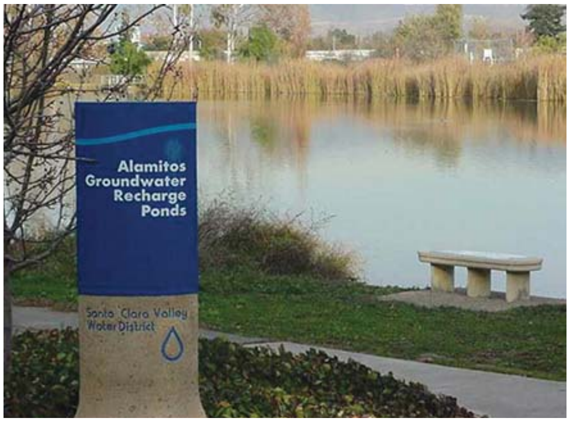
Guadalupe fish ladder

of California Department of Fish & Game Code 5937 and failed to satisfy the Public Trust Doctrine. Through a multiparty dispute resolution process called the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE), the District is working collaboratively with state and local resource agencies, local environmental interests, and the City of San Jose to finalize the settlement agreement and thereby resolve the challenge. Completion of the environmental review under CEQA/NEPA is anticipated in early 2005.

The plan will improve local fisheries while serving as the basis for dismissal of the water rights challenge and provide the District with assurances that its water rights are protected from future challenges. The terms of the settlement will require managing water supply operations to tight standards designed to protect fisheries resources while meeting water supply management objectives. To ensure success, the District will implement a range of actions that include habitat restoration, fish passage, and capital improvement projects consistent with its watershed stewardship program. Furthermore, additional studies will be undertaken in areas such as stream flow augmentation using advanced treated recycled water, geomorphologic restoration of stream channels, and groundwater basin management in the Coyote Subbasin.

Aggressively Protect the Groundwater Basins

The District relies on groundwater for a significant portion of its water supply, particularly in South County where groundwater provides more than 95 percent of supply for all beneficial uses and 100 percent of the drinking water supply. Continuation of the District's proactive ground-water management programs is critical to sustaining and protecting groundwater resources from land subsidence and contamination.



To minimize the risk of land subsidence, the District must maintain existing groundwater recharge facilities and should investigate additional opportunities to improve conjunctive use. The development of new recharge facilities would help to maintain groundwater levels over time and would enable more rapid replenishment of groundwater storage levels after drought or supply outages. The District is currently investigating the possibility of developing its own water supply well fields connected to the treated water distribution system to improve system reliability. The District should continue to explore opportunities to re-operate the water supply system to improve the integration of surface water and groundwater resources.

To protect groundwater from contamination and the threat of contamination, the District should continue to rigorously monitor the groundwater basins and should expand monitoring and groundwater quality management programs as necessary. Groundwater quality in Santa Clara County is very good, supporting municipal, domestic, agricultural, and industrial uses. Historically, the most significant exception has been nitrates, which continue to be a concern in South County. The District's comprehensive nitrate management program and other proactive groundwater quality management programs are critical to protecting the viability of this important local resource. The District should also closely monitor developments regarding emerging contaminants, such as perchlorate. The District is working to address community needs with regard to perchlorate by actively participating in the Perchlorate Working Group (with the cities of Morgan Hill and Gilroy and the County), by working with the Regional Water Quality Control Board, and by supporting the community through the Perchlorate Community Advisory Group.

Continue to Provide Clean, Safe Drinking Water

As the understanding of human health impacts from contaminants improves and water quality standards change, the District's water treatment technologies and source water protection efforts must keep pace.

Santa Teresa Water Treatment Plant

Treated Water Improvement Project

The District has committed over $275 million to upgrade treatment facilities, improve water quality, and comply with new water quality regulations. Converting the primary drinking water disinfection process from chlorine to ozone will reduce disinfection by-products, eliminate undesirable taste and odors, and allow the District to meet or exceed anticipated federal water quality standards. Improving plant recycled water filtering, washing, and clarifying systems will minimize recirculation of undesirable microorganisms and other constituents in the drinking water treatment process. Strengthening existing plant structures will improve their resiliency during an earthquake and minimize disruptions to water service if such an event occurs. The District is also expanding production capacity of the Rinconada Water Treatment Plant by 20 million gallons per day (mgd) by building an additional flocculation and sedimentation basin (clarifier).

Source Water Protection

Ensuring a safe and healthful supply of water requires more than treatment; thus, local surface water supplies must continue to be protected. The District has finalized a federally mandated Drinking Water Source Assessment and Protection (DWSAP) report that identifies the potential contaminants and potentially contaminating activities to which District surface water sources are most vulnerable. In addition, the District is pursuing source water protection in the Bay-Delta through CALFED water quality initiatives and locally through the Watershed Management Initiative. As more contaminants are identified and concerns about drinking water increase, the District's source water protection efforts become more crucial.

Shore Up Existing Infrastructure

Maintaining the integrity of the District's existing infrastructure is essential to ensuring the reliability of the District's water supply. This includes maintaining the existing capacity of recharge facilities and ensuring that other facilities, such as reservoirs, treatment plants, and conveyance and distribution infrastructure, are safeguarded from risk.

The IWRP 2003 analysis assumed no impacts to existing District facilities, including reservoirs and conveyance, treatment, and distribution infrastructure. The District is currently developing a Water Infrastructure Reliability Plan and an Asset Management Plan to evaluate risks and develop recommendations to strengthen the District's infrastructure. The recommendations of these studies will be critical to protecting District facilities in the long term.

Protect Streams, Fisheries, and Natural Habitat

In its role as environmental steward for the streams and riparian habitats of Santa Clara County, the District is likely to face as yet unidentified challenges in the coming years. Since there are inherent tradeoffs between water supply and many other beneficial uses, it is likely that addressing these challenges will place local water supplies under additional pressure and scrutiny. To protect both the local environment and the District's ability to meet future water supply demands (including CVP contract renewal), the District must continue to take a science-based watershed approach to environmental issues. This will require an ongoing focus and commitment to monitoring beneficial uses and adaptively managing environmental resources to ensure their health. For example, the District is participating in the development of a County multispecies Habitat Conservation Plan/Natural Communities Conservation Plan (HCP/NCCP).

Next Steps

Defining the baseline water supply outlook and actions needed to secure that supply were the first two steps in the IWRP framework. The next chapter represents the third step: exploring how factors other than hydrologic variability can challenge the baseline water supply.

3. Risk Analysis for the Baseline Water Supply

Chapter 1 presented the baseline water supply under just one challenge: the natural variation in hydrology that occurs from year to year. Yet the District operates in an environment of uncertainty, including meteorological, technical, physical, and political risk factors that affect its ability to meet water supply planning objectives. Identifying these risk factors and characterizing their water supply consequences is an important step in the IWRP process. This chapter describes how the risks identified by the IWRP project team and stakeholders were evaluated for the baseline water supply.

Identifying Risk Factors

The IWRP project team and stakeholders identified dozens of risks that could affect the District's water supply outlook. The most significant, representative, and quantifiable of these risks were selected for analysis.

Both the IWRP project team and IWRP stakeholders were asked what risks and uncertainties concern them that could affect the District's water outlook. Risks were identified; these are described in Appendix 3.

In order to keep the evaluation manageable, the most significant, representative, and quantifiable risks were carried through the risk analysis. For example, earthquakes along one of several faults, terrorist activities, and other catastrophic events could all result in infrastructure failure. Of these risk factors, an earthquake in the Delta was identified as having the most significant water supply impacts, as it could interfere with both of the District's imported water supply systems. The selected risks are described below.

- **Random risks.** Random risks are expected to occur; the only uncertainty is when. Random risks evaluated in IWRP 2003 include

  Delta infrastructure failure resulting in disruption of imported water supplies. An earthquake that affects the Sacramento-San Joaquin Delta could reduce the District's ability to take its imported water supplies from both the CVP and SWP, either from conveyance system outage or salt-water intrusion due to Delta island levee failure. In addition to disrupting contract supply deliveries, outages to

San Francisco Bay-Delta

this conveyance system would also impact the District's ability to put water into or take it from the Semitropic water bank, or to take delivery of water transfers from most sources.

A halt in Delta export pumping to protect endangered fisheries. The "take" of listed endangered species is regulated under the Environmental Species Act. The operation of export pumps in the Delta may result in the incidental take of fish such as the Delta smelt, a listed species. When take limits are exceeded, the export pumping is reduced or halted to protect endangered fisheries, potentially reducing export deliveries. As more is learned about the impacts of water system operations on fisheries, operations of water facilities statewide as well as locally may change, further altering the water supply outlook.


Algae bloom in San Luis Reservoir

San Luis Reservoir low-point disruption in CVP supply. At present, when San Luis Reservoir approaches its late summer/early fall "low point," operational constraints combine with the design of existing facilities to limit the flexibility of both federal and state contractors to fully use reservoir storage. This "low-point problem" poses a threat to about half of the San Felipe Division agency's CVP Delta supply. If the algal layer is sufficiently thick, when the water level reaches approximately 300,000 af of storage, algae may begin to enter the lower Pacheco intake. At these lower water levels the concentration of algae in water drawn down into the Pacheco Pumping Plant may be so high that the water becomes very difficult to treat, and water supply may be interrupted. Even without algal growth, if the water level were to drop below the elevation of the lower Pacheco Intake, water could not be drawn into the Pacheco Pumping Plant and no supply would be conveyed to the San Felipe Division.

Market/contract cost increases for water transfers. Although transfer water is expected to be available in the future, the market availability and contract cost of transfers can vary from year to year, depending on competition.

- **H.O. Banks Pumping Plant pumping permit not increased.** Projections of water available to the District from the SWP assume that DWR's current efforts to obtain permits to utilize the expanded pumping capacity at its

H.O. Banks Pumping Plant proceeds successfully. If this project is not completed by 2008 as anticipated, the District will receive less water than has been projected.

- **More stringent drinking water quality standards and emerging contaminants affecting both surface water and groundwater.** Drinking water quality is and will continue to be a major concern for surface water supplies. The District treats imported and local supplies to disinfect and remove disease-causing pathogens. During the disinfection process, the presence of bromide in Bay-Delta water can lead to the formation of brominated disinfection by-products (DBPs). The U.S. EPA has set the regulatory drinking water standard for one such DBP, bromate, at 10 parts per billion (ppb). Future drinking water regulations could become stricter if results from ongoing research indicate significant human health risks from DBPs. While future regulatory developments are uncertain, they build upon existing legislation and are often increasingly stringent. If the EPA lowers the bromate maximum contaminant level (MCL) from 10 ppb to 5 ppb, the change will impose additional treatment, operational, cost, and technological requirements on the District to maintain consistent compliance with stricter standards. A revised bromate standard is anticipated in 2011.

  More stringent water quality standards could also affect groundwater. Naturally occurring substances, such as arsenic, can impact the usability of groundwater supplies if present in high enough concentrations. The California Department of Health Services is currently assessing the risks of low levels of arsenic, and is considering lowering the state MCL in the near future. Depending on the outcome of this process, some well water in Santa Clara County may exceed the MCL for arsenic. Other emerging contaminants, such as perchlorate, can impact both surface water and groundwater quality. If water quality is sufficiently compromised, some water sources may become unusable and water supply may suffer.

- **Climate change resulting in decreased imported water deliveries and increased agricultural demands.** One of the largest unknowns affecting California's water supply is the water management impact of global warming. Effects on precipitation are hard to predict, with some models forecasting less rainfall for the state and some models forecasting more rainfall. Regardless of the impacts on the total amount of precipitation, rises in average temperature will increase sea level and decrease the snow pack—by far the largest water "storage" facility in California. Decreased snow pack and projected earlier spring melts will reduce the amount of water available to meet peak demands in late spring and summer. These changes could decrease imported water and possibly local water supplies, while increasing salinity in the Delta—thus adversely impacting water quality and Bay-Delta ecosystems.

- **Greater-than-expected water demand.** As described in Chapter 1, the District uses the best estimates available for future development in estimating future water demand. Changes in land use plans and policies or in water use practices could result in future water needs that are greater than anticipated.

The District developed a new risk analysis model to determine how selected risks could influence the frequency, magnitude, and costs of water shortages. The model was applied first to the District's baseline water supply and then to portfolios of potential building blocks.

District staff and outside experts were interviewed to estimate the probabilities and consequences of each risk factor. The results were presented to the IWRP stakeholders and the management team for their comments. Information on risk probabilities and consequences are in Appendix 3. Once the key risks were identified, the IWRP technical team used the IWRP 2003 risk analysis model to evaluate water shortage impacts to the baseline under different risk scenarios.

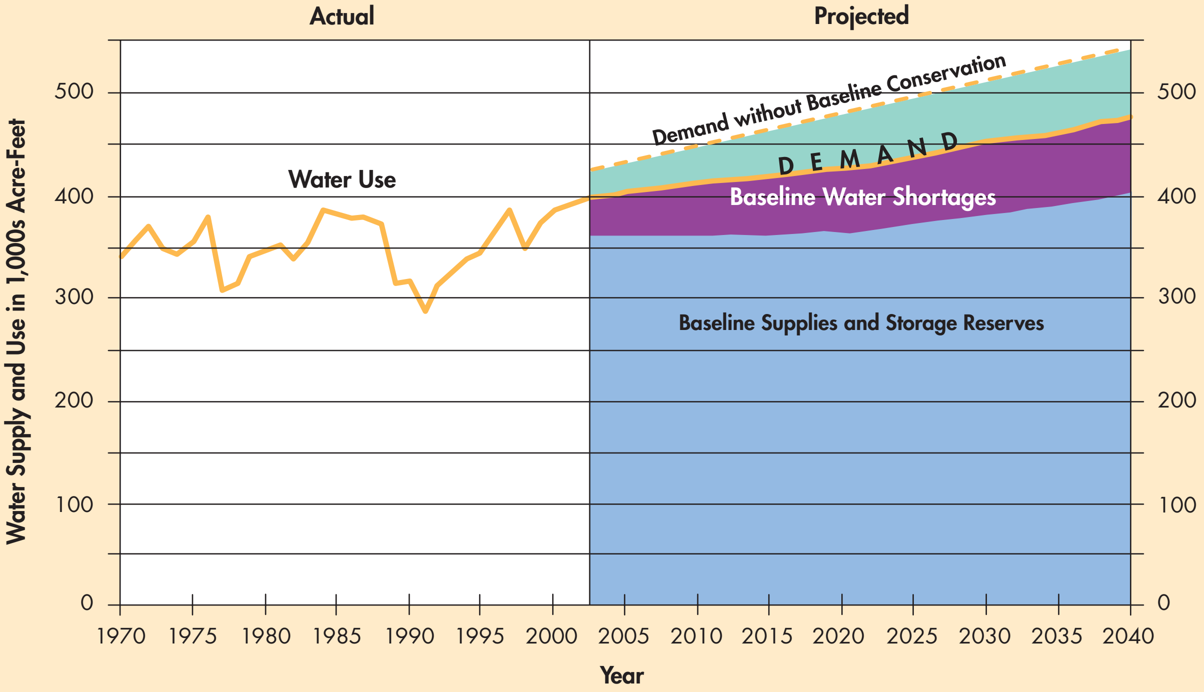
Risk Analysis for the Baseline Water Supply

In Chapter 1, figure 3-1 was presented, which shows expected dry-year shortages for the baseline water supply.

However, when potential risks to the baseline supply are considered, a different picture emerges. Figure 3-2 portrays the erosion of the District's baseline supply through 2040 if all risk factors evaluated were to become reality. When Figures 3-1 and 3-2 are compared, the impact risk has on the baseline can be clearly seen. While Figure 3-1 projects a 2040 shortage of 75,000 af, Figure 3-2 (which includes all risks) shows that the potential dry-year shortage in 2040 is approximately 175,000 af.

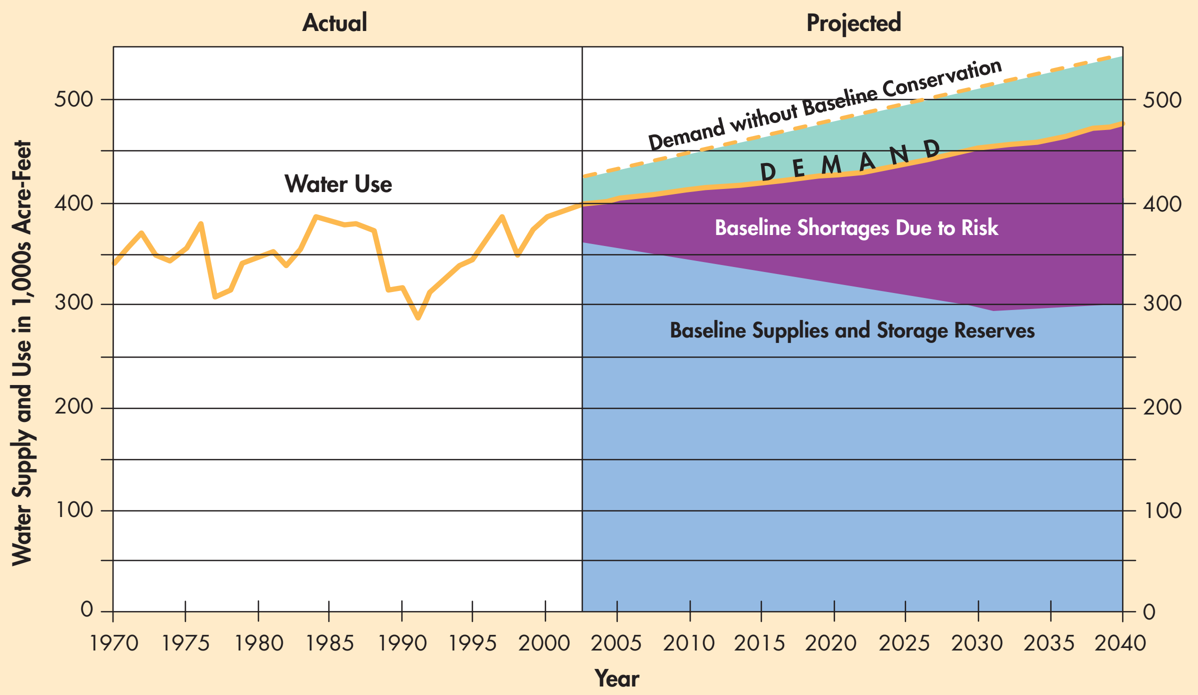
The baseline risk analysis also revealed that the range of uncertainty and potential water supply shortages increases significantly over the planning horizon. If only random risks occur (along with the hydrologic variability presented in the baseline outlook in Chapter 1), by the year 2010 there is

Baseline Water Shortages *Figure 3-1*



Baseline water shortages call for new IWRP investments.

