

Draft
ASSUMPTIONS

&

ESTIMATES

January 2008



ASSUMPTIONS

This draft A&E report contains data and information sources available at press time that will be used to develop technical information for California Water Plan Update 2009.

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Let us know

We are interested in hearing about additional information sources and general comments about improving the usefulness of the A&E report. Please direct suggestions by June 30, 2008:

E-mail Rich Juricich at ane@water.ca.gov

or write c/o California Department of Water Resources
Statewide Water Planning
P.O. Box 942836
Sacramento, CA 94236-0001

Phone 916-651-9225

FAX 916-651-9289

Draft A&E Report online at
<http://www.waterplan.water.ca.gov/cwpu2009/ae/>

California Water Plan Update 2009 Draft Assumptions and Estimates Report

Introduction

The purpose of this brochure is to summarize the content contained in the draft Assumptions and Estimates (A&E) Report for California Water Plan Update 2009 and to solicit public comments. It also provides background on the measures we are taking to improve data and analytical tools used to develop the Water Plan. The A&E Report describes the most significant data and data sources that will be used to prepare Water Plan Update 2009. California Water Code (Section 10004.6) requires that DWR publish the assumptions and estimates for the California Water Plan one year prior to the plan’s publication. This is a draft A&E Report for Update 2009. We will publish the final A&E Report in December 2008.

In this brochure, we discuss seven of the eight activities for Update 2009 and summarize the assumptions and estimates that will be used to develop them. All eight activities are described on the following page. Although the first activity, which is the Water Plan’s strategic plan, is not discussed in the A&E Report, results from the assumption and estimates will influence recommendations and other aspects of the final strategic plan.

Update 2009 will include strategic planning for statewide flood management

On CD and Internet

Data, data sources, and other technical information are presented electronically in the CD inserted in this brochure and also online at www.waterplan.water.ca.gov/cwpu2009/ae/. The draft A&E Report data are presented in a drill down fashion geographically and according to the major quantitative deliverables—water portfolios, future scenarios, and response packages—developed for the Water Plan.

Table 1
Mapping Water Plan activities to quantitative deliverables

Activities	Quantitative deliverables		
	Water portfolios	Future scenarios	Response packages
Water Plan vision, mission, goals, and principles	√	√	√
Develop multiple future scenarios		√	√
Incorporate climate change		√	√
Update Regional Reports	√		
Update Resource Management Strategies			√
Estimate and present actual water uses, supplies, and quality	√		
Improve data and analytical tools	√	√	√
Use companion State strategic plans	√	√	√

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Activity #1

The A&E Report discusses only seven of the eight Water Plan activities.

Although Activity #1, the Strategic Plan, is not discussed in this report, the recommendations of Water Plan Update 2009 will be influenced by the findings of our data and analysis.

Integrated flood management, as part of integrated water resources management, increases flood protection, improves preparedness and emergency response, enhances floodplain ecosystems, and promotes sustainable flood management systems.

Water Plan Activities

- 1. Review and revise the Water Plan vision, mission, goals, and principles;** and update its initiatives, recommendations, and implementation plan. This includes (a) reporting progress on actions associated with Update 2005's 14 recommendations, (b) addressing "Parking Lot" topics from the Update 2005 Advisory Committee, (c) incorporating issues and initiatives from Steering Committee members, (d) updating the Water Plan stakeholder/customer survey, and (e) including strategic planning for statewide flood management.
- 2. Develop multiple scenarios** of future California water conditions, and use scenarios to evaluate different combinations of resource management strategies (called response packages) for a range of water demand and supply assumptions plus climate change.
- 3. Incorporate climate change in Water Plan scenarios** to evaluate impacts on California's water resources and water systems, and to identify and recommend statewide and regional adaptation strategies.
- 4. Update the Regional Reports** for the 10 Hydrologic Regions and for the Sacramento-San Joaquin Delta and Mountain Counties as areas of special concern. Use information from the Integrated Regional Water Management and local water and flood planning efforts to describe critical issues, key initiatives, effectiveness of regional planning efforts, and region-specific response strategies.
- 5. Update the 25 Resource Management Strategies** with current research and information. Expand strategy narratives to describe their suitability for integrated flood management and their current and future implementation in various regions.
- 6. Estimate and present actual water uses, supplies, and quality** (Water Portfolios) for water years 1998 through 2005. Improve methods for representing consumptive and non-consumptive environmental water, and where reuse of water is occurring.
- 7. Improve information exchange and data integration, data, and analytical tools** to inform all Water Plan activities and decisions and to assist California water planners and managers.
- 8. Incorporate findings and recommendations** from companion State government plans.

