Sustainable Use of Water

California Success Stories

Executive Summary/Introduction
January 1999

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Executive Summary

The intense political and legal battles that have characterized California water policy throughout the 20th century have not ended—nor are they likely to end in the near future. But unexpectedly, with little fanfare or attention, California is moving toward more sustainable water management and use. In 1995, the Pacific Institute published *California Water 2020: A Sustainable Vision*, which presented a positive vision of where California water resources could be in the year 2020 and a detailed analysis of how to get there using existing and proven economic incentives, efficient water technologies, and innovative governmental and non-governmental management practices. That analysis offered compelling support for the argument that alternative approaches to water planning and use can be—and have been—very successful.

As a follow-up to the 1995 report, the Pacific Institute now offers *Sustainable Use of Water: California Success Stories*: 28 successful, informative, and educational examples of collaborative water planning, effective institutional and governance structures, intelligent use of technology or economic incentives, and environmental protection and restoration in areas where deadlock and litigation used to be the norm.

These "success stories" identify, describe, and analyze examples of sustainable water policies and practices in the state and show water managers, policymakers, and the public how to move California toward more equitable and efficient water management and use. As we stated in our 1995 report, long-term sustainable use of water does not require drastic advances in technology or heroic or extraordinary actions. Instead it requires an ethic of sustainability and the will to continue expanding positive trends that are already underway. These "success stories" offer lessons for the rest of us—lessons about what works and why, and how we might begin to solve our other water problems.

The 28 success stories described here are the tip of the iceberg. In communities around the state, smart and committed individuals and groups are getting together to take water policy into their own hands. The result is a growing movement away from state or federally sponsored programs and policies and toward regional and local watershed and community actions, though several successful state and national activities are also described here. As a result, official state water policies now often lag behind—rather than define—the state-of-the-art. The official California Water Plan, for example, fails to acknowledge these many successful activities or to incorporate them into its projections for California's water future. Integrating the lessons learned from these success stories into long-term policy and planning could lead to a very different California—one where efficient, equitable, and sustainable water uses are the norm, rather than the dream.

In compiling these 28 stories, several common themes and factors for success became clear. We describe these lessons and offer some common-sense recommendations for others interested in emulating the successes described here.

Lessons and Recommendations

The most successful water projects have individuals andgroups with different agendas working together to meet common goals.

Almost all successful water projects brought competing and conflicting stakeholders together in cooperative arrangements. Cooperation, rather than confrontation, led to an understanding of different points of view and a willingness to explore compromises and creative solutions that benefited all parties. Nearly every successful partnership had an individual or individuals strongly committed to the project. In many cases this leadership was vital for managing any stakeholder conflicts that did arise and keeping the project alive.

The effort to split water stakeholders into ‘‘special interest groups’’ should be resisted.

All critical water planning and decision-making efforts need to invest sufficient time and effort into assuring that all stakeholders are identified and brought into the process as early as possible.

Existing technologies for improving water-use efficiency and forcleaning waste water have enormous untapped potential. Smart water policies will unleash this potential.

With little notice, a wide range of new technologies has been developed and made available for using water more efficiently, for reducing overall water needs, or for cleaning contaminated water to permit its reuse. These technologies, including low-flow toilets, faucets, and showerheads, efficient washing machines, drip and precision sprinkler irrigation, reverse osmosis water purification systems, and others, are changing the face of California water. As a result, per-capita water use in California has begun to drop and appears likely to continue to decrease, even as our economy grows.

Industry, public agencies, and governments need to continue to invest in and support research and development of water-efficient and water-treatment technologies.

Demonstration programs, technical assistance, and education programs that introduce water users to existing technologies and their effective application should be adequately funded and expanded.

Financial incentive programs should be implemented to assist with conversion to and adoption of new technologies.

Regulatory incentives and motivation are effective tools.Smart regulation is more effective than no regulation.

Despite recent anti-government rhetoric, even among government officials and agencies, there is a critical role for federal, state, and local regulatory actions in helping move toward sustainable water management and use. Many of the success stories described here were encouraged by regulations that protect drinking water or groundwater quality, or reduce threats to remaining natural ecosystems.

Regulations and standards should be considered important components of water policy reform.

Policymakers and the public should continue to look for `effective regulatory tools in the water area. Such tools should be designed with flexibility in approach.

The power of the proper pricing of water in California isunderestimated.

The old sayings "there is no free lunch" and "you get what you pay for" apply to California's water situation. Inexpensive water only appears inexpensive. It often carries high or hidden costs for the citizens of California. Many of the following success stories repeatedly show that prices of water and water services play a major role in decisions about water use, investment, and behavior. Experience also shows that implementing proper pricing policies takes careful thought, preparation, and consumer education.

Water providers should adopt prices that better reflect the costs of service, including capital costs and environmental costs.

Water retailers should adopt pricing structures that encourage efficient use of water.

Economic innovation leads to cost-effective changes.

In addition to effective regulatory tools, a new set of economic tools can influence California water management and use. Several cases studies described here were successful because they used new approaches to water pricing, low-interest loans, smart rebates, and appropriate cost sharing. In general, sending the right price signals to water users leads to more efficient water allocation, use, and management, while making funds available for capital investments can lead to the rapid adoption of new technologies. Most successful projects secured funding from a broad array of sources—federal, state, and other public and private sources.

Water agencies should adopt strategies that reduce economic risks associated with sustainable water projects.

Governments and others need to be willing to fund and share in the economic risks of projects with multiple benefits.

In the water area, ignorance is not bliss. The more water users know about their own water use and the options and alternatives available to them, the better decisions they make.

As in most areas of public policy and interest, lack of information (or failure to disseminate that information), hinders rational and effective action. In case after case reviewed here, the availability of good information was critical to making good decisions. The more individuals and groups know about water, including the nature of supplies and demands, water quality, water laws and prices, and so on, the better are their choices and decisions. When farmers or landscape managers know how much water is in their soils, what the weather may do, and how effective their irrigation systems are, their use of water becomes much more efficient. When water districts or industries know how much water they use, where wasteful uses are occurring, and what new technologies are available, water-use efficiency rises dramatically.