Baseline Water Shortages from Risk—A Different Picture *Figure 3-2*



Risks can erode baseline supplies, increasing the need for new investments.

a 4 percent chance in any year that an additional 60,000 af of supply or demand cutback would be required to avoid risking land surface subsidence. By 2040, the projected frequency of shortage increases to 18 percent, with an average shortage of 80,000 af when shortages occur.

If all risks analyzed in IWRP 2003 were to occur simultaneously, the expected frequency of shortage in 2010 increases to 8 percent, with an average shortage of nearly 70,000 af when shortages occur. By 2040, the expected frequency of shortage if all risks occur (and no new projects are implemented) is 98 percent, with shortages averaging over 175,000 af per year.

Results of the baseline risk analysis are summarized below.

Findings

Risk analysis reveals that if the District does not implement any new water resource projects beyond the baseline, shortages as high as 175,000 af could occur by 2040, depending upon how risk scenarios unfold.

1. The risk analysis confirms the importance of securing the baseline.

Chapter 2 described the actions necessary to secure the foundation of the District's water supply, ensuring the validity of the baseline assumptions in the IWRP. The risk analysis confirmed the importance of these actions in meeting future water needs. Without these measures to secure the baseline, shortages under the different risk scenarios would be much greater.

2. The District's groundwater storage reserves help to mitigate the impacts of random risks.

Random occurrences are infrequent and of short duration, and the District's groundwater storage reserves contribute toward mitigating their impacts. However, the District is not able to directly substitute groundwater for surface water due to a lack of District-owned water supply wells. The District is currently investigating District-owned well fields that will tie directly to the treated water distribution system for increased operational flexibility and system reliability. The District should also work with local retailers to ensure that backup groundwater supplies are ready and available from retailers' wells when needed to supplement treated surface water supplies.

3. Multiple concurrent risks could seriously challenge the reliability of the District's water supply.

If all risks analyzed in IWRP 2003 occur simultaneously, the future water supply outlook could be very bleak indeed. Water shortages could be much greater and much more frequent, with shortages averaging over 175,000 af per year almost every year by 2040 if these risks all come to pass and the District does not implement additional water supply programs.

4. No single risk dominates over the entire planning horizon.

In the near term, the water supply impacts from random risk occurrences dominate for the simple reason that many of the other risks either don't occur until later (such as the new water quality standard for bromate) or build up slowly over time (such as global warming). If DWR is unsuccessful in obtaining permits to increase the Banks Pumping Plant capacity, there will be significant impacts on the water supply outlook, assuming no new programs are implemented in response. But the largest risk impact is due to demand rising over time faster than anticipated, resulting in increasingly severe and frequent shortages. While this picture may seem bleak, it is important to recognize that we are evaluating these risks today to develop strategies to manage the uncertainties in water supplies and demand in the future.

5. Planning for a broad range of risk requires flexible solutions.

If the District were to plan to meet all the shortages possible under future risk and those risks did not come to pass, the District would have overinvested unnecessarily. To meet future needs efficiently requires looking at different futures (or scenarios), each corresponding to a different combination of risk factors, and identifying what actions are required to meet each possible future should it arise. This process will be described in Chapter 8.

Next Steps

So far, this report has described the baseline outlook and the shortages that could occur if actions are not taken to prevent them. Chapter 4 describes the fourth step in the IWRP process: defining planning objectives to help guide development of new water supply investments. Later chapters will use the planning objectives in Chapter 4 to evaluate possible investment alternatives.

4. Defining Planning Objectives

This chapter describes the fourth step in crafting a long-term water resources strategy: identifying planning objectives and developing predictive indicators. Together, objectives and predictive indicators serve as evaluation criteria by which to rate building blocks and compare water resource portfolios.

Identifying IWRP 2003 Planning Objectives

Although there are many analytical approaches that can be used to aid decision-making, one step is common to virtually all approaches: identifying objectives. Objectives articulate the reasons an organization exists. They express its key values and help communicate its purpose to policy makers, governing boards, and the public. Identifying objectives requires looking within an organization to determine what really matters most.

The mission of the District is a healthy, safe, and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective, and environmentally-sensitive manner.

A key step in IWRP 2003 was to identify planning objectives that would reflect the District's mission and the Board's Ends Policies. These policies, which were adopted in 1999, express the District's mission (see sidebar) as it relates to water supply, water quality, flood protection, and environmental stewardship.

IWRP Relationship to Board Policy *Figure 4-1*

The IWRP is driven by the District's mission and Board policy.

Implementation of these policies is the responsibility of the District's CEO. Figure 4-1 shows the relationship between the District's mission, the Ends Policies, and the IWRP planning objectives.

At the start of the IWRP process, four half-day workshops were held with the IWRP management team. At these workshops, the management team reviewed the Ends Policies and particularly the role of CEO interpretation, identified seven IWRP planning objectives, developed predictive indicators for each objective, and validated the use of the evaluation framework. In addition, two stakeholder workshops were held to obtain input on the planning objectives. Summaries of both stakeholder workshops appear in the Appendix to the Introduction.

The seven IWRP planning objectives developed by the management team and revised by the stakeholders are shown in Figure 4-2 and listed below, along with their sub-objectives.

IWRP 2003 addresses seven planning objectives that reflect the District's mission and the Board's Ends Policies.

1. Ensure Supply Reliability.

As the wholesale water manager for Santa Clara County, the District strives to meet water demand under all hydrologic conditions, including satisfying its contract obligations for deliveries to the water retailers. The District also works to ensure supply reliability by managing the groundwater basins and maximizing its influence over sources of water supply and operations.

2. Ensure Supply Diversity.

Originally, water supply in Santa Clara County meant local streams and groundwater. Over the past four decades, the District has increased the diversity of County water supplies by looking statewide. The emphasis is now shifting again, and the District is looking to regional and local projects. Water supply diversity helps reduce the County's exposure to the risk of any one supply investment not performing up to expectations.

3. Ensure Water Quality.

Given increasing information on the public health impacts of constituents often found in water, water quality has become a primary driver in evaluating potential new investments. The District's water quality efforts focus on minimizing the variability of surface water quality delivered to the water treatment plants, meeting or exceeding water quality regulations, and protecting the groundwater basins.

IWRP Planning Objectives *Figure 4-2*

Objectives	Sub-Objectives	Predictive Indicators
Ensure Supply Reliability	Provide for County Water Demands	Frequency and magnitude of unmet County demand
	Meet Contract Obligations	Frequency and magnitude of unmet contract treated water
	Maximize District Influence	Degree of District influence
Ensure Supply Diversity	Provide a Variety of Sources	Local supplies as a percentage of total supply
Ensure Water Quality	Maximize Treatability	Daily variability, algae (surface water)
	Meet or Exceed Water Quality Regulations	Levels of bromide (surface water)
	Protect Groundwater Quality	Impact on groundwater
Minimize Cost Impacts	Minimize Community Costs	Total present value cost of supply portfolio for community
	Minimize District Costs	Total present value cost of supply portfolio for District
Maximize Adaptability	Maximize Capital Investment Flexibility	Variable cost as a percentage of total (variable + fixed) cost
	Maximize Scalability	Degree of phased expansion
Protect the Natural Environment	Maximize Benefit to Habitat and the Environment	Degree of overall environmental habitat benefit
	Ensure Environmental Water Quality	Impact on stream water quality
	Maximize Efficiency of Existing Resources	Acre-feet of County demand offset by water conservation
		Acre-feet of County demand met by recycled water
Ensure Community Benefits	Increase Recreational Benefits	Degree of recreational opportunity
	Improve Flood Protection	Degree of flood protection
	Prevent Land Surface Subsidence	Groundwater storage

4. **Minimize Cost Impacts.**
When assessing the cost of developing, treating, and delivering high-quality reliable water, the District looks at two cost impacts: the ultimate cost to the community's residents and businesses, and the District's own expenditures.

5. **Maximize Adaptability.**
The District maximizes those supply investments that are flexible, modular, and scalable to adapt to changes in future water demands. This helps minimize the risk of over- or underinvesting capital, or overbuilding.

6. **Protect the Natural Environment.**
At the District's request, the California legislature recently added environmental stewardship to the District's mission. The District's efforts in this area include enhancing benefits to habitat and the local environment, protecting water quality for local habitat, and maximizing the efficient use of existing resources.

7. **Ensure Community Benefits.**
This objective includes three benefits to the community not already reflected in the other six objectives: recreational benefits, incidental flood protection, and prevention of land surface subsidence (caused by overpumping the groundwater basins). Although recreation and flood protection are not specifically water supply functions, the District incorporates them into water supply projects where feasible.

Determining Relative Importance of Planning Objectives

After the IWRP 2003 planning objectives were defined, the relative importance of each objective was determined using two weighting exercises. The IWRP technical team and the stakeholders participated separately in each exercise.

The first method was "paired comparisons." For every possible pair of objectives, participants chose which one they deemed more important. Results were tallied and used to determine relative importance expressed as percentages.

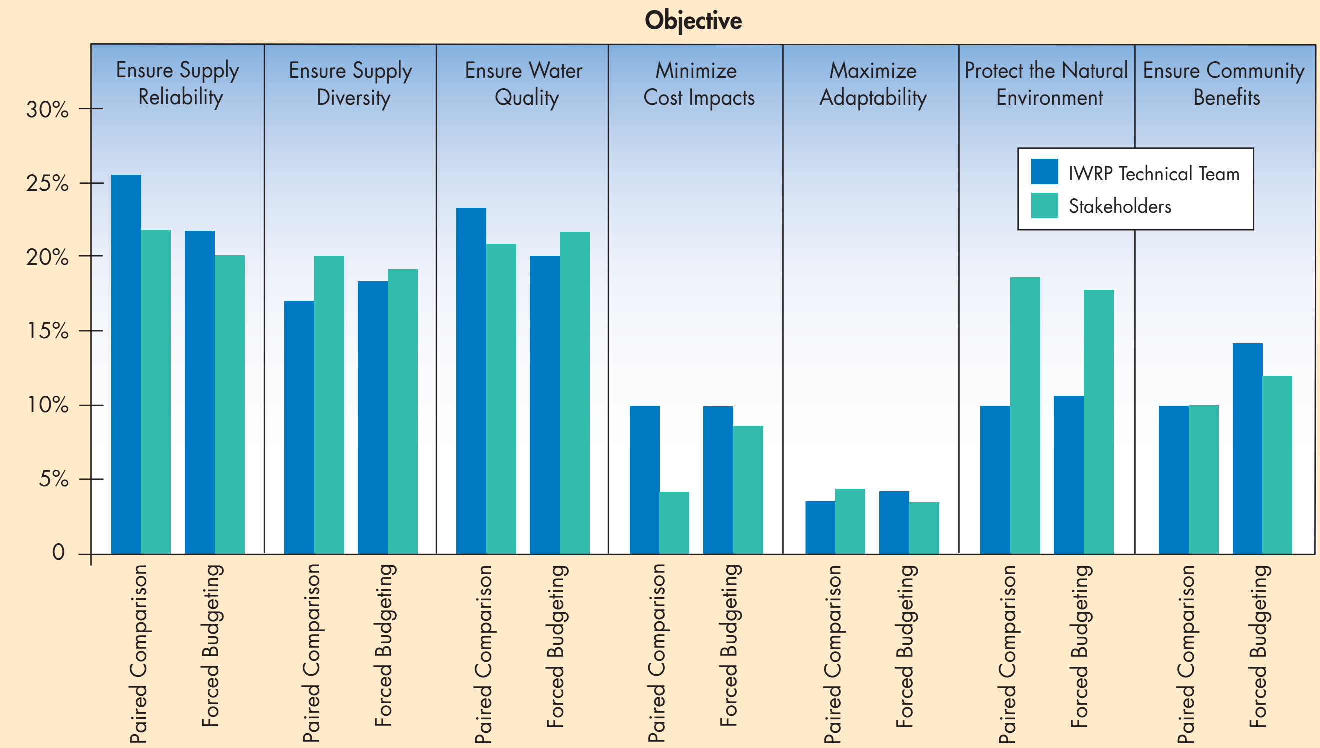
The second exercise was "forced budgeting." Each participant was given a budget of 20 points to distribute among the seven planning objectives. The only rule was that a participant could not award more than 5 points to any single objective. Results were tallied to discern total points and percentages for each objective.

Figure 4-3 summarizes the results of both exercises. The District's technical team and the stakeholders weighted the objectives similarly. Both groups ranked water supply reliability, water quality, and diversity in the top tier. Stakeholders ranked the environmental objective in the top tier while the IWRP technical team placed it closer to a second tier, along with the community and cost objectives.

A number of stakeholders were surprised that the Minimize Cost objective scored so low. Some thought this indicated that the least cost alternative would not necessarily be the preferred alternative (although they assumed the District would keep costs reasonable). Others suggested that there were obvious financial limits to maximizing performance on other objectives, and that a key question would emerge later: *"What am I buying for that additional money?"*

Reliability, diversity of supply, water quality, and environmental objectives were identified as the most important objectives by the IWRP technical team and stakeholders.

Results of Objective Weighting Exercises *Figure 4-3*



It is important to note that a distinction was made between the "Ensure Supply Reliability" objective and the "Ensure Supply Diversity" objective. Reliability focuses on the District's ability to meet demand under normal conditions, within expected hydrologic variability. Diversity is more of an insurance measure, focusing on the ability to meet demand if unforeseen circumstances, such as infrastructure failure, should occur.

The stakeholders felt that the four highest-ranking objectives (e.g., Reliability, Diversity, Water Quality, and Environment) clearly needed to be the focus of the performance assessment.

Developing Predictive Indicators

Once objectives are identified and defined, the next step in the decision-making process is to develop predictive indicators. Predictive indicators are measures of performance that can be used to evaluate whether building blocks and water resource portfolios achieve the IWRP planning objectives.

Predictive indicators were developed for each planning objective. These would become the metrics by which each water resource portfolio was evaluated and scored.

The management team, technical team, and stakeholders developed predictive indicators for each objective, with a single indicator corresponding to each sub-objective. The predictive indicators were carefully selected and worded to ensure that they were qualitatively or quantitatively measurable, nonredundant, concise, and understandable.

Predictive indicators that were quantitative indices had their values derived from real data or modeled calculations. Predictive indicators that were qualitative indices had their values based on a consensus of expert opinion. The technical team converted the qualitative indicators to a quantitative metric using a constructed scale from 0 to 100.

Once the predictive indicators were developed and refined, the technical team assigned weights to each of them. These weights indicated the relative importance of the predictive indicators within each objective. The predictive indicators are explained below, with their relative weights in parentheses.

1. Ensure Supply Reliability

Three sub-objectives characterize supply reliability:

- ***Provide for County Water Demands (70%).*** The predictive indicator for this sub-objective focused on the frequency and magnitude of water shortages over 20,000 af as determined by the District's simulation model. Shortage was defined as demand that cannot be met from available supplies and storage without risking land surface subsidence.

- ***Meet Contract Obligations (15%).*** The predictive indicator for this sub-objective quantified the ability of the District to meet its treated water contract obligations to retailers. The model calculated water available to the treatment plants on an annual basis, compared that to future contract demands, and tallied the frequency and magnitude of shortages to the treatment plants.

- ***Maximize District Influence (15%).*** The predictive indicator for this sub-objective evaluated the level of District influence over source supplies and operational responsibility. A constructed scale assessed the degree to which the District can influence the intended outcome of water resource programs and projects.

2. Ensure Supply Diversity (100%)

This objective is an insurance measure that says, in effect, *"Don't put all your eggs in one basket."* This means investing in a variety of sources that are not too closely correlated to the same vulnerabilities and potential failures. In order to keep the number of predictive indicators as concise and simple as possible, this planning objective was measured with a single predictive indicator that focused on the area of greatest shared vulnerability.

The IWRP technical team identified the District's imported water supply and the groundwater basins as the two most significant resources upon which the District depends. In addition to being a source of naturally recharged supply, the groundwater basins are recharged with imported and local surface supplies for storage and later extraction. Imported water contractual supplies make up about half of the District's water supply; transfers and withdrawals from the Semitropic water bank also depend on components of the Bay-Delta conveyance system.

