DEPARTMENT OF WATER RESOURCES
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September 19, 2007

Mr. Phil Isenberg, Chairman
Delta Vision Blue Ribbon Task Force
650 Capitol Mall, 5th Floor
Sacramento, California 95814

Dear Mr. Isenberg:

This letter is in response to the August 31, 2007 Delta Vision Blue Ribbon Task Force (Task Force) request for more information from the Department of Water Resources (DWR) regarding the Water Plan Update 2005 resources management strategies and to describe from a regional perspective the potential for additional water benefits. Enclosed is DWR's response to the Task Force's request which provides information on the following:

- Integrated Regional Water Management Planning;
- Increasing regional self-sufficiency and the challenges;
- Water Plan Update 2005 resource management strategies;
- Water Plan Update 2005 water management strategies and major implementation issues: agricultural water use efficiency, urban water use efficiency, surface storage, conjunctive groundwater management, water recycling, water desalination;
- Water transfers; and
- Three examples of regional planning efforts.

If you have any questions or require additional information, please contact me at (916) 651-9202.

Sincerely,

Mark W. Cowin
Deputy Director

Enclosures

cc: Lester A. Snow
DWR Director

Implementing Integrated Regional Water Management to Meet Future Water Demands Using Diverse Resource Management Strategies

The Delta Vision Blue Ribbon Task Force at its August 31, 2007 meeting asked the Department of Water Resources (DWR) to provide more information on the 25 resource management strategies in Update 2005 of the California Water Plan, and to describe from a regional perspective the potential for additional water benefits. In this response, DWR is providing the Task Force information on how Integrated Regional Water Management can and is being implemented regionally to meet future water demands by diversifying regional water portfolios using an array of resource management strategies described in Update 2005. This response also includes quantitative information on a statewide basis for several of these management strategies and provides examples of the current and planned regional implementation efforts.

Recognizing that regions cannot rely on a single, or even a few, water management strategies to meet future demands and resource challenges, Water Plan Update 2005 identifies 25 strategies to help meet regional water management objectives. These strategies are described in Volume 2 of Update 2005 and summarized in Attachment 1. They include urban and agricultural water use efficiency, recycling, desalination, and storage, as well as improving water quality, management of floodplains, runoff and watersheds, and ecosystem restoration. One of the guiding principles of Water Plan Update 2005 is to increase regional self-sufficiency articulated in this way, "Increase regional self-sufficiency by considering activities that reduce the need to import water from the another hydrologic region, particularly during times of limited supply availability such as during a drought or after a catastrophic event like an earthquake". Communities can plan, invest, and diversify their water portfolios using these management strategies. When implemented in an integrated way, these strategies will help regions become more resilient in the face of future uncertainty and risk and will reduce conflicts with other resource management efforts and other regions.

Increasing Regional Self-Sufficiency

Generally, the goal of greater regional self-sufficiency is to achieve a condition where the local demand for water is met with supplies derived within a hydrologic region. Today, many of the hydrologic regions in California, and especially highly populated regions, rely on annual water imports from other hydrologic regions, some of which is conveyed through the Delta.

From the perspective of the Delta, the goal of regional self-sufficiency is to better manage, convey, and perhaps reduce, imports from the Delta, during periods when the water leaving the Delta could adversely affect other Delta water uses – including but not limited to water necessary to sustain desired ecosystem functions. Increasing regional self-sufficiency can help hydrologic regions that import water supplies from the Delta to reduce their dry-year imports from the Delta by relying more on local surface and groundwater supplies that may include Delta water that is imported and stored during times of Delta water surplus. This approach is being considered by some regional water managers described in the section below Examples of Regional Planning Success.

Statewide, the concept of regional self-sufficiency is being supported through the development of Integrated Regional Water Management Planning (IRWMP). On their own or with the incentive of grant funding, many water management entities are gathering together to look for opportunities to optimize available water supplies; protect and improve water quality and the environment, and manage demands in a more comprehensive manner (see Figure 1).

Resource flexibility – an inherent component of regional self-sufficiency – requires a diversified portfolio of water management strategies. As described in Volume 2 of the Water Plan Update 2005, these actions include: (1) improving the efficiency of existing and future agricultural and urban uses of water; (2) creating new places to bank supplies either above or below ground during periods of surplus; (3) building new facilities to reclaim or desalt otherwise non-potable or poor quality supplies; and (4) managing land uses to improve water quality and control water demands. Implementing more of these strategies throughout all hydrologic regions of the state will increase opportunities to schedule annual Delta water diversions in unison with annual hydrologic variability and the water needed for sustainable management of the Delta ecosystem.

Supply Reliability and Regional Self Sufficiency

To effectively implement a diversified water management portfolio needs reliable water supply sources and aggressive water demand management in each hydrologic region. The ability to achieve a diversified water portfolio is compromised without reasonable certainty that water from identified sources is available under defined or agreed-upon hydrologic or regulatory circumstances. Water supply reliability across a range of defined circumstances helps maximize the benefit of regional actions and minimize stranded investments. For instance, a region's IRWMP may assume that locally stored groundwater, in conjunction with temporary demand management measures, will offset future anticipated reductions in available Delta water supplies. The region builds the infrastructure to store and extract the reliable quantities of groundwater. If, however, assumptions prove wrong and planned self-sufficiency actions prove inadequate to meet regional demands, the result can be counter-productive short-term actions.

Delta Vision can encourage regions to develop diversified portfolios in two ways: (1) increasing the reliability of exports from the Delta under predefined conditions to facilitate regional planning and implementation of local and regional water management strategies, and (2) promoting greater implementation of integrated local and regional strategies through additional economic incentives and more effective regulations.

Challenges for Achieving Greater Regional Self-Sufficiency

Many hydrologic regions currently rely on Delta supplies for all or a large portion of their overall water supplies, and consider Delta water a part of their base supply. Residential, commercial, industrial and, agricultural water demands exist today in parts of the state because water from the Delta enabled those demands to establish.

Unique geographic conditions in some hydrologic regions (or sub-regions) may limit or preclude implementation of some of the management strategies recommended to develop regional self-sufficiency.

There is uncertainty about the relationship between regional self-sufficiency and direct or statewide benefits to the Bay-Delta system. The occurrence, type and magnitude of statewide benefits are a function of many issues and conditions surrounding regional water management actions; like how and where benefits are allocated. This relationship needs to be explored.

California Water Plan Update Water Management Strategies

Water Plan Update 2005 presented statewide water supply and water demand reduction estimates for 8 of the 25 resource management strategies (See chart entitled, "Range for Additional Water for Eight Resource Management Choices", in Attachment 1). The estimates shown for the 8 strategies were compiled on an individual basis, and no attempt was made to quantify the cumulative interactions among them. In some cases, individual strategies could compete for the same water supply. For this reason, the estimates should be treated as preliminary indicators of the scale of potential benefits, and are not additive. Update 2005 also identified major issues associated with implementation of the water management strategies.