Gaps in water data and information must be filled by more active water information programs.

Available water data and information should be made more widely available. Existing cost-effective programs, such as CIMIS, should be expanded.

‘‘Waste not, want not.’’ The potential for improving the efficiency of water use is greatly underestimated.

Growers are producing more crops, or generating more income for every acre-foot of water consumed by installing precision irrigation equipment. Industry is increasing economic output while decreasing total water use by auditing and modifying production processes. Water use in the home is dropping, even while income and populations are growing, through new technology and proper home water management. In the most interesting examples in this report are "win-win" situations, where environmental and other water needs are simultaneously being met. Cleaning and recycling wastewater to meet clean water goals is increasingly meeting environmental water needs. Agricultural goals and environmental goals can also be effectively integrated.

Manage agricultural lands to improve wildlife habitat, reduce agricultural water requirements, and improve air and water quality.

Include agricultural values in environmental restoration efforts. This will work most effectively when environmentalists and growers work together.

Urban water agencies must also consider the upstream and downstream environmental impacts of their activities. Cooperative actions with other users can increase environmental benefits.

In sum, many in California are moving toward a more sustainable water future, with little fanfare or notice. One of the reasons so many successful activities are underway in California is the serious pressure that exists on the state's water resources and the great competition among different users for limited water supplies. These pressures, as unwanted as they may be, serve to stimulate innovation and new thinking. In the end, therefore, we can take some consolation from the old adage "out of adversity, comes strength" and add the observation that out of competition and disputes over California water can come innovation and progress.

The Success Stories

Chapter 1:
Marin Municipal Water District's Innovative Integrated Resource Management Program

The Marin Municipal Water District has implemented a comprehensive integrated resource management plan that links phased development of new water supply to a sophisticated demand management program. Through its conservation and water recycling programs, the District has stabilized demand at close to 1980 levels (despite a substantial increase in population), and has not yet had to implement the third phase of its supply plan, which includes building a major new pipeline. By tying new supply to demand management, the District relies first on the proven conservation capabilities of its customers, and avoids incurring the financial and environmental costs of new supply until such development can no longer be avoided.

Chapter 2*:*
Promoting Conservation with Irvine Ranch Water District's Ascending Block Rate Structure

Experience is showing that creative thinking about water rates and prices can have a major effect on water use and efficiency. In 1991, Irvine Ranch Water District (IRWD) replaced its flat rate-per-unit charge with an innovative ascending block rate structure. IRWD's rate structure represents an aggressive approach to promoting conservation, has formed the foundation of a larger water conservation program, and is regarded as a long-term water management tool. As a result of its programs, IRWD has seen a significant drop in per capita water use.

Chapter 3:
Effective Public Participation in the Rate Setting Process: LADWP Blue Ribbon Committee on Rates

Most people think that water rates are solely designed to serve the revenue needs of a water agency. We now understand, however, that such rates also have implications for equity (who pays and how much) and water conservation (sending signals regarding water use and reflecting the true cost of delivering water). Despite the often technical nature of designing a water rate structure, the Los Angeles Department of Water and Power acknowledged these other issues and formed a citizens' committee to design a new rate structure. This successful community–agency collaboration brought a far greater section of the public into the process than ever before, helped address issues of fairness and equity, and produced a rate structure that was eventually approved.

Chapter 4:
Reducing Water Use in Residential, Industrial, and Municipal Landscapes

Urban landscapes consume a significant amount of water in California. Yet too little attention has been given to different ways of promoting efficient landscape practices and the potential for these practices to reduce water use. Three separate district programs show what can be accomplished if water developers and users are informed and if proper incentives for efficient water use are provided. The North Marin Water

District's landscape water reduction program targets developers with incentives in the form of credits and rebates. A successful voluntary audit program at the Santa Clara Valley Water District is aimed at teaching large landscape customers proper irrigation scheduling and careful maintenance. And the Irvine Ranch Water District reaches both large and residential landscapes with a combination of a progressive rate structure and outreach programs. All three districts have seen remarkable decreases in landscape water use.

Chapter 5:
Community–Agency Partnerships Save Water and Revitalize Communities through ULFT Programs

Over the past decade, water agencies have formed highly successful partnerships with community groups to distribute ultra-low-flush toilets (ULFTs) in cities throughout the state. As of August 1998, these programs had saved an estimated annual 13,000 acre-feet of water. Agencies hire local, unemployed residents to run their ULFT programs and invest revenues from the programs in community activities. Participation in these programs has been greater than in similar programs run by agencies alone, since residents are eager to support programs managed by—and benefiting—their communities. Agencies benefit from improved public relations and the ability to better meet their conservation goals.

Chapter 6:
An Overview of Water-Efficiency Potential in the CII Sector

Commercial, industrial, and institutional (CII) water users account for approximately 30 percent of urban water use in California. While some CII users have installed water-efficient technologies, the enormous potential for significant water savings in this sector remains largely untapped. This case study reviews this potential and describes some of the actual savings that have been achieved through municipal and water agency programs targeting the CII sector. It also discusses some of the issues and motivating factors involved in implementing and maintaining successful CII conservation programs.

Chapter 7:
Assessing Commercial, Industrial, and Institutional Water-Efficiency Potential: The MWD Audit Program

In 1991, the Metropolitan Water District of Southern California (MWD), in conjunction with its member agencies, initiated a major water-efficiency improvement program in the commercial, industrial, and institutional (CII) sector involving water audit support, analysis, and recommendations. During its five-year life, the program audited over 900 commercial, industrial, and institutional water users in MWD's service area. Results from these surveys are believed to represent the largest and most extensive database on this sector developed to date, providing valuable information on water use, water-savings potential, and implementation of conservation programs.

Chapter 8:
Increasing Institutional Water-Use Efficiencies: University of California, Santa Barbara Program

The University of California, Santa Barbara campus provides an outstanding institutional example of a comprehensive water-efficiency program leading to significant water and cost savings. Through a wide variety of cost-effective indoor and outdoor conservation efforts, total campus water use was reduced by nearly 50 percent between 1987 and 1994, even as the campus population increased. Total cost savings to the campus for the years 1989 through 1996 from efficiency improvements were on the order of $3.7 million, excluding energy and maintenance savings.