In evaluating these two resources further, it was felt that the imported sources were more strongly interdependent than the groundwater basins in that single threats (such as an earthquake) could impact all imported water, while no single event could impact more than a portion of the groundwater basins. Therefore, the predictive indicator for this objective was defined as the yields of those building blocks that do not rely on the Bay-Delta supplies to meet reliability needs (i.e., local supplies) as a percentage of total supply.

3. Ensure Water Quality

The District implements programs and projects that protect source water quality, invests in treatment technologies, and aggressively protects the groundwater basins. The sub-objectives for the water quality objective reflect this three-pronged approach.

Santa Teresa Water Treatment Plant

- ***Maximize Treatability (20%).*** The variability and constituents of source water greatly impact the effectiveness of the water treatment processes at the three water treatment plants. Algal growth, turbidity, salinity, organic carbon, and fluctuations in source water pH and temperature create operational problems that can result in plant shutdowns. The predictive indicator for this sub-objective used a constructed scale to rate building blocks for their effects on treatment process effectiveness and efficiency.

- ***Meet or Exceed Water Quality Regulations (30%).*** The District's treatment plants must comply with a long list of state and federal water quality regulations related to chemical, biological, radiological, and physical parameters prior to treatment, during treatment, and within the treated water distribution system. A key treatment challenge is to maximize the disinfection of biological contaminants such as bacteria, viruses, and protozoa, while minimizing the formation of harmful disinfection by-products such as bromate and trihalomethanes. When using ozone as the primary disinfectant, the challenge is to minimize bromate formation in the presence of the high levels of bromide often found in Delta water. The District is also concerned with a number of potential threats to surface water quality, such as perchlorate, MTBE, protozoan pathogens, endocrine disruptors, pharmaceuticals, and personal care products, each of which could require the addition of new treatment processes. The predictive indicator for this sub-objective used a constructed scale to rate building blocks for their ability to improve treated water quality, using bromate as the leading indicator.

- ***Protect Groundwater Quality (50%).*** The District is concerned with a number of potential threats to groundwater quality, such as perchlorate, MTBE, nitrates, and arsenic. The predictive indicator for this sub-objective used a constructed scale to assess potential impacts on groundwater quality, with nitrates and arsenic as the leading indicators. For example, due to the generally slow infiltration of water, residual nitrate concentrations in the soil from past practices may contribute to increasing nitrate concentrations in groundwater for years or decades to come. The impact of a building block on either diluting groundwater nitrates or removing the nitrates through treatment was considered. Recycled water projects were rated on the quality of the water they produce and its potential impact on groundwater quality.

4. Minimize Cost Impacts

In its planning, the District focuses on total costs to the businesses and residents of the County, not just District costs. In order to be able to calculate the District water rate impacts of different alternatives, District costs and non-District (community) costs were tracked as two distinct sub-objectives.

- ***Minimize District Costs (50%).*** These include both capital and O&M costs borne by the District. The predictive indicator for this sub-objective was the total present value (PV) of the cost of a portfolio for the District.

- ***Minimize Community Costs (50%).*** These include capital costs and O&M costs not borne by the District, as well as shortage costs, when applicable. The predictive indicator for this sub-objective was the total PV of the cost of a portfolio for the community.

  As part of community costs, the IWRP recognized that economic losses due to water shortages have major societal impacts and can add up to significant dollars. To arrive at a cost-of-shortage analysis the IWRP technical team examined several studies that analyzed the cost of shortage during the 1987–1992 drought, and examined different techniques used to quantify economic losses. The team then tracked water shortage costs as part of overall costs in the portfolio analysis.

The qualification of costs was based on the total present value (PV) of portfolio costs over a 40-year life cycle using a 3.9 percent discount factor. A detailed explanation of the economic analysis can be found in Appendix 4.

5. Maximize Adaptability

Two sub-objectives characterize adaptability:

- ***Maximize Capital Investment Flexibility (10%).*** Investments in infrastructure requiring very high fixed costs may preclude taking advantage of new opportunities in the future. Thus, the predictive indicator for this sub-objective was based on two cost components—fixed and variable costs—in each portfolio. The model calculated the ratio of PV of variable costs (which could be avoided if conditions change) to the total PV of the portfolio. This ratio indicated how easily the portfolio could avoid costs if conditions changed in the future.

- ***Maximize Scalability (90%).*** Scalability is a similar concept to flexibility with a focus on phasing-in or building projects in stages to match supply with need. The predictive indictor for this sub-objective was a constructed scale, used to rank each building block according to the degree it was scalable, modular, or kept a wide range of options open.

6. Protect the Natural Environment

Three sub-objectives characterize environmental protection:

- ***Maximize Benefit to Habitat and the Environment (60%).*** No building block was identified exclusively for its environmental benefits. However, the predictive indicator for this sub-objective used a constructed scale to reflect the environmental impacts, ranging from beneficial to negative, caused by the development and use of each building block. Environmental resources that were evaluated include fish and other aquatic habitat; wildlife; botanical resources; and waterways, including wetlands, reservoirs, creeks, and streams. The relative potential impacts were evaluated at a program level because site-specific information was not available.

- ***Ensure Environmental Water Quality (20%).*** The two major water quality characteristics that impact aquatic habitat are water temperature and contaminants introduced into streams, creeks, and reservoirs. The predictive indicator for this sub-objective used a constructed scale to measure water quality impacts in waterways caused by the development and use of each building block.

- ***Maximize Efficiency of Existing Resources (20%).*** There is a benefit to the environment in making the most efficient use of water. To the extent additional water is not developed or diverted, more water resources remain for environmental benefit. The predictive indicator for this sub-objective measured the amount of water saved through conservation and produced by recycled water on an annual basis.

7. Ensure Community Benefits

Three sub-objectives characterize community benefits:

- ***Increase Recreational Benefits (20%).*** While it is not the District's role to provide recreational facilities, it does build and operate water supply facilities to maximize their multifunctionality. No building block was identified exclusively for its recreational benefits; however, the predictive indicator for this sub-objective used a constructed scale to rank building blocks for contributing scenic enhancements and recreational access for motor boating, rowing, sailing, fishing, hiking, bicycling, birding, and picnicking when compatible with other uses.

- ***Improve Flood Protection (20%).*** No building block was identified exclusively for its flood protection benefits; however, the predictive indicator for this sub-objective used a constructed scale to measure the extent that any building block could provide incidental flood protection. Projects that expressly provide flood protection are developed and implemented by the District's Capital Program Services and Watershed Management divisions.

- ***Prevent Land Surface Subsidence (60%).*** Land surface subsidence has occurred in Santa Clara Valley because of significant overpumping of the groundwater basins. The costs of subsidence are high, as it can lead to infrastructure damage, damage from flooding, and saltwater intrusion that degrades groundwater quality. The predictive indicator for this sub-objective scored each portfolio for how close groundwater levels would be to land subsidence thresholds at the end of a multi-year drought.

The objectives, sub-objectives, and associated predictive indicators represent the District's and stakeholders' best understanding of what is important to consider in developing a water resource strategy.

Next Steps

Predictive indicators are used in conjunction with planning objectives to evaluate the performance of water resource portfolios. Chapter 5 describes the building blocks that were used to build portfolios. Chapter 6 describes the construction and evaluation of portfolios.

5. Identifying Building Blocks

Due to the District's continuous investments to diversify its water supply, a wide variety of water supply resources are available. IWRP 2003 identified 46 feasible projects and programs for meeting future water demand. Known as building blocks, these include conservation, recycling, desalination, reservoir storage, recharge, banking, transfers, treatment, and re-operations.

The fifth step in the IWRP process is to identify feasible projects and programs, or building blocks, for meeting future water demands. IWRP 2003 identified 46 building blocks. This chapter describes the various types of building blocks that were used to construct water resource portfolios on top of the foundation of the existing water supply baseline described in Chapter 1.

Types of Building Blocks

The 46 building blocks fall into five major categories:

- All-weather supplies (includes conservation, recycling, and desalination)
- Storage (includes reservoir storage, recharge, and banking)
- Dry-year transfers
- Treatment
- Re-operations

Each type of building block is described below, along with its distinct advantages and disadvantages. Appendix 5 contains a description of each of the 46 building blocks and the rationale for how they were rated by predictive indicator.

All-Weather Supplies

These supplies are available and used in all weather years (dry, normal, or wet). These building blocks include ***Conservation, Recycling,*** and ***Desalination.***

Conservation building blocks include 20 programs that were grouped into similar-cost options, resulting in three agriculture building blocks and six M&I building blocks. The agricultural conservation programs focus on maximizing water use efficiency through irrigation management and loans to use or repair water-saving equipment. The M&I conservation programs include pre-rinse kitchen sprayers, weather-based irrigation controllers, dual-flush toilets, water-efficient landscaping incentives, and other programs to maximize water conservation in the commercial, industrial, and residential sectors. The water savings from conservation are approximately 28,000 af per year.

Water conservation reduces demands on existing water supplies and water facilities, helping to defer the cost and environmental impact of developing additional supplies and infrastructure. Conservation programs also help to protect the South Bay marsh habitats by reducing flows to wastewater treatment facilities, thereby reducing freshwater discharge to the Bay. Furthermore, most of the conservation building blocks identified are low in cost, compared to other all-weather supplies. However, savings can be dependent on customer (end user) participation and conservation does little to improve water quality.

Recycling building blocks would deliver an estimated 33,000 af per year of nonpotable recycled water for irrigating landscape and agricultural lands and for industrial processes. Most of the projects are related to expanding water recycling distribution systems and many of these projects are linked. The recycled water would come from four facilities:

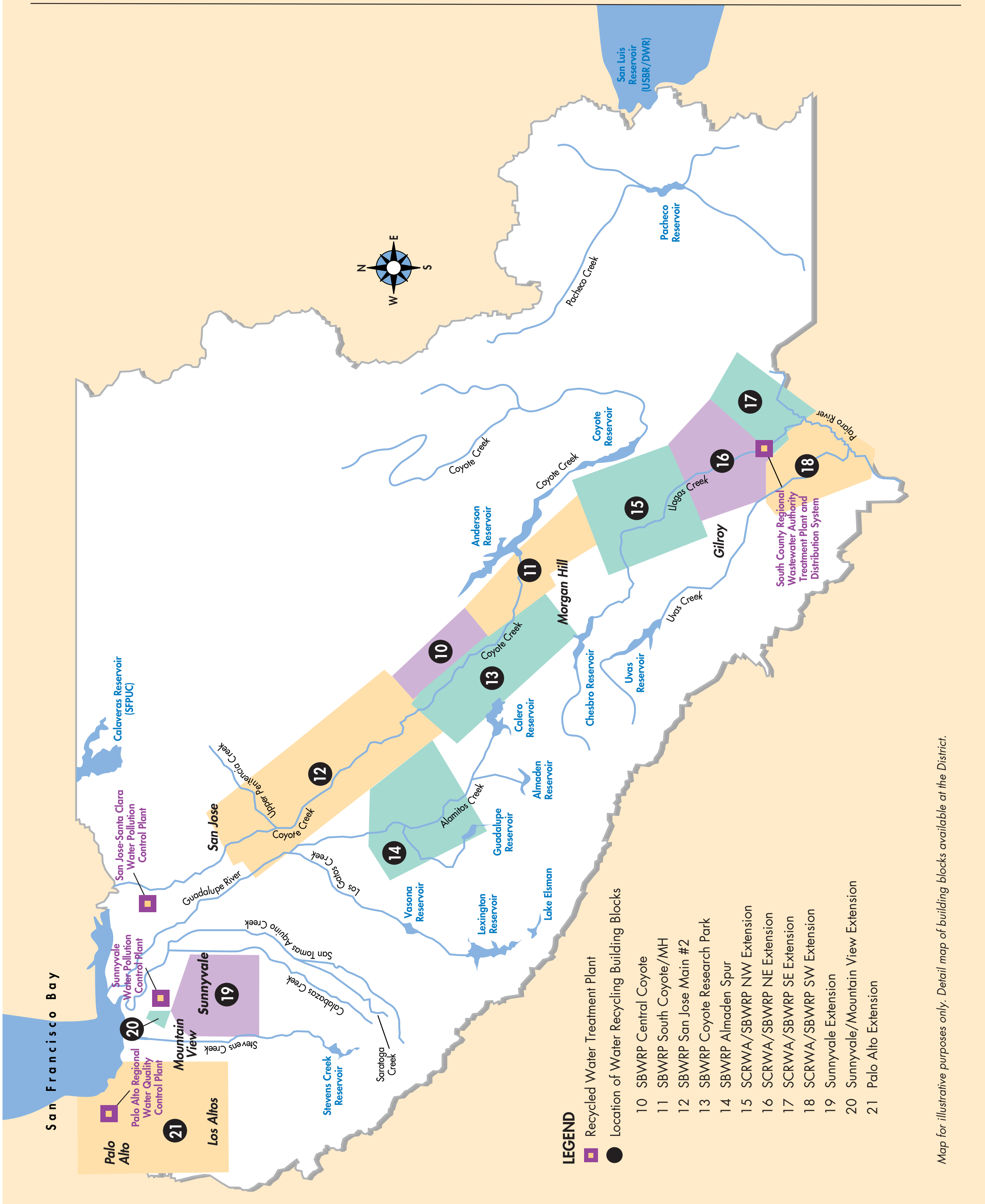
- South Bay Water Recycling Program (SBWRP), San Jose/Santa Clara Water Pollution Control Plant (SJ/SCWPCP)
- South County Regional Wastewater Authority (SCRWA), Gilroy/Morgan Hill area
- Sunnyvale Water Pollution Control Plant (SWPCP)
- Palo Alto Regional Water Quality Control Plant (PARWQCP)

Figure 5-1 shows the location of the recycled water building blocks. Recycled water projects offer partnership opportunities with local agencies and decrease wastewater discharges to the Bay, resulting in significant environmental benefits to sensitive salt marsh habitats. Although recent technologies have reduced the cost of recycling and future improvements may reduce the costs even more, recycling is currently the most expensive all-weather option. There are unresolved questions related to the groundwater quality impacts of recycled water, although these may be addressed with advanced treatment. Finally, public acceptance of recycled water can be a challenge.

Desalination building blocks involve the removal of salts from brackish groundwater or Bay water to provide a high-quality potable water supply. Each of these building blocks would have a 9 mgd capacity.

Desalination is a previously underutilized source that offsets the need for traditional diversions from streams and the Bay-Delta. Just a decade ago, desalination was only considered a viable option in extremely arid regions with few options, like the Middle East. Improvements in technology have made desalination a more feasible water supply option, but the cost and

IWRP Water Recycling Building Blocks *Figure 5-1*



environmental impacts of brine disposal can be significant. Although public acceptance of ocean desalination in California has been high, it is uncertain whether Bay desalination will have the same perception. Also unknown is the potential for brackish groundwater treatment in Santa Clara County.

Conservation, recycled water, and desalination projects all increase system flexibility. Since all-weather supplies are available every year, they have the most predictability and certainty, but are typically more expensive when trying to meet the last marginal demand. This is because the fixed costs for these supplies are paid for year in and year out, but the supply may only be needed during droughts or emergencies. Trade-offs for the three types of all-weather supplies evaluated in IWRP 2003 are summarized in Figure 5-2.

Storage

These are facilities that can hold and reserve supplies for later use during times of need. These building blocks include ***Reservoir Storage, Recharge,*** and ***Banking.***

Reservoir Storage building blocks include both storage enhancements and new reservoir options. Storage enhancement projects include sediment removal from local reservoirs, the expansion of Uvas Reservoir, and the expansion of Calero Reservoir. New surface storage projects, including reservoirs of varying capacity, were evaluated to determine how they performed in water resource portfolios.

Recharge building blocks augment existing conjunctive use programs that bank surface water supplies within the local groundwater basins. These building blocks include additional instream recharge in the western portion of the

Trade-Offs among All-Weather Supplies *Figure 5-2*

Conservation

- Low cost
- Environmental benefits
- Can be dependent on customer participation
- Does little for water quality
- Savings are hard to quantify

Recycling

- Environmental benefits
- Costly, but funding and technology improvements possible
- Uncertain groundwater quality impacts

Desalination

- Provides high-quality drinking water
- Costly, but funding and technology improvements possible
- Potential adverse environmental impacts

County, in South County, and upstream of Ford Road on Lower Coyote Creek. Building blocks also include additional pond recharge in North County (5 acres) and South County (15 acres).

Banking building blocks would increase the volume of water the District banks in the Semitropic Water Banking Program. The District currently has 140,000 af of storage in this groundwater bank in Kern County. These building blocks would increase the District's storage capacity in Semitropic by 60,000 af or 210,000 af. The addition of 210,000 af would result in reaching the maximum of 350,000 af storage allocated to the District.

Surface or groundwater storage improves the operational flexibility of the water system. Storage can make better use of existing resources by retaining local and imported wet-year supplies that might otherwise be lost. This stored water can then be used in dry years or for emergencies. Surface storage can help achieve better water quality objectives by taking advantage of deliveries of imported supplies during wet periods that typically have less TDS and bromide. These higher-quality volumes can be used to blend with lower-quality water. Surface storage can also be operated for other beneficial uses including flood protection and recreation.