Additional information for several water management strategies, regional implementation, and implementation challenges and issues are presented below.

Agricultural Water Use Efficiency

California Water Plan Update 2005 identifies 200,000 to 800,000 acre feet per year (af/y) of real water saving, statewide, that can be achieved by year 2030 through implementation of on-farm and district level improvements. The cost of achieving this saving has been estimated, based on level of investment in efficiency efforts, to be $0.3 to $4 billion. The real water savings can be achieved in areas where irrecoverable losses can be reduced or eliminated. Examples of irrecoverable water loss are agriculture wastewater that is discharged into the ocean; wastewater that infiltrates into groundwater with impaired water quality; and evaporation losses such as evaporation from surface water in canals or spraying during irrigation.

A separate analysis of agricultural water use efficiency (CALFED Water Use Efficiency Program Plan- Final Programmatic EIS/EIR Technical Appendix; July 2000), based on on-farm and water supplier water use efficiency improvements, for different hydrological regions of the state indicate that there is between 206,000 to 565,000 af/y of real water saving at a cost of $35 to $900 per acre-feet of water saved statewide. This data indicates that while majority of the total statewide saved water, almost 1/3 comes from Lower Colorado Region (127,000 to 221,000 af/y), Tulare Lake region (40,000 to 192,000 af/y) and South Cost (35,000 to 54,000 af/y) provide water saving opportunities that have an impact on the Delta. Westside and Eastside San Joaquin River regions provide water saving opportunities of up to 16,000 and 13,000 af/y, respectively. San Francisco Bay region with 4,000 to 6,000 af/y water saving potential has little or no agricultural water use and insignificant agricultural impacts on the Delta water exports.

Currently, the agricultural water suppliers are encouraged to become a member of the Agricultural Water Management Council (AWMC) and prepare an Agricultural Water Management Plan for submittal to the AWMC and implement their Efficient Water Management Practices, under certain conditions, on a good faith basis.

One example of real water savings project is canal lining in Lost Hills Irrigation District, where by lining the canal water is not infiltrated into poor quality (saline and unusable) groundwater. This project took two years in planning, design, grant approval, contract execution, and project construction to complete for a total cost of $745,000 for lining 3 miles of canal saving 250 af/y of water.

One example of agricultural water conservation success is in changes in irrigation systems. Almost all trees and vines established since 1990 are irrigated using micro-irrigation. Between 1990 and 2000 the crop area under micro irrigation in California grew from 0.8 million to 1.9 million acres, a 138% increase. For example, Kern County Water Agency reports that between 1975 and 1986 the irrigation efficiency was improved from 67% to 75% resulting in applied water savings of 250,000 af/y.

Major Issues:
Funding- While management techniques, hardware technologies and science of improving agricultural water use efficiency - both for on-farm and at the water supplier level - exist, the major issue facing implementation of water use efficiency measures is funding.

Demand hardening- An important factor impacting the future of the Delta is continued increase of conversion of annual crops to permanent crops, thus hardening agricultural water use and decreasing current flexibility to fallow land either for agronomic purposes, or for drought/water shortage circumstances. In addition to water demand hardening, conversion to permanent crops may also increase overall water use.

Overdraft- The regions downstream of the Delta have groundwater overdraft problems, and saline shallow groundwater problems, and seawater intrusion problems in case of Central Coast.

Water rights- Water conserved through water use efficiency measures stays with the farm or the district.

Verification of saved water- A less recognized and underestimated challenge regarding agricultural water efficiency and water savings, and by extension its impacts on the Delta, is difficulty and complexity of monitoring and verification of water savings. Verification of water savings depends upon availability of accurate pre-project and post project data. Many projects do not have pre-project data.

Policy- Current State policy is to use incentives to encourage implementation of efficient water management practices.

Urban Water Use Efficiency

The Water Plan Update estimate for 2030 urban water conservation savings potential is 1.1 million acre feet per year (maf/y) to 3.1 maf/y for a cost of $2.5 to $6 billion. This conservation will be achieved from three sources: operation of efficiency codes that require certain water using appliances and fixtures to meet specified level of efficiency, local water agency implementation of cost effective best management practices, and additional urban water conservation measures co-funded through state and federal agency grants.

Currently, certain urban water suppliers are required to prepare an Urban Water Management Plan every five years and submit to DWR. The water suppliers are required to report on the description of 14 urban Demand Management Measures. There are many water conservation measures that are cost-effective, but implementation usually requires an initial investment by the water supplier or water user. State and federal programs have provided funding for the BMPs that may not be locally cost effective.

Through the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding (MOU), local agencies have committed to implementing locally cost-effective Best Management Practices (BMPs). However, not all water suppliers have signed on to the MOU and not all of the signatories are fully implementing those practices.

State/federal policies and financial assistance can leverage local investment in conservation, promote the most promising and cost-effective conservation technologies, and help to forge regional and statewide urban conservation initiatives.

Major Issues:
Funds- Funds dedicated to water use efficiency have fallen below commitments made in 2000 through the CALFED Record of Decision that called for a state and federal investment of $1.5 billion to $2 billion during Stage 1 from 2000-2007.

Program Implementation- There are a number of challenges faced by agencies when implementing urban water conservation programs. A recent study sponsored by California Urban Water Agencies (CUWA) recommends collaborative action by agencies, further research, and continued State/federal support in addressing the implementation challenges. CUWA study concludes that the program should be as easy as possible for customers, its design should be simple, it should provide customers with guidance on water efficient fixtures, it should be coordinated with other agencies regarding permitting or potential funding, and emphasize a high level of customer service.

Data Collection- Easily retrievable, standardized and comprehensive baseline data about California urban water use are not available. Documentation and evaluation of the achievements attributable to water use efficiency projects and programs, need to be improved. The quantification of benefits for many projects lacks the necessary level of scientific rigor.

Education and Motivation- There is a need to determine which technological changes should be pursued for short-term situations (during water shortages) compared to long-term, and which behavioral changes are most effective short and long term?

Innovation- Emerging water conservation technologies and techniques offer new opportunities to save water, but often field-testing and evaluations are needed before being promoted and fully adopted.

Policy- Current State policy is to use incentives to encourage implementation of best management practices.

Surface Storage

The CALFED Record of Decision (2000) identified five potential surface storage reservoirs that are being investigated by the DWR. U.S. Bureau of Reclamation (Reclamation), and local water interests:

- Shasta Lake Water Resources Investigation
- North-of-the-Delta Offstream Storage
- In-Delta Storage Project
- Los Vaqueros Reservoir Expansion
- Upper San Joaquin River Basin Storage Investigation

CALFED noted that perhaps the greatest benefit of new surface storage would be the operational flexibility that storage adds to today's constrained system. The Bay-Delta system provides water for a wide range of needs, including in-stream flows for aquatic species, riparian habitat, wetlands, as well as benefits to municipal, industrial, and agricultural users. These often-competing demands have restricted the operational flexibility of the State Water Project (SWP) and Central Valley Project (CVP) systems and consequently negatively impacted the quantity, quality, and timing of deliveries.

