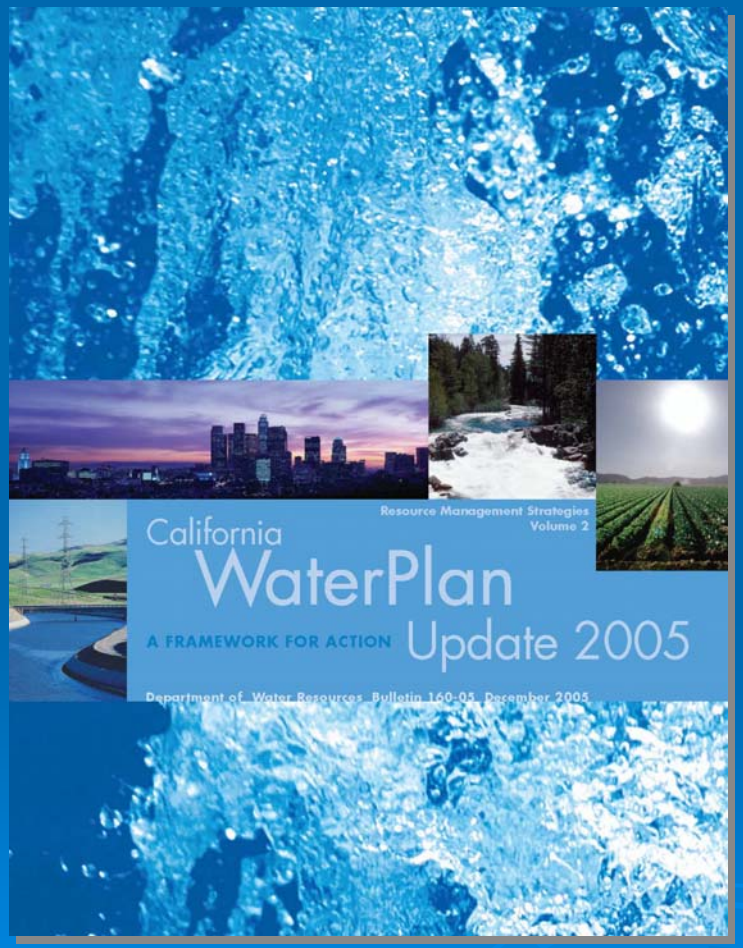
Climate Change and California Water Management Challenges

Climate Change Conference
Austin, Texas
May 12, 2006

Topics for Today's Briefing

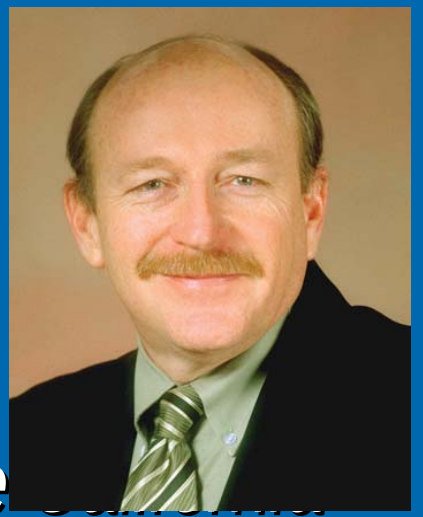
- California Water Plan Update 2005
- Overview of California Water Resources
- Potential Climate Change Impacts
- Meeting the Challenge / Next Steps

The California Water Plan



- Comprehensive plan to guide water management
- First published 1957
- Updated every 5 years
- Eighth update 2005

Director's Message



"This is not just another update of the California Water Plan. Update 2005 represents a fundamental transition in how we look at water resource management in California. It also represents a fundamental transition in the way state government needs to be involved with local entities and interest groups to deal with water issues in the state."

Lester Snow
April 14, 2005

New Process

- Open & transparent public process
- Collaborative recommendations
  - 65 on Advisory Committee
  - 350 in Extended Review Forum
  - 2000 Participants
- Prepared a strategic plan

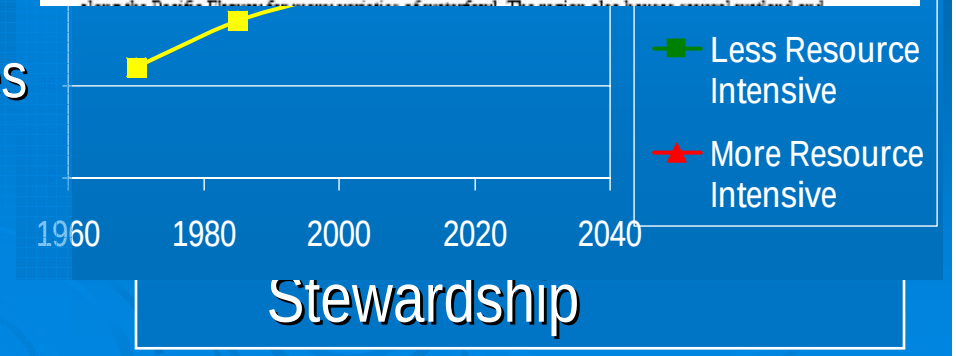
Meeting	Number	Person Hours
Advisory committee	43	12,681
Extended review forum & organizational briefings	43	1,558
Workshops	43	3,161
2005 Public comment workshops	15	1,512
Work groups	62	4,271
Tribal outreach	7	69
Totals	**197**	**23,252**

New Features

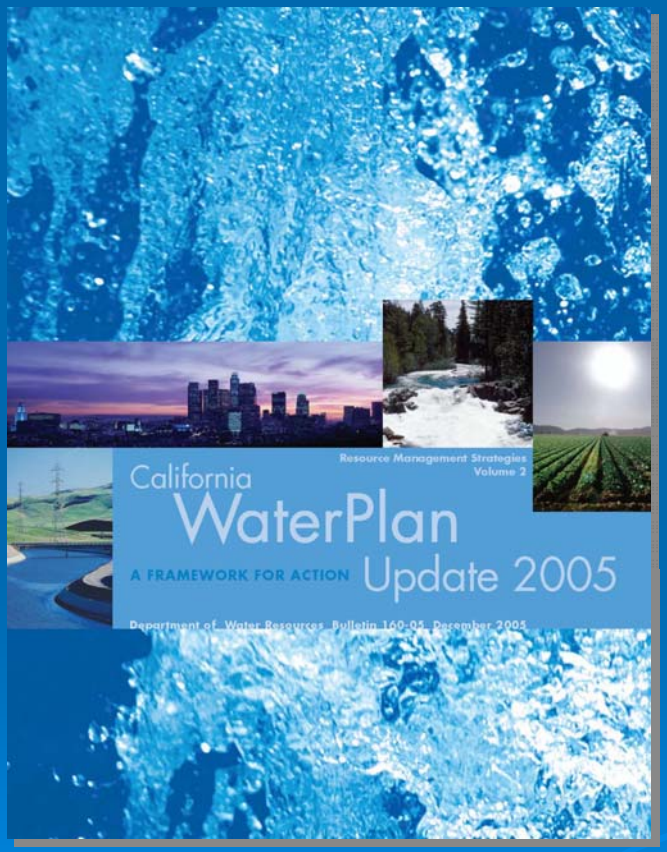
- Water Portfolios
  - Over 80 data categories of water supply & quality for 1998, 2000 & 2001
- Regional Reports
  - For 10 hydrologic regions, the Delta, and Mountain Counties
- Multiple Future Scenarios
  - Plausible yet different base conditions to plan for uncertainties
- 25 Resource Management Strategies
  - Tools for water managers & resource planners to …

cold, wet winters and large amounts of snow providing runoff for summer water supplies. The Sacramento Valley floor has mild winters with less precipitation and hot dry summers. Overall annual precipitation in the region generally increases as you move from south to north and west to east. The heavy snow and rain that falls in this region contributes to the overall water supply for the entire state.

The many rivers and streams that are tributary to the Sacramento River provide important riparian habitat that is critical for many aquatic and terrestrial species including the spring-run Chinook salmon (Oncorhynchus tshawytscha), winter-run Chinook salmon (Oncorhynchus tshawytscha) and Central Valley steelhead (oncorhynchus mykiss). This region is the only known area for the winter-run Chinook. The valley floor region section adjoining the river, provide some of the most important wintering areas