Water Code Requirements

California Water Code (Section 10004.6) lists the minimum information that is required for the A&E report. Table 2 highlights the major categories of information required by the Water Code. In some cases, information required by the Water Code is not currently used in the development of Update 2009 because of limited resources or the lack of information. However, where possible, estimates are included for all items required by the Water Code.

Table 2 Major categories of information required by the Water Code

Basin hydrology	Current and projected water use
Groundwater supplies	Evapotranspiration rates for major crops
Current and projected water supplies provided by water recycling and reuse	Current and projected adoption of urban and agricultural water conservation practices
Environmental water needs	Current and projected land use patterns
Current and projected population	

Water Plan Activities

Develop Multiple Future Scenarios

California Water Plan Update 2005 introduced a new analytical approach to evaluating future water management conditions: multiple future scenarios and alternative response packages. The scenarios are not meant to be forecasts of the future, but represent alternatively plausible conditions for the future. They are explained here. Response packages comprise selected resource management strategies, which are explained in a later section.

Scenarios are shaped by factors considered to be beyond the control of water managers. Each scenario considers alternative values for some factors such as population growth and land use. We use scenarios to explore questions about the future; for example, what will the year 2050 be like if California’s population continues to grow at the rate it has over the past several years, and what if the rate increases over the next 10, 20, or more years? How will shifting land use influence future water demands for agriculture or municipalities?

Activity #2

Develop multiple scenarios of future California water conditions, and use scenarios to evaluate different combinations of resource management strategies (called response packages) for a range of water demand and supply assumptions plus climate change.

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A guiding principle for Update 2009: Incorporate future variability, uncertainties, and risk in the decision-making process. Use multiple future scenarios to consider drivers of change and emerging conditions, such as population growth and climate change, when making planning, management, and policy decisions.

WEAP = Water Evaluation and Planning, a modeling tool used to simulate and evaluate more refined integrated water management scenarios.

Update 2009 is using 2050 as the planning horizon for developing scenarios. And because the California Water Plan considers climate change, some studies may reach into the 22nd century. With 2005 as the initial condition, Update 2009 scenarios will be used to consider changes in 10-year increments through 2050. Table 3 shows factors that will be considered in developing scenario narratives for Update 2009 based on preliminary discussion through Water Plan public outreach.

For Update 2009, DWR is pursuing a joint study by Montgomery-Watson-Harza, the Stockholm Environment Institute, the National Center for Atmospheric Research, and the RAND Corporation to quantify scenarios and evaluate potential future water management responses. DWR has already begun developing information on regional demand and supply for California's 10 hydrologic regions in the WEAP (Water Evaluation and Planning) modeling platform. The joint study will complete and then build upon this work and other studies by employing the WEAP modeling tool to simulate and evaluate more refined integrated water management scenarios for Water Plan Update 2009. The joint study will quantify a small set of hand-crafted narrative scenarios developed during the Water Plan public process; it also will generate a larger ensemble of plausible scenarios to systematically evaluate the performance of various regional water management response packages in the face of a number of critical uncertainties, including climate change, population growth, land use patterns, and others.

This work will pursue the following objectives:

1. Develop an integrated scenario analysis modeling framework.
2. Use this framework to assess a spectrum of uncertainties that confront water planning in California, including global climate change, land use and demographic changes, and others.
3. Develop an analytical approach to evaluate promising regional water management responses.
4. Evaluate the results of these analyses using a set of performance metrics, introducing the notions of robustness and risk as part of the evaluation process. Robust strategies perform relatively well, compared to the alternatives, across a wide range of plausible futures. Risk characterizes the potential for understating or overstating the economic, water supply, public safety, and other consequences if assumptions about the future turn out to be incorrect.