Additional surface storage will provide flexibility to the state's water management system, which can be operated to contribute to the long-term sustainability of the Delta ecosystem, maintaining water quality and supply reliability, and allow for better response to the effects of earthquakes, floods, and climate change.

Potential Water Supply Benefit for CALFED Storage Projects	
Shasta Lake Water Resources Investigation	Driest periods average: up to 133 thousands acre feet (taf)/year
North-of-the-Delta Offstream Storage	Long-term average: 150 - 403 taf/year Driest periods average: 110 - 390 taf/year

In-Delta Storage	Long-term average: 65-70 taf/year (2006) Driest periods average: Approximately ½ of average year benefits (2004)
Los Vaqueros Expansion Investigation	Long-term average: 143 taf annual average supplies to Bay Area water users. Up to 175 taf emergency supply
Upper San Joaquin River Basin Storage Investigations	Long-Term Average: 165- 208 taf/year (based on pre-Settlement flows)

Potential Water Quality Benefits for CALFED Storage Projects	
Shasta Lake Water Resources Investigation	NA
North-of-the-Delta Offstream Storage	Long-term average: 69 – 176 taf/year Driest periods average: 34 - 186 taf/year
In-Delta Storage (Delta Wetlands)	Long-term average: 23 - 36 taf/year (Maximum release of 1,500 cfs from reservoir islands) In critically dry years, Chloride minimums (max benefit) are -29.4 to -62.5 mg/L Chloride
Los Vaqueros Expansion Investigation	Bay Area Water quality benefits calculations are not final but preliminary modeling showed significant reductions in salinity and total organic carbon to Bay Area water agencies served by the South Bay Aqueduct. Also provides water quality benefits for CCWD.
Upper San Joaquin River Basin Storage Investigations	Have not been calculated yet.

Potential Water Supplies for Ecosystem Restoration Benefits for CALFED Storage Projects	
Shasta Lake Water Resources Investigation	Up to 378 taf dedicated storage
North-of-the-Delta Offstream Storage	Long-term average: 140 – 240 taf/year
In-Delta Storage (Delta Wetlands)	Long-term average: 15 - 19 taf/year
Los Vaqueros Expansion	Long-term average: 60 - 140 taf/year (Included in

Investigation	the Water Supply Benefit Table above)
Upper San Joaquin River Basin Storage Investigations	Enhanced water temperature and flow benefits on the San Joaquin River have not been calculated.

Costs of CALFED Surface Storage

Construction Cost Estimates for CALFED Storage Projects	
Shasta Lake Water Resources Investigation	$530 million for a 6.5 foot dam raise $825 million for a 18.5 foot dam raise (2006 dollars)
North-of-the-Delta Offstream Storage	$2.3 to $3.2 billion (2007 dollars)
In-Delta Storage	$789 million (2005 dollars)
Los Vaqueros Expansion Investigation	$550 million (2006 dollars)
Upper San Joaquin River Basin Storage Investigations	Fine Gold Reservoir – $640 million Temperance Flat RM274 – $2 billion Temperance Flat RM279 - $2- billion (2006 dollars)

Major Issues:
Funding - Sufficient and stable State and federal funding are critical to successful completion of the feasibility and environmental studies for the five projects.
Common Assumptions Effort - DWR, Reclamation and the California Bay-Delta Authority initiated the Common Assumptions process to develop consistency and improve efficiency among the surface storage investigations.
Developing Project Alternatives - One of the next key steps in the surface storage planning process is developing project alternatives that meet the requirements of federal, State, and local participants.

Conjunctive Management and Groundwater Storage

Conservative estimates of additional implementation of conjunctive management indicate the potential to increase average annual water deliveries throughout the state by 500,000 af/y with 9 maf of "new" groundwater storage. New storage includes both reoperation of existing groundwater storage and recharging water into de-watered aquifer space. More aggressive estimates from screening level studies indicate the potential to increase average annual water deliveries by 2 maf with about 20 maf of new storage. The more aggressive estimates are based on assumptions that require major reoperation of existing surface water reservoirs and groundwater storage to achieve the benefits and do not fully consider the conveyance capacity constraints for exports from the Delta and other conveyance facilities.

Range in Conjunctive Management Supply and Groundwater Storage Benefit by Hydrologic Region					
	Sacramento River	San Joaquin River	Tulare Lake	South Coast	Colorado River
Available Groundwater Storage Capacity (Thousand Acre-Feet)	400-2000	200-2000	300-8000	800-6000	4000
Average Annual Supply Benefit (Thousand Acre-feet per year)	30-500	10-500	200-300	100-600	200

Grant applications from DWR's fiscal year 2003-2004 Conjunctive Water Management Program show water costs ranging from $20 to $3000 per acre-foot. The statewide implementation costs are approximately $1.5 billion for the conservative level of implementation and $5 billion for the aggressive implementation.

Major Issues:
Lack of Data - There is rarely a complete regional network to monitor groundwater levels, water quality, land subsidence, or the interaction of groundwater with surface water and the environment.

Infrastructure and Operational Constraints - Physical capacities of existing storage and conveyance facilities are often not large enough to capture surface water when it is available in wet years. Operational constraints may also limit the ability to use the full physical capacity of facilities.

Surface Water and Groundwater Management - In California, water management practices and the water rights system treat surface water and groundwater as two unconnected resources. In reality, there is often a high degree of hydrologic connection between the two.

Water Quality - Groundwater quality can be degraded by naturally occurring or human introduced chemical constituents, low quality recharge water, or chemical reactions caused by mixing water of differing qualities.

Environmental Concerns - Environmental concerns related to conjunctive management projects include potential impacts on habitat, water quality, and wildlife caused by shifting or increasing patterns of groundwater and surface water use.

Funding - There is generally limited funding to develop the infrastructure and monitoring capability for conjunctive management projects.

Water Recycling

Water recycling is an emerging component of water resources supply and management which started gaining grounds in recent years as reliable alternative to supplement conventional water sources so as to meet the growing demand for fresh water and guarantee a sustainable socioeconomic development.

Water recycling creates 'new water' from discarded wastewater as a potential water source that will free up freshwater for domestic water needs. Additionally, recycled waters are local sources that could offset the need for further transfers and diversions from the Delta.

Water Recycling, also known as Water Reclamation or Water Reuse, is an umbrella term encompassing the process of treating, storing, distributing, and using wastewater. Water recycling has been occurring in California since the late 1800s with public health protections in effect since the early part of the 1900s. Water recycling is gaining considerable attention from scientists, resource planners, policy-makers, and other stakeholders. Today, California water agencies reuse about 700,000 af/y of recycled water, about 40 percent more than in 1970 for 40 different uses. The uses include agricultural and landscape irrigation including golf course irrigation, groundwater recharge, industrial cooling and processing, toilet flushing, and a variety of environmental enhancement and other uses. The Water Plan Update projection level for water recycling for 2030 is 1.4 maf/y.