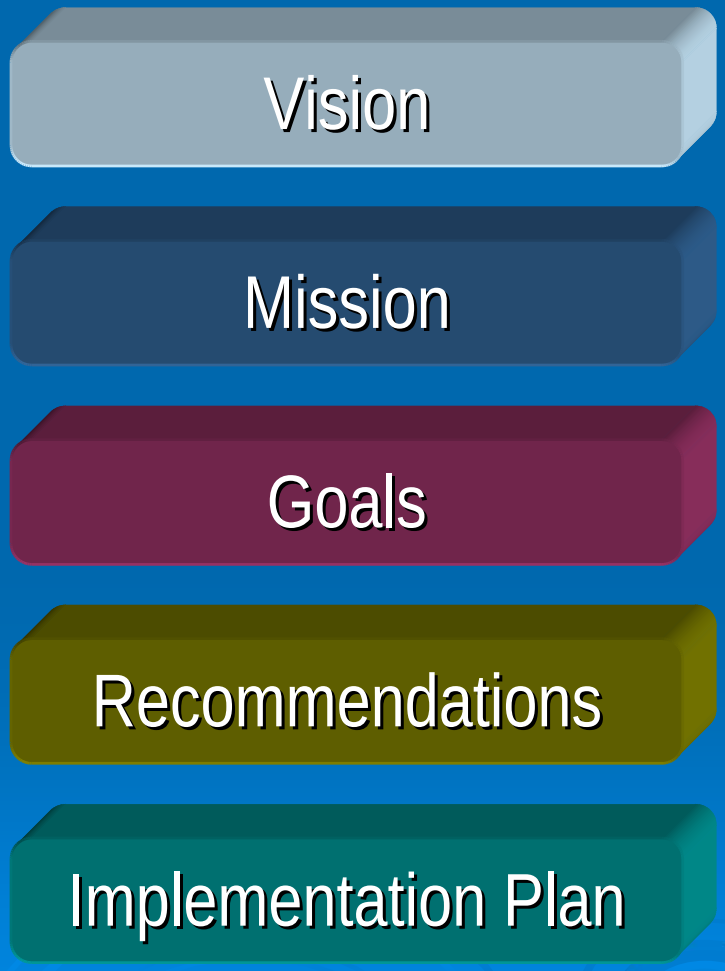


Water Plan Update Organization



- Introductory Video (8-minutes)
- Water Plan Highlights (with CD & DVD)
- Vol. 1 > Strategic Plan
- Vol. 2 > 25 Resource Management Strategies
- Vol. 3 > 12 Regional Reports
- Vol. 4 > Reference Guide
  (60+ online articles)
- Vol. 5 > Technical Guide
  (Online documentation)

Strategic Plan Overview



Framework for Action

Sustainable & Reliable Water in 2030

Diversifying Water Portfolios

Resource Management Strategies

Reduce Water Demand

- Agricultural Water Use Efficiency
- Urban Water Use Efficiency

Improve Operational Efficiency & Transfers

- Conveyance
- System Reoperation
- Water Transfers

Increase Water Supply

- Conjunctive Management & Groundwater Storage
- Desalination –Brackish & Seawater
- Precipitation Enhancement
- Recycled Municipal Water
- Surface Storage – CALFED
- Surface Storage - Regional/Local

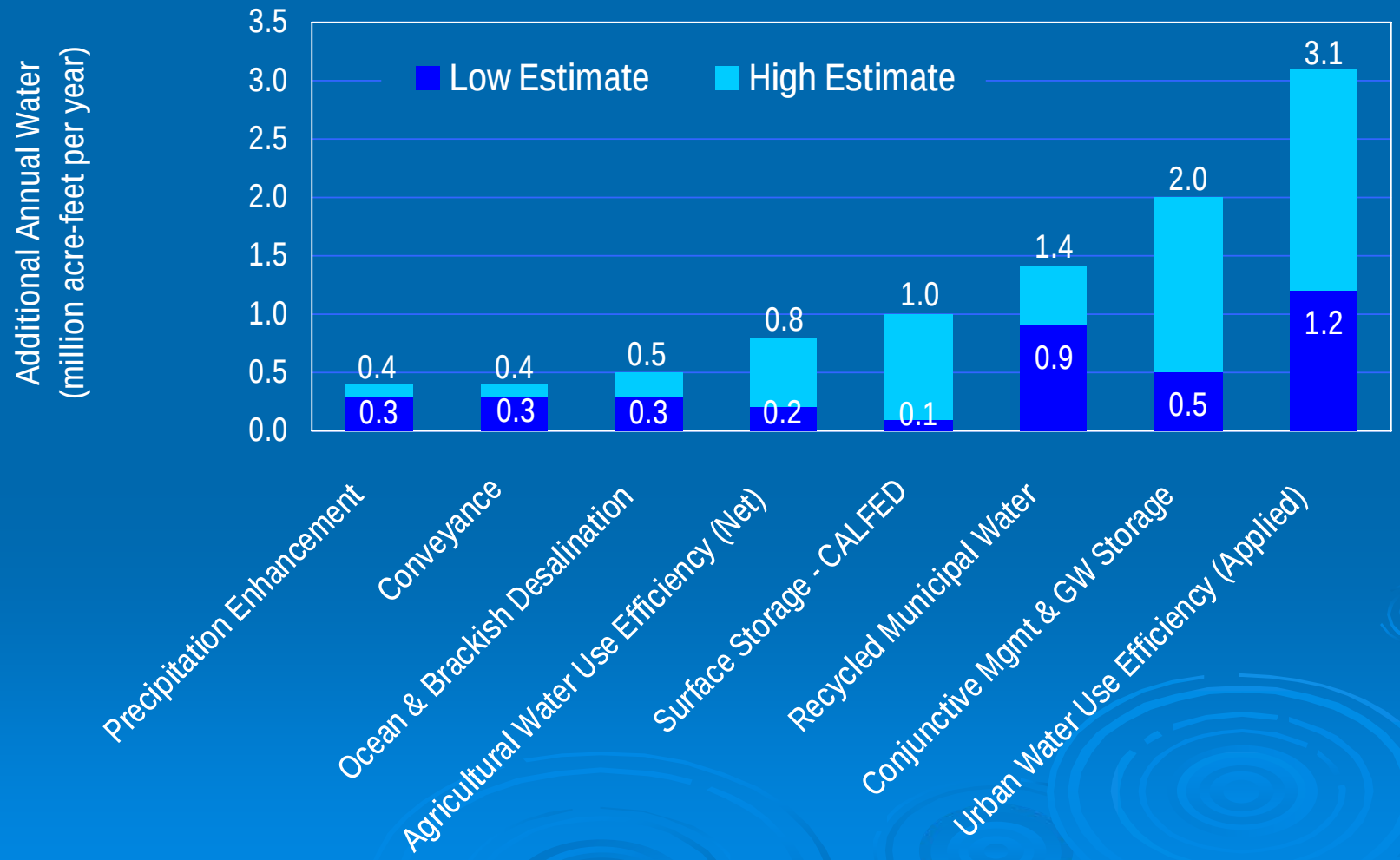
Improve Water Quality

- Drinking Water Treatment and Distribution
- Groundwater/Aquifer Remediation
- Matching Quality to Use
- Pollution Prevention
- Urban Runoff Management

Practice Resource Stewardship

- Agricultural Lands Stewardship
- Economic Incentives (Loans, Grants, and Water Pricing)
- Ecosystem Restoration
- Floodplain Management
- Recharge Areas Protection
- Urban Land Use Management
- Water-Dependent Recreation
- Watershed Management

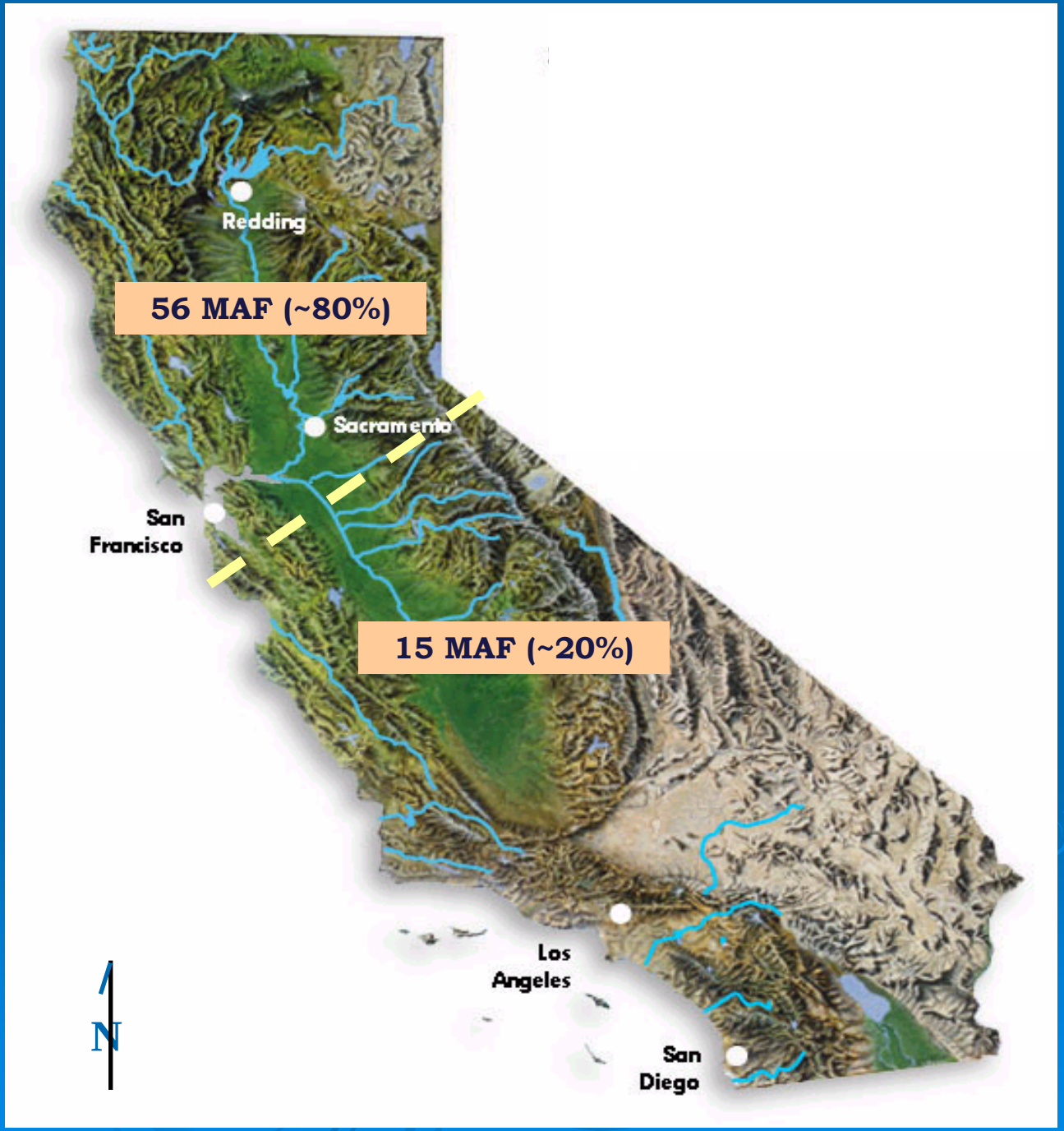
Range of Additional Water for Eight Resource Management Choices