Chapter 9:
Increasing Industrial Water-Use Efficiencies: Naval Aviation Depot, North Island

The North Island Naval Aviation Depot is an excellent example of the potential for water savings in industrial processes. Between 1987 and 1997, due to new local regulations, higher wastewater treatment costs, and explicit military directives, the Depot reduced its water use by over 90 percent, from 305 million gallons to under 27 million gallons per year. Many of the dramatic improvements were accomplished with low-tech, operational changes that simply reduced water use and prevented waste.

Chapter 10:
Reducing Water Use and Solving Wastewater Problems with Membrane Filtration: Oberti Olives

Most food-processing plants use large quantities of fresh water and dispose of considerable volumes of wastewater each year. In response to environmental regulations and concerns, some companies have looked for technical innovations that reduce water needs and wastewater volumes while offering substantial economic and environmental benefits. One example is the water-saving membrane filtration and byproduct-recovery system operating at Oberti Olives in Madera since September 1997. By reusing 80 percent of the olive plant's processing water, this technology has reduced Oberti's daily groundwater pumping requirements by 91 percent and solved environmental concerns by eliminating wastewater discharges.

Chapter 11:
An Overview to Water Recycling in California

While early water-recycling projects were largely motivated by the need to find alternatives to wastewater disposal, recycled water continues to grow in importance as a source of water that can replace the need for potable water supplies for certain kinds of uses. This section provides an overview of water recycling in California, its regulation, its increased use, and challenges in implementing projects.

Chapter 12:
Using Recycled Water in Urban Settings: West Basin Recycling Project and South Bay Water Recycling Program

Recycled water can reduce wastewater volumes, provide water supply, and generate environmental benefits. These advantages are leading to a surge in interest in the production and use of recycled water throughout California. A significant amount of growth in its use has taken place in urban areas, and these trends are likely to continue. The West Basin Water Recycling project in Los Angeles County and the South Bay Water Recycling Program in Santa Clara County provide two examples of the current trend in urban recycling projects. The West Basin Water Recycling project will ultimately provide 100,000 acre-feet of new water annually (approximately one-half of demand) for its 17-city service area. The South Bay Water Recycling Program will serve the cities of San Jose, Santa Clara, and Milpitas. The first two phases are expected to provide over 16,000 acre-feet each year.

Chapter 13:
Using Recycled Water for Agricultural Irrigation: City of Visalia and City of Santa Rosa

California agriculture, under growing pressure for water, is beginning to explore innovative uses of recycled water. Some growers already use reclaimed wastewater in different ways, depending on the level of treatment the water receives. Most common is the use of secondary-treated wastewater on fodder and fiber crops. Increasingly, however, growers are irrigating fruits and vegetables with tertiary-treated water, producing high quality crops and high yields. The city of Santa Rosa uses tertiary-treated water to irrigate about 6,000 acres of land in and around Santa Rosa. The city of Visalia has developed a project to irrigate a walnut orchard with secondary-treated wastewater. Though each project was primarily designed to reduce wastewater discharge, both cities have gained from the water-supply benefits recycled water offers.

Chapter 14:
Crop Shifting in California: Increasing Farmer Revenue, Decreasing Farm Water Use

With little fanfare or attention, the mix of California crops and planting patterns has been changing. These changes are the result of decisions made by large numbers of individuals, rather than any intentional actions by state policymakers. California farmers are planting more and more high-valued fruit and vegetable crops, which have lower water requirements than the field and grain crops they are replacing. They can also be irrigated with more accurate and efficient precision irrigation technologies. As a result, California is slowly increasing the water productivity of its agricultural sector—increasing the revenue or yield of crops per unit water consumed. Over time, these changes have the potential to dramatically change the face of California agriculture, making it even more productive and efficient than it is today, while saving vast quantities of water.

Chapter 15:
Converting to Efficient Drip Irrigation: Underwood Ranches and High Rise Farms

In the past two decades, California farmers have made considerable progress converting appropriate cropland and crops to water-efficient drip irrigation. Much of this effort has focused on orchard, vineyard, and berry crops. Recent innovative efforts now suggest that row crops not previously irrigated with drip systems can be successfully and economically converted as well. This case provides the example of two farmers converting bell pepper row crops to drip irrigation with great success. Subsurface drip irrigation substantially increased pepper yields, decreased water consumption, and greatly improved profits. In these cases, initial capital costs were supported by state loans that were promptly repaid. The growers made subsequent investments themselves.

Chapter 16:
The Power of Good Information: The California Irrigation Management Information System (CIMIS)

Experience has shown over and over that the availability of timely, good information makes an enormous difference in decisions about water use and management. The California Irrigation Management Information System (CIMIS) is an example of an inexpensive system set up to provide timely information to growers and landscape irrigators about the water demands of their plants and the likely climatic conditions facing them. With this information, growers can make smart decisions about when, where, and how much to irrigate, reducing overall irrigation water needs, increasing crop water productivity, and saving money. A recent independent assessment of the program suggested that growers using CIMIS have reduced applied water use on their lands by an average of 13 percent, and increased yields by eight percent. The costs to state and local agencies of operating the system are approximately $850,000 per year, while estimated benefits exceed $30 million per year—a hugely successful project.

Chapter 17:
Improving Water Quality Through Reducing the Use of Herbicides on Rice: An Effective Collaboration Between Growers and Public Agencies

In the early 1980s, rice herbicides were implicated in fish kills and the contamination of drinking water in the Sacramento Valley. Through smart regulations and a strong collaborative effort, rice growers, state agencies, agricultural extension services, and local organizations developed and adopted new approaches to permit rice farmers to continue the necessary use of herbicides while greatly reducing the risks these chemicals have for humans and wildlife. A combination of innovative technological changes in the way water is held on rice lands and careful monitoring and education has reduced the concentrations of chemicals to below legal limits and, sometimes, below detectable limits.