Surface storage can have both positive and negative impacts on the environment. Surface storage can provide operational flexibility to take water from the Delta when pumping has less impact on fisheries. In addition, it can provide resource assets for habitat and fisheries benefits, such as the Environmental Water Account (see glossary for description) and wildlife refuges. On the negative side, surface storage can harm ecosystem habitat

Trade-Offs among Storage Options *Figure 5-3*

Banking

- Quick implementation
- Little environmental impact
- Flexible and incremental
- No water quality benefit
- Does little for diversity

Reservoir Storage

- Can be operated for water quality benefit
- Long lead time and uncertain implementation
- Adverse environmental impact
- Costly

Groundwater Recharge

- Improves efficient use of surface water and groundwater resources
- Potential adverse fisheries impacts for in-stream recharge

and species, and adversely change stream flow geomorphology and water quality. In addition it can be very expensive and difficult to implement.

The advantages and potential disadvantages of the different storage options analyzed for IWRP 2003 are summarized in Figure 5-3.

Dry-Year Transfers

The IWRP looked at dry-year option transfers and spot market transfers. Dry-year option transfers include entering into a contract with another party or parties to purchase additional imported water during dry periods. These agreements usually include an option payment due every year, with an additional amount payable in the years that the water is actually delivered. Short-term or spot market water transfers usually involve an agreement to purchase water within a 1- to 2-year period. IWRP assumes short-term transfers could be obtained from a State Drought Water Bank if it exists when needed.

Dry-Year Transfers are often low in cost, as the majority of costs are only incurred when the supply is used. However, most dry-year transfers are outside of the District's service area and therefore carry some risk due to earthquakes or environmental restrictions in the Bay-Delta region. There are also third-party impacts and concerns and issues of overdrafting groundwater basins related to transferring water out of a watershed.

Water transfers can be an important asset to system operational flexibility when seen in combination with groundwater, surface water storage, and water treatment improvements. Transfers combined with other building blocks can result in increased value over and above the sum of each building block.

Treatment

Water treatment is often needed to make existing supplies reliable and safe for end use. The treatment building blocks are included for surface water and groundwater.

Treatment building blocks include increasing the capacity of the Rinconada Water Treatment Plant (WTP) from 100 mgd to 120 mgd, a new 25 mgd WTP in South County, wellhead treatment, and ultraviolet disinfection.

Treatment is valuable because it improves water quality for consumptive use that would otherwise not be available. However, treatment can be costly and complex. For instance, a treatment process may solve one problem but create another. Chlorine, which has been used effectively for years to kill bacteria and viruses in water, creates disinfection by-products that can have negative health impacts. As a result, the District is switching over to another disinfection treatment process, ozone, which in turn raises other water quality challenges and costs. As water quality regulations become more stringent, water quality issues become key factors in water supply challenges.

Re-operations

This category includes the re-operation of supplies and interconnecting infrastructure as a means to stretch existing supplies and maximize their efficient use.

Re-operations

Re-operations building blocks include a westside Hetch-Hetchy intertie to provide emergency back-up supply or to serve as an interconnection to receive a water transfer. A building block involving a raw water pipeline from Lexington Reservoir to the Vasona pumping plant would allow the District to store imported water and would serve as a backup for Rinconada. Also included in the re-operations building blocks are District-owned well fields, providing the District groundwater pumping capability to back up raw and treated water systems. The integration of District groundwater pumping and surface water supplies could help to optimize management of local supplies and provide emergency back-up supply.

As CALFED relates to the re-operation of and investment in state and federal programs, two building blocks were developed to reflect CALFED alternatives. The first, which is an element of all portfolios, includes most projects that are being implemented as part of the CALFED Record of Decision Stage 1: ecosystem restoration, water use efficiency, water transfers, watershed management, the Environmental Water Account, drinking water quality program, levee protection, and conveyance programs. The second CALFED building block includes potential projects to expand existing reservoirs or to develop new reservoirs, such as raising Shasta Dam and constructing Sites Reservoir.

T-valve at Alamitos Pond

Figure 5-4 summarizes the water supply benefits and costs of each building block and includes the predictive indicators that the building blocks support.

Building Blocks Support Planning Objectives *Figure 5-4*

Building Blocks	Projects	Dry-Year Water Supply Benefit (acre-feet)	Sub-Objectives										Estimated Total Cost (million dollars)
			Maximize District Influence	Maximize Treatability	Meet or Exceed Water Quality Regulations	Protect Groundwater Quality	Maximize Scalability	Maximize Benefit to Habitat and the Environment	Ensure Environmental Water Quality	Maximize Efficiency of Existing Resources	Increase Recreational Benefits	Improve Flood Protection	
1 Conservation Ag	Moisture Monitoring Equipment Loans	1,500			•		•	•		•			$18.2
2 Conservation Ag	Irrigation Management	8,870			•		•	•		•			$16.1
3 Conservation Ag	Equipment Repair Loans	500			•		•	•		•			$15.0
4 Conservation M&I	Submeters, Controllers, Sprayers	5,250			•		•	•		•			$10.2
5 Conservation M&I	Residential Eto Controllers	4,480			•		•	•		•			$14.0
6 Conservation M&I	Toilets, Rebates, Urinals, Industrial & Commercial Dishwashers	6,400			•		•	•		•			$96.4
7 Conservation M&I	Residential Dishwasher Rebates	200			•		•	•		•			$13.2
8 Conservation M&I	Pool Cover Incentives, Commercial & Industrial Landscape Incentives	160			•		•	•		•			$31.2
9 Conservation M&I	Residential Landscape Incentives & Rainwater Harvesting System Rebates	60			•		•	•		•			$24.2
10 Recycling	SBWRP Central Coyote	3,000			•		•	•		•			$36.2
11 Recycling	SBWRP South Coyote/MH	3,160			•		•	•		•			$60.8
12 Recycling	SBWRP San Jose Main #2	1,920			•		•	•		•			$124.7
13 Recycling	SBWRP Coyote Research Park	2,500			•		•	•		•			$41.7
14 Recycling	SBWRP Almaden Spur	1,500			•		•	•		•			$17.9
15 Recycling	SCRWA/SBWRP NW Extension	1,850			•		•	•		•			$67.2
16 Recycling	SCRWA/SBWRP NE Extension	6,050			•			•		•			$76.2
17 Recycling	SCRWA/SBWRP SE Extension	2,170			•		•	•		•			$26.4
18 Recycling	SCRWA/SBWRP SW Extension	4,170			•			•		•			$54.6
19 Recycling	Sunnyvale Extension	1,000			•		•	•		•			$18.1
20 Recycling	Sunnyvale/Mountain View Extension	1,000			•		•	•		•			$18.1
21 Recycling	Palo Alto Extension	4,700			•			•		•			$85.2
22 Desalination	Desalination—Groundwater (9mgd)	5,000	•	•	•								$46.0
23 Desalination	Desalination—Bay (9mgd)	5,000	•	•	•								$71.5

Building Blocks Support Planning Objectives *Figure 5-4*

Building Blocks	Projects	Dry-Year Water Supply Benefit (acre-feet)	Sub-Objectives										Estimated Total Cost (million dollars)
			Maximize District Influence	Maximize Treatability	Meet or Exceed Water Quality Regulations	Protect Groundwater Quality	Maximize Scalability	Maximize Benefit to Habitat and the Environment	Ensure Environmental Water Quality	Maximize Efficiency of Existing Resources	Increase Recreational Benefits	Improve Flood Protection	
24 Storage Enhancements	Sediment Removal (20 taf Storage)	4,000	•	•	•			•	•			•	$1000.0
25 Storage Enhancements	Uvas Expansion	4,000	•	•	•				•		•	•	$113.0
26 Storage Enhancements	Calero Expansion	2,000	•	•	•				•		•	•	$122.0
27 New Surface Storage	Alternate 1—100,000 af	20,000	•	•	•						•		$500.0
28 New Surface Storage	Alternate 2—350,000 af	70,000	•	•	•						•		$725.0
29 Recharge	Instream Recharge—West	2,100	•			•		•			•		$6.0
30 Recharge	Instream Recharge—Ford	2,000	•			•					•		$8.7
31 Recharge	Instream Recharge—South County	2,400	•			•					•		$7.1
32 Recharge	Pond Recharge—North County	3,900	•			•	•	•			•		$9.5
33 Recharge	Pond Recharge—South County (15 acres)	11,000	•			•	•	•			•		$4.5
34 Transfers	Options	40,000	•				•						$10.0
35 Transfers	Spot—Critically Dry	N/A					•						N/A
36 Banking	Semitropic—Additional 60,000 af	7,500	•				•						$8.0
37 Banking	Semitropic—Additional 210,000 af	26,250	•				•						$28.1
38 Treatment	Rinconada to 120 mgd	N/A	•										$40.3
39 Treatment	South County WTP (25 mgd cap)	N/A	•			•							$88.3
40 Treatment	Wellhead Treatment (20 mgd cap)	N/A	•			•	•						$25.0
41 Treatment	Ultraviolet	N/A	•		•								$25.6
42 Re-operations	Westside Hetch-Hetchy Intertie	N/A	•										$62.1
43 CALFED	Stage 1 + Reservoirs	9,500		•	•						•		$229.0
44 CALFED	Stage 1	1,900						•	•				$160.0
45 Re-operations	Lexington Reservoir Pipeline	N/A	•	•	•						•		$15.0
46 Re-operations	Groundwater Pumping	N/A	•	•	•								$6.0

This chart lists only those planning objectives' predictive indicators that apply at the building block level. It does not list the predictive indicators that are only meaningful when applied to portfolios. One example is the planning objective Ensure Supply Diversity. Diversity is best measured when analyzing a mix of building blocks and making comparisons between them. The same is true for Ensure Supply Reliability: all building blocks contribute to this objective, but different portfolios meet reliability in different ways.

Prospective Building Blocks

Other possible projects and programs were identified that are currently being studied. These prospective building blocks were not explicitly evaluated in IWRP 2003 but may be viable projects in the future.

- **Indirect Potable Recycling.** The District is investigating the impacts of nonpotable recycling on groundwater quality, and the benefits of advanced treatment of recycled water when used for irrigation, for the purposes of expanding recycling in the County. The District is also currently investigating indirect potable reuse alternatives.

- **Alternative Water Transfer Agreements.** The IWRP building blocks include dry-year option transfers, which provide additional dry-year supplies. However, it is also possible to develop long-term water transfer agreements that make water available every year, or even that make water available under certain conditions. Sharing an "every year" water transfer with one or more partners can be a more cost-effective approach than dry-year agreements. The IWRP 2003 tools will be used to evaluate the effectiveness of such opportunities as they are developed.

- **Lexington Reservoir/Montevina Treatment Plant Operations.** Both the District and San Jose Water Company own and operate facilities in the Los Gatos Watershed and are exploring options to coordinate the optimal use of water resources and existing facilities for water supply management. San Jose Water Company owns and operates Elsman Reservoir in the upper Los Gatos Watershed and the Montevina Treatment Plant located on the banks of the District's Lexington Reservoir. There are times when the District could recharge the groundwater basin with other water sources and send Lexington water to the Montevina Treatment Plant. This would optimize groundwater recharge while meeting current water demands. Also, because the Montevina Plant service area overlaps the Rinconada Treatment Plant service area, the Montevina facility could provide back-up services in emergencies and back-up for scheduled maintenance shutdowns.

- **Management Tools.** The District is evaluating management tools that could be used to create incentives to influence water use (such as water pricing structures), and other potential mechanisms to protect groundwater resources and to promote equitable cost allocations.

As these investigations progress, new building blocks and others will be analyzed in the context of the IWRP framework.

Next Steps

The technical team used the IWRP building blocks to construct water resource portfolios for evaluation. Chapter 6 describes the construction and evaluation of single-focus and complex hybrid portfolios. Chapter 6 also describes the many interesting relationships between building blocks that were observed during the analysis phase of the IWRP.

6. Portfolio Construction and Evaluation

The sixth step in crafting a long-term water resources strategy is to explore the interrelationships among building blocks and to determine which combinations are most effective in meeting the planning objectives and sub-objectives described in Chapter 4. This was accomplished by grouping the building blocks into water resource portfolios. This chapter explains why and how portfolios were constructed, and describes the portfolios that were built for IWRP 2003.

Why Build Portfolios?

The IWRP technical team combined diverse water supply building blocks into water resource investment portfolios. No single portfolio can be a perfect water resource solution; rather, they serve as tools for analyzing which building blocks work best in which combinations.

No individual water resource is adequate for meeting the District's needs in the future. Instead, a variety of building blocks are necessary to provide a safe, reliable water supply. Just as investors combine stocks and bonds to create a diversified financial portfolio that maximizes gain and minimizes risk, so too can the District combine a number of water supply building blocks into water resource investment portfolios to achieve its water supply objectives.

During IWRP 2003, the purpose of developing portfolios was to evaluate the interaction between potential water resource projects in terms of advantages, disadvantages, and trade-offs. Through this analysis, high-scoring portfolios that optimized the value of individual building blocks and minimized trade-offs were developed. These high-scoring portfolios were then analyzed to learn what they had in common and what constrained portfolio performances.

Portfolio Construction

As described in Chapter 5, the District identified 46 water supply building blocks that could be used to construct portfolios. With so many building blocks, the number of possible portfolios that could be built was far greater than can be effectively analyzed. The District used the planning objectives and sub-objectives as a basis for creating a reasonable number of varied portfolios.

As a starting point, the technical team built ten single-focus portfolios, one for each of the sub-objectives that were applicable to building blocks as well as portfolios. These portfolios each sought to maximize only one given sub-objective. Building blocks that scored well for the sub-objective were included in the portfolio. For example, a portfolio built around the planning objective/sub-objective "Protect the Natural Environment/Maximize Efficiency of Existing Resources" included all building blocks that contributed toward the Maximize Efficiency sub-objective (See Figure 4-2).

Reliability Target

Economic analysis of the initial portfolios revealed that the cost of available options to meet needs is less than the cost of shortage to the community, making it more cost-effective to meet demand than to do nothing. Based on this critical finding, the technical team established a reliability target for all portfolios of no more than a 20,000 af shortage in any year (roughly 5% of total demand), even under a repeat of the 1987–1992 drought. The District could manage this level of shortage through demand reduction and voluntary cutbacks without significant economic losses to the community.

An iterative modeling process resulted in five hybrid portfolios that included beneficial combinations of compatible building blocks. Three initial hybrids focused on the water quality, environment, and cost objectives; two others focused on a blend of the water quality and environment objectives.

As expected, individual portfolios did not score well for all sub-objectives. However, evaluation of the ten single-focus portfolios provided valuable information about the interrelationships among building blocks—how they work together or against each other—and the trade-offs between sub-objectives.

One critical outcome of the initial portfolio build was the realization that the highest-scoring portfolios met Countywide demand through the planning horizon and demonstrated excellent reliability at a lower community cost. The cost of available options to meet needs was less than the cost of shortage, making it more cost-effective to meet demand than to have demand reductions. Based on this critical finding, a reliability target was established (see sidebar).

The technical team used the insights gained from the initial single-focus portfolios to build, model, and test numerous portfolios in an iterative process using several combinations of building blocks. These hybrid portfolios were also built to meet the reliability target. Through this process, the value of each individual building block was enhanced by implementing it in tandem with other compatible water supplies. Thus, each of the hybrid portfolios can be seen as a whole that is greater than the sum of its parts.

Description of Hybrid Portfolios

Ultimately, five high-scoring water resource portfolios were constructed and their performance in relation to the seven IWRP 2003 planning objectives was evaluated. Three of the final hybrid portfolios were those built to meet the following planning objectives: Ensure Water Quality; Protect the Natural Environment; and Minimize Cost Impacts. Two additional hybrid portfolios were then constructed for further comparison. The final two hybrid portfolios used various combinations of building blocks from the water quality and environmental hybrid portfolios.

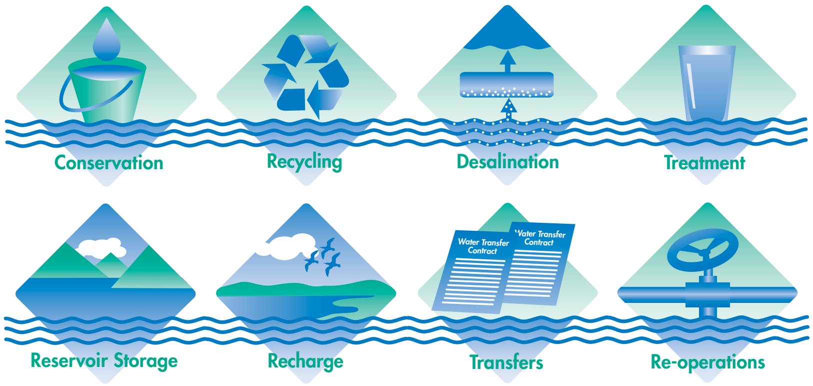
The hybrid portfolios and their building blocks are described below. Information on the construction of the hybrid portfolios and the specific building blocks in each hybrid can be found in Appendix 6.

Hybrid Portfolio #1: Ensure Water Quality

The Ensure Water Quality hybrid portfolio was constructed to meet the three water quality sub-objectives below, with additional building blocks added to meet the reliability target.

- Maximize Treatability
- Meet or Exceed Water Quality Regulations
- Protect Groundwater Quality

Building Blocks: This hybrid includes building blocks that provide treatment, improve source water quality, and/or improve the operational flexibility of the system to meet water quality objectives: conservation, some recycling, desalination, treatment, reservoir storage, recharge, transfers, and re-operations.