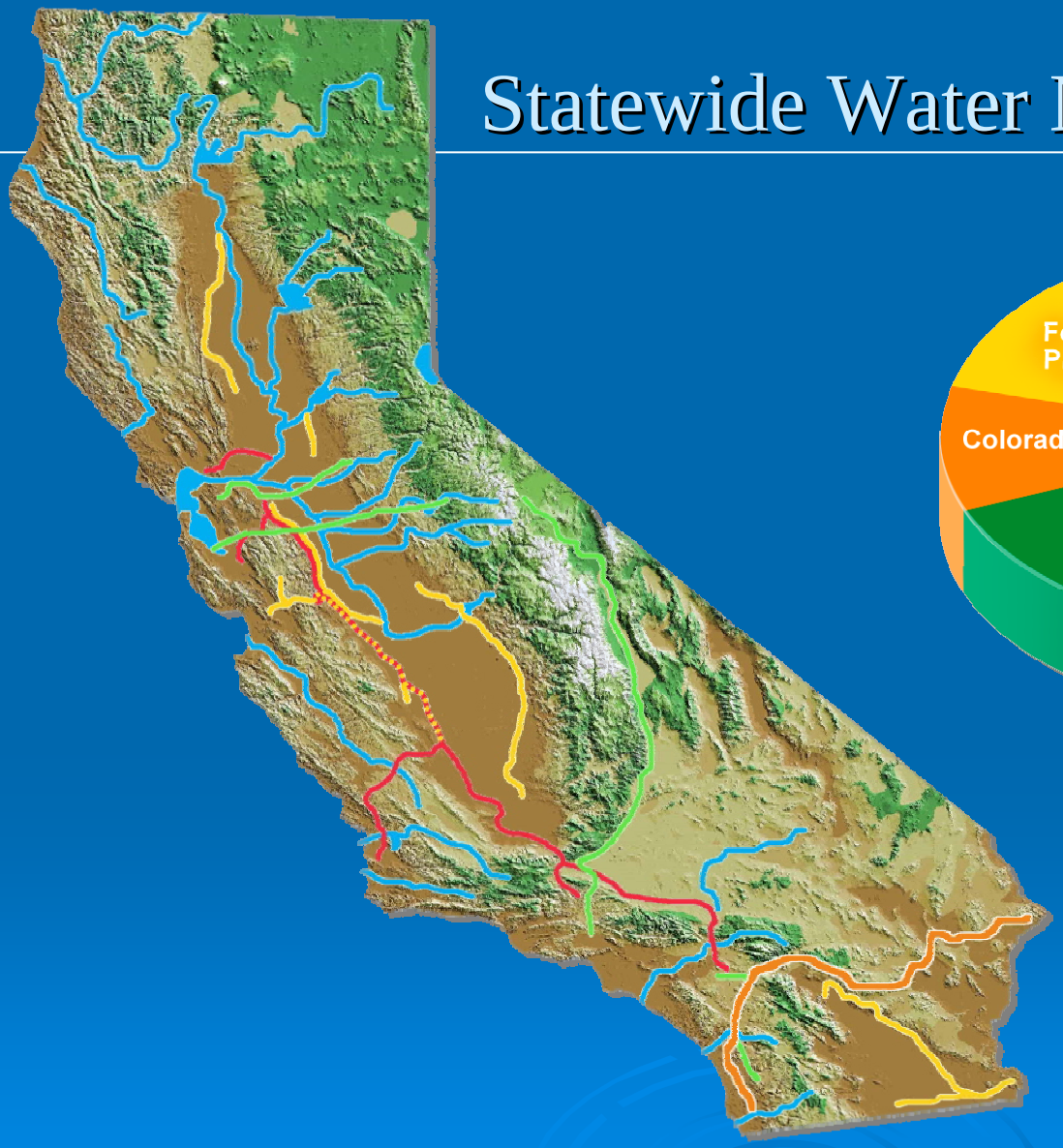
California's Water Resources

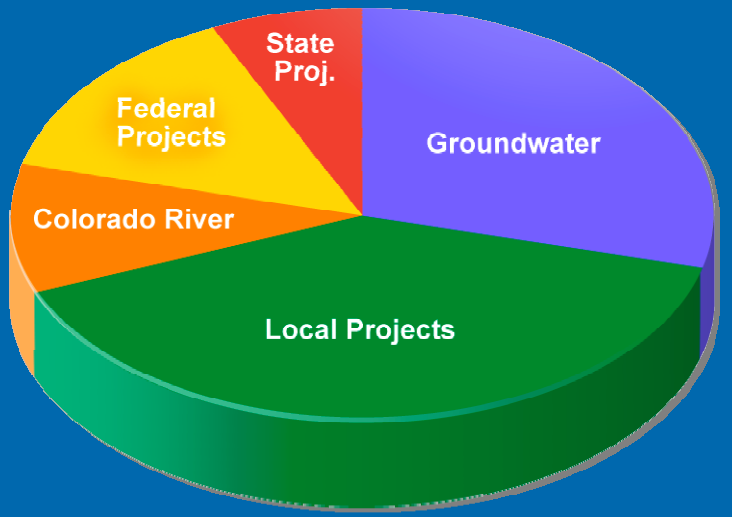
California's Major River Systems

Distribution of Annual Average Runoff In California

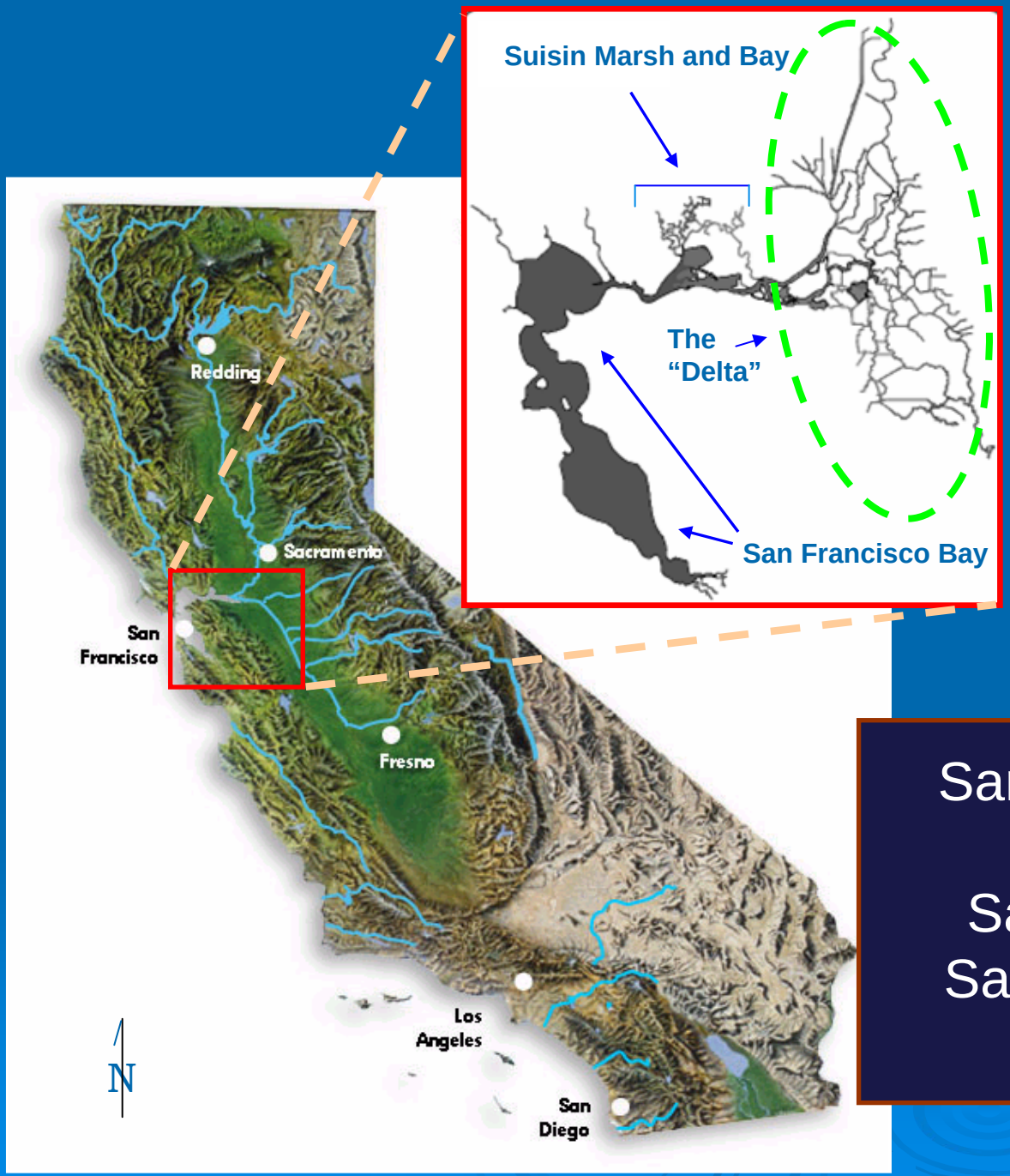


Statewide Water Management Systems





State
Federal
Colorado
Local

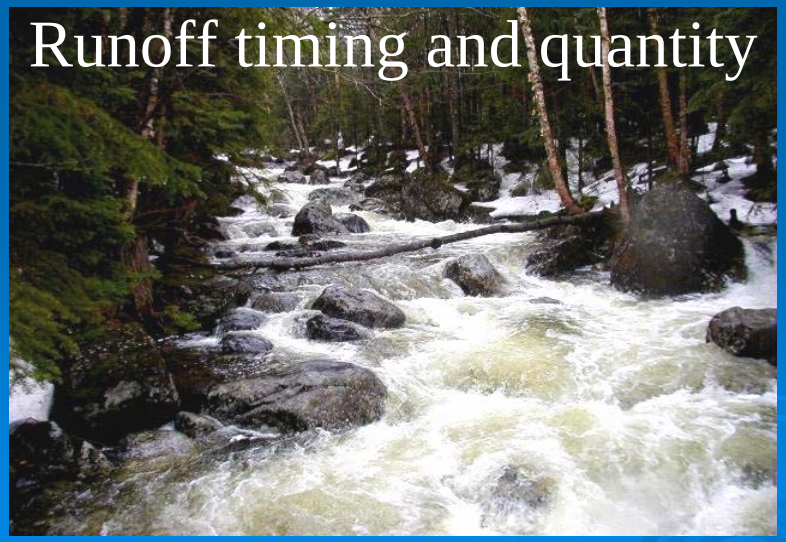


The Delta is critical to farms, cities, and the environment

San Francisco Bay
- and-
Sacramento and San Joaquin River Delta

What risks does climate change pose for the management of California's water resources?