Table 3 Scenario factors affecting regional and statewide water management

Total Population	Urban Runoff Regulations
Per Capita Income	Ag Discharge Requirements
Total Commercial Activity	Regulation of Delta Exports
Commercial Activity Mix	Colorado River Agreements
Total Industrial Activity	Endangered Species Listing
Industrial Activity Mix	Air Temperature variability
Energy Costs	Air Temperature trends
Irrigated Crop Area - Irrigated land area	Precipitation Variability
Irrigated Crop Area - Multi-cropped land area	Precipitation Trends
Irrigated Crop Area - Permanent crop land area	Snowpack/melt
Irrigated Crop Area - Seasonal crop land area	Sea-level Rise
Water Management Funding	River/Stream Unimpaired Flows
Population Density	Extent of Invasive Species
Population Distribution	Resilience of Endangered Aquatic Species
Passive Conservation	Membrane Technology Innovation
Drinking Water Standards	Groundwater Injection Technology Innovation
Irrigation Technology Use	Water Use Technology Innovation
Water Price - Rate Structure	Flood System Integrity
Water Price - Cost Recovery	Infrastructure Performance
Managed Wetlands - Irrigated habitat area	Demand for Water-based Recreation
Private Wetlands - Irrigated habitat area	
Instream Flow Requirements / Objectives	
Floodplain Development	
Flood Threat Recognition	
Flood Protection Standards	

Incorporate Climate Change in Water Plan Scenarios

Update 2009 will make use of California Climate Change Center (Center) studies to help develop recommendations for how California can adapt to long-term climate change. The California Energy Commission in 2003 created the Center to implement the Commission’s Public Interest Energy Research (PIER) Program and its long-term climate change research plan. The Center is a virtual research organization with core research at the Scripps Institute and complementary research at other scientific institutions in California. Of particular interest to the Water Plan are studies from the 2006 and upcoming 2008 Biennial Climate Science Reports required by Executive Order # S-3-05, signed by Governor Schwarzenegger on June 1, 2005.

In addition to the Center’s studies, DWR is pursuing a proposal to use the WEAP model (described earlier) to quantify future scenarios and to evaluate potential management responses. All the regions represented in the WEAP modeling will include plausible sequences of future weather (reflecting historical variability and possible trends in precipitation and temperature due to climate change) and use these sequences to see how they may affect outdoor urban and agricultural irrigation demand requirements, groundwater basin recharge, and local surface flows. Climate change scenarios used in the WEAP application will be consistent with scenarios developed by the Center.

Activity #3

Incorporate climate change in Water Plan scenarios to evaluate impacts on California’s water resources and water systems, and to identify and recommend statewide and regional adaptation strategies.

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Activity #4

Update the 12 Regional Reports for the 10 Hydrologic Regions and for the Sacramento-San Joaquin Delta and Mountain Counties as areas of special concern.

Update the Regional Reports

Update 2009 contains 12 reports summarizing California's hydrologic regions as well as the Mountain Counties area and the Sacramento-San Joaquin Delta area. The latter two describe areas with significant water issues that overlay parts of the other hydrologic regions. These 12 regional reports provide information on the current water supplies and uses in each region or area, as well as a discussion of the water issues, accomplishments, and challenges that are specific to each region of California. To the extent possible, the regional reports will use information from the Integrated Regional Water Management and local water and flood planning efforts to describe critical issues, key initiatives, effectiveness of regional planning efforts, and region-specific response strategies.

Update the 25 Resource Management Strategies

A resource management strategy is a project, program, or policy that helps manage water and related resources. The Water Plan describes more than two dozen resource management strategies. Different strategies can be used to accomplish different objectives and goals of water management: reducing water demand, improving operational efficiency and transfers, increasing water supplies, improving water quality, and practicing resource stewardship.

The strategies are intended to guide development of Integrated Regional Water Management plans. By selecting a mix of resource management strategies aimed at meeting its water management objectives, a region develops management response packages. By analyzing how different response packages might perform across a range of future scenarios, decision-makers, water managers, and planners can reduce uncertainty in water planning.

The draft A&E Report describes the key information sources for each of the resource management strategies described in the Water Plan. Table 4 groups 25 resource management strategies under the objective or goal each is intended to accomplish. The number of water resource strategies may increase as new techniques are learned and new technology is developed.

Activity #5

Update the 25 Resource Management Strategies with current research and information. Expand strategy narratives to describe their suitability for integrated flood management and their current and future implementation in various regions.