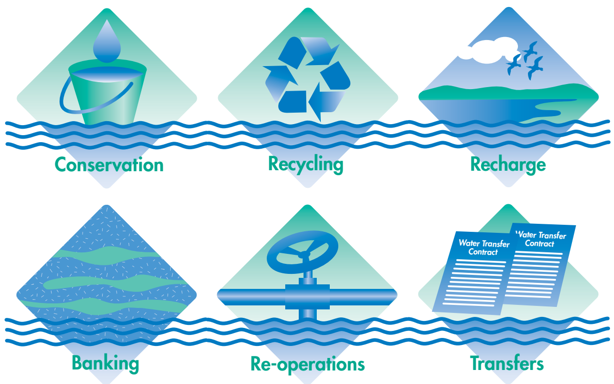


Hybrid Portfolio #2: Protect the Natural Environment

The Protect the Natural Environment hybrid portfolio was constructed to meet the three environmental planning sub-objectives that follow, with additional building blocks added to meet the reliability target.

- Maximize Benefit to Habitat and the Environment
- Ensure Environmental Water Quality
- Maximize Efficiency of Existing Resources

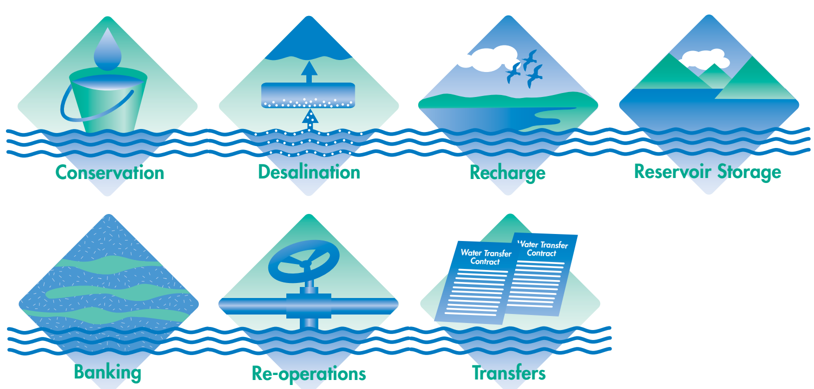
Building Blocks: This hybrid includes building blocks for conservation, recycling, recharge, groundwater banking, re-operations, and transfers.



Hybrid Portfolio #3: Minimize Cost Impacts

The Minimize Cost Impacts hybrid portfolio was constructed to meet the reliability target with the least total cost to the community and the District. Constructing this hybrid required two stages: ranking the building blocks according to unit cost, then iteratively determining the combination of building blocks that produced the lowest total portfolio cost. Iterations were required because building blocks interact with one another within portfolios, and the most cost-effective combination is not the same as the combination of building blocks with the lowest unit cost.

Building Blocks: This hybrid includes conservation, desalination, recharge, expanding existing reservoir storage, groundwater banking, re-operations, and transfers.

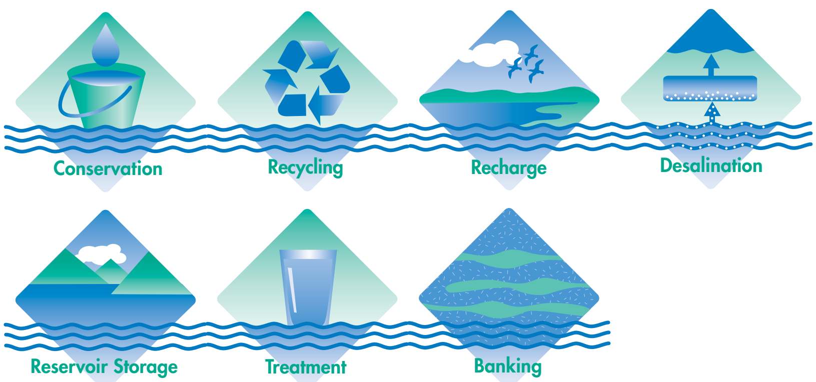


Hybrid Portfolio #4: Environment + Water Quality

This hybrid portfolio uses the Protect the Natural Environment hybrid portfolio

(#2) as a starting point, with modifications to enhance portfolio performance under the Ensure Water Quality planning objective. Hybrid #4 was developed iteratively by adding and subtracting building blocks until the reliability target was met and both water quality and environmental performance were improved relative to the original water quality and environment hybrids.

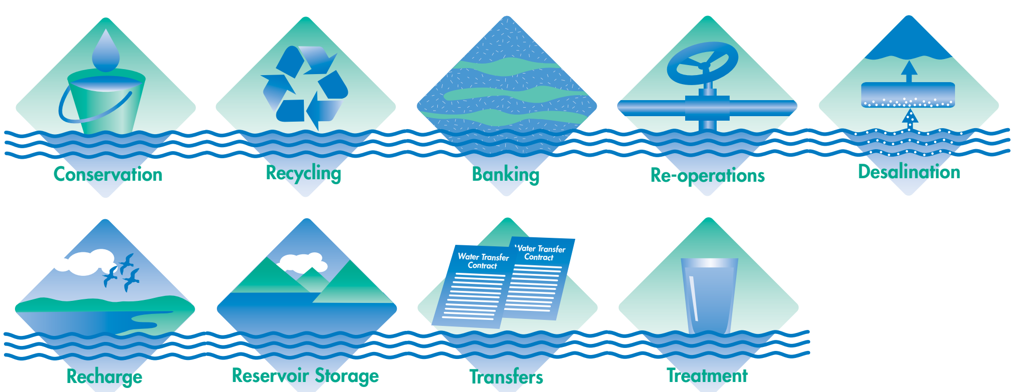
Building Blocks: Compared to hybrid portforlio #2, this hybrid adds Bay desalination, reservoir storage, treatment, and reduces the size of the additional groundwater banking.



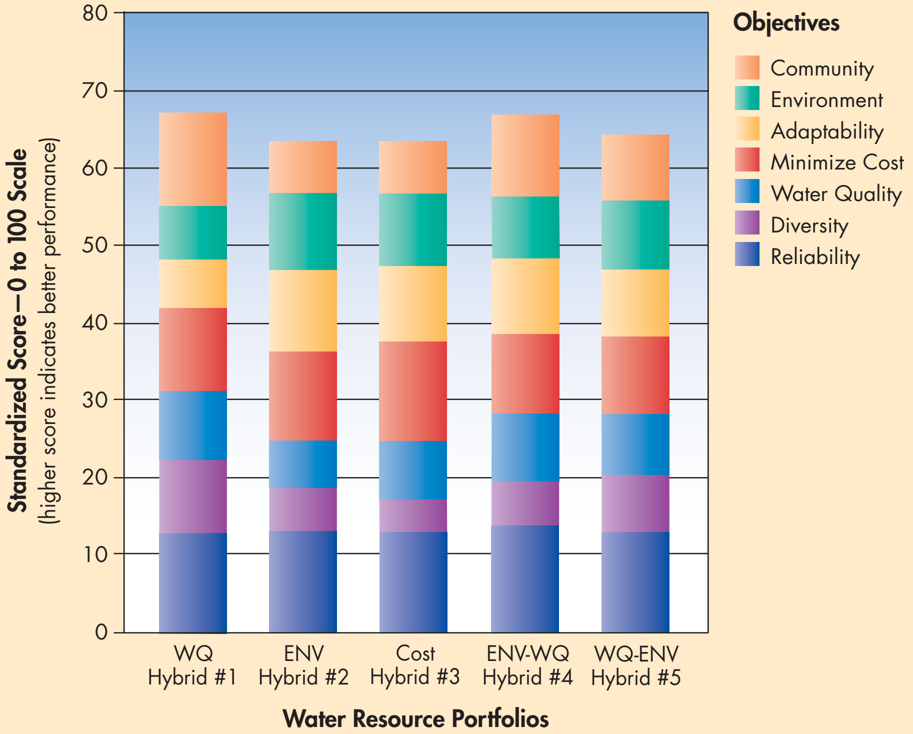
Hybrid Portfolio #5: Water Quality + Environment

This hybrid portfolio was constructed by starting with the Ensure Water Quality hybrid portfolio (#1) and then iteratively looking to improve performance under the Protect the Natural Environment planning objective.

Building Blocks: This hybrid uses less conservation and more recycling, removes the large local reservoir, adds the large groundwater banking program, and removes some re-operations, as compared to hybrid portfolio #1.



Hybrid Portfolio Scores *Figure 6-1*



Evaluation of the Hybrid Portfolios

Each of the five hybrid portfolios was structured to meet the same level of reliability, and the performance of each was judged based on its overall cost, diversity, adaptability, effects on water quality, environmental impacts, and community benefits (i.e., the planning objectives).

The best-performing hybrid portfolios include a combination of all-weather supplies, storage, and dry-year transfers. All three types of supply will be necessary to meet future water needs.

Portfolios were evaluated using the Extend simulation model, which simulates water demand and supplies under different hydrologic conditions and other scenarios. The results from Extend were converted into weighted scores ranging from 0 to 100 in order to make comparisons between the portfolios easier. Figure 6-1 shows the scores for the hybrid portfolios.

An interesting observation made during the portfolio analysis was that the weighting of the planning objectives did not significantly affect the portfolio scores. From a planning perspective, it's reassuring that the analysis is not overly sensitive to the importance attached to one objective over another.

The hybrid analysis illustrates which combinations of building blocks work well together and what is common among the best-performing hybrids for each planning objective.

Portfolio Findings

The portfolio evaluation revealed several important findings.

1. It pays to be reliable. The costs of ensuring reliability through the planning horizon are less than the costs of shortage.

The IWRP did not start out with a predetermined reliability target because the District wanted to learn more about the relationship between reliability and cost. The technical team varied the level of reliability and tracked the effects on portfolio costs using a consistent economic analysis.

The portfolio evaluation revealed that the highest-scoring portfolios met Countywide demand through the planning horizon and demonstrated excellent reliability at a lower community cost. The cost of available building blocks was less than the cost of shortage, making it more cost-effective to meet demand than to have demand reductions.

Based on this critical finding, the technical team established a reliability target for all portfolios of no more than a 20,000 af shortage in any year (roughly 5% of total demand), even under a repeat of the 1987–1992 drought. This target stems from the baseline assumption that the District could manage a water shortage up to 5 percent of total demand in any given year through demand reduction and voluntary cutbacks without significant economic losses to the community.

2. Portfolios should include investments in all-weather supplies, storage, and dry-year transfers.

Although reliability can be achieved in many different ways, the analysis showed that the best-performing hybrids each include a combination of additional all-weather supplies, storage, and dry-year transfers. This reflects the fact that while each building block can provide water supply benefits, each also has shortcomings and the true value becomes apparent when building blocks work together in portfolios.

- Dry-year transfers are the best way to achieve reliability for rare events.
- All-weather supplies and storage together are much more efficient than either alone. In tandem with storage, all-weather supplies provide greater benefits in dry years than their actual annual yield since they produce surpluses in wet years that can be stored for later use. However, relying

on an all-weather-storage combination for the prolonged severe drought is still not efficient.

- All-weather supplies and transfers complement each other, providing a way to minimize the use of expensive all-weather supplies and at the same time minimize risk associated with an increase in dependence on the Bay-Delta system.

Therefore, a complementary combination of all-weather supplies, storage, and dry-year transfers is necessary to provide a diverse and operationally flexible water system to meet future needs.

Drought tolerant plant

3. Although many different all-weather supply and storage building blocks can be used to ensure reliability, there are trade-offs among building blocks that impact other planning objectives.

Reliability can be met through a number of different combinations of additional all-weather supplies and storage, with dry-year transfers for rare events. However, each individual all-weather supply and storage building block has trade-offs. Therefore, building blocks may score well for one planning objective and poorly for another.

Conservation is present in all the portfolios because of its many benefits. In the portfolio analysis, using desalination to augment existing supplies performs better than recycled water because the projects would be located in North County (where most shortages after 2010 occur) and such augmentation can enhance water quality through direct use or blending with groundwater or treated water. Unlike desalination, many of the recycled water building blocks identified are situated in South County and offset groundwater used for irrigation. IWRP modeling suggests that South County will be prone to more frequent shortages in the future and recycling, as well as conservation, can address these frequent small shortages. An overdevelopment of recycled water, however, can result in underutilization of the groundwater basin in many years. Development of recycling should be closely coordinated with a groundwater management strategy. One South County groundwater/recycled water strategy involves connecting groundwater pumping to the surface water conveyance system in order to move water where it is needed in the County, while taking advantage of recycled water as a new supply.

The differences among storage alternatives, such as groundwater banking and additional local reservoir storage, are significant. Groundwater banking programs, such as the Semitropic groundwater bank, can be implemented quickly and expanded incrementally over time, whereas additional local reservoir storage requires a much longer lead time, has more adverse environmental impacts, and has greater costs. However, advantages of local reservoir storage include the ability to operate for water quality benefits and greater reliability under many risk scenarios, as local storage would be available when Delta water is limited due to environmental constraints, pumping limitations, or random outages.

4. High-scoring portfolios share common building blocks.

High-scoring portfolios ensure reliability through the 2040 planning horizon and score well for all seven planning objectives. The portfolio analysis revealed that water conservation, recharge, and dry-year transfer building blocks are common to all high-scoring portfolios.

5. Water reliability and water quality tend to drive the need for new investments, and neither is cheap.

The District draws on a variety of sources—groundwater, surface water, and recycled water—to meet water needs. Because treatment processes and water quality requirements differ for each supply source, a multipronged approach is needed that addresses source water quality, treatment processes, re-operations, and matches water quality to type of use.

Investments in these areas are expensive and securing funds in the future will be challenging and complex. The District is currently spending $275 million to upgrade its water treatment facilities to meet stricter standards established by the U.S. Safe Drinking Water Act. More stringent water quality standards now under consideration may trigger new investments in ultraviolet radiation, system re-operations, and groundwater treatment. Most recently, perchlorate has been discovered in South County wells and the District has committed time and resources to ensuring a long-term solution to this problem. Major investments in water quality improvements are essential for ensuring reliability.

6. It is difficult to meet all three environmental sub-objectives.

Many of the building blocks that score well for one environmental sub-objective do not score well for another sub-objective. Consider the case of expanding reservoirs. Increasing existing reservoir storage improves environmental water quality because raising dams creates deeper reservoirs where cooler water temperatures can be maintained and ultimately released to downstream creeks, benefiting valuable cold-water fisheries. However, additional storage inundates land and can negatively impact sensitive species and habitat.

7. Portfolios that score well for water quality also tend to have better diversity.

This is because both water quality and diversity are adversely impacted by increased reliance on dry-year Delta water. Local alternatives, like local surface reservoir storage and desalination, are favored by these two objectives. One exception, however, is water recycling. Although recycling contributes to supply diversity, questions remain about the groundwater quality impacts of extensive recycled water use for irrigation.

8. Portfolios that ensure water quality tend to be adverse to the environment, and vice versa.

Portfolios that score well under the Ensure Water Quality planning objective tend to include capital projects that may have adverse habitat impacts, such as Bay desalination and reservoir storage. Portfolios that score well under the Protect the Natural Environment planning objective favor groundwater banking over reservoir storage and include recycling building blocks that could adversely impact groundwater quality.

9. Future South County shortages can be met more economically with recharge and conservation than with a new South County water treatment plant.

The base case modeling had shown frequent shortages in South County under future demand conditions. The IWRP analysis compared three options for meeting those shortages: a South County surface water treatment facility, additional South County conservation, and additional South County groundwater recharge capacity. The results showed that a new South County plant would not be efficient in using imported and local water supply sources, and would result in underutilization of the groundwater basin. The technical team found that additional recharge capacity in combination with conservation can provide reliability for South County more economically, without adding a new demand to surface water supplies. New recharge facilities in South County would increase recharge capacity and would also allow for more rapid replenishment of local groundwater supplies after a drought. If, in the future, treatment is required due to groundwater contaminants such as perchlorate, well-head treatment is more economical than a surface water treatment plant when Countywide water reliability impacts are taken into consideration.

10. As the spot market is difficult to anticipate, it was used as a contingency tool rather than a building block.
The costs and availability of spot market water vary from year to year, something difficult to anticipate accurately in scenario planning. Like demand reduction programs, spot market transfers are more appropriately used as a contingency tool to reduce shortages that remain in a portfolio under unforeseen or extreme conditions. That being the case, whether to utilize spot market transfers is the purview of annual operations decision-making.

Next Steps

In the next chapter, the five hybrid portfolios, with their varying combinations of all-weather supplies, storage, and dry-year water, will be evaluated under different risk scenarios.

Chinook Salmon

7. Risk Analysis for the Water Resource Portfolios

The District developed a new risk analysis model to determine how selected risks could influence the frequency, magnitude, and costs of water shortages. The risks that were applied to the baseline water supply as described in Chapter 3 were subsequently applied to the water resource portfolios.

As described in Chapter 3, the District operates in an environment of uncertainty, including meteorological, technical, physical, and political risk factors that affect its ability to meet water supply planning objectives. While Chapter 3 presented an evaluation of the effects of various risks on the baseline water supply, this chapter evaluates the impacts of those risks on the water resource portfolios.

The Portfolio Risk Analysis

The five hybrid portfolios described in Chapter 6 were carried into the risk analysis to evaluate how well the building blocks in each responded to future uncertainty. The risk analysis for the hybrid portfolios used the same risk scenarios that were applied to the baseline water supply:

- Random risks, including
  - A major incident resulting in disruption of imported water supplies.
  - A halt in Delta export pumping to protect endangered fisheries.
  - San Luis Reservoir low-point disruption in CVP supply.
  - Market/contract cost increases for water transfers.
- H.O. Banks Pumping Plant pumping permit not increased.
- More stringent drinking water quality standards and emerging contaminants affecting both surface water and groundwater.
- Climate change resulting in decreased imported water deliveries and increased agricultural demands.
- Greater-than-expected water demand.