Potential Impacts of Climate Change

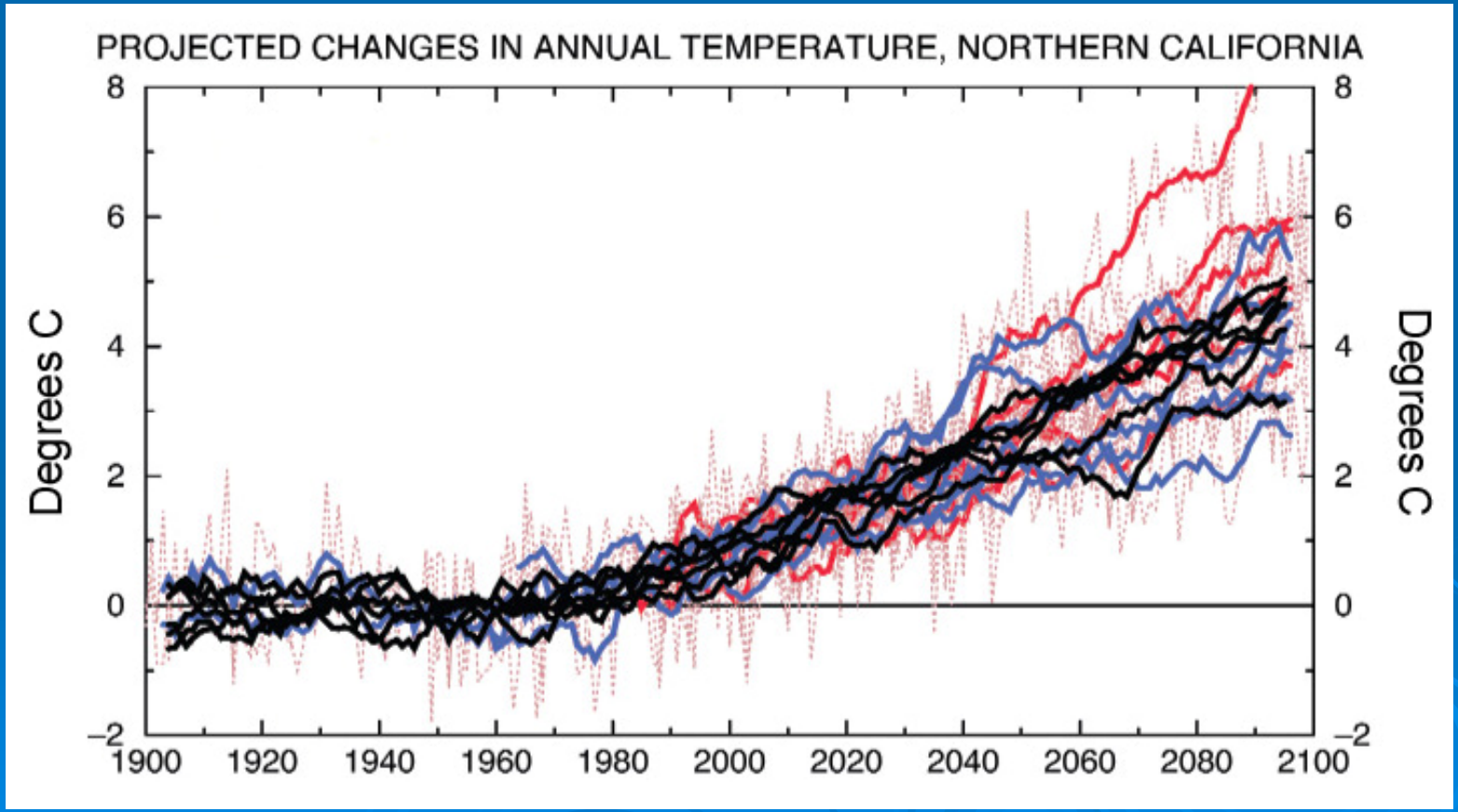


Potential Water Resources Impacts

- Flood Management
- Water Supplies
- Water Quality
- Water Demands
- System Operations
- Ecosystems

Increased Temperatures

Projections



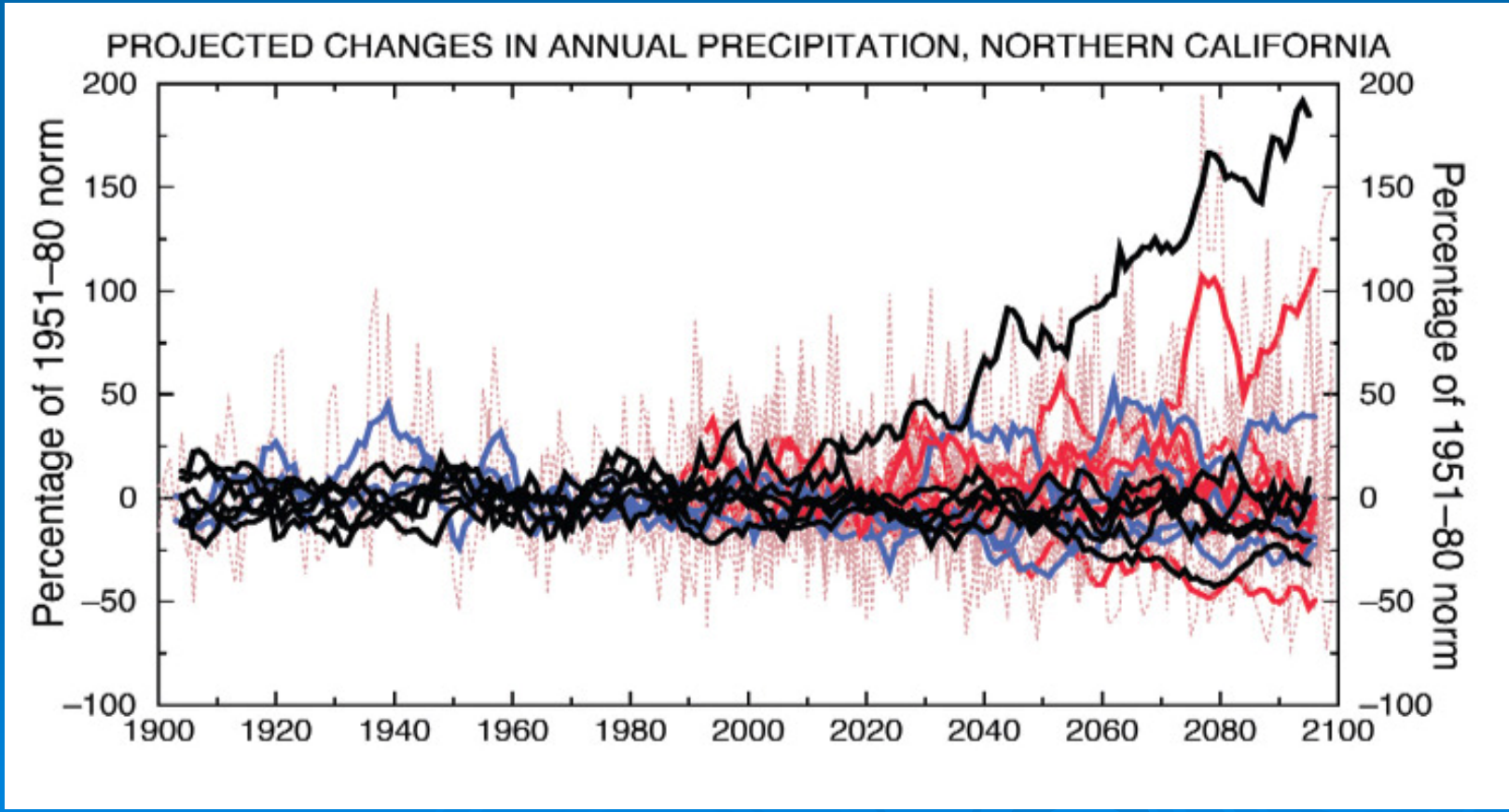
From: Dettinger, 2005

Expected Water Resource Impacts from Increased Temperatures

- Less precipitation falling in the form of snow
- Earlier snowmelt
- Changes in water demand
- Increased evaporation losses
- Changes in watershed vegetation and runoff
- Increased water temperatures