Given the wide range of local conditions that can affect costs, the majority of water recycling projects would cost between $300 and $1,300 per acre-foot of recycled water. Costs outside this range may be plausible depending on local conditions and uses that require higher water quality and have higher public health concerns.

Major Issues:
Funding- Funding is needed to support recycling projects and for health research, technology advancement, public awareness, academic programs.

Environmental issues- Environmental issues must be considered while developing a complete mix of water supply alternatives

Participation- Public and regulatory agencies need to be engaged in an active dialogue regarding water recycling projects from inception to finish

Regulations- Uniform state-wide regulations are needed dealing with the use of recycled water are needed

Water Desalination

Desalination is a water treatment process for the removal of salt from water for beneficial use. There are two primary types of desalination, one for brackish (low-salinity) surface or groundwater, and the second for ocean water. In California, the principal method for desalination is through reverse osmosis technology. This process can be used to remove salt as well as specific contaminants in water such as trihalomethane precursors, volatile organic carbons, nitrates and pathogens. Desalination technology is also used to treat wastewater effluents for reuse purposes and to improve the quality of fresh water for potable and industrial uses.

The California Water Desalination Task Force emphasized that desalination should be considered, where economically and environmentally appropriate, as an element of a balanced water supply portfolio, which also includes conservation and water recycling to the maximum extent practicable. It also directed that "since each desalination project is unique and depends on project-specific conditions and considerations, each project should be evaluated on a case-by-case basis".

Similar to water recycling, water desalination creates 'new water' from discarded wastewater or ocean water or brackish water as a potential water source that will free up freshwater for domestic water needs Additionally, desalinated waters are local sources that could offset the need for further transfers and diversions from the Delta.

Currently in California, desalination technologies generate approximately 180,000 af/y of potable water; over 95% generated from brackish water sources. The 2005 California Water Plan, is projecting a potential of about 0.5 maf/y of additional desalinated water by the year 2030. Of that amount, about 200,000 af would be ocean water desalination. More than two third of potential desalinated water is anticipated to supply south coast regions' communities.

Desalination has historically been prohibitively expensive. The improvements in technology and the rising cost of conventional water supplies have made desalination competitive with importing water and recycled municipal wastewater in a number of cases. The cost will be influenced by the type of feedwater, the available concentrate disposal options, the proximity to distribution systems, and the availability and cost of power. The higher costs of desalting may, in some cases, are offset by the benefits of increased water supply reliability and/or the environmental benefits from substituting desalination for a water supply with higher environmental costs. The total amortized production cost of reverse osmosis desalination ranges from $860/af to $1,300/af (assuming electricity costs of $0.08/kWh). On the average, an increase in electric energy cost of $0.01/kWh would increase the total cost of desalination by $53/af of desalinated water.

Major Issues:
Cost- A major issue for water desalination project is high cost.

Energy use- The energy use of water desalination is high and could lead to increase in greenhouse gas emission.

Environmental impacts- environmental impacts of brine disposal and feedwater intake, and also growth-inducing factors.

Water Transfers

Water transfers are not one of the water management strategies of the Water Plan Update. But water transfer has been and will be a mechanism to provide water supply for areas with water shortage. Water transfers fall in two distinct categories; programs that produce transferable water upstream of the Delta and those that produce transferable water downstream of the Delta. Water transfers that originate upstream of the Delta depend on capacity to pump water from the Central Valley Project and State Water Project facilities. Conjunctive use projects and groundwater banking depend on refill water in normal and wet years. Many of these projects depend on water from upstream of the Delta for refill. Generally speaking upstream of the Delta transfers increase pumping from the Delta and could have impact on the Delta. Water transfers from downstream of the Delta to urban water users have the potential to ease Delta water demands.

Agriculture to agriculture transfers and exchanges have been a common practice in the San Joaquin Valley for several years. Agriculture to urban transfers is a relatively new and untried concept in the San Joaquin Valley and therefore, difficult to assess the quantities of water that may be available for transfer since this is "new ground". California Water Code requires that water transfers do not cause injury to other legal users of water, do not cause unreasonable effects to fish, wildlife, or other instream beneficial uses and are without unreasonable economic impacts on the county of origin.

Water transfers have the ability to alleviate water supply shortfalls, provide supplemental water during water shortage, and refill groundwater basins. The effectiveness of water transfer programs will depend on the willingness of potential downstream of the Delta sellers to enter into water transfer agreements and the ability to move water through the Delta above baseline amounts during times that are least harmful to the environment.

Major Issue:
Delta export limitation- Any limitation on export from the Delta can limit water transfers from upstream of the Delta to downstream of the Delta.

Impacts- Water transfers from downstream of the Delta will require close groundwater monitoring to assess potential impacts on groundwater. Upstream of the Delta transfers increase pumping from the Delta and could have impact on the Delta.

Examples of Regional Planning Success

As regions invest in water management strategies they may shift water from wet years, wet seasons, or wet locations for storage and use at drier times. The regions are looking at the Delta as their baseline needs by trying to improve their water portfolio by using the Water Plan Update water management strategies to reduce their future demand on the Delta. Below are three examples of regional efforts in using portfolio of water management strategies to manage their future needs.

Integrated Regional Water Management Planning Activities by the Regional Water Authority

In April 2004, Regional Water Authority (RWA) launched its Integrated Regional Water Management Planning Program (http://www.rwah2o.org/rwa/programs/irwmp/)
In partnership with the United States Army Corps of Engineers and with grant funding assistance from DWR, 16 RWA members have participated in developing an IRWMP and associated tools to identify the regional projects and partnerships to help the region best meet its future needs. The program builds on previous efforts, such as the 2003 Regional Water Master Plan through the American River Basin Cooperating Agencies, to support a regional conjunctive use program and promote water recycling, water use efficiency and other strategies that improve local water supply reliability.

Participants represent a diverse array of water interests including public water supply, recycled water supply, water conservation, and environmental monitoring and improvement.

At the time of adoption of the IRWMP in June 2006, a suite of 14 projects were identified as the highest priority for implementation from among some nearly 200 identified in the plan. The projects were the subject of a successful $25 million grant through Proposition 50 and include: water supply, flood management, habitat restoration, groundwater management, water recycling, and conjunctive use.