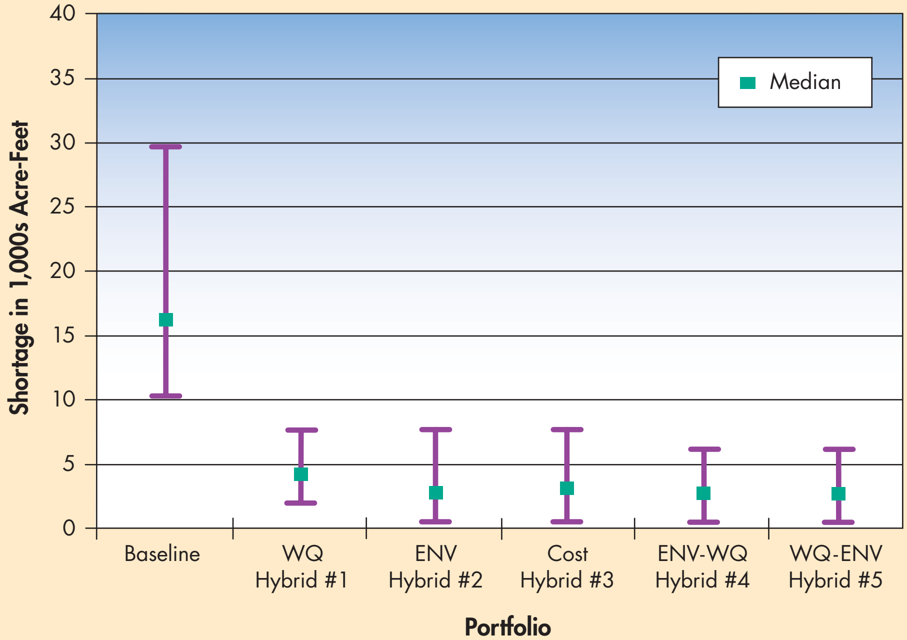
Under all risk scenarios, the hybrid portfolios performed better than the baseline condition, in that shortages were less frequent and less severe.

Portfolio Risk Analysis Findings

1. Through 2020, all portfolios are effective in reducing risk compared to the baseline condition.

As shown in Figure 7-1, all five of the hybrid portfolios are about equally effective in reducing risk through 2020. The figure shows the median shortages (when shortages occur) and a range of potential shortages (not including the most favorable or severe risk scenarios, as these occur very infrequently). Average shortages (when shortages occur) are less than half of those occurring for the baseline condition, with shortages occurring less than a third as often.

Portfolio Shortage Range Due to Risk (2011–2020) *Figure 7-1*



This figure shows the median shortage for the baseline and portfolios due to risk. Also shown is the range of potential shortages for each case.

2. Local building blocks (such as additional water conservation, groundwater recharge, recycling, desalination, and local surface storage) decrease vulnerability to risk.

Through 2020, all portfolios are effective in reducing risk compared to the baseline condition. Further out in the planning horizon, however, shortages for the portfolios vary widely according to how risk factors unfold.

The District's baseline imported water supplies, outside-County water banking, and water transfer agreements all rely on the Bay-Delta system, and there are several potential risks that relate to Bay-Delta issues. The risk analysis indicates that portfolios more reliant on local building blocks have fewer shortages than portfolios that depend mainly on water from outside the County because imported supplies are much more susceptible to impacts from global warming, an earthquake in the Delta, more stringent water quality standards, and the unsuccessful increase in pumping at the Banks Pumping Plant. In addition, local building blocks common to all hybrids, such as water conservation and groundwater recharge, go a long way toward increasing reliability, especially in South County.

While imported supplies are an essential component of the District's water supply, the risk analysis suggests value in the development of new local resources to decrease vulnerability to risk and minimize dry-year dependence on the Bay-Delta ecosystem. Therefore, the District should continue to explore local options, such as expanded conservation, groundwater recharge, water recycling, desalination, and local storage to promote greater resource diversity. Local storage may be the best alternative if any of these risks result in severe

long-term loss of imported water supplies, and if all-weather supplies are developed to a cost-effective maximum level.

3. Ensuring that existing supplies are available when needed offers the greatest protection against random risks.

The IWRP risk analysis revealed the importance of strengthening existing supplies and infrastructure as the District's best protection against random risks. Three areas are of key importance.

Infrastructure Reliability. A key assumption of IWRP 2003 is that local infrastructure will be reliable throughout the planning horizon. Through the Water Infrastructure Reliability Plan and the Asset Management Program, the District is currently evaluating the condition of existing District infrastructure, such as the water treatment plants and the water distribution system. These efforts will be vital to ensuring reliability of the treatment and conveyance systems during emergencies.

Groundwater Management. Protecting the local groundwater basins is critical to maintaining water supply reliability in the County, especially when random risks are considered. The basins supply nearly half of the water used annually in the County and also provides emergency reserve for droughts or outages. The District needs to verify that facilities are in place to utilize this resource during emergencies, particularly outages to the treated water system. IWRP 2003 recommends surveying the ability of existing water retailer wells to meet retailer needs in an outage, and adding District groundwater pumping that is able to serve the treated water distribution system with back-up supply.

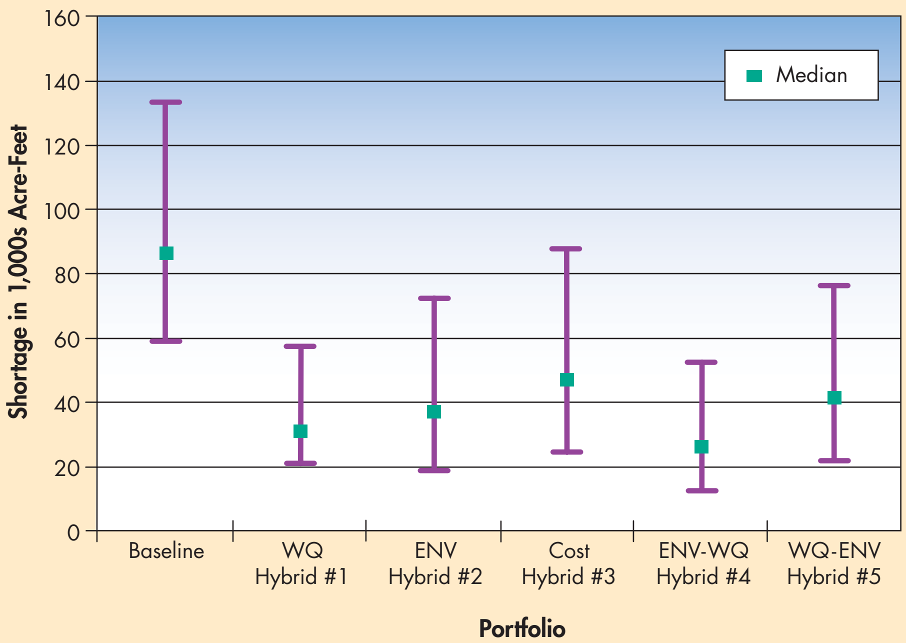
The District's vulnerability to risk of shortages can be decreased by developing new local water resources and safeguarding and strengthening existing local and imported water supply infrastructure.

Imported Water. The District should also safeguard our access to imported supplies. For example, the District and the other South Bay Aqueduct contractors are currently working with the DWR on resolving SBA infrastructure issues. Resolving the San Luis Reservoir low-point issue will be essential to ensuring that the District's deliveries of CVP water are not curtailed.

4. The lowest-cost portfolio is very vulnerable to risk.

The Minimize Cost Impacts portfolio was created to minimize cost by using only those building blocks necessary to meet the reliability target. Although the portfolio meets the reliability target and water supply needs, it does so with very little margin of safety, even when no risk is assumed. As many of the building blocks in this portfolio are related to imported supplies, such as the transfer

Portfolio Shortage Range Due to Risk (2031–2040) *Figure 7-2*



This figure shows the median shortage for the baseline and portfolios due to risk. Also shown is the range of potential shortages for each case.

market or water banking outside the County, they are more vulnerable to many risks than local supplies, as described above. The risk analysis reveals that while reliability can be met with the lowest-cost portfolio, this portfolio is extremely vulnerable to risk.

5. The range of risk through 2040 is wide. No single solution can best meet all needs throughout this broad range.

Depending on how future risks unfold, the frequency of shortages in the 2031–2040 decade can range from almost 50 percent of the time to over 90 percent of the time, assuming only the baseline water supply. Figure 7-2 shows the median shortages (when shortages occur) for the 2031–2040 decade. The figure also shows a range of potential shortages. The range does not include the most favorable or most severe risk scenarios as these occur very infrequently. A portfolio designed to meet the median risk condition could result in significant shortages or expensive overinvestment, depending on how the future actually unfolds. The range of possible shortages in the future supports the use of a scenario planning approach, as described in Chapter 8.

Next Steps

Chapter 8 describes the new investments necessary to manage risk through 2010, and maps out potential scenarios and strategies to manage a range of risk through 2040.

8. Investments and Actions to Ensure Water Supply Reliability

The portfolio risk analysis in Chapter 7 revealed a broad range of potential risks to the District's water supply and confirmed that it does not make financial sense to plan for the full range of risk with one set path of investments over the planning horizon. Accordingly, this chapter uses the tool of scenario planning to evaluate potential water supply strategies into the future. Using a phased approach, recommendations are made to help ensure reliability through 2010, through 2020, and from 2021 through 2040.

Why Scenario Planning?

IWRP 2003 relies on scenario planning to address water resource needs beyond 2010. Scenario planning helps the District to evaluate different future risk scenarios and develop a number of potential response portfolios to manage those risks, depending on how they unfold.

Much can change over 40 years, and no single plan can best meet the range of all possible futures that may unfold. It would be fiscally irresponsible to over-build the District's water supply facilities to meet every possible risk, especially given the current budget-conscious condition of the State of California and the District. It would also be irresponsible to ignore risk and hope for the best.

Scenario planning allows the District to look at a range of possible futures and evaluate the benefits of various water supply options. It helps the District identify options that are beneficial under a number of scenarios, and actions that are needed now to ensure that these options remain available to meet potential needs in later years. Scenario planning also shows what value today's opportunities may have later.

The Scenario Analysis

As an extension of the risk analysis, which looked at potential risks and their impacts, scenario planning helps the District to take the next step: to develop a number of potential response portfolios to manage different risk scenarios, depending on how they unfold. Seven risk scenarios are presented in this chapter, illustrating the range of possible risks:

- Random Risks Only
- Climate Change
- More Stringent Water Quality Standards
- No Expanded Banks Pumping Permit
- Demand Growth Greater than Projected
- No Expanded Banks Pumping Permit and Climate Change
- All Risk Events

Random occurrences, including a major disruption such as an earthquake, the San Luis Reservoir low-point problem, and pumping curtailment due to the presence of ESA-listed species in the Delta, are expected to occur; the only uncertainty is when. In the IWRP scenario planning, these random risks are grouped together and are included in the modeling of every risk scenario.

In addition to random risks, the other four risk factors identified in the risk analysis were carried through the scenario planning. The combination of climate change and the unsuccessful increase in pumping from the Banks Pumping Plant was included in the scenario planning to illustrate the water supply impacts from combined risks. Although the odds of all risks occurring concurrently are extremely low, an All Risk Events scenario was included to define the maximum possible risk assessed in the IWRP.

Response Strategies—A Phased Approach

A phased approach to future water resource investments will ensure reliability through 2040 while maximizing investment flexibility.

Which risk scenario ultimately comes to pass will have a significant impact on the water supply outlook and the response strategies (portfolios and other actions) the District will pursue to meet the needs of the community. In exploring potential responses, the IWRP calls for a phased approach to ensure water supply reliability while maximizing investment flexibility.

- **Phase I**
  Near-Term Water Supply Investments and Actions Through 2010
  The IWRP presents specific recommendations for investments and other actions to ensure reliability through 2010, where risks and opportunities are better understood.

- **Phase II**
  Flexible Water Resource Strategies (2011–2020)
  Using the tool of scenario planning, the IWRP provides a detailed analysis of potential water resource projects and possible strategies to meet demands further in the future, where risks are less understood.

- **Phase III**
  The Long-Term Outlook (2021–2040)
  The IWRP presents a general description of the types of investments that may be needed to ensure water quality and reliability in the long term, where uncertainty is the greatest.

Near-Term Water Supply Investments and Actions (Phase I)

The IWRP risk analysis revealed that random risks dominate through 2010, with shortages that are relatively small and infrequent. If the District does not implement any new water resource projects, the chance of shortage per year is 4 to 8 percent by year 2010, depending upon how risk factors unfold. To help formulate recommendations to ensure near-term reliability, the IWRP technical team identified building blocks common to the five high-scoring hybrid portfolios; these included option transfers, groundwater recharge, agricultural conservation, M&I conservation, and re-operations.

Using these common building blocks, the technical team created a "No Regrets" portfolio to help ensure reliability through 2010, under any risk scenario. This portfolio was nicknamed "No Regrets" because its implementation is unlikely to cause anyone to regret it later—the elements are cost-effective and environment-friendly. Although it does little to improve water quality, none of its elements degrades groundwater quality or impairs drinking water quality over the baseline condition. Lastly, the elements are flexible, with no major capital construction. The District costs for this improved supply reliability are expected to total $42 million (in real dollars), which includes improved capital infrastructure, O&M expenditures, and program implementation for the cost of the No Regrets portfolio. This would increase water rates by about $30 per af. The No Regrets portfolio includes the following:

- **Agricultural and M&I conservation for a total annual savings of nearly 28,000 af.** The agricultural building blocks include programs to increase agricultural water use efficiency in South County while the M&I building blocks include programs to increase water conservation savings in the residential, commercial, and industrial sectors. The cost to implement these new conservation programs through the decade is $7 million. The cost grows annually as successful programs are expanded and new programs are brought on-line. The costs for these programs ramp up annually from $535,000 in 2004 to $1.4 million by 2010.

- **Groundwater recharge capacity, including 4,500 af of instream recharge and 14,900 af of pond recharge (approximately 20,000 af annually).**
  Groundwater recharge building blocks include additional instream recharge capacity in the western and southern portions of the County and an additional 20 acres of groundwater recharge ponds throughout the County. The capital cost to develop four recharge facilities totals $27 million. This includes land purchases and construction.

- **An additional 60,000 af in water banking capacity.**
  This will increase the District's total in the Semitropic bank to approximately 200,000 af. The cost to vest an additional 60,000 af in storage in the Semitropic Groundwater Banking program is $8 million.

IWRP 2003 recommends a "No Regrets" portfolio of agricultural and M&I conservation, groundwater recharge, and water banking. With these measures in place, our water supply will be reliable through 2010. This portfolio also goes a long way toward meeting needs through 2020.

With the No Regrets portfolio in place, shortages through 2010 are reduced to levels that could be managed through contingency planning and response, including spot transfers or demand reduction. Beyond 2010, risk factors other than random risks become significant and there is no longer a single, simple solution or "one size fits all" approach to managing risk. By 2010, much more information will be available about which future scenario is likely to occur, making the District's choices of actions clearer.

Flexible Water Resource Strategies (Phase II: 2011–2020)

Figure 8-1 summarizes the shortage impacts for each of the seven risk scenarios for years 2011 to 2020, with the No Regrets portfolio in place. The range of shortages in the scenarios varies from a less than 1 percent chance of shortage in any given year, with an average shortage of 45,000 af (when shortage occurs) to a 27 percent chance of shortage with an average magnitude of 95,000 af.

Response strategies (portfolios) were built for each scenario except the All Risk Events scenario, which is unlikely to occur. Figure 8-2 shows some of the possible response strategies that may be required to ensure a high level of water supply reliability through 2020.

The selection and combination of building blocks in each portfolio were also evaluated and scored using the IWRP planning objectives. Appendix 8 summarizes how the portfolios performed as measured by planning objectives.

All of the response portfolios developed for Phase II include local re-operations and option transfers, building blocks common to the five high-scoring hybrid portfolios. The strategies outlined in Figure 8-2 are explained in more detail on the following pages.

- **Random Risks.**
  Addressing shortages from random risk requires relatively little additional investment: only water transfers and re-operations. If options agreements are available at reasonable cost compared to the spot market, options transfers provide a higher degree of certainty that the water will be there when needed at a predetermined price. IWRP recommends exploring some re-operation alternatives to ensure that water demand, including treated water deliveries, can be met with local water and groundwater should there be an outage in imported water deliveries due to random risks. Although this seems relatively simple, the IWRP 2003 analysis is predicated on the success of efforts to secure the baseline, as described in Chapter 2. The capital costs to implement water transfers and infrastructure re-operation projects are estimated at $21 million. This would increase water rates by $42 an af.

Shortage in Risk Scenarios for Years 2011 through 2020

(with No Regrets portfolio implemented) *Figure 8-1*

Risk Scenario	Frequency of Shortage (%)	Average Expected Shortage in Acre-Feet (when shortage occurs)
Random Occurrences	Less than 1%	45,000
Climate Change	2%	50,000
More Stringent Water Quality Standards	3%	60,000
No Expanded Banks Permit	5%	65,000
Demand Growth Greater than Projected	6%	80,000
No Expanded Banks Permit and Climate Change	7%	75,000
All Risk Events	27%	95,000

Random risks are included in every scenario.