Changes in the Amount of Precipitation

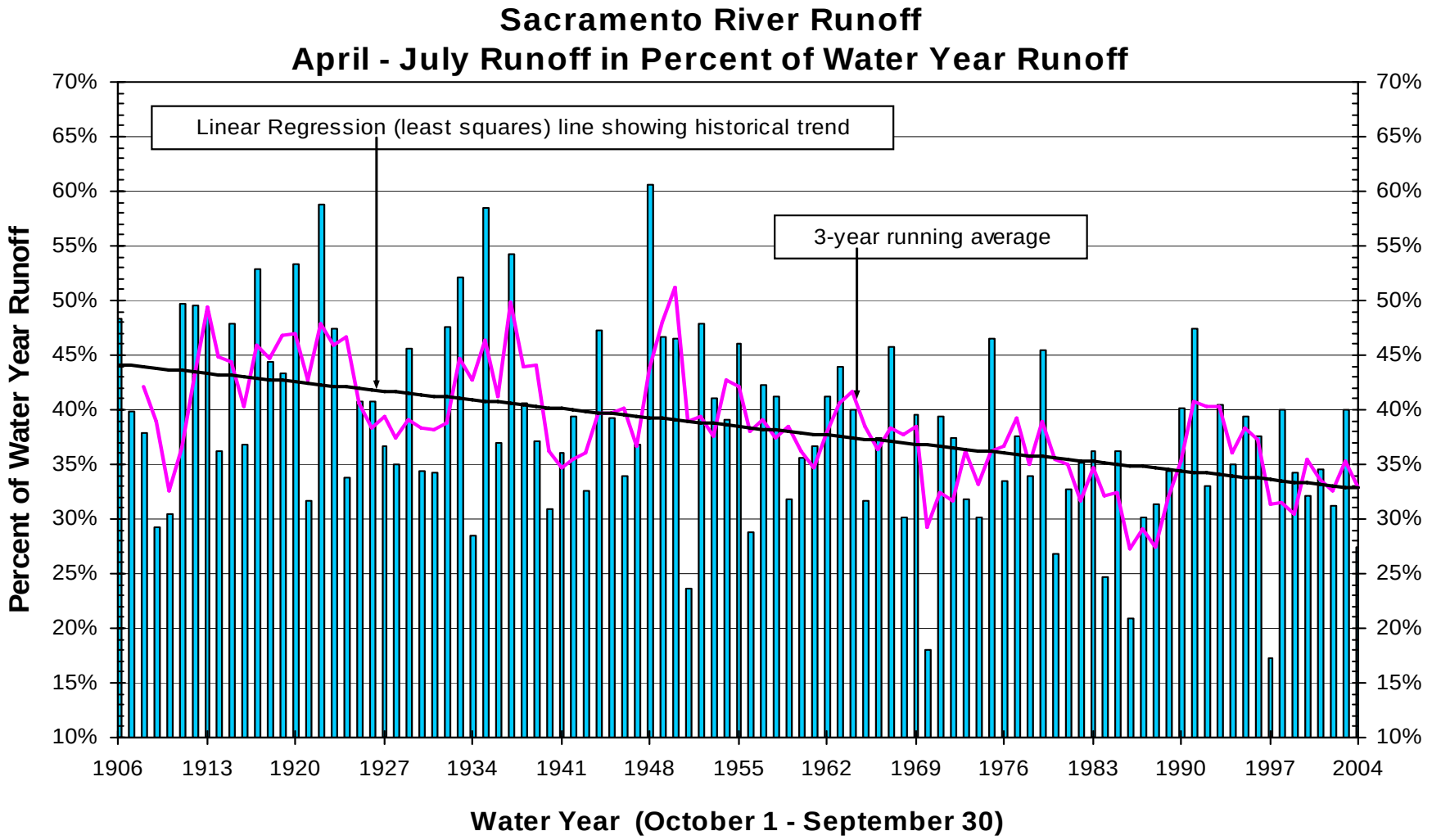
Projections



From: Dettinger, 2005

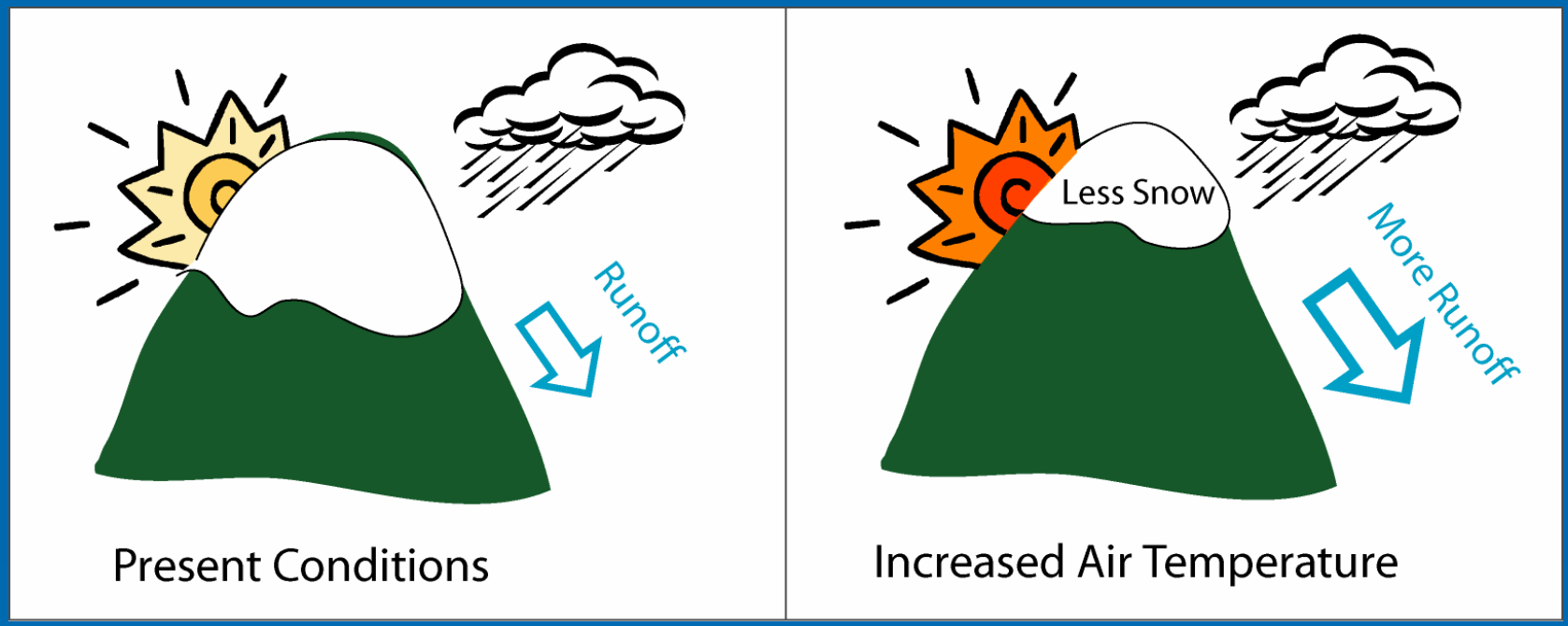
Changes in Runoff Timing

Historical Evidence



From: Roos, 2003

Changes in Type of Precipitation, Storm Runoff & Water Quality



- **Less precipitation as snow**
- **Earlier snowmelt**
- **Changes in watershed runoff**
- **Increased water temperatures**