Metropolitan Water District Integrated Water Resources Management

The Metropolitan Water District of Southern California's Integrated Water Resources Plan Update established new targets using conservation, local supplies, transfers, recycling, groundwater recovery, desalination, with continued reliance on the Delta and the Colorado River Aqueduct.
(www.mwdh2o.com/mwdh2o/pages/yourwater/irp/IRPupdate.pdf)

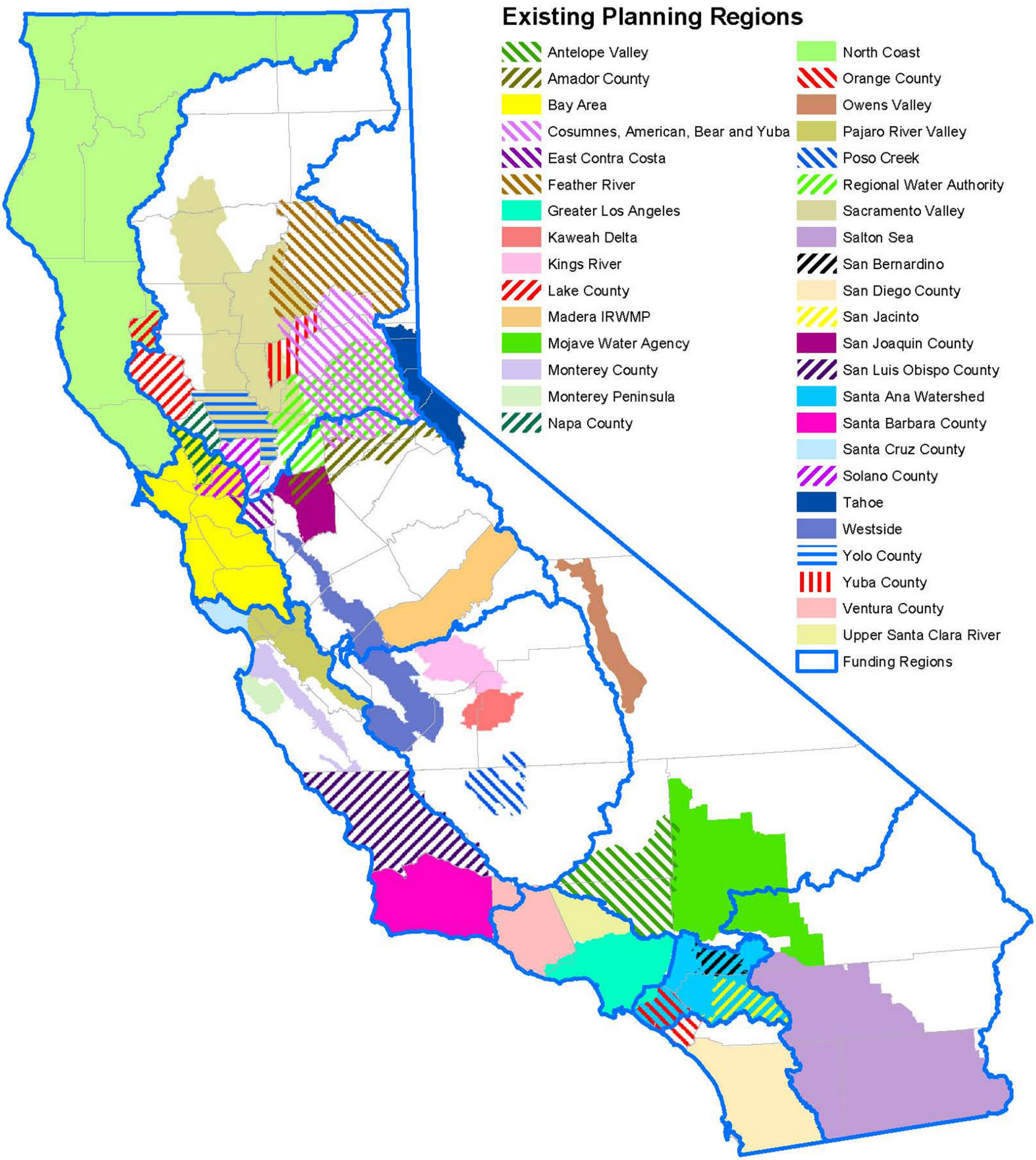
Santa Clara Valley Water District Urban Water Management Plan (2005)

The Santa Clara Valley Water District (SCVWD), acts as wholesaler to various local retail water suppliers within the region and on their behalf, acts as groundwater manager and distributor of the Santa Clara/Llagas Sub-basin (http://www.valleywater.org/water/Where_Your_Water_Comes_From/Water%20Supply%20Sustainability%20Planning/_pdf/2005-12-20_WSSPUnit_UWMPWithErrataSheets_Final.pdf)
The SCVWDs supplies are contracted from DWR and the U.S. Bureau of Reclamation, therefore appearing stable for the foreseeable future.

The SCVWDs demand appraisal is based on estimated water savings of conservation efforts provided by the San Francisco Public Utilities Commission (SFPUC) on behalf of the retail suppliers and their individual Urban Water Management Plans for recycled water supply availability. SCVWD estimated groundwater reserves, recycled water availability, and historical conservation savings, indicate that supplies should be adequate to meet current, estimated future, and multiple dry year demands.

Figure 1

PROPOSITION 84
Integrated Regional Water Management Program



Attachment 1
Summary of
Resource Management Strategies
California Water Plan Update 2005

Table 1 - Strategy Summary Table

Resource Management Strategies	Water Management Objectives: Provide Water Supply Benefit	Improve Drought Preparedness	Improve Water Quality	Operational Flex & Efficient	Reduce Flood Impacts	Environmental Benefits	Energy Benefits	Recreational Opportunities	Reduce GW Overdraft	Cumulative Cost of Option by 2030 ($ Billion) See narratives for backup
Reduce Water Demand										
Agricultural Water Use Efficiency	●	●	●	●		●	●		●	0.3 – 4.0
Urban Water Use Efficiency	●	●	●	●		●	●			2.5 - 6.0
Improve Operational Efficiency & Transfers										
Conveyance	●	●	●	●	●	●	●	●	●	0.2 – 2.4
System Reoperation	●	●	●	●	●	●		●		
Water Transfers		●	●	●		●				
Increase Water Supply										
Conjunctive Management & Groundwater Storage	●	●	●	●	●	●			●	1.5 – 5.0
Desalination – Brackish	●	●	●	●					●	0.2 – 1.6
– Seawater	●	●	●	●					●	0.7 – 1.3
Precipitation Enhancement	●	●					●			0.2
Recycled Municipal Water	●	●	●	●		●	●	●	●	6.0 – 9.0
Surface Storage – CALFED	●	●	●	●	●	●	●	●	●	0.2 – 5.6
Surface Storage – Regional/Local	●	●	●	●	●	●		●	●	
Improve Water Quality										
Drinking Water Treatment and Distribution			●							17.0 – 21.0
Groundwater/Aquifer Remediation	●	●	●						●	20.0
Matching Quality to Use	●	●	●							0.1
Pollution Prevention			●			●		●		15.0
Urban Runoff Management	●	●	●		●	●		●	●	
Practice Resource Stewardship										
Agricultural Lands Stewardship	●	●	●	●	●	●	●	●	●	5.3
Economic Incentives (Loans, Grants, and Water Pricing)	●	●	●	●		●			●	
Ecosystem Restoration	●			●	●	●		●		7.5 – 11.3
Floodplain Management				●	●	●		●		0.5
Recharge Areas Protection	●	●	●		●				●	
Urban Land Use Management	●		●		●	●		●	●	
Water-Dependent Recreation								●		3 – 6% of total
Watershed Management	●	●	●		●	●			●	0.5 – 3.6

Essential Support Activities to Integrate Strategies and Reduce Uncertainty

The following support activities are essential for successfully integrating packages of these resource management strategies. Compared with the costs of implementing the resource management strategies, the costs are relatively small for the essential support activities shown below (see Chapters 2 and 4 of Volume 1).