New Investments Needed over Time *Figure 8-2*

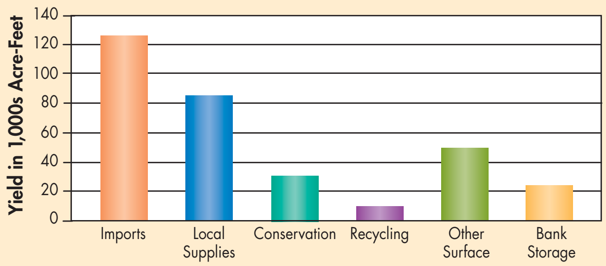
Current Baseline Supplies

Securing the Foundation

Phase 1 (2004–2010)

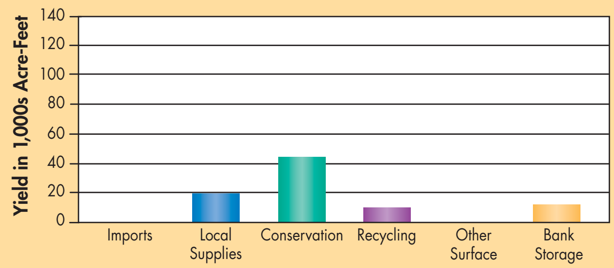
Recommended Near-Term Investments

Current Baseline Supplies—Dry-Year Yield



The single most important component of meeting future water needs is ensuring that the District's existing supplies, facilities, and programs perform as intended.

No Regrets Portfolio and Additional Baseline Commitments—Dry-Year Yield



The No Regrets portfolio includes modest additional investments in conservation, groundwater recharge, and water banking. These investments, in addition to the District's baseline recycling and conservation commitments, will help ensure reliability through 2010.

Notes

- *All quantities shown in 1,000s of acre-feet.*
- *Dry-year yield is the average annual supply that could be expected if the 1987–1992 hydrology were repeated.*
- *"Other Surface" supplies include Hetch-Hetchy and non-District water rights.*
- *Investments shown in each phase are in addition to those in the previous phase.*
- *All risk scenarios include random risks.*

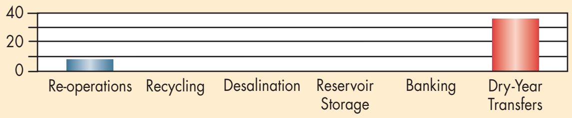
Phase 2 (2011–2020)

Possible Responses to Risk Scenarios

Phase 3 (2021–2040)

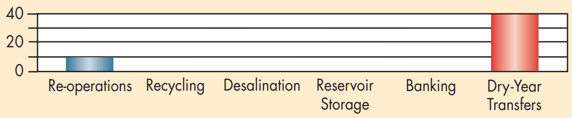
Keeping Options Open

Random Occurrences



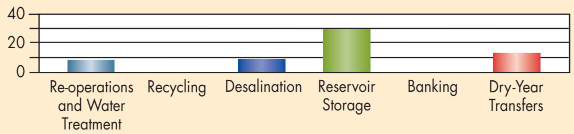
Will need additional storage or all-weather supplies by 2030. An expanded banking participation, a new 100,000 af reservoir, desalination, or recycling could all reduce shortages through 2030 to negligible levels.

Climate Change



Significant impacts from climate change beyond 2020 may require water treatment for salinity. All-weather supplies and storage will also be needed.

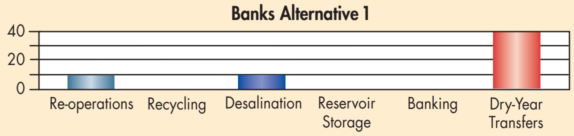
More Stringent Water Quality Standards



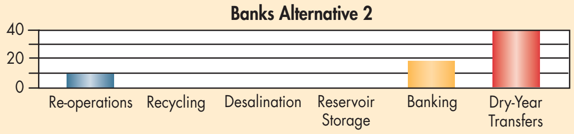
Implementation of CALFED reservoirs would improve water quality. Whether source quality improvements (re-operations, reservoir storage, or blending) are needed will be evaluated after the District's Treated Water Improvement Project is on-line in 2008.

No Expanded Banks Permit

Banks Alternative 1



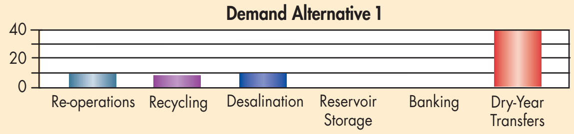
Banks Alternative 2



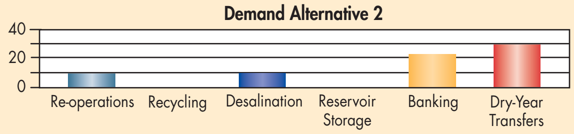
Beyond 2020, alternative 1, which includes desalination, is more effective than alternative 2, which includes water banking. However, even with desalination before 2020, additional all-weather supplies and storage are necessary after 2020. Recycling or other all-weather supplies may substitute for desalination if desalination is not shown to be feasible in further study.

Demand Growth Greater than Projected

Demand Alternative 1



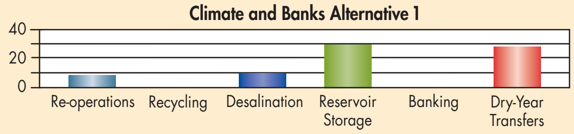
Demand Alternative 2



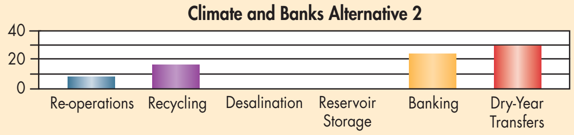
Beyond 2020, additional all-weather supplies will be necessary. This may require additional building blocks above those identified in IWRP 2003, such as advanced treatment of recycled water for groundwater recharge or aggressive desalination. Additional storage will also be needed.

No Expanded Banks Permit and Climate Change

Climate and Banks Alternative 1



Climate and Banks Alternative 2



Impacts from this risk scenario may require water treatment for salinity beyond 2020. Additional all-weather supply will be required before 2030.

Rinconada Water Treatment Plant

- **Climate Change.**
  Global warming is not expected to have significant water supply impacts before 2020 since this phenomenon and its effects are growing gradually. Thus, the only building blocks needed before 2020 are those identified for the random risk scenario.

- **More Stringent Water Quality Standards.**
  Changes to the arsenic standard will require some degree of wellhead treatment, and changes to the bromate standard are expected to require UV treatment at the water treatment plants. The degree, to which UV treatment augments the treatment plant improvements currently under way (TWIP 2), will be much better understood after TWIP 2 is on-line in 2008. Relatively simple actions such as pH suppression combined with ozonation go a long way toward improving the treatability of high-bromide water, but how this figures in with recent cryptosporidium inactivation requirements is less clear, making it difficult to identify a complete response portfolio to the more stringent water quality standards. Other strategies may be required, such as a reservoir for blending or source water protection projects. The capital cost to implement a multipronged strategy for water quality approximates $850 million with an estimated rate impact of $275 per af.

As shown in Figure 8-2, two alternate responses were identified for each of the following scenarios. Through 2020 at least, these alternatives resulted in similar reliability improvements, although their costs and other impacts differ.

- **No Expanded Banks Pumping Permit.**
  If the pumping permitted from the Banks Pumping Plant is not increased, either additional banking or desalination can improve reliability through 2020. The capital costs for these two alternatives are $50 million (banking) and $123 million (desalination), with a corresponding rate impact of $45 per af and $100 per af.

- **Demand Growth Greater than Projected.**
  This risk factor presents the biggest challenge in the long term. Maintaining water supply reliability would be best handled by additional all-weather supplies (desalination or recycling) to offset the magnitude of increased

demand because all-weather supplies are reliable in every year and therefore could effectively match the increase in demand. As shown in the figure, water banking can also be beneficial in combination with desalination. The capital costs for these two alternatives range from $130 million to $183 million, with a water rate impact of $105 per af to $120 per af.

- **No Expanded Banks Permit and Climate Change.** In this case, transfers, storage, and all-weather supplies may be necessary before 2020. Storage could be either a new local reservoir or additional banking, while all-weather supplies could be either in the form of recycled water or desalination. The capital costs range for these two alternatives range from $172 million to over $650 million, with a corresponding water rate impact of $100 per af to $240 per af.

Because the All Risk Events scenario is unlikely to occur and includes all the uncertainties inherent in each of the risk factors, identifying options needed for this combination scenario is speculative. However, if this scenario does come to pass, more investments, especially all-weather-supply investments, will be needed in the long term than were identified in IWRP 2003 as building blocks.

Figure 8-3 summarizes the range of possible building block investments that may be needed between 2011 and 2020. In the best-case scenario, only option transfers may be needed through 2020. Alternatively, under less favorable scenarios, up to 100,000 af of additional surface storage, 150,000 af capacity in groundwater storage, and up to 26,000 af of additional all-weather supply may be needed, in addition to the option transfers.

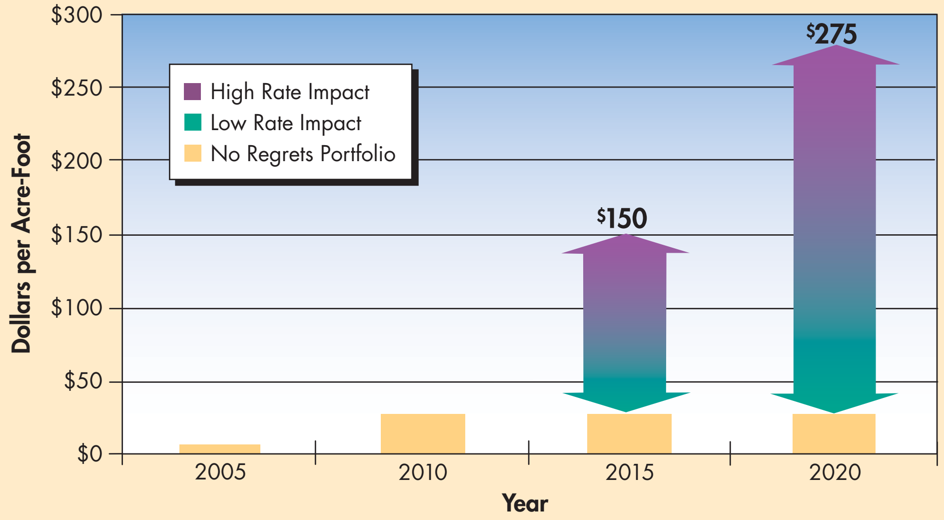
Range of New Supply Investments (2011–2020) *Figure 8-3*

Potential Range of Additional Supplies
(over Baseline and No Regrets portfolio)

- Recycling = 0 to 26,000 acre-feet/year
- Desalination = 0 to 10,000 acre-feet/year
- Options Transfers = 40,000 acre-feet/year*
- Surface Storage = 0 to 100,000 acre-feet (total capacity)
- New Banking = 0 to 150,000 acre-feet (total capacity)

**Represents dry-year supply*

Range of Potential Rate Impacts from IWRP Investments *Figure 8-4*



The scenario planning revealed that once the District implements the cost-effective projects in the No Regrets portfolio, the District will have to look at other, more expensive, investments to help ensure water supply reliability in the future. Figure 8-4 shows potential effects on water rates as a result of new investments needed to achieve reliability through 2020.

The low-impact scenario includes new investments in re-operations and transfers, and can be accomplished without huge capital outlays and with only slight increases in water rates through 2020. If higher-impact conditions materialize, future investments will be significantly more expensive because a mix of costly all-weather supplies and storage will be needed to meet demands in average and dry years.

The Long-Term Outlook (Phase III: 2021–2040)

Planning for 20 to 40 years in the future requires significant flexibility as risks and opportunities are not fully understood and because actions and decisions in the near term can significantly affect the future water supply outlook. Risks such as climate change, changes in water quality standards, an unsuccessful Banks expanded pumping permit, and demand growth greater than projected all have the potential to impact District supplies in the long term, although the degree of impact is unknown at this time.

IWRP 2003 uses the tool of scenario planning again in this phase to evaluate potential risks and their associated water supply impacts. Since it is unknown at this time what responses will be implemented before 2020, IWRP 2003 does not present specific recommendations for investments beyond year 2020. Rather, it presents general descriptions of the types of investments that may be needed to manage these risks in the more distant future (see Figure 8-2). For all the risk scenarios, the response beyond 2020 will require some additional all-weather supplies or storage to meet needs and ensure water supply reliability. Under the best cases, more all-weather or storage will be required. If land use decisions result in development beyond that included in the IWRP analysis, additional all-weather supplies will be necessary to offset the impacts of the additional water need. Determining the best response to more stringent water quality standards for bromate is best pursued after the completion of the District's Treated Water Improvement Program in 2008.

The development of District projects and programs to meet needs beyond 2020 must take into account the evidence of global warming, its impacts on water quality and potential salt water intrusion, its impacts on imported and local water supplies and the water transfer market, and federal and state legislative, regulatory, and project responses. Under any climate change—impacted scenario, the District may need to consider additional treatment options to respond to water quality impacts such as increased salinity in the Delta, additional storage to take advantage of more wet-season water, additional all-weather supply to replace reduced water supply from existing sources, and additional water transfers (depending on water market impacts).

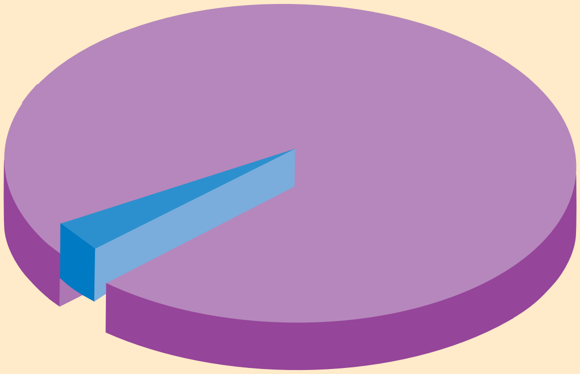
IWRP Response in the Broader District Context

The IWRP analysis of the need for future investments and the costs of those investments must be viewed in a broader context: in light of other water utility program commitments, and with a recognition of drivers outside the IWRP framework that also influence the choice and timing of investment decisions.

Related Investments

While the No Regrets portfolio has relatively small impacts on water rates in the near term, the District faces other financial challenges to meet overall water objectives. Pressure on the budget will continue to rise as the District brings new facilities on-line, retrofits infrastructure, implements creative water management programs, and responds to emerging water quality and environmental requirements. At the same time, financial resources available to both the District and its retailers are limited, and difficult choices will have

Near-Term Comprehensive Reliability *Figure 8-5*



- Ongoing operations and programs.
- Successful resolution of the San Luis Reservoir Low-Point Improvement Project.
- Infrastructure improvements resulting from the Water Infrastructure Reliability Plan and Water Utility Asset Management Program.
- Completion of the Treated Water Improvement Project at the three District water treatment plants.
- Implementation of the Fish Habitat Management Plan to restore local populations of steelhead trout and fal-run Chinook salmon.
- Resolution of perchlorate contamination issues in South County.

IWRP investments No Regrets portfolio

Although IWRP near-term investments seem relatively simple, the IWRP 2003 analysis is predicated on the successful completion of other foundational efforts to secure the baseline water supply, infrastructure, and programs.

to be made to live within our means and in accordance with Board policy to not spend "extravagantly, inefficiently, or in ways more costly than necessary."

Figure 8-5 illustrates IWRP No Regrets portfolio investments relative to other critical resource needs to ensure near-term comprehensive reliability. The District must be certain that it is making an adequate investment in both new facilities and those already in service, protecting health and safety, and ensuring delivery availability and reliability. Significant investments are necessary to preserve and maintain District assets and water resources, as shown in Figure 8-5.

Upcoming Decisions

In addition to the investments described above, the District must make a number of decisions within this decade that will impact investment choices and future water supplies. For example, the District has the option to expand its participation in the Semitropic Water Banking program up to 350,000 af of capacity. Unfortunately, this option expires in 2006, requiring a decision to be made before many of the expected risk trigger events occur. Another example relates to the local surface storage building block. One possibility is participation in the expansion of Los Vaqueros Reservoir, currently being studied as part of CALFED. The District will need to decide whether to participate in this project in the near future, comparing this alternative to possible sites in Santa Clara County, other possible regional projects, or no additional surface storage at all.

The IWRP recommends that these upcoming decisions be evaluated in the context of the IWRP planning framework, which allows comparison of potential projects for water supply impacts. The timeline for upcoming decisions and external triggers that could impact available supplies is shown in Figure 8-6.

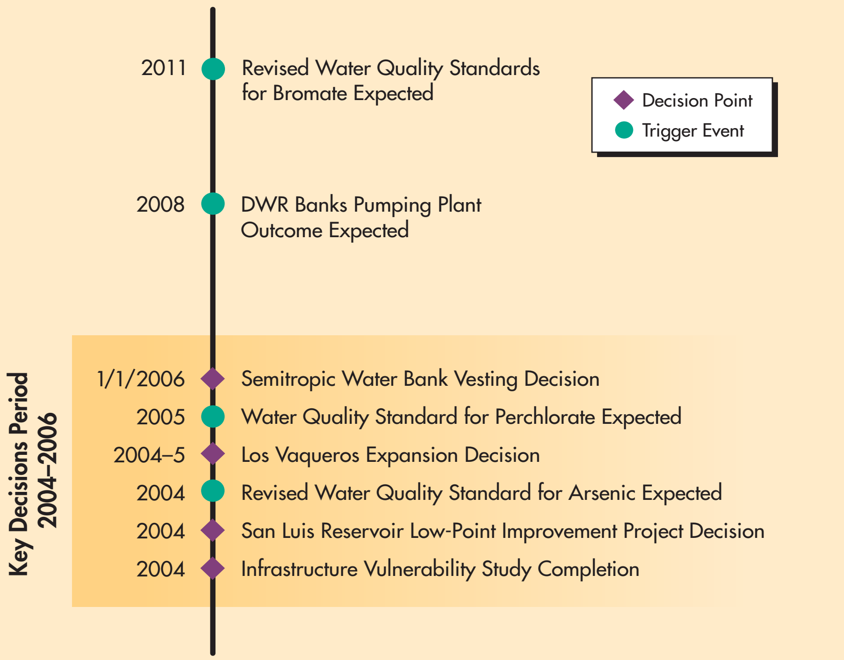
Findings

The key findings related to investments and other actions to ensure reliability are summarized below.