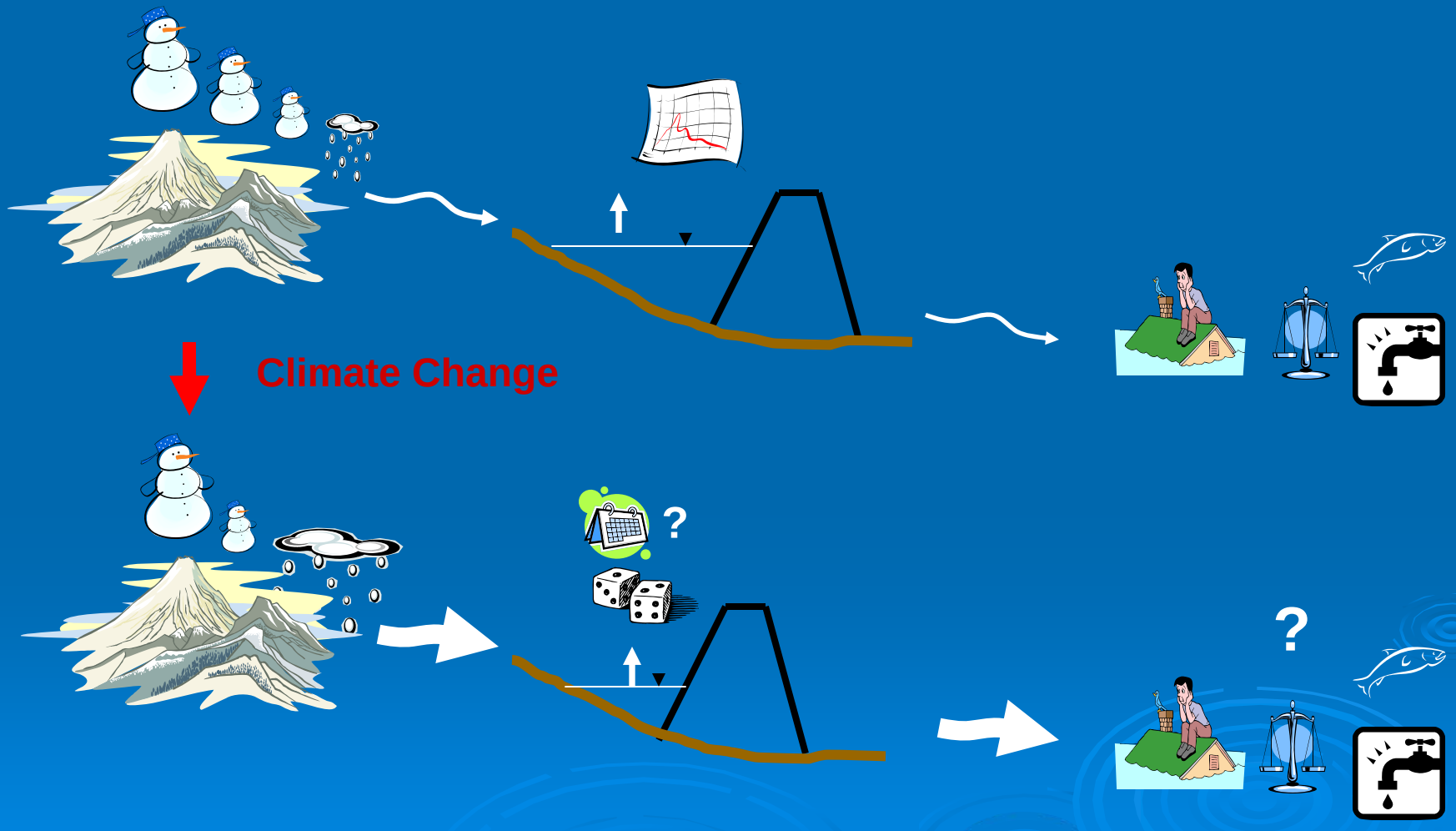
Let's compare…….

- 13.5 MAF ~ Approx. total reservoir capacity for the Sacramento Valley
- 11 MAF ~ Approx. total reservoir capacity for the San Joaquin Valley
- 14 MAF ~ Average annual Sierra snow pack for the Central Valley
- 5 MAF ~ Estimated loss of Sierra snow pack from a 3 degree C rise in temperature over the next century ("moderate" projection)

This would increase the snow elevation about 1,500 feet.

Operational Challenges

- Reservoirs -



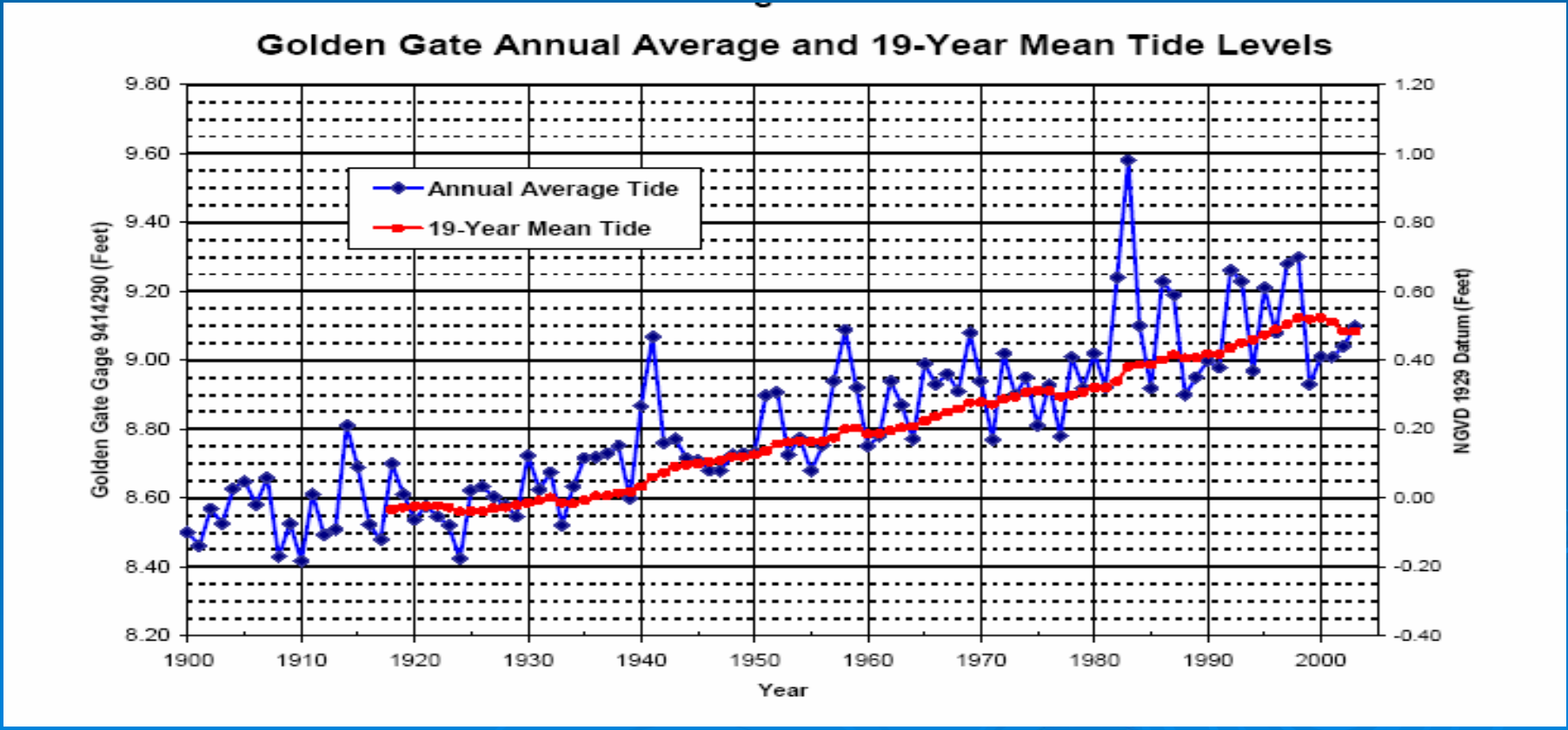
Winter/Early Spring

Operational Challenges for Multi-use Reservoirs

- Higher Inflow During Winter & Early Spring
  - Need to Maintain Greater Flood Reservation
  - Need to Accommodate Higher Flows
- Lower Inflows During Late Spring & Summer
  - Flood Management versus Water Supply
  - Salinity Intrusion in the Delta
  - Warmer Water