Chapter 18:
Winter-Flooded Fields Benefit Farmers and Wildlife

As the Central Valley's open lands and farms are increasingly threatened by conversion to residential subdivisions and commercial developments, agricultural lands that also act as wildlife habitat will become even more crucial for many wildlife species. This case study describes how a growing number of California farmers are flooding their fields to shallow depths each winter, both to decompose crop stubble and to provide habitat for the hundreds of thousands of waterfowl and shorebirds migrating through the Valley on the Pacific Flyway. In the Sacramento Valley, this practice also offers one solution to the air-quality problem caused when rice stubble is burned.

Chapter 19:
Reviving Central Valley Wetlands: Upper Beach Lake Wildlife Enhancement and the Beach Lake Mitigation Bank

With only 10 percent of the Central Valley's original wetlands remaining, much wetland restoration is needed in the region. The lessons offered by the two projects in this case study will be invaluable for guiding future restoration efforts. Although different in approach and scope, both projects demonstrate that a combination of agency initiative, creative funding, and reliance on sound restoration principles can yield good restoration results. Both illustrate the linkage between good water management and wetland restoration and both have multiple benefits. Finally, both will be important complements to the planned 18,000-acre Stone Lakes National Wildlife Refuge.

Chapter 20:
Restoring Riparian Forests and Natural Flood Regimes: The Cosumnes River Preserve

Conventional wisdom tells us that humans, floods, and riparian forests should not be mixed. The Nature Conservancy has successfully challenged this wisdom by working with other organizations to establish and maintain 14,000 acres of seasonal and permanent wetlands, grazing, and agricultural lands on the Cosumnes River Preserve. They have taken steps to restore natural flood regimes in the interest of promoting the restoration of riparian forests on the Preserve. They have also taken steps to "floodproof" their farming operation, illustrating that human uses in floodplains can be compatible with periodic inundation and that riparian forests and floods are good for each other.

Chapter 21:
Improving Passage for Spring-Run Salmon: Cooperative Efforts on Deer, Mill, and Butte Creeks

California's declining fisheries are at the forefront of conflicts over the need to reallocate water for environmental benefits while at the same time satisfactorily operate existing water supply systems. This case describes innovative actions taken by local landowners on Mill, Deer, and Butte Creeks, in cooperation with regulatory and resource agencies, to improve conditions for spring-run Chinook salmon, and to prevent possible challenges to the landowners' water rights and existing water use. In each case, local residents took the initiative in finding ways to better manage resources to meet all stakeholders' needs. Each community was able to find alternatives that flexibly accommodated both human and environmental needs.

Chapter 22:
Collaborative Watershed Management "Above the Dams": Feather River Coordinated Resource Management

Watershed management is being implemented in a wide range of settings around California, with varying degrees of success. The Feather River Coordinated Resource Management project provides a positive example of watershed management in a rural, higher-elevation region of the Sierra Nevada. Since its inception in 1985, 21 member agencies have worked to implement 45 projects in the roughly 3,200 square-mile program area, including an array of plans, education efforts, and on-the-ground projects. These efforts have been instrumental in restoring meadows, wetlands, and streams, as well as expanding regional understanding of what does and doesn't work for restoring hydrologic systems.

Chapter 23:
Working for Healthy Urban Watershed Communities: Santa Ana River Basin and Napa River Watershed

The two cases discussed here illustrate two different approaches for successfully anticipating and managing watershed problems in urban areas. The first is the Santa Ana Watershed Project Authority, a regional planning and project management agency that has worked to ameliorate the worst water-quality problem in the Santa Ana River basin: the build-up of salts in groundwater and surface water. The second is from the Napa River watershed, where the Napa County Resource Conservation District has facilitated a number of innovative projects, including a demonstration of sustainable vineyard practices, watershed-wide volunteer monitoring, the development of a watershed management plan, and educational programs in local schools.

Chapter 24:
Restoring Urban Streams Offers Social, Environmental, and Economic Benefits

This case study offers three examples of stream restoration projects that resulted in social, economic, and environmental benefits in urban communities. The restoration of San Luis Obispo Creek helped revive the city's failing downtown by highlighting the creek as the focal point of a pedestrian plaza and retail hub. The Wildcat Creek restoration demonstrates how flood problems can be solved with more attractive, environmentally benign methods than concrete channels or culverts. And the unearthing—or "daylighting"—of long-buried Strawberry Creek created new riparian habitat in a blighted area and jobs for local youth hired to maintain the project.

Chapter 25:
Finding Mono Basin Replacement Water: Mono Lake Committee and Los Angeles Department of Water and Power

The struggle to "save" Mono Lake reached a milestone in 1994 when California amended LADWP's licenses to divert Mono Basin water. With amended licenses, LADWP would necessarily take less water from the Mono Basin and would need to find a way to replace "lost" supplies. The Mono Lake Committee, concerned that LADWP would seek water from other environmentally sensitive sources, worked with it to develop replacement water through recycling and conservation projects. The projects currently produce more than 50,000 acre-feet of water per year, and, with additional funding, will yield as much as 88,000 acre-feet per year by 2015—enough to make up for lost Mono Lake supplies.

Chapter 26:
Improving Water Management through Groundwater Banking: Bakersfield 2800 Acre Recharge Facility and Semitropic Groundwater Banking Program

Increasingly, localities are recognizing the importance of supporting groundwater management to ensure the productivity and future protection of their basins. By taking advantage of groundwater storage options, groundwater banking offers a valuable supply-side management tool. In addition to supply benefits, banking programs also provide a management tool to help a district better coordinate groundwater and surface water activities to improve basin conditions. The city of Bakersfield's 2800 Acre Recharge Project and Semitropic's Water Banking Project offer two examples of successful banking projects undertaken in Kern County.

Chapter 27:
Comprehensive Groundwater Management: Orange County Water District and West and Central Basins

Much of California's groundwater use is not monitored or managed, leading to serious problems in some regions. Two Southern California examples provide different models for successful groundwater management. The Central and West Coast Basins offer examples of basins where groundwater extractions have been adjudicated and are now being effectively managed and monitored, and where collaborative efforts among multiple agencies are successfully addressing the basins' problems. Orange County Basin offers the case of a non-adjudicated basin where groundwater pumping is not limited and a supply-side strategy is pursued.