1. Near-term IWRP investments will need to be augmented with significant investments in other District projects currently under way to ensure comprehensive reliability.

While the investments recommended in the No Regrets portfolio will help the District to ensure reliability through 2010, they are only part of the solution.

Upcoming Decisions Facing the District *Figure 8-6*



Comprehensive reliability will only be achieved through significant improvements in infrastructure (based on findings of the Water Infrastructure Reliability Project and the Asset Management Program), the successful resolution of the San Luis Reservoir Low-Point Improvement Project, and the completion of water quality improvements at the District's three water treatment plants. Although the programs in the No Regrets portfolio are cost-effective and are not expected to result in significant rate impacts, programs and projects necessary to ensure comprehensive reliability will have significant costs.

2. Other considerations may require decisions on investments sooner than specified in the IWRP 2003 phased-response approach.

As explained previously, in the near future the District will need to decide whether to expand its participation in the Semitropic Water Banking program up to 350,000 af of capacity and whether to participate in the expansion of Los Vaqueros Reservoir. Other decisions likely to arise in the next few years include defining the District's interest in recycling programs like the South Bay Water Recycling Program and potential regional programs such as desalination.

3. IWRP investments beyond the near-term No Regrets portfolio will be more expensive.

The IWRP recommends that the District implement the cost-effective projects and programs in the No Regrets portfolio by 2010. Beyond 2010, the risks of unanticipated changes in demand, more stringent water quality standards, and an unsuccessful expansion of the Banks Pumping Plant may trigger the need for significant investments in more expensive all-weather supplies and storage. These investments to ensure high-quality, reliable water may cause rate increases from IWRP as high as $150 per af by 2015 and over $275 per af by 2020.

4. Scenario planning reinforces the need for investments in all-weather supplies, storage, and dry-year transfers to meet future water supply needs.

In the scenarios with less risk, either all-weather supplies or storage can be used with dry-year transfers. As risk increases, both all-weather supply and storage building blocks are necessary in addition to the dry-year transfers. The District has choices in how to address future needs; as discussed in previous chapters, there are advantages and disadvantages among the all-weather supply and storage alternatives.

5. The most severe risk scenarios may require additional building blocks not defined in IWRP 2003.
The more extreme risk scenarios require additional all-weather supply beyond those building blocks defined in the IWRP. These supplies, if needed, may come from expansions of building blocks already defined, such as desalination or recycling, or new opportunities not yet known.

Next

Chapter 9 summarizes the recommendations presented in IWRP 2003.

9. Recommendations

The main outcome of IWRP 2003 is the development of a planning framework and new tools to evaluate water supply alternatives. Thanks to the flexibility of the District's water supply system, a wide variety of water supply resources are available, and the District has choices in how to meet long-term water needs. Although the future is uncertain, the District has enough information to take action now to ensure future water supply reliability. Specific recommendations are summarized below.

Board Policy and IWRP 2003 Recommendations

Board Policy

Staff made presentations to the District Board of Directors to inform them of key findings of IWRP 2003. In December 2005 the Board adopted revised water supply policies based on their discussion of the IWRP 2003, staff recommendations, and input from Board Public Advisory Committees. The adopted policies are presented below:

2.1 There is a reliable supply of healthy, clean drinking water.

2.1.1 The water supply meets or exceeds all applicable water quality regulatory standards in a cost-effective manner.

- 2.1.1.1 Local drinking water source quality is protected and improved in a cost-effective manner.

2.1.2 The water supply is reliable to meet current demands.

2.1.3 The water supply is reliable to meet future demands in Santa Clara County, consistent with the County's and cities' General Plans and other appropriate regional and statewide projections.

- 2.1.3.1 Baseline water supplies for Santa Clara County are safeguarded and maintained.
    - 2.1.3.1.1 Local water supplies are sustained.
    - 2.1.3.1.2 The integrity of the District's existing Water Utility infrastructure is maintained.
    - 2.1.3.1.3 Imported water supplies and quality are protected and maintained.

2.1.4 There are a variety of water supply sources.

- 2.1.4.1. The District's variety of water supply sources is protected.
- 2.1.4.2 The District's water supply sources are further diversified by making new investments in a mix of all weather supplies, storage, and dry year transfers or option agreements.

E 2.1.5 Groundwater resources are sustained and protected for water supply reliability and to minimize land subsidence.

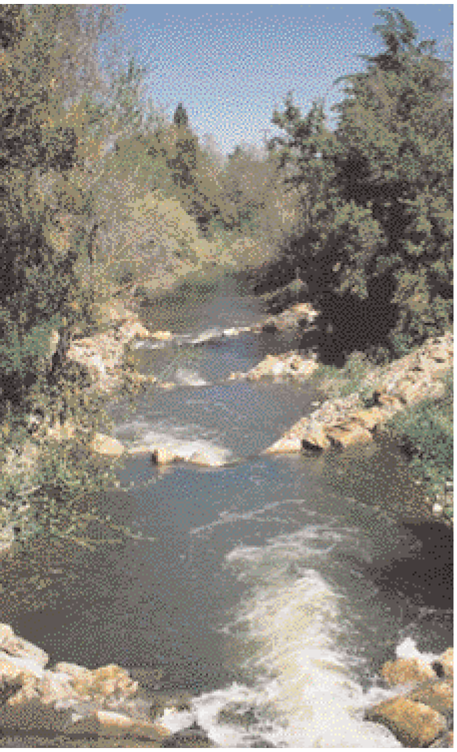
E 2.1.6 The groundwater basins are aggressively protected from contamination and the threat of contamination.

E 2.1.7 Water recycling is expanded within Santa Clara County in partnership with the community, consistent with the District's Integrated Water Resources Plan (IWRP), reflecting its comparative cost assessments and other Board polices.

2.1.7.1. Target 2010, water recycling accounts for five percent of total water use in Santa Clara County.

2.1.7.2. Target 2002, water recycling accounts for ten percent of total water use in Santa Clara County.

E 2.1.8. Water conservation is implemented to the maximum extent that is practical.



Guadalupe River fish pools

IWRP 2003 Recommendations

Staff recommendations from IWRP 2003 are summarized below and are categorized as staff work or process recommendations.

Staff-Work Recommendations

IWRP 2003 identifies specific investments and actions needed to ensure reliability through 2010, including securing the baseline water supply and investing in the No Regrets portfolio. In addition, the District must prepare now to make the harder decisions that will be necessary to meet water demand beyond 2010. Actions the District can take now to help ensure long-term water supply reliability include the following.

1. Safeguard and maintain existing supplies, infrastructure, and programs to ensure their long-term viability.

As discussed in Chapter 2, the majority of water for meeting future needs will come from the District's existing water supply baseline. To secure this baseline, IWRP 2003 recommends the District take the following actions:

- Protect imported water supplies by resolving contract and policy issues, by supporting Bay-Delta system improvements, and by resolving the San Luis Reservoir low-point problem.

additional groundwater recharge, investigation of additional conjunctive use, and the expansion of monitoring programs as necessary.

- Uphold the ability to provide clean, safe drinking water and to meet and exceed water quality standards through aggressive source water protection and ongoing improvements to treatment facilities.

- Shore up existing infrastructure based on the recommendations from the Water Infrastructure Reliability Plan and the Asset Management Program.

- Protect streams, fisheries, and natural habitat by taking a science-based watershed approach to new environmental issues as they emerge and through the development of a Habitat Conservation Plan/Natural Communities Conservation Plan (HCP/NCCP).

2. Invest in the No Regrets portfolio to help ensure water supply reliability through 2010.

In addition to securing the water supply baseline, implementation of the No Regrets portfolio will ensure future reliability through 2010 and perhaps 2020, depending on how risk factors unfold. The No Regrets portfolio, presented in Chapter 8, calls for new investments in conservation, groundwater recharge, and water banking as follows:

- 28,000 af annual savings from agricultural and M&I conservation
- 20,000 af additional groundwater recharge capacity
- 60,000 af additional capacity in the Semitropic Water Banking Program

3. Evaluate opportunities to improve reliability through transfer and re-operations alternatives.

IWRP 2003 identified dry-year water transfers as an important component of long-term water supply, but other transfer alternatives can be beneficial as part of the water supply portfolio. For example, wet-year transfers can be more cost-effective and of better water quality than dry-year water. However, the usefulness of the transfer depends on conveyance capacity and storage capacity being available at the time. The District should evaluate whether existing infrastructure allows the operational flexibility necessary to move and store water when it is available.

Adjusting a sprinkler

Other opportunities to increase operational flexibility and improve reliability include re-operations alternatives. For example, the ability of the water retailers to switch to groundwater supplies in an outage varies. The District is currently exploring the development of District-owned well fields capable of tying into the existing treated water distribution system. IWRP 2003 recommends that this, and other re-operations alternatives that may improve the District's operational flexibility and water supply reliability, continue to be explored.

Recycled water pumps

4. Resolve water quality and market issues related to recycled water to evaluate the potential for expanded use in the future.

Twelve potential recycled water projects were evaluated as building blocks in the IWRP analysis. However, no additional water recycling projects beyond baseline commitments were included in the No Regrets portfolio, developed to help ensure water supply reliability through 2010. This is because conservation, groundwater recharge, and banking were able to meet near-term needs better than additional recycling, as measured by the IWRP planning objectives. However, additional water supply investments will be required beyond 2010, and recycled water remains a potential future investment to meet long-term needs.

The District's Advanced Treated Recycled Water Study is nearing completion and its conclusions thus far indicate that advance-treating currently produced recycled water will improve the quality of the water, making it suitable for all intended uses. IWRP 2003 recommends

- Further study of advanced treatment
- Engaging the public to avoid hurdles in recycled water perception and acceptance
- Seeking funding for advanced treatment projects and other recycled water projects

Taking these steps now will prove valuable if the District contemplates expanding recycled water use over unconfined areas as well as indirect potable reuse in the future.

seasons, when imported water quality is poorer. Regional alternatives, such as CALFED's proposed expansion of Los Vaqueros Reservoir, are being monitored and evaluated to determine the costs and benefits of District participation. CALFED currently is supporting research into how different water treatment technologies can address high total dissolved solids and bromides.

7. Monitor risks that can change the water supply outlook and influence key external decisions to the extent possible.

The IWRP risk analysis and scenario planning highlighted the need for District vigilance in monitoring for risks that can change the water supply outlook and challenge the reliability of the District's water supply. For example, failure to expand the pumping capacity at the Banks Pumping Plant would pose a significant challenge in meeting water needs through 2020 and beyond. The District must monitor, support, and influence (to the degree it can) the decision to allow expansion of the Banks facility, in order to maintain the District's expected imported water allocation.

Staying abreast of the available science and local consequences of global warming can facilitate an appropriate District response. Consideration of the following are critical: the evidence of global warming; its impacts on water quality, water demand, potential salt water intrusion, imported and local water supplies, and the water transfer market; and, federal and state legislative, regulatory, and project responses.

Land use, demographic projections, and water use patterns can all change with time. For these reasons, the District must remain committed to monitoring land use development and water demand. The water demand projections used by the District will be updated in 2004–2005.

Other issues the District must monitor include risks to imported, local surface, and groundwater source quality, and the current science of the health impacts of trace and emerging constituents. The District is studying potential changes in water quality standards and how these changes may impact its ability to provide high-quality drinking water.

8. Strengthen statewide and regional partnerships to support improvements to water supply reliability and water quality, and to garner support for new investments.

Regional partnerships are key to the successful implementation of many of the potential water supply improvements identified in IWRP 2003. In fact, some building blocks, like new reservoir storage, are probably more politically feasible if pursued regionally. Regional partnerships can help the District gain a competitive edge for garnering political and financial support. In order for the District to succeed, it must remain involved in statewide and regional efforts such as

- CALFED
- San Francisco Bay Area partnerships, such as Bay Area Water Agencies Coalition (BAWAC)
- Partnerships to the south with cities and agencies in San Benito County and the Pajaro Valley

9. Look for technology changes that improves project feasibility and decreases costs.

Technological improvements in recent years have made recycled water and desalination more cost-effective and practical. The nature of future technology changes is hard to anticipate, but many technology advancements are expected to continue. Improvements are also possible in more everyday areas, such as new household fixtures that save water (much as front-loading washing machine technology has provided new savings opportunities in recent years).

10. Improve planning to guide future District water conservation efforts.

The District is committed to an aggressive water conservation program, and an ability to estimate actual water savings from such programs continues to improve. The District is currently performing a Water Use Efficiency Baseline Study to show where these programs are doing well and where there is room for additional water savings. This comprehensive survey will provide the specific data needed to streamline the District's current programs and to develop a Water Use Efficiency Master Plan to guide future water conservation efforts, consistent with the recommendations of IWRP 2003.

11. Study supply and demand in South County to evaluate potential water resource impacts from development.

The City of San Jose has defined a "Coyote Valley Vision" that adds significant new development to the Coyote Valley. IWRP 2003 took a broad look at whether the demand for this Vision could be met with the County's water supplies. An evaluation, of whether the infrastructure or the Coyote groundwater subbasin is able to support the new demand in that location, is beyond the scope of the IWRP. Additional studies are necessary to better understand and model the natural groundwater recharge and the operational storage in South County, and the ramifications of the development plans on the South County water supply.

12. Explore water management tools such as water pricing structures that create incentives to influence water use.

The District is evaluating management tools that could be used to create incentives to influence water use, such as water pricing structures, as well as other potential mechanisms to protect groundwater resources and to promote equitable cost allocations.

13. Develop demand reduction contingency planning with County retailers to improve response during droughts or unforeseen events.

The IWRP 2003 reliability target includes no more than a 5-percent shortage in any year, assuming future droughts are similar to those observed historically. But in actual operations, it is possible that droughts worse than historical, or other unforeseen catastrophes, may occur. How such events will be faced is the purview of contingency planning. The District will update its contingency plans in coordination with the local water retailers as part of the Urban Water Management Plan Update, due in 2005.

IWRP Process Recommendations

1. Use the IWRP 2003 planning framework and related tools to provide ongoing analysis of potential water resource projects.

IWRP 2003 is not a rigid water supply blueprint, but rather a framework for providing a fair and consistent comparison of investment alternatives. The framework and related tools are not static; they can be used to analyze new potential projects or opportunities as they arise. It is recommended that these tools be used to provide ongoing analysis of potential water resource projects to help guide decision-making.

2. Improve modeling capabilities to simulate more complex water system operations and to include water quality goals.

As water system operations become more complex, more complex tools are required to simulate them so that opportunities to optimize water supply surpluses and droughts can be identified. For example, the recent FAHCE negotiations require more complex operations at the District's local reservoirs than can be captured by the District's existing simulation model. New tools to model operations, including water quality goals, will be developed in 2004–2005.

3. Continue stakeholder involvement.

The IWRP 2003 planning framework and evaluation tools are intended to assist in ongoing analysis of water supply alternatives and challenges. The stakeholders involved in IWRP 2003 expressed a strong desire for continuing participation in the IWRP process as new and potential projects arise. For future updates the District will involve stakeholders and will use the IWRP planning framework and evaluation tools.

5. Explore the feasibility of desalination through studies to confirm potential quantities, public acceptance, and costs.

In the IWRP analysis, desalination is seen as a promising way to expand supply diversity and increase water reliability through a new source of high-quality potable water in the long term. Of the IWRP building blocks studied, however, desalination is the least clearly defined, and estimates of costs and feasibility were based on projects under development in Southern California. IWRP 2003 recommends additional feasibility studies to confirm the potential quantities, public acceptance, and costs for both brackish groundwater desalination and seawater/Bay desalination in the District's service area.

District staff is working on brackish groundwater desalination research studies through premier research universities like Stanford University, using District funds and grant money from DWR. The District is partnering with the San Francisco Public Utilities Commission, the East Bay Municipal Utilities District, and the Contra Costa Water District to explore the feasibility of a regional desalination facility. The District is also exploring grant funding and potential institutional arrangements for establishing equitable benefits and costs to partnering agencies. IWRP 2003 recommends that this work be continued to understand the feasibility of desalination for the District.

6. Investigate drinking water quality improvement alternatives to ensure the continued delivery of high-quality drinking water.

District staff and IWRP stakeholders agreed that ensuring water quality is critical to overall water supply reliability, as reflected in the top-tier ranking of the water quality planning objective. Chapter 2 described the need to secure and strengthen the District's baseline efforts to protect and improve water quality, including the Treated Water Improvement Project and source water protection activities. Additional alternatives for improving drinking water quality should be studied, including blending, new treatment technologies, the re-operation of local reservoirs, and regional storage projects.

For example, one way to address the bromide concentration in imported water is to blend the source water for the water treatment plants with other source waters, such as local surface water or groundwater. Given the right opportunity, existing local water storage can also be operated for water quality benefits by the District's releasing of water when quality is good for use during dry years or dry

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