Sea Level Rise

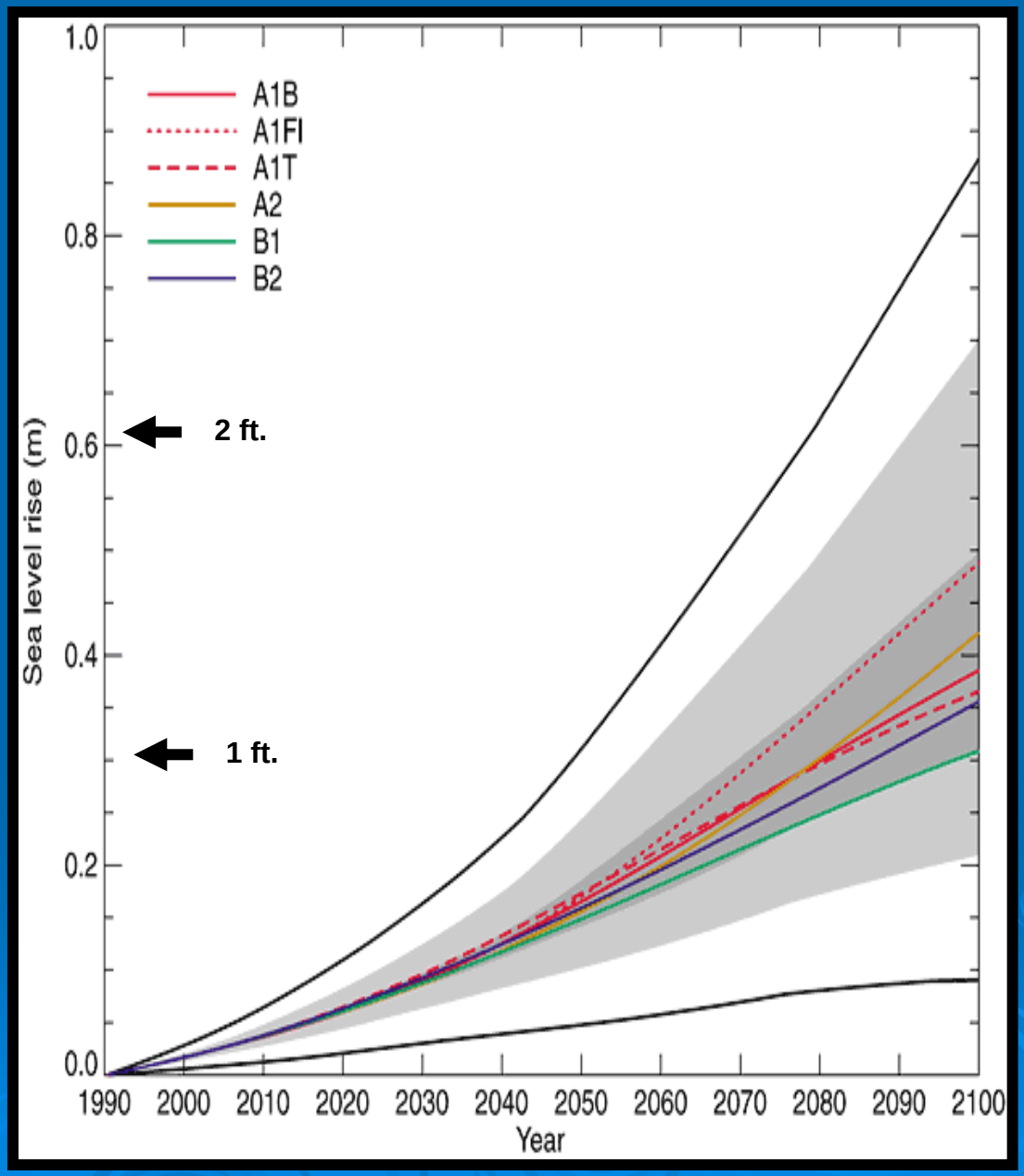
Historical Evidence



Source: Roos, 2003

Sea Level Rise

Projections



Source: IPCC, 2001

Impacts of Sea level Rise

- Effects on estuaries and tidal marshes
- Backwater effects and related flooding
- Sea water intrusion into coastal aquifers

What Happens to Bay-Delta Estuary?

Bay-Delta detail image from CALFED


Levee Overtopping
Photo by Rob Duvall Jan 1, 2006

Implications of Sea Level Rise for the Bay-Delta Estuary

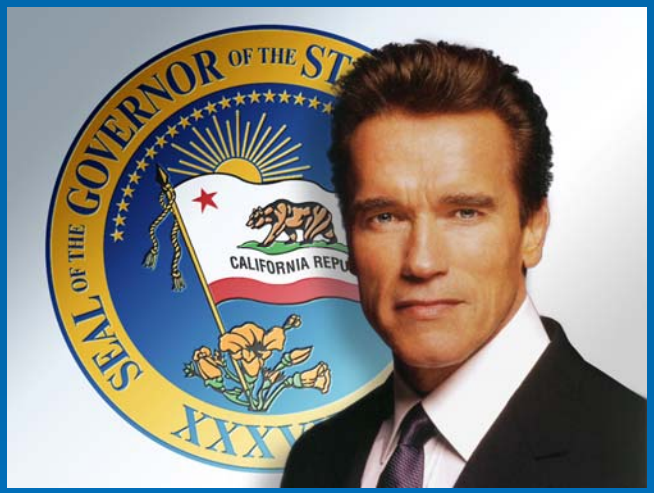
- Ocean salinity intrusion
- Levee failures & inundation of property
- Disrupted transportation corridors & utility lines
- Interrupted water supply conveyance
- Habitat changes, conversion or loss in natural ecosystems and restoration projects

Meeting the Challenge

What We Know

- Climate change is real
- Climate change has significant challenges for California water management
- We need to plan for it

Governor Arnold Schwarzenegger says on Global Warming:

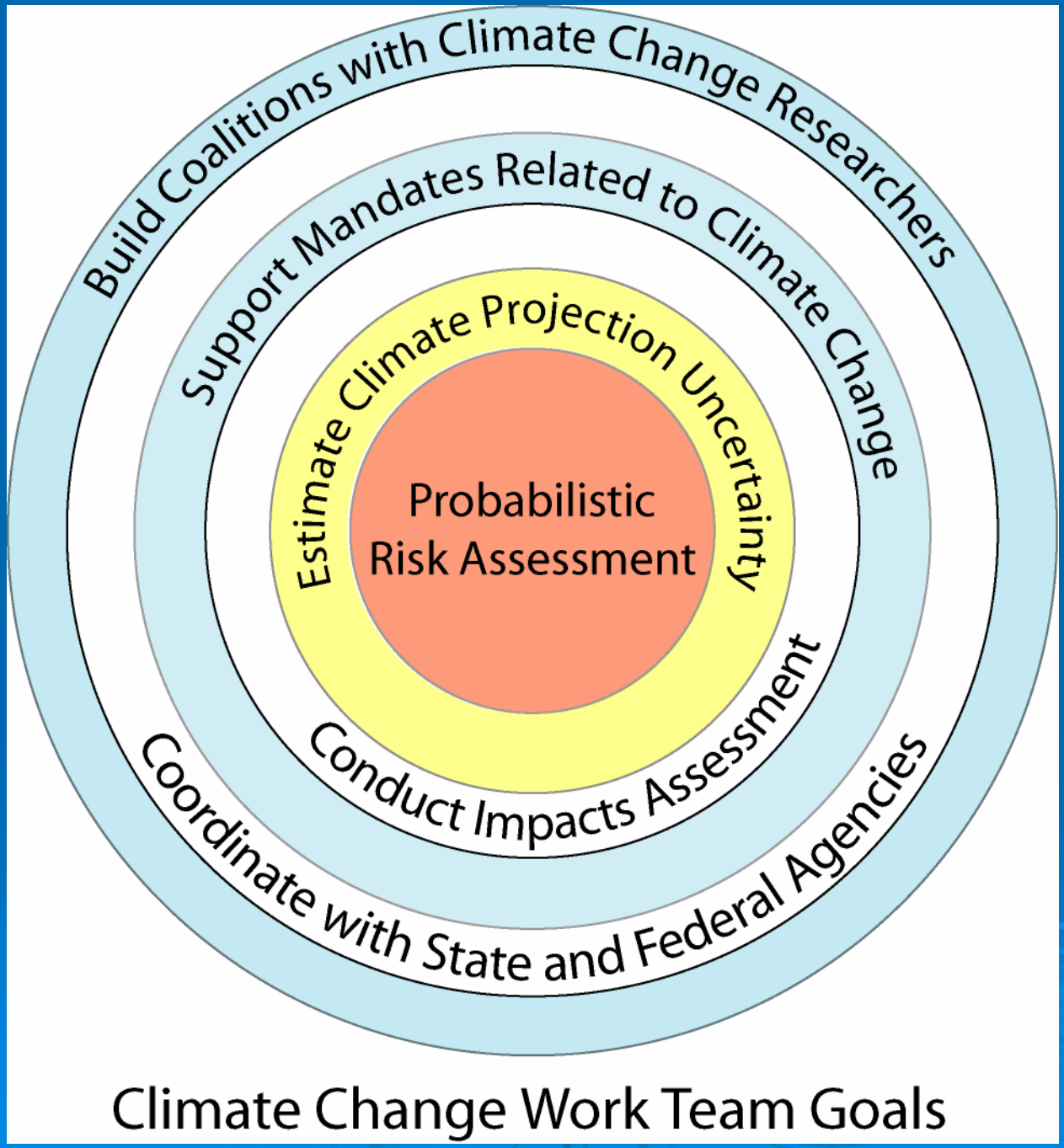


"I say the debate is over. We know the science. We see the threat.
And we know the time for action is now."

United Nations World Environment Day Conference, June 1, 2005, San Francisco

Governor's Executive Order S-3-05

- Recognizes global climate change and its impacts on California.
- Establishes aggressive greenhouse gas emission reduction targets for the State.
- Requires biennial assessments of climate change impacts and the development of impact mitigation & adaptation plans.
- Requires the formation of an interagency team to implement the Executive Order.