Chapter 28:
Legal Protection for Rivers: the State and Federal Wild and Scenic Rivers Acts

Over the past three decades, public interest in restoring and preserving rivers and streams has blossomed. This case describes two important legal "tools" for protecting California's unique rivers: the National Wild and Scenic Rivers Act of 1968 and the State Wild and Scenic Rivers Act of 1972. In large part due to these legal remedies, California still possesses many free-flowing river sections: over 95 percent of the state's dams were built prior to 1968, the year the federal Act was passed. This story also describes several recent legal decisions under the federal Act that can protect rivers from the impacts of grazing and logging.

Introduction

Background and Project Description

In 1995, the Pacific Institute published *California Water 2020: A Sustainable Vision*, which presented a positive vision of where California water resources could be in the year 2020 and a detailed analysis of how to get there using existing and proven economic incentives, efficient water technologies, and innovative governmental and non-governmental management practices. That analysis offered compelling support for the argument that alternative approaches to water planning and use can be—and have been—very successful. Despite mounting evidence of the applicability and effectiveness of many of the report's suggestions, some water policymakers and managers remain skeptical about new ways of tackling California's water problems. This skepticism is in part due to lack of information, incomplete data, and poor communication among the many different actors in the water community. The most recent version of the official California Water Plan—Bulletin 160-98—shows that the agencies in charge of state water planning still don't understand either the benefits of rethinking California's water future, or the real opportunities for moving in a new and productive direction. It also indicates that there are sizable institutional obstacles to the development and implementation of the new and innovative approaches described in this report.

As stated in our 1995 report, long-term sustainable use of water does not require drastic advances in technology or heroic or extraordinary actions. Instead it requires a commitment to an ethic of sustainability and the will to continue expanding positive trends that are already underway. As a follow-up to that first study, the Pacific Institute initiated the Sustainable Use of Water: California Success Stories project to identify, describe, and analyze successful examples of sustainable water policies and practices in the state. The goal of this new project is to show water managers, policymakers, and the public how to move California toward more equitable and efficient water management and use.

Nearly 100 case studies were reviewed in the context of the Institute's sustainability criteria and guidelines. Ultimately, 28 were chosen as successful, informative, and educational examples of collaborative water planning, effective institutional and governance structures, innovative use of technology or economic incentives, and environmental protection and restoration. As examples of successful practices already in use, these cases offer viable alternatives to the traditional approaches to meeting today's water management challenges. In each case we identify the key factors that led to success, with the objectives of highlighting smart practices for individual managers and actors and identifying those policy levers that can promote such practices.

For agriculture, we selected activities that have resulted in more efficient applied water use, increased crop yields, or enhanced water quality, and practices that produced multiple benefits for other sectors, such as the environment. We looked at practices that have been implemented by both large and small farms, as well as by irrigation districts. Successful examples of planning and management practices, technological improvements, information dissemination, use of reclaimed water, and incentive and assistance programs are all included.

Successful urban case studies presented here include the innovative use of reclaimed water, the substitution of recycled water for potable supplies, improvements in institutional water management, and environmental restoration. Several cases highlight successful demand management programs, such as design of efficient outdoor gardens, industrial and commercial efficiency improvements, and residential conservation programs such as ultra-low-flush toilet rebates/installation. Successful management practices, including integrated resource planning, groundwater management, and conjunctive use, are also described.

Environmental successes presented here encompass innovative management of floodplains and watersheds, river and wetland restoration, and collaborations with farmers to preserve or expand natural habitat in agricultural areas. The cases selected demonstrate the potential for simultaneously achieving ecological and human goals.

A final set of cases focuses on institutional and governance mechanisms that have broadly affected and improved water management and use. These include legal mandates such as the federal and state Wild and Scenic Rivers Acts as well as successful consensus-based processes and the forums and institutional activities that were developed to promote them.

The Case Studies: What Makes Success?

What makes a program a success? Achieving a specified goal? Learning something unexpected? Exceeding an expectation? In our study and review of California water activities, we sought to identify programs that did all of the above while teaching lessons about ways of solving California's complex water problems. Many individuals, organizations, and institutions are involved in California water issues, and while this mix sometimes produces rancorous debates and disagreements, it also can produce unusual collaborations and innovations.

As we evaluated many different possible stories we developed criteria for evaluating the "success" of a project. Ultimately, we followed a strict set of guidelines for selecting success stories, shown in the sidebar. These guidelines are standards by which projects and activities could be measured. Each case we studied was different—with a unique set of actors, characteristics, and approaches. In the end, we chose examples that met our criteria and seemed to hold the most promise for teaching us how to think about water management and planning. This chapter identifies five themes that capture the common lessons learned from these many examples.

Criteria for Evaluating "Success"

Overall criteria

The project or activity contributes to long-term economic, environment, and social well-being

General characteristics

The project or activity should be:

- Replicable
- Durable
- Socially, environmentally, and economically affordable
- Acceptable to multiple stakeholders
- Adequately monitored and documented

Criteria with respect to resource management or use

The project should do at least one, and preferably more, of the following:

- Meet or assure a basic human or ecosystem need for water
- Result in more efficient use of water
- Result in more equitable distribution of costs and benefits of water use
- Reduce or eliminate an unsustainable use of water
- Improve water quality
- Promote a better match between water quality and end use

Criteria with respect to institutional management

The project should do at least one, and preferably more, of the following:

- Promote stakeholder and community participation in decisionmaking and management
- Promote planning and management coordination among government agencies
- Promote flexibility and adaptability in decision making and management
- Develop a mechanism for avoiding and resolving water disputes

1. Cooperative Partnerships Among Stakeholders Lead to Successful Programs

State and local water administrators and a small number of powerful agricultural and urban interest groups seeking reliable agricultural and urban water supplies have long dominated water policy and planning in California. Recently, interest groups representing the environment have also come to play an important role in water policy. These three groups represent important constituents, but they do not fully represent all the interests with a stake in the outcome of water policy debates. Even when broader public participation is permitted, it is often limited to a public hearing process held after major decisions have been made, or a public election where input is reduced to simple approval or rejection of a complex proposition or bond issue.