Table 4 Resource management strategies and their related goals and objectives

Reduce Water Demand		
Agricultural water use efficiency	Urban water use efficiency	
Improve Operational Efficiency & Transfers		
Conveyance	System reoperation	Water transfers
Increase Water Supply		
Surface storage – CALFED	Conjunctive management and groundwater storage	Ocean and brackish water desalination
Surface storage – regional / local	Precipitation enhancement	Recycled municipal water
Improve Water Quality		
Drinking water treatment and distribution	Matching water quality to water use	Groundwater / aquifer remediation
Pollution prevention	Urban runoff management	
Practice Resource Stewardship		
Agricultural lands stewardship	Recharge area protection	Economic incentives
Ecosystem restoration	Floodplain management	Water-dependent recreation
Urban land use management	Watershed management	
Other Strategies		
Crop idling for water transfers	Irrigated land retirement	Rainfed agriculture
Dewvaporation or atmospheric pressure desalination	Fog collection	Water bag transport/storage technology

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Activity #6

Estimate and present actual water uses, supplies, and quality (Water Portfolios) for water years 1998 through 2005. Improve methods for representing consumptive and non-consumptive environmental water, and where reuse of water is occurring.

See the full, electronic draft A&E Report for a complete description of Water Portfolio data categories.

In the Water Plan, data for Water Portfolios are presented in tables, flow diagrams, and in illustrations like this one. Here key components of the flow diagrams are shown as characteristic elements of the hydrologic cycle.

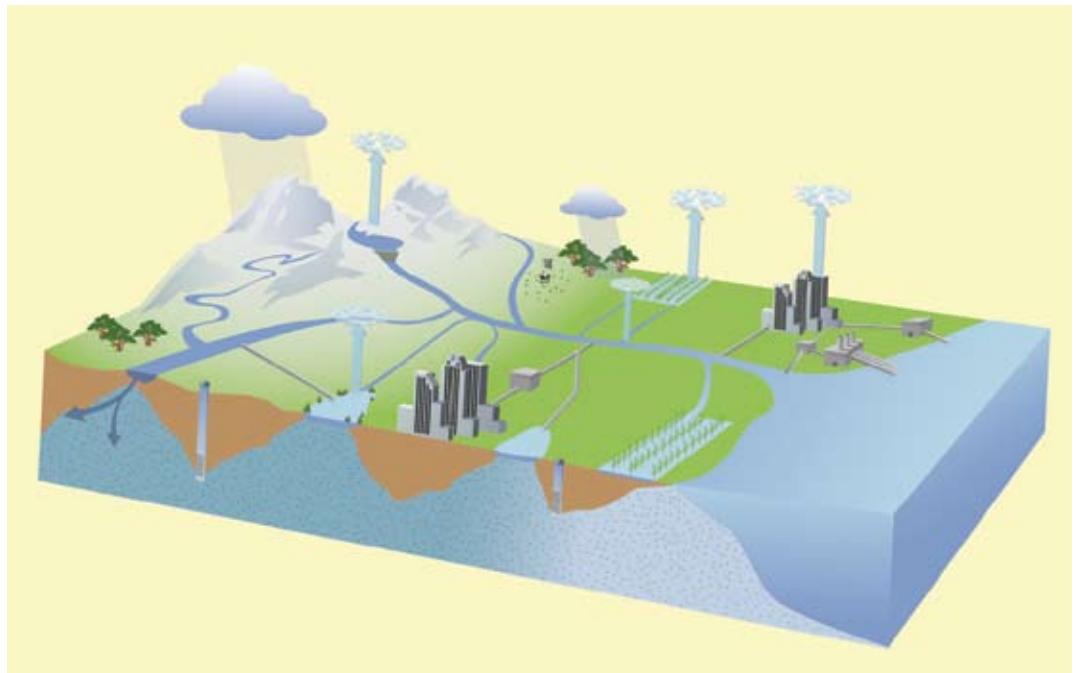
Estimate and Present Actual Water Uses, Supplies, and Quality