Climate Change Work Team Goals

Building Coalitions

SCRIPPS Institute of Oceanography

U.S. Geological Survey

Lawrence Livermore Lab

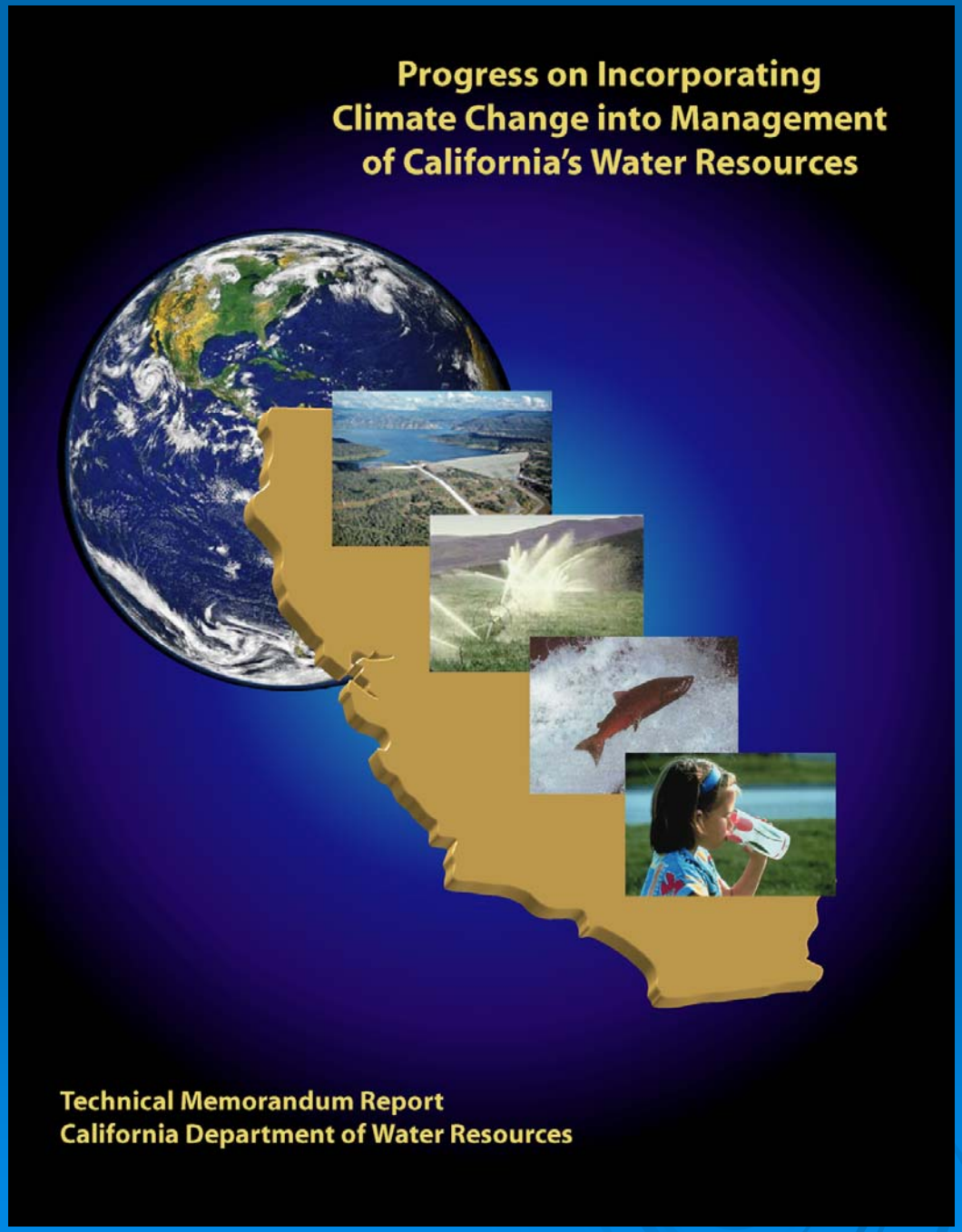
Santa Clara University

Lawrence Berkeley Lab

UC Davis

California Energy Commission

UC Berkeley



CAT Assessment

Water Appendix Coming soon

1 Introduction
2 Background
3 DWR Studies
4 SWP-CVP Impacts
5 Delta Impacts
6 Flood Management
7 Evapotranspiration
8 Future Directions

Climate Change in California Water Plan Update 2005

- State of knowledge on water resource impacts
  - Discussion in Strategic Plan (Vol 1 – Ch 4)
  - Reference articles & literature review (Vol 4)

- Recommendation - Adapt for Global Climate Change Impacts

  State government must help predict and prepare for the effects of global climate change on our water resources and water management systems. (Vol 1 – Ch 5)

Climate Change Action Items in Update 2005 Implementation Plan

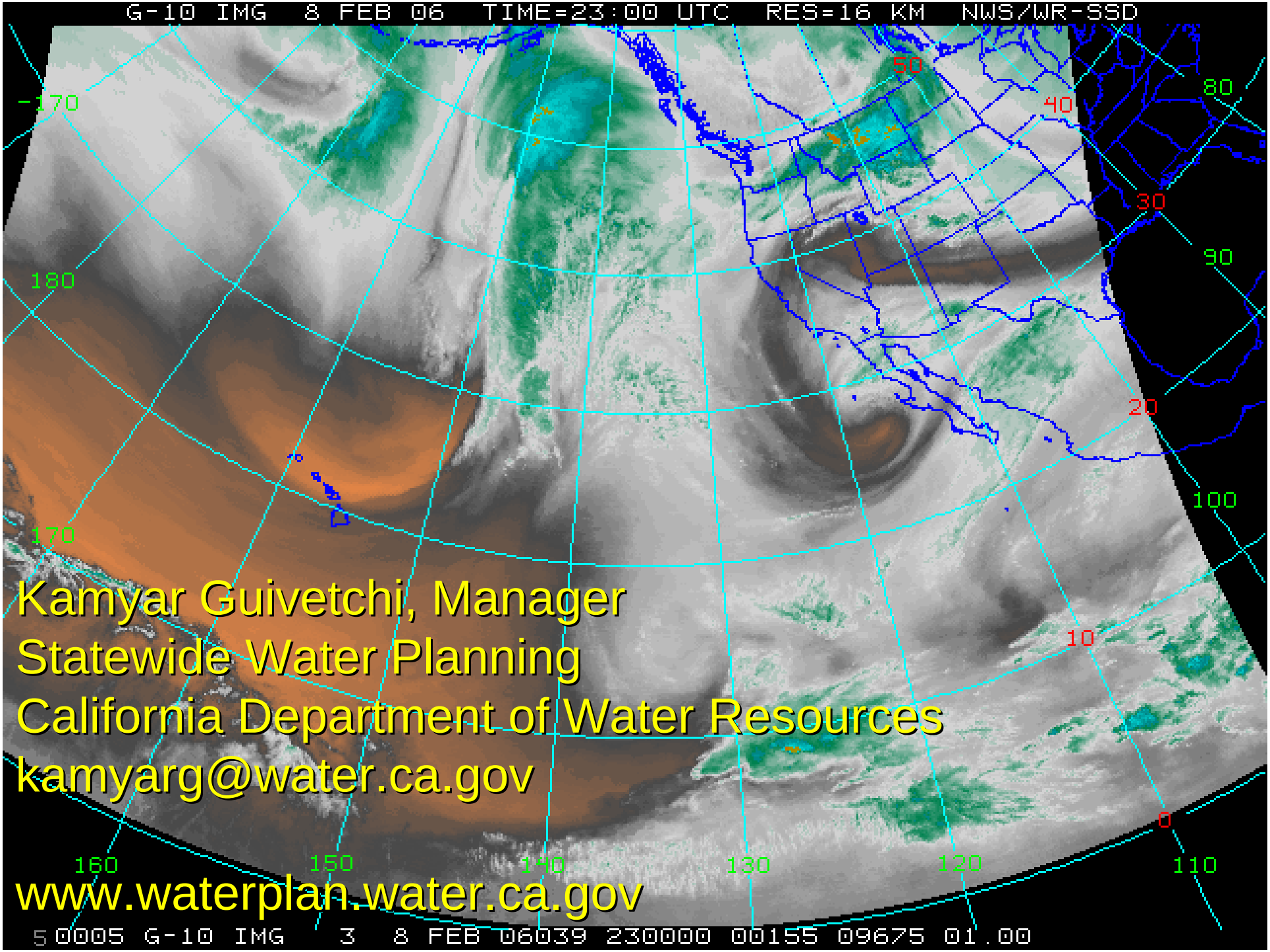
- DWR work with CAT to prepare biennial assessments and adaptation plan
- Help reduce GHG emissions by identifying means of energy savings for the storage, conveyance, distribution, and use of water
- Evaluate responses to potential impacts on the SWP and California's hydrology
- Develop alternative flow data indicative of climate change conditions to help State and regional planners
- Dedicate more staff and resources to climate change analysis and response planning

Some Strategies to Cope with Climate Change

- Observe, understand, and adapt
- Increase monitoring of climatologic & water resource conditions
- Promote Integrated Regional Water Management to use water efficiently, protect quality, support environmental stewardship
- Diversify regional water portfolios with appropriate mix of 25 management strategies in Water Plan 2005
- Develop long-term strategic plan for Delta and Suisun Marsh
- Implement strategies to improve Delta levee management
- Change operation strategy & rules for reservoirs & facilities
- Install additional cold-water release facilities from reservoirs
- Adapt strategies for aquatic and wetland habitat restoration
- Review water rights – amount, timing & location of diversions

Future Direction

- Expand quantitative climate change information and scenarios in future California Water Plan Updates
- Improve and link flood and supply forecasting to climate change model projections
- Evaluate reservoir re-operation scenarios for SWP, CVP & local
- Assess impacts on hydropower
- Improve and develop analytical tools
- Expand collaboration


G-10 IMG 8 FEB 06 TIME=23:00 UTC RES=16 KM NWS/WR-SSD
-170
180
170
160
150
140
130
120
110
100
90
80
50
40
30
20
10
0
Kamyar Guivetchi, Manager
Statewide Water Planning
California Department of Water Resources
kamyarg@water.ca.gov
www.waterplan.water.ca.gov
5 0005 G-10 IMG 3 8 FEB 06039 230000 00155 09675 01.00