Without broader and earlier public participation, water policy and management will continue to fail to recognize the needs of many of California's increasingly diverse communities, particularly rural, low-income, or communities of color that have historically been poorly represented. Many people and organizations involved in water policy or planning are beginning to acknowledge this problem.

A wide variety of recent activities, including the important CALFED process, have tried to broaden public participation in water policy decisions and to include members of the public in discussions of water problems. In almost every successful project, we found that a wide range of stakeholders came together to work out their differences and to explore collaborative solutions. Some of the most successful projects included groups that have traditionally been left out of water policy discussions.

A set of successful collaborations has developed between growers and environmentalists. Environmentalists often criticize California farmers for using too much water and too many chemicals, and for the impacts of agriculture on water quality and wildlife habitat. In turn, farmers often criticize environmentalists for failing to understand or acknowledge the importance of farming to the economy and land preservation. Since 1991, an unusual combination of stakeholders, including California rice growers and the rice industry association, The Nature Conservancy, Ducks Unlimited, and the California Waterfowl Association, has worked to develop winter habitat for migrating waterfowl while simultaneously helping the state reduce air quality problems and rice growers dispose of rice straw. This collaboration, known as the "Ricelands Habitat Partnership," effectively integrates agricultural needs with ecological and environmental values (*see* Chapter 18).

Rice cultivation in California has also led to problems with water quality. By the early 1980s it was apparent that large quantities of rice herbicides were entering rivers and streams, killing fish and adversely affecting drinking water quality in downstream communities, including the state capital, Sacramento. Public concern over these problems led to the creation of a joint government–industry group that worked to lessen these impacts without harming rice growers (*see* Chapter 17). This working group effectively reduced herbicide concentrations in public waterways through a combination of regulatory actions, innovations in farming techniques, and education of growers. For more than a decade, the concentrations of rice pesticides in water have been below legal limits, despite the regular tightening of those limits.

The South Bay Water Recycling Program case study (Chapter 12) offers a more urban example of increased agency cooperation and coordination among cities, agencies, and the local community. The program is a joint effort to increase the use of recycled water to solve local water supply and discharge problems. Participating in the program are three large cities (San Jose, Santa Clara, and Milpitas), five sanitation agencies, the San Jose Water Company, Great Oaks Water Company, the Santa Clara Valley Water District, U.S. Bureau of Reclamation, and a 27-member Citizens Advisory Committee. The committee includes representation from environmental groups such as CLEAN South Bay, the Silicon Valley Toxics Coalition, stream preservation interests, local universities, and the League of Women Voters.

Another successful citizen advisory committee was the Los Angeles Blue Ribbon Committee on Water Rates (*described in* Chapter 3). This committee successfully involved citizens in the water policy and rate-setting process in the early 1990s and included individuals drawn from outside traditional water policy circles. During the process the members became engaged in both educating and representing their own constituencies throughout the city. The process allowed Los Angeles Department of Water and Power staff to engage in open discussions with members of the communities they serve, and lent credibility to the idea that complex and often contentious issues can be worked out with community involvement.

In many different parts of the state, coalitions of local grassroots groups, city planners, municipal agencies, environmental non-profits, and even the U.S. Army Corps of Engineers are working to restore long degraded urban streams. These efforts are reversing decades of policies that eliminated or hid waterways in urban areas. Today, close to 100 "friends of creeks" groups work to preserve and protect urban streams throughout California. Three examples are presented in Chapter 24 that improved the quality of riparian habitat or even created habitat where none existed. All of the projects led to increased community awareness and involvement in local watersheds and the formation of both formal and informal environmental education programs. Two of the projects improved water quality by decreasing erosion and by identifying and eliminating serious sources of pollution. All three projects led to economic benefits by boosting local business or employing local residents to maintain the restoration sites and monitor water quality. And one of the projects provided flood-control benefits to the local community.

The restoration and protection of streams outside of cities is also gathering momentum, particularly with efforts to provide better instream flows for fish. Like the cases described above, the most successful projects are those that include the participation of all affected parties. Three such success stories are offered here: Deer, Mill, and Butte Creeks in Northern California (*see* Chapter 21). Each project succeeded when the Department of Fish and Game, Department of Water Resources, and local landowners came together to fashion an agreement to provide better conditions for spring-run Chinook salmon while maintaining reliable water deliveries to local users and protecting landowners' water rights. The Butte Creek siphon project, in conjunction with several other separately funded projects, improved conditions for salmon by opening up 18 miles of stream for their migration; Deer and Mill Creeks now have better year-round flows to aid migrating salmon.

Recent collaborations between non-governmental organizations and state and local officials have simultaneously restored wetlands and reduced flooding risks, while allowing agricultural and grazing activities to continue. One such example has been the partnership among The Nature Conservancy and local, state, federal, and private organizations, including the California Department of Water Resources and the California Department of Fish and Game, and local landowners in creating the Consumnes River Preserve (*see* Chapter 20). This partnership has led to an environmentally affordable solution to floodplain management without the use of new structural approaches. Additional examples can be found at the Beach Lake site in the Stone Lake National Wildlife Refuge, where state and federal agencies came together with a local sanitation district to restore a tract of wetlands that will ultimately link with other wetland habitat in the Central Valley (see Chapter 19). A third example is the Feather River Coordinated Resource Management project (Chapter 22) that has involved 21 different stakeholder groups and implemented 45 projects since 1985 to restore meadows, wetlands, and streams. This project has also expanded our understanding of what does and doesn't work in protecting the 3,200 square-mile Feather River watershed and other portions of the Sierra Nevada. These projects demonstrate that creative, collaborative funding and management can lead to environmental restoration that offers multiple benefits to multiple stakeholders.