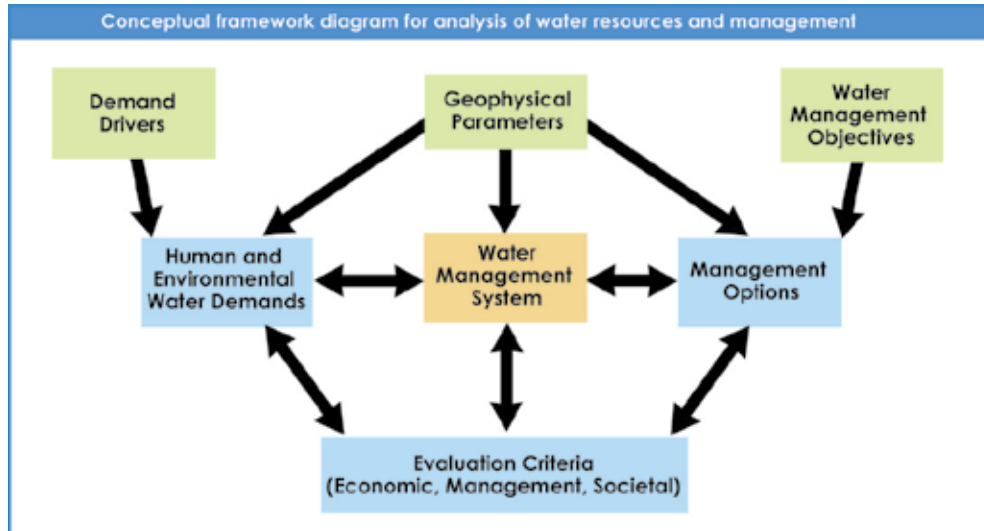
The Water Plan presents information about recent statewide and regional water conditions through Water Portfolios. Water Portfolios describe the distribution of water throughout the hydrologic cycle, how the water is used by the urban and agricultural sectors, and water in the environment. This information is necessary for Integrated Regional Water Management. Regions then have data needed to develop and pursue relevant and achievable water management objectives.

Update 2009 will include Water Portfolio information for water years 1998 through 2005. It will be part of the Water Plan's regional reports. Table 5 shows the major categories that are included in the draft A&E Report.

Table 5 A&E Report Water Portfolio content

Local deliveries	Residential interior and exterior water use	Large landscape water use
Local imported deliveries	Commercial and industrial water use	Reuse of water
Colorado River deliveries	Large landscape water use	Recycled water
Central Valley Project deliveries	Evapotranspiration of applied water for agriculture	Evapotranspiration of applied water for managed wetlands
Other federal deliveries	Groundwater recharge	Required instream flow
State Water Project deliveries	Deep percolation to a salt sink	Required Delta outflow
Groundwater extraction	Conveyance system losses	Wild and Scenic flows





We use information from items at the top level of this diagram to define scenarios. At the center is the water management system where most decisions are implemented within analytical tools. The remaining boxes represent information that varies dynamically within the water management system.

Improve Information Exchange and Data Tools and Integration

Several factors have led DWR to rethink how it evaluates California's future water conditions. Policy-makers and the public need more detailed quantitative information about the costs, benefits, and tradeoffs associated with different water management strategies. But data, analytical tool development, and data management have not kept pace with growing public awareness of the complex interactions among water-related resources. Additionally, California lacks a consistent framework and standards for collecting, managing, and providing access to data and information on water and environmental resources essential for Integrated Regional Water Management. More accurate data and analytical tools and better information management can reduce many uncertainties about the state's current and future water resources: how water supplies, demands, and quality change in response to different resource management strategies; how ecosystem health and restoration can succeed; and how we can adapt our water system to reduce controversy and conflicts.

DWR, through California Water Plan Update 2009, has taken the lead in organizing a response to the limitations described above. DWR has identified three broad activities that have been initiated and are being conducted concurrently to improve analytical capabilities in support of the Water Plan. The context and next steps for implementing the three activities are described below. Implementing a response requires significant participation by many entities that either generate information used by the Water Plan or use information in the Water Plan to make decisions. The critical activities are:

- Promoting Collaboration through SWAN
- Facilitating Information Exchange
- Improving Numbers for the California Water Plan

Activity #7

Improve information exchange and data integration, data, and analytical tools to inform all Water Plan activities and decisions and to assist California water planners and managers.

SWAN = Statewide Water Analysis Network, a technical advisory group formed by the California Department of Water Resources

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Get more information on SWAN, its publications, and its pilot studies at the SWAN Web site:

www.waterplan.water.ca.gov/swan

California Water and Environmental Modeling Forum (CWEMF) issued the report, “Strategic Analysis Framework for Managing Water in California”

Promoting Collaboration through SWAN

Update 2009 promotes technical collaboration through SWAN (Statewide Water Analysis Network), which is a technical advisory group formed by DWR. There are many reasons to promote collaboration:

- Integrated Regional Water Management requires multi-disciplinary information, and no single entity has the expertise or other resources required to develop all of the analytical tools and data needed to answer these broad questions.
- People want to improve the shared understanding and access to useful information across the state at an appropriate resolution.