Activity	Cost ($ Billion)
Regional Integrated Resource Planning & Management	0.25
Statewide Water Planning	0.17
Data & Tool Improvement	0.25
Research & Development	0.25
Science	3 – 5% of total

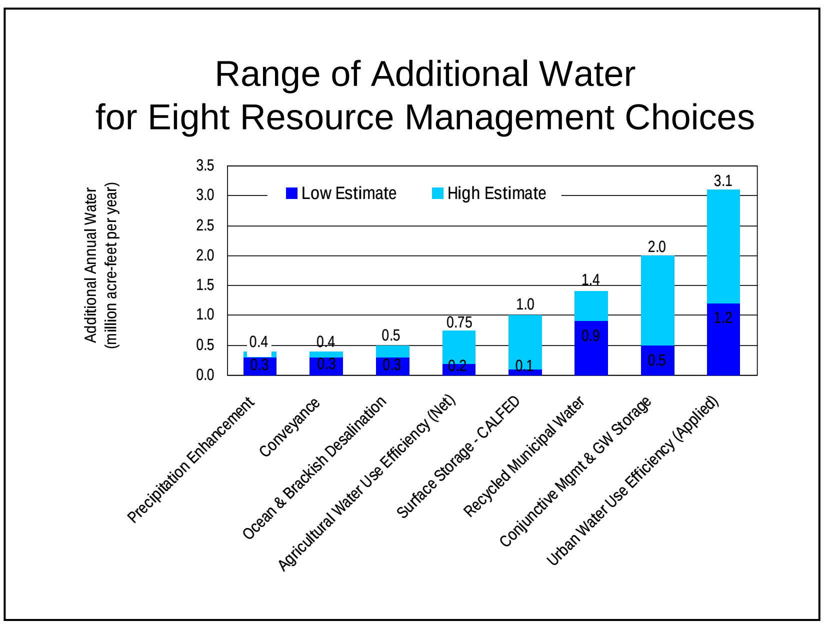
Resource Management Strategies

A resource management strategy is a project, program or policy that helps local agencies and governments manage their water and related resources. For example, urban water use efficiency is a strategy to reduce urban water use. A pricing policy or incentive for customers to reduce water use also is a strategy. New water storage to improve water supply, reliability and quality is another strategy.

Think of these strategies as tools in a tool kit. Just as the mix of tools in the kit will depend on the job, the combination of strategies will vary from region to region depending on climate, projected growth, existing water system, and environmental and social conditions. At the local level, it is important that the proposed strategies complement the operation of the existing water system. Some strategies may have little value in some regions. For example, because of geology, the opportunity for groundwater development in the Sierra Nevada is not nearly as significant as in the Sacramento Valley. Other strategies may have little value at certain times. For example, precipitation enhancement may not be effective during droughts.

A key objective of the California Water Plan is to present a diverse set of resource management strategies to meet the water related resource management needs of each region and statewide. The basic intent is to prepare good plans that are diversified, satisfy regional and state needs, meet multiple objectives, include public input, address environmental justice, mitigate impacts, protect public trust assets, and are affordable.

This graph shows the potential range of more water demand reduction and supply augmentation for eight resource management strategies by 2030. Low estimates are shown in the lower (dark blue) section of each bar. Estimates are from different studies described in Volume 2 of *California Water Plan Update 2005.*



The water supply benefits of the resource management strategies are not always additive. As presented here, urban water use efficiency includes reduction in both consumptive and non-consumptive uses (or applied water), whereas agricultural water use efficiency only includes reduction in consumptive uses (or net water). As presented, implementing agricultural water use efficiency measures by 2030 could reduce applied water use by 2.9 million acre-feet per year.

Strategies to Reduce Water Demand

Agricultural Water Use Efficiency
Agricultural water use efficiency involves improvements in technologies and management of agricultural water that result in water supply, water quality, and environmental benefits. These improvements generally include hardware (on-farm irrigation equipment), crop and farm water management practices, and improvements to water supplier distribution systems. Such improvements are intended to reduce water losses from excess surface runoff, seepage and excess plant evapotranspiration. Drip water systems and computerized water system controllers are two common examples of this technology.

Urban Water Use Efficiency
Urban water use efficiency involves technological or behavioral improvements in indoor and outdoor residential, commercial, industrial and institutional water use that lower water demand, lower per capita water use, and result in benefits to water supply, water quality, and the environment. The primary benefit of improving water use efficiency is the lowering of demand and the ability to cost-effectively stretch existing water supplies. Once viewed and invoked primarily as a temporary source of water supply in response to drought or emergency water shortage situations, water use efficiency and conservation approaches have become a viable long-term supply option, saving considerable capital and operating costs for utilities and consumers, avoiding environmental degradation, and creating multiple benefits.

Strategies to Improve Operational Efficiency

Conveyance
Conveyance provides adequate capacity for the movement of water. Specific objectives of natural and managed water conveyance activities include flood management, consumptive and non-consumptive environmental uses, water quality improvement, recreation, operational flexibility, and urban and agricultural water deliveries. Conveyance infrastructure includes natural watercourses as well as constructed facilities like canals, pipelines and related structures, including pumping plants, diversion structures, distribution systems, and fish screens. Groundwater aquifers are also used to convey water. Common water management objectives are to design water transmission systems with adequate water capacity to efficiently distribute imported or locally produced water to storage or the end users, so that system bottlenecks do not occur.

System Reoperation
System reoperation means changing the existing operation and management procedures for such water facilities as dams and canals to meet multiple beneficial uses. System reoperation may improve the efficiency of existing uses, reduce water losses, or it may increase the emphasis of one use over another. In some cases, physical modifications to the facilities may be needed to expand the reoperation capability.