2. Existing Technologies Have Enormous Untapped Potential

Water disputes cannot be solved with technology alone. California's problems include a complex mix of economic, political, social, and geophysical characteristics. Yet many technologies that are already available can play a vitally important role in conserving water, protecting water quality, providing recycled water for different uses, monitoring and measuring water availability and use, or managing complex demand and supply situations. In the positive "vision" for water described in our report *California Water 2020: A Sustainable Vision*, we noted that:

"To realize this positive vision *no significant new supply infrastructures need be built, nor are any drastic advances in technology necessary*." (Italics in original)

This conclusion is even more true today, as shown by the intelligent application of existing technologies in several of the case studies included here. The continued penetration of the best new technologies will have a long-term beneficial effect on California water policy by reducing demand and increasing available supply through improvements in water quality and management.

In recent years California farmers have made progress converting appropriate cropland and crops to water-efficient drip irrigation systems, significantly reducing applied water requirements for many growers. By the mid-1990s, approximately 13 percent of California farmland was irrigated with drip systems, up from five percent in the mid-1980s. Much of this conversion has happened on land planted with vine and orchard crops, and with high-valued fruit and vegetable crops. Recently, however, innovative efforts have shown that row crops not previously irrigated with drip systems can be successfully and economically converted as well, reducing applied water needs and increasing crop yield and quality *(see* Chapter 15). These examples show that existing drip technology has far greater potential than has yet been realized. Furthermore, the trend statewide toward more valuable, permanent crops (*see* Chapter 14) is leading to even more acres of crops suitable for efficient drip systems, further increasing the water productivity of California agriculture.

In the commercial and industrial sectors, dramatic improvements in water-use efficiency have been achieved by company after company, without new technology (*see* Chapter 6). Careful review of processes, innovative use of existing technology, and smart water management have repeatedly been shown to be effective at cutting industrial water use, industrial wastewater generation, and production costs. One such success story is the Naval Aviation Depot in San Diego, which reduced water use between 1987 and 1997 by over 90 percent, from 305 million gallons to fewer than 27 million gallons each year, largely through careful water management and the wise use of existing technology (*see* Chapter 9).

Similar improvements are materializing in the residential and institutional sectors. Existing low-flow toilet technology, efficient showerheads and faucets, and new washers all can reduce household water use by 20 to 30 percent, or more. Over the past decade, water agencies have explored ways to get these existing technologies to residents, including highly successful partnerships with community groups to distribute ultra-low-flow toilets (*see* Chapter 5) in cities throughout the state. As of August 1998, these programs alone have saved an estimated annual 13,000 acre-feet of water, and they have only begun to scratch the surface. Institutions can also use existing technologies wisely to save water.

The University of California, Santa Barbara implemented a comprehensive water-efficiency program between 1987 and 1994 that reduced total campus water use by nearly 50 percent, while the campus population increased (see Chapter 8). Application of existing technology and more careful attention to water management was the key to this program's success.

Technological innovation also plays a role in reducing water-quality problems. The food-processing industry, for example, often generates wastewater with high concentrations of pollutants such as salts. Many plants have traditionally discharged their wastewater into evaporation ponds -an inexpensive option.

This approach, however, can lead to groundwater contamination and other environmental problems. As a result of increasingly strict state and federal regulations, the food-processing industry has begun to look for alternative approaches to both reduce wastewater volumes and treat remaining effluent. Oberti Olives, one of only four olive processors in California, studied the possibility of modifying state-of-the-art water-treatment technologies usually used for other purposes and eventually installed a membrane filtration/water-recycling system in its own plant. This innovative application of technology, driven by the need to meet a regulatory requirement, has cut Oberti's groundwater use by 90 percent and completely eliminated wastewater discharges, at a cost far below the other options available for meeting wastewater discharge requirements (*see* Chapter 10).

The technology for cleaning wastewater has long existed. Only recently, however, has this resource been considered a potential source of new supply, as water managers have come to realize that not all water demands require the supply of potable water. The West Basin Water Recycling project is an example of an effort that will ultimately provide 100,000 acre-feet of water that can be used for a wide variety of demands

Despite many concerns over the federal Endangered Species Act, this law has stimulated a wide range of innovative state and local programs to meet the needs of species that are on the verge of extinction. The South Bay Water Recycling program (*see* Chapter 12) was undertaken in response to federal mandates to protect a salt water marsh that provides habitat for two federally-listed endangered species. In addition to meeting this regulatory mandate, the project now provides multiple benefits for humans as well. It provides a new source of water to meet growing demands, reduces sensitivity to decreased quantities of local and wastewater treatment have stimulated technological innovation and waste reduction. Urban and agricultural rate structures are being designed to send useful price signals to different kinds of users to change water use patterns. Joint funding programs are helping bring multiple interests together on collaborative projects and are spreading the burdens and benefits of different activities.

The drought of 1987–1992 brought many water agencies face-to-face with the problem of implementing water conservation programs while maintaining revenue streams and economic viability. To avoid having to raise rates after asking customers to conserve, the Irvine Ranch Water District (IRWD) replaced its flat rate-per-unit charge with an innovative ascending block rate structure in 1991 (*see* Chapter 2). At the same time it offered its customers the support, education, and information needed to help them fully understand and accept the ascending rate structure and to respond to the conservation incentives. IRWD's rate structure represents part of an aggressive but cost-effective approach to promoting water-use efficiency improvements, and it has proven very successful at reducing demand in all customer classes.

Innovative rate structures have also helped support and encourage the use of recycled water. In the West Basin Municipal Water District and the San Jose area (*see* Chapter 12) discounted rates were implemented that encouraged users to identify where recycled water could be used and to develop programs to use that water, reducing pressure on the water agencies to find expensive new supplies. The Marin Municipal Water District has also developed a range of rate structures to encourage improvements in water-use efficiency and the use of recycled water wherever possible (*see* Chapter 1). These conservation and recycling programs have permitted Marin Municipal to avoid developing new sources of water, at higher cost.

Orange County Water District (OCWD) developed a different kind of economic mechanism to signal groundwater users about the desired amount of pumping each year (*see* Chapter 27). OCWD developed a basin production percentage and a basin equity assessment that creates a disincentive to pump a above a particular level. This has proven highly effective as a management tool.