Through SWAN, DWR will endeavor to improve the institutional setting for analysis performed for the Water Plan, partner with others on near-term analytical studies, and use Shared Vision Planning techniques to increase technical collaboration.

Improving the Institutional Setting for Quantitative Work

Perhaps one of the most critical activities for the near future is to engage interested parties throughout the state to leverage available resources and improve the shared quantitative capability involving California’s water management system. Effectively meeting today’s needs for quantitative information requires considerable networking, collaboration, and information-sharing between federal, tribal, State, local, and regional entities. The September 2005 report prepared by the California Water and Environmental Modeling Forum (CWEMF) titled *Strategic Analysis Framework for Managing Water in California* presents a wide array of possible institutional arrangements that could improve the institutional setting for developing and applying qualitative capability over the long-term.

Partnering on Near-term Studies

To prepare *California Water Plan Update 2005*, DWR established some mutually beneficial partnerships with entities engaged in research or pilot studies of interest to the Water Plan. DWR will continue to form these partnerships as a way of infusing new ideas and to maximize the benefit of outside expertise and funding.

Shared Vision Planning

DWR is collaborating with the US Army Corps of Engineers' Institute for Water Resources to apply Shared Vision Planning methods to develop water resources planning decisions in an open and accessible way. Shared Vision Planning is an approach specifically designed to address difficult conflicts between stakeholders within a complex water management problem. The essence of Shared Vision Planning is to create a planning process capable of building a mutual understanding of the facts involved in a problem for the ultimate purpose of focusing decision-participants' attention, debate, and resolution on values.

Learn more about Shared Vision Planning at www.sharedvisionplanning.us

Facilitating Information Exchange

In *California Water Plan Update 2005*, DWR committed to implementing “the Water Plan Information Exchange (Water PIE) for collecting and sharing data and networking existing databases and Web sites; using GIS software to improve analytical capabilities; and developing timely surveys of statewide land use, water use, and estimates of future implementation of resource management strategies.” Implementing Water PIE requires both short-term and long-term phases. The short-term phase includes showing linkages and providing easy access to information used by the California Water Plan and companion State government agency plans to assess current and future water management conditions. This will help promote transparency and build confidence among stakeholders that related statewide planning efforts are sufficiently coordinated. The goal of the long-term phase is to develop an interactive data management system to promote Integrated Regional Water Management. Water PIE will require protocols for managing data, including a common definition of terms and data quality control. DWR is developing the Water PIE Strategic Plan and Implementation Plan and multi-year budget.

Water PIE = Water Plan Information Exchange

DWR is developing Water PIE Strategic Plan and Implementation Plan and multi-year budget.

Improving Numbers for the California Water Plan

California Water Plan Update 2005 outlined three primary sets of quantitative deliverables:

- Water Portfolios
- Future Scenarios
- Alternative Response Packages

The information provided from these quantitative deliverables will be in the form of reporting metrics. Reporting metrics are quantitative numbers that represent something measurable. These numbers are reported prior to a judgment of the adequacy or desirability of the numbers with respect to specific objectives.

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A goal of the Water Plan is to build better understanding about how the California water management system works and how it responds to change. Improved communication and collaboration help us to reach important agreements. To achieve this, we must engage in a process that simultaneously improves the conceptual understanding of California's water management system and its representation in the analytical tools we use. The Water Plan team has committed to the following:

- Take a fresh look at our collective understanding of how the water management system works.
- Interact with experts to make sure we capture the latest thinking.
- Document our collective understanding of the water management system in an archival manner that can evolve over time.

Activity #8

Incorporate findings and recommendations from companion State government plans.

Find list of more than 100 State government plans on CD

Use Companion State Plans

Our list of State government plans has grown to more than 100. From that list, the State agency Steering Committee will identify those that are most pertinent to the Water Plan. From the companion State government plans, the Steering Committee will review their data, data sources, and analysis and scenarios and compare with our own.