Water Transfers
A water transfer is defined in the Water Code as a temporary or long-term change in the point of diversion, place of use, or purpose of use due to a transfer or exchange of water or water rights. Many transfers, such as those among contractors of the State Water Project or Central Valley Project, do not fit this definition. A more general definition is that water transfers are a voluntary change in the way water is usually distributed among water users in response to water scarcity. Transfers can be from one party with extra water in one year to another who is water-short that year. Transfers can be between water districts that are

neighboring or across the state, provided there is a means to convey and store the water. Water transfers can be a temporary or permanent sale of a water right by the water right holder; a lease of the right to use water from the water right holder; or a sale or lease of a contractual right to water supply. In practice many water transfers become a form of flexible system reoperation linked to many other water management strategies including surface water and groundwater storage, conjunctive management, conveyance efficiency, water use efficiency, water quality improvements, and planned crop shifting or crop idling. These linkages often result in increased beneficial use and reuse of water overall.

Strategies to Increase Water Supply

Conjunctive Management and Groundwater Storage

Conjunctive management is the coordinated operation of surface water storage and use, groundwater storage and use, and conveyance facilities to meet water management objectives. Although surface water and groundwater are sometimes considered to be separate resources, they are connected by the hydrologic cycle. Conjunctive management allows surface water and groundwater to be managed in an efficient manner by taking advantage of the ability of surface storage to capture and temporarily store storm water and the ability of aquifers to serve as long-term storage.

Desalination

Desalination is a water treatment process for the removal of salt from water for beneficial use. There are two primary types of desalination, one for brackish (low-salinity) surface or groundwater, and the second for ocean water. In California, the principal method for desalination is through reverse osmosis technology. This process can be used to remove salt as well as specific contaminants in water such as trihalomethane precursors, volatile organic carbons, nitrates and pathogens. Desalination usually requires large amounts of energy to run the reverse osmosis equipment, which in turn results in generally results in high production costs.

Precipitation Enhancement

Precipitation enhancement, commonly called “cloud seeding,” artificially stimulates clouds to produce more rainfall or snowfall than they would naturally. Cloud seeding injects special substances into the clouds that enable snowflakes and raindrops to form more easily. Precipitation enhancement in the form of cloud seeding has been practiced continuously in several California river basins since the early 1950s. Most projects are along the central and southern Sierra Nevada with some in the coast ranges. The projects generally use silver iodide as the active cloud-seeding agent, and it can be applied from either ground generators or from airplanes. The number of operating projects has tended to increase during droughts, up to 20 in 1991, but have leveled off to about 12 or 13 in recent years. Precipitation enhancement projects are intended to increase surface water supplies or hydroelectric power. The amounts of water produced are difficult to determine, but estimates range from a 2 to 15 percent increase in annual precipitation or runoff.

Recycled Municipal Water

Water recycling, also known as reclamation or reuse, is an umbrella term encompassing the process of treating wastewater from previous uses, and then storing, distributing, and using this recycled water to meet demands. Recycled water is defined in the California Water Code to mean “water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.” The treatment and use of municipal wastewater for golf course irrigation is an example of water recycling. Higher levels of treatment can make municipal wastewater reusable for school yards, residential landscape and park irrigation, industrial uses or even uses within office and institutional buildings for toilet flushing. The use of recycled water to meet additional demands results in a direct reduction in the amount of new water supplies needed to serve a community or region.

Surface Storage - CALFED

The CALFED Record of Decision (2000) identified five potential surface storage reservoirs that are being investigated by the California Department of Water Resources, U.S. Bureau of Reclamation, and local water interests. Building one or more of the reservoirs would be part of CALFED's long-term comprehensive plan to restore ecological health and improve water management of the Bay-Delta. The five surface storage investigations are:

- Shasta Lake Water Resources Investigation (reservoir enlargement)
- North-of-the-Delta Offstream Storage (Sites reservoir project)
- In-Delta Storage Project
- Los Vaqueros Reservoir Expansion
- Upper San Joaquin River Basin Storage Investigation

Planning for the five CALFED-directed investigations has made varying levels of progress, with all planning studies to be completed by 2009. Essentially, the planning consists of project formulation, environmental documentation and engineering design, and project cost estimates.

Surface Storage – Regional / Local

Surface storage is the use of reservoirs to collect water for later release and use. Surface storage has played an important role in California where the pattern and timing of water use does not always match the natural runoff pattern. The two categories of surface storage are (1) on-stream storage where a dam and reservoir are located directly in a river system, and (2) off-stream storage, where surface water is moved to a basin or valley that is in a location away from the river course. When justified, local agencies can plan, finance and build surface reservoirs without federal or State partners. Recent examples of surface storage reservoirs completed by local/regional entities include Olivenhain Dam, Los Vaqueros Reservoir, Diamond Valley Reservoir and Seven Oaks Dam. The primary benefits of new reservoirs are related to flood control (Seven Oaks), water quality, system operational flexibility, and system reliability against catastrophic events and droughts.

Strategies to Improve Water Quality

Drinking Water Treatment and Distribution

Drinking-water treatment includes physical, biological, and chemical processes to make water suitable for potable use. Distribution includes the storage, pumping, and pipe systems to protect and deliver the water to customers. Potable water supplies generally require some of level of water treatment (disinfection and fluoridation) to achieve a safe level of quality, which will then need to be maintained in a distribution system. By producing improved water quality in distribution systems the dangers from water contamination can be reduced, which in turn provides health benefits to customers and reduces waterborne illnesses and associated costs.

Groundwater Remediation / Aquifer Remediation

Groundwater remediation involves the extraction of contaminated groundwater from the aquifer, treating it through physical and chemical processes, and then discharging it to a water course or using it for approved purposes. It is also possible to inject the treated water back into the aquifer as a form of groundwater recharge. Contaminated groundwater can result from a multitude of sources, both manmade and naturally occurring. Examples of naturally occurring contaminants include heavy metals, high total dissolved solids, and high salinity from specific geologic formations or conditions. There are about 18,500 sites in California where active cleanup of groundwater contaminants is ongoing, which will eventually create usable aquifers to store water for urban and agricultural purposes.

Matching Water Quality to Water Use

Matching water quality to water use is a management strategy that recognizes that not all water uses require the same quality of source water. One common example of inefficient use occurs when source water is treated for urban distribution and use, after which a portion is diverted from the distribution system for agricultural purposes (which did not require treatment). This can occur in areas where only one water distribution system exists to serve both urban and agricultural customers. High quality water sources can be used for drinking and industrial purposes that benefit from higher quality water, and lesser quality water can be adequate for other uses, such as riparian streams with plant materials benefiting fish. Further, some new water supplies, such as recycled water, can be treated to a wide range of purities that can be matched to different uses. By properly matching the water source and level of treatment to the intended uses, system efficiency can be improved and treatment costs can be minimized.

Pollution Prevention

Pollution prevention can improve water quality for all beneficial uses by protecting water at its source, reducing the need and cost for other water management and treatment options. By preventing pollution throughout a watershed, water supplies can be used, and re-used, for a broader number and types of downstream water uses. Improving water quality by protecting source water is consistent with a watershed management approach to water resources problems. In addition, the legal doctrine of “public trust” demands that the State protect certain natural resources for the benefit of the public, including uses such as fishing, protection of fish and wildlife, and commerce, all of which are affected by pollution.