Experience in the agricultural sector also shows the importance of proper water pricing, as well as the value of offering growers ways to share the economic risks of implementing non-traditional water management programs. State programs that share the economic risks of the initial capital costs have accelerated the innovative use of drip irrigation technology, as shown in Chapter 15. For the two farms described in the drip irrigation case study, initial capital cost barriers were overcome through low-interest loans offered by the California Energy Commission. The initial costs were quickly recovered by increased crop yields, and by decreases in the cost of water, chemicals, and labor. As a result, the loans were repaid: one of the two growers even repaid the loan a year early and then installed another 200 acres of drip systems, using private financing. State or federal loans also played a role in encouraging water recycling in West Basin and the South Bay (Chapter 12), and both programs also offer financial assistance to help customers retrofit their water systems to use recycled water. Agencies also offer rebates to customers for landscaping retrofits, installation of efficient toilets and appliances, and audits and retrofits in commercial, industrial, and institutional settings (*see* Chapters 4, 5, 6, and 7). Increasing prices for water in some irrigation districts are encouraging growers to think about using new water-management approaches and planting different crop types (*see* Chapter 14). As a result, the productivity of water used in agriculture, measured by farmer revenue per acre-foot of water applied or other comparable indicators, is going up statewide.

Higher prices also play a role in driving technological change and innovation in the urban and industrial sector. The high cost of wastewater treatment has proven enormously effective in pushing industrial water users to reevaluate internal water use and improve their water-use productivity. For the Naval Aviation Depot North Island, San Diego, wastewater costs were 15 to 200 times higher than the simple costs of water supply. This offered a great incentive—and stimulated successful efforts—to reduce water use and disposal (*see* Chapter 9).

5. The Value of Information Is High

The lack of good or complete information on water use or quality, the availability, applicability, and cost of new technologies greatly inhibits changes in water policy. Numerous examples show that collecting and disseminating proper data and information permits individuals, organizations, or even government agencies to make fast and successful changes in water management and use. Several of the case studies described in this report show the value of information in encouraging and accelerating water policy changes.

One of the great uncertainties in the water arena is the potential for water-use efficiency in various sectors of the economy. Limited and inconsistent information is collected by state water agencies on actual water use at the industry, household, or commercial levels. As a result, many local and regional water suppliers are beginning to collect and analyze their own water use data. For example, the Metropolitan Water District of Southern California (MWD), in conjunction with its member agencies, initiated a major program in 1991 to gather information on the potential for improvements in water use in the commercial, industrial, and institutional sectors (*see* Chapter 7). During a five-year period, MWD provided water audits, analyses, and recommendations for actions to companies in these sectors. The program audited over 900 commercial, industrial, and institutional water users, providing valuable information on water use, water savings potential, and implementation of conservation programs.

Good information on water supply and demand at the field level is also critical to farmers interested in carefully managing water resources. In 1982, the California Department of Water Resources (DWR) and the University of California created the California Irrigation Management Information System (CIMIS) to encourage farmers and other water users to include weather information in irrigation decisions (see Chapter 16). If growers have available—and use—actual data on evaporation and transpiration rates in a region, they can irrigate in a more accurate and timely manner and replace only the water actually used by crops. This approach can increase water-use efficiency and crop yields and decrease costs to growers. By 1998, CIMIS consisted of more than 100 computerized weather stations collecting weather data throughout the state and converting those data into estimates of water needs for different purposes. CIMIS is used to help determine water needs on more than 370,000 acres of farmland and urban and municipal landscaping, and the information it provides has reduced applied water use on these lands by an average of 13 percent. At the same time, agricultural yields on these lands have increased eight percent. The costs to state and local agencies of operating the system are approximately $850,000 per year, while estimated benefits exceed $30 million per year—a hugely successful project.

In the case studies of successful groundwater management, groundwater banking, and watershed management, a premium was placed on data gathering and monitoring. Designing and adapting groundwater management strategies (see Chapter 27) requires that agencies better understand and monitor basin hydrology, water quality, and actual use. Both the Water Replenishment District of Southern California and the Orange County Water District devote substantial resources to maintaining and improving information on their basins. Similarly, the information requirements for successful groundwater banking programs (*see* Chapter 26) showed that such programs are best implemented in conjunction with broader groundwater management or monitoring programs. The two case studies on watershed management (Chapters 22 and 23) also illustrate the value of information in successful restoration efforts. Emphasis was placed on carefully monitoring the activities undertaken in the three watersheds (the Feather, Napa, and Santa Ana rivers) to provide for program evaluation and adaptive management.

Water-use efficiency programs also benefit from good information on customer water use and behavior. After conducting detailed studies of water use in their service areas, both Irvine Ranch Water District and the Marin Municipal Water District were able to tailor effective water-conservation programs to meet customers' needs. The rate structures designed by

Irvine Ranch (*see* Chapter 2) and MMWD (*see* Chapter 1) were designed to provide customers with clear signals about appropriate water use to provide incentives for conservation. The landscape efficiency programs described in Chapter 4 also rely on providing customers with adequate information so they can adopt better management practices. Similarly, audit programs for residential, commercial, and industrial customers provide water users with information about efficient water use, available technologies, improved practices, and assistance programs.

Making information available to the general public, and involving the public in collecting that information, can facilitate citizen involvement in the management of water resources. The Napa River Watershed Management project is a case in point. Here, the Napa County Resource Conservation District and its citizen collaborators have established a program of consistent citizen-led watershed monitoring. The compilation of monitoring results, combined with publishing watershed management goals, has helped increase the number of citizen groups involved in active stewardship of various sections of the Napa River.

The 28 success stories described here are the tip of the iceberg. In communities around the state, smart and committed individuals and groups are getting together to take water policy into their own hands. The result is a growing movement away from state or federally sponsored programs and policies toward regional and local watershed and community actions, though several successful state and national activities are also described here. As a result, official state water policies now often lag behind—rather than define—the state-of-the-art. The official California Water Plan, for example, fails to acknowledge these many successful activities or to incorporate them into its projections for California's water future. Integrating these success stories into long-term policy and planning could lead to a very different California—one where efficient, equitable, and sustainable water uses are the norm, rather than the dream.