Documentation for Assumptions and Estimates

The draft A&E Report includes the following documentation to describe the data and how the information is generated and used by the Water Plan:

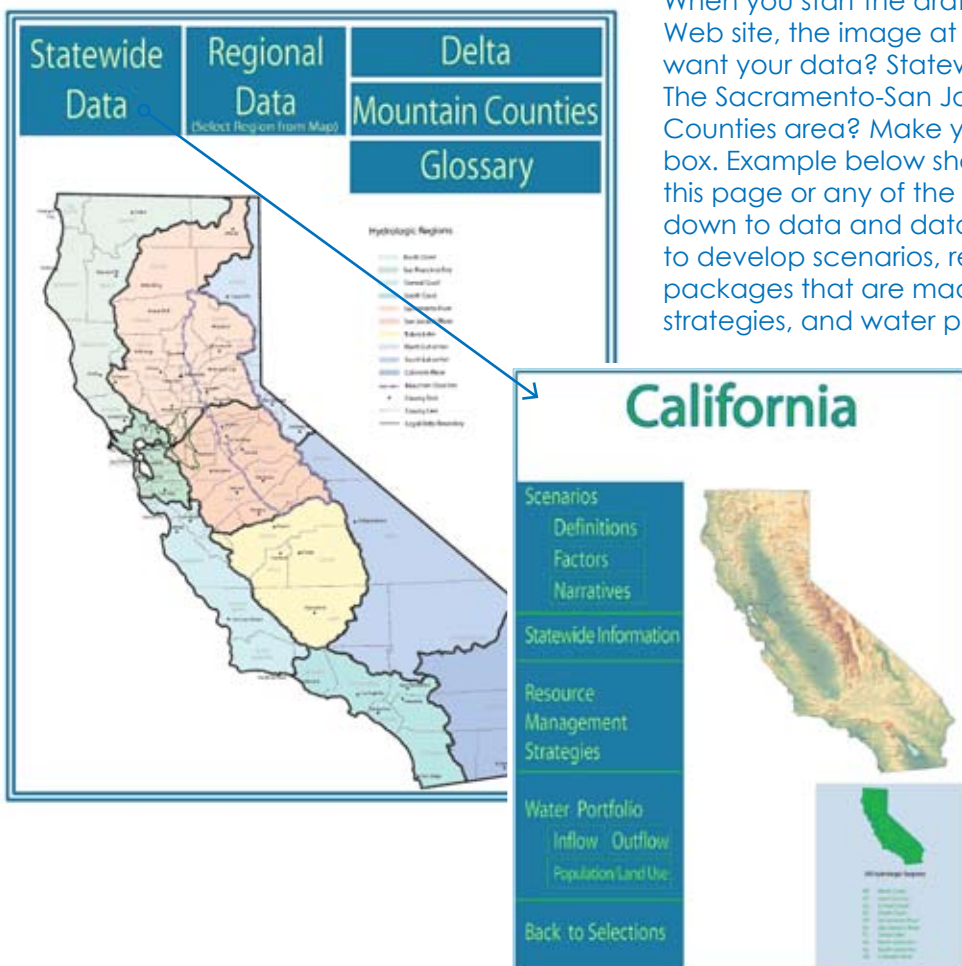
- Estimate – The value of data items to be used in Update 2009 (estimates are only available for the underlying Water Plan assumptions, and not for data items that will be calculated during development of the Water Plan.)
- Definition – The definition of the data item.
- Source – The source of information or reference that DWR used to obtain the estimate.
- Process diagram – A flow chart, which describes the process DWR uses to develop the estimate for the data item.
- Water Code reference – Describes data items that are required to be included in the A&E Report.
- Data recommendation – Recommendations by DWR staff or the public to improve the accuracy of the data item.

Drill Down to Data and Data Sources on the CD

California Water Plan Update 2005 promoted Integrated Regional Water Management as an effective approach to helping communities and regions incorporate sustainable actions into water management. Regional planning recognizes that place plays a significant role when planning and managing water supply. Therefore, assumptions and estimates data for this report are presented electronically (CD and online) in a drill down fashion geographically for the following areas:

A Glossary is provided on the draft A&E Report CD and online.

- the entire state,
- each of 10 hydrologic regions,
- the Sacramento-San Joaquin Delta including Suisun Bay and Marsh, and
- the Mountain Counties Area, which includes foothills and mountains of the western slope of the Sierra Nevada and a portion of the Cascade Range.



When you start the draft A&E Report CD or visit the Web site, the image at left appears. How do you want your data? Statewide or by hydrologic region? The Sacramento-San Joaquin Delta or the Mountain Counties area? Make your selection by clicking the box. Example below shows the statewide page. From this page or any of the regional pages, you can drill down to data and data sources that will be used to develop scenarios, regional reports, response packages that are made up of resource management strategies, and water portfolios.

Statewide
Data

Regional
Data
(Select Region from Map)

Delta
Mountain Counties

Glossary