Urban Runoff Management

Urban runoff management is a broad series of activities that manage both stormwater and dry-weather runoff. Dry weather runoff occurs when, for example, excess landscape irrigation water flows to the storm drain. Urban runoff management is linked to several other resource strategies including pollution prevention, land use management, watershed management, water use efficiency, recycled water, protecting recharge areas, and conjunctive management. Traditionally, urban runoff management was viewed as a response to flood control concerns resulting from the effects of urbanization. Concerns about the water quality impacts of urban runoff have led water agencies to look at watershed approaches to control runoff and provide other benefits. The watershed approach for urban runoff management tries to emulate and preserve the natural hydrologic cycle that is altered by urbanization. The watershed approach consists of a series of best management practices (BMPs) designed to reduce the pollutant load, volume, and flow rate of urban runoff reaching waterways.

Strategies to Practice Resource Stewardship

Agricultural Lands Stewardship

Agricultural lands stewardship broadly means conserving natural resources and protecting the environment by utilizing farming practices that conserve and improve lands for food, fiber, watershed functions, soil, air, energy, plant and animal and other conservation purposes. Effective use of these practices will help improve watersheds and stream systems, which can lead to improvements to water quality, the environment and water resources. This strategy is focused on agricultural land (cropped and grazed land) as defined by the California Land Conservation (Williamson) Act. A few examples of effective agricultural lands stewardship can include crop rotation practices, wetland restoration, irrigation tailwater recovery, and riparian buffers to help filter runoff.

Economic Incentives (Loans, Grants, and Water Pricing)

Economic incentives are financial assistance and pricing policies intended to influence water management. For example, economic incentives can influence amount of use, time of use, wastewater volume, and source of supply. Economic incentives include low-interest loans, grants, and water pricing rates. Free services, rebates, and the use of tax revenues to partially fund water services also have a direct effect on the prices paid by the water users. In general, higher water rates to water users tends to reduce water use, which can result in water conservation when water supplies are inadequate (such as during drought conditions).

Ecosystem Restoration

Ecosystem restoration generally includes practices that change the flows in streams and rivers, restore fish and wildlife habitat, control waste discharge into streams, rivers, lakes or reservoirs, or remove barriers in streams and rivers so salmon and steelhead can spawn. Ecosystem restoration improves the condition of our modified natural landscapes and biotic communities to provide for the watershed sustainability and improved water quality. Ecosystem restoration focuses on rehabilitating damaged ecosystems so that they can supply important elements of their original structure and function in a sustainable manner.

Floodplain Management

Floodplain management reduces risks to life and property and benefits natural resources. Management of broadened floodplains allows for periodic flooding of the watercourse and generally is a preferred alternative to keeping rivers confined to narrow channels. Seasonal inundation of floodplains provides essential habitat for hundreds of species of plants and animals, many of them dependent on periodic floods. There are also benefits to the economy, agriculture and society from keeping rivers and their floodplains connected, including water quality improvements (sediment settles in slower currents), groundwater recharge, and minimizing of flood impacts to adjacent urban and agricultural lands.

Recharge Areas Protection

Recharge areas protection involves keeping important groundwater recharge sites from being paved over or otherwise developed, and guarding such recharge areas so they do not become contaminated. Protection of recharge lands, whether natural or man-made, is necessary if the quantity and quality of groundwater in the aquifer are to be maintained. Existing and potential recharge areas must be protected so that they remain functional and they are not contaminated with chemical or microbial constituents. Protecting recharge areas by itself does not provide a supply of groundwater, but instead insures that the capability to percolate surface water into the groundwater aquifer will be available when needed.

Urban Land Use Management

Effective urban land use management consists of planning for the housing and economic development needs of a growing population while providing for the efficient use of water and other resources. The way in which land uses are planned has a direct relationship to water supply and water quality needs of a region. Higher density urban development and the redevelopment of existing urban areas promotes more efficient use of new water supplies, and reduces water transmission and water quality costs.

Water-Dependent Recreation

Water-dependent recreation includes a wide variety of outdoor activities that can be divided into two categories. The first category includes fishing, boating, swimming and rafting, which occur on lakes, reservoirs, and rivers. The second category includes recreation that is enhanced by water features but does not require actual use of the water, such as wildlife viewing, picnicking, camping and hiking. Water-dependent recreation is included among the water management strategies because recreation is an important consideration for water managers. Water management, and water infrastructure, can have significant effects on recreation. By considering recreation during the planning process, water managers can take advantage of opportunities to enhance recreation, and can guard against actions that would limit recreation. Water-dependent recreation influences tourism, business and residential choices. It increases expenditures in the community for travel, food and accommodations.

Watershed Management

Watershed management is the process of evaluating, planning, managing, restoring and organizing land and other resource use within an area of land that has a single common drainage point. Watershed management tries to provide sustainable human benefits, while maintaining a sustainable ecosystem. Watershed management assumes that a prerequisite for any project is the sustained ability for the watershed to maintain the functions and processes that support the native ecology of the watershed. It is recognized that watersheds are dynamic and the precise make up of plants, animals, and other characteristics will change over time. Watershed management seeks to balance changes in community needs with these evolving ecological conditions in ways that generate water quality and water supply benefits.

Other Strategies

The *California Water Plan Update 2005* highlighted a variety of water management strategies that can potentially generate benefits that meet one or more water management objectives, such as water supply augmentation or water quality enhancements. However, these management strategies are currently limited in their capacity to strategically address long-term regional water planning needs.

Crop Idling for Water Transfers

Crop Idling is removal of lands from irrigation with the aim of returning the lands to irrigation at a later time.

Dewvaporation or Atmospheric Pressure Desalination

Dewvaporation is a specific process of humidification-dehumidification desalination. Brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall. Energy for evaporation is supplied by the energy released from dew formation.

Fog Collection
Precipitation enhancement also includes other methods, such as physical structures or nets to induce and collect precipitation. Precipitation enhancement in the form of fog collection has not been used in California as a management technique but does occur naturally with coastal vegetation; fog provides an important portion of summer moisture to our coastal redwoods.

Irrigated Land Retirement
Irrigated land retirement is the removal of farmland from irrigated agriculture. The permanent land retirement is perpetual cessation of irrigation of lands from agricultural production, which is done for water transfer or for solving drainage-related problems. Crop idling, with the intent of water transfer, is discussed in the Crop Idling for Water Transfers strategy.

Rainfed Agriculture
Rainfed agriculture is when all crop consumptive water use is provided directly by rainfall on a real time basis. Due to unpredictability of rainfall frequency, duration, and amount, there is significant uncertainty and risk in relying solely on rainfed agriculture.

Waterbag Transport/Storage Technology
The use of waterbag transport/storage technology involves diverting water in areas that have unallocated fresh water supplies, storing the water in large inflatable bladders, and towing to an alternate coastal region.