



INFRASTRUCTURE, SAFETY,
AND ENVIRONMENT

Center for Collaborative Policy
California State University, Sacramento

Narrative Scenarios for CWP Update 2009

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Center for Collaborative Policy

CWP Update 2009 Advisory Committee Meeting
19 December 2007

Outline

- **Recap scenario work done for CWP Update 2005**
- **Describe the framework for 2009 scenario analysis**
- **Develop New Narrative Scenarios**

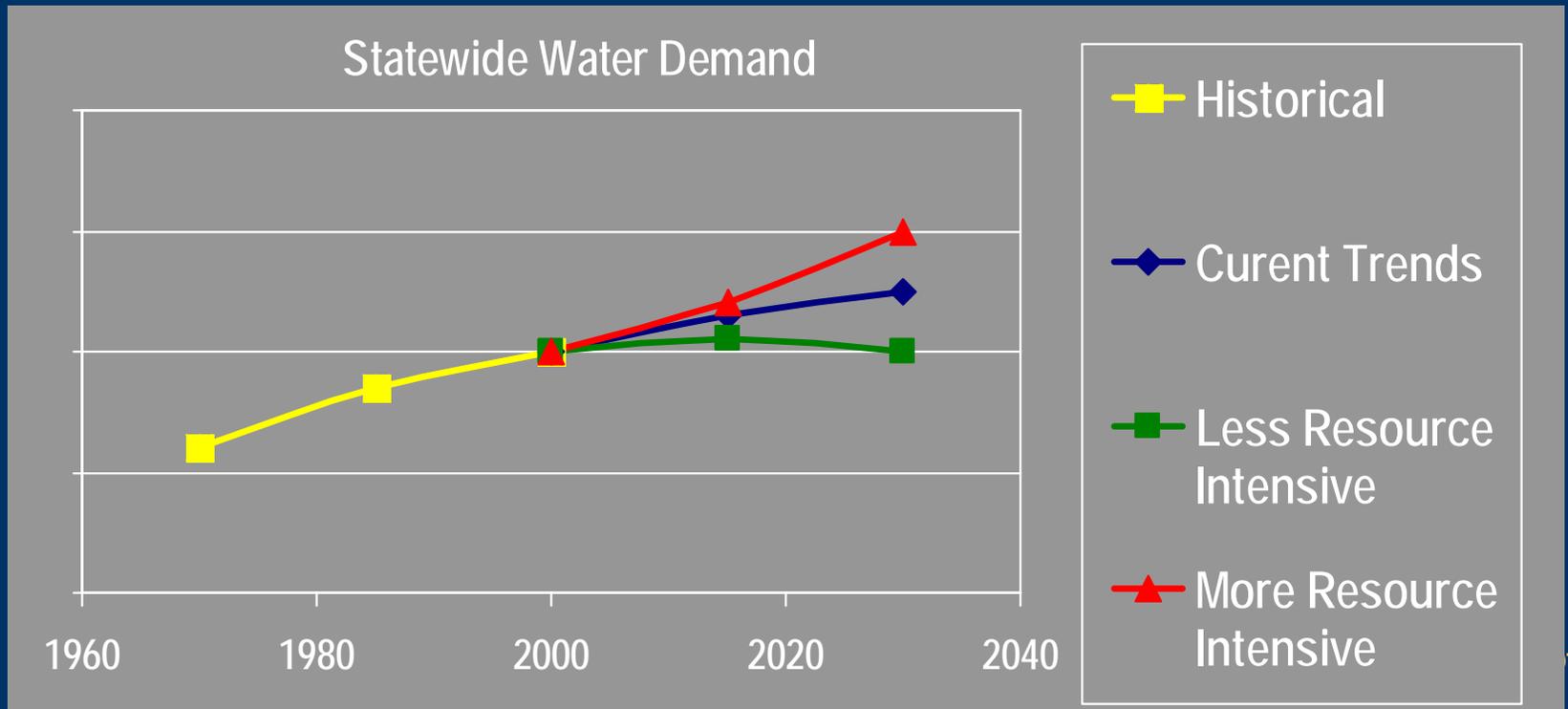
CWP Update 2005

Developed Hand-Crafted Scenarios

- **Identified key drivers**
 - “Table 1”
- **Focused on key parameters**
 - Water demand only
- **Defined three storylines based on alternative assumptions for key drivers**
 - “Current trends”
 - “Less resource intensive”
 - “More resource intensive”

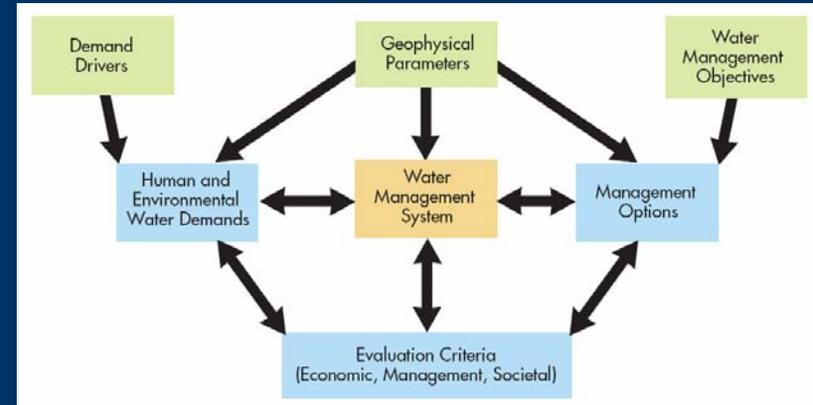
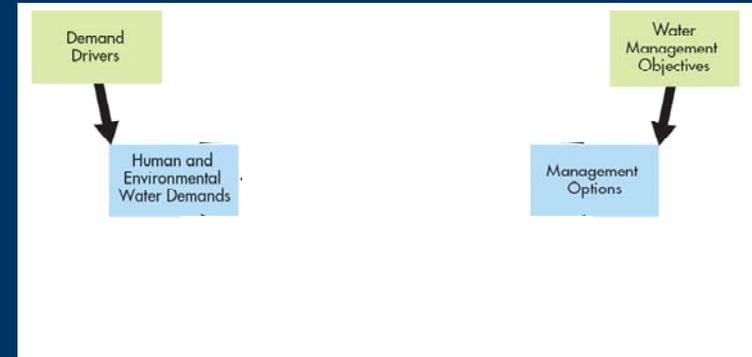
...and Then Quantified Them

- Used a simple model of water demand by Hydrologic Region
- Defined parameter values consistent with narratives
- Evaluated model for each scenario



CWP Update 2009 Will Build On This Analysis

- Expand scenarios to consider
 - water supply
 - climate change
 - water quality
 - flood issues
- Refine scenario narratives
- Use analytical framework to support the evaluation of response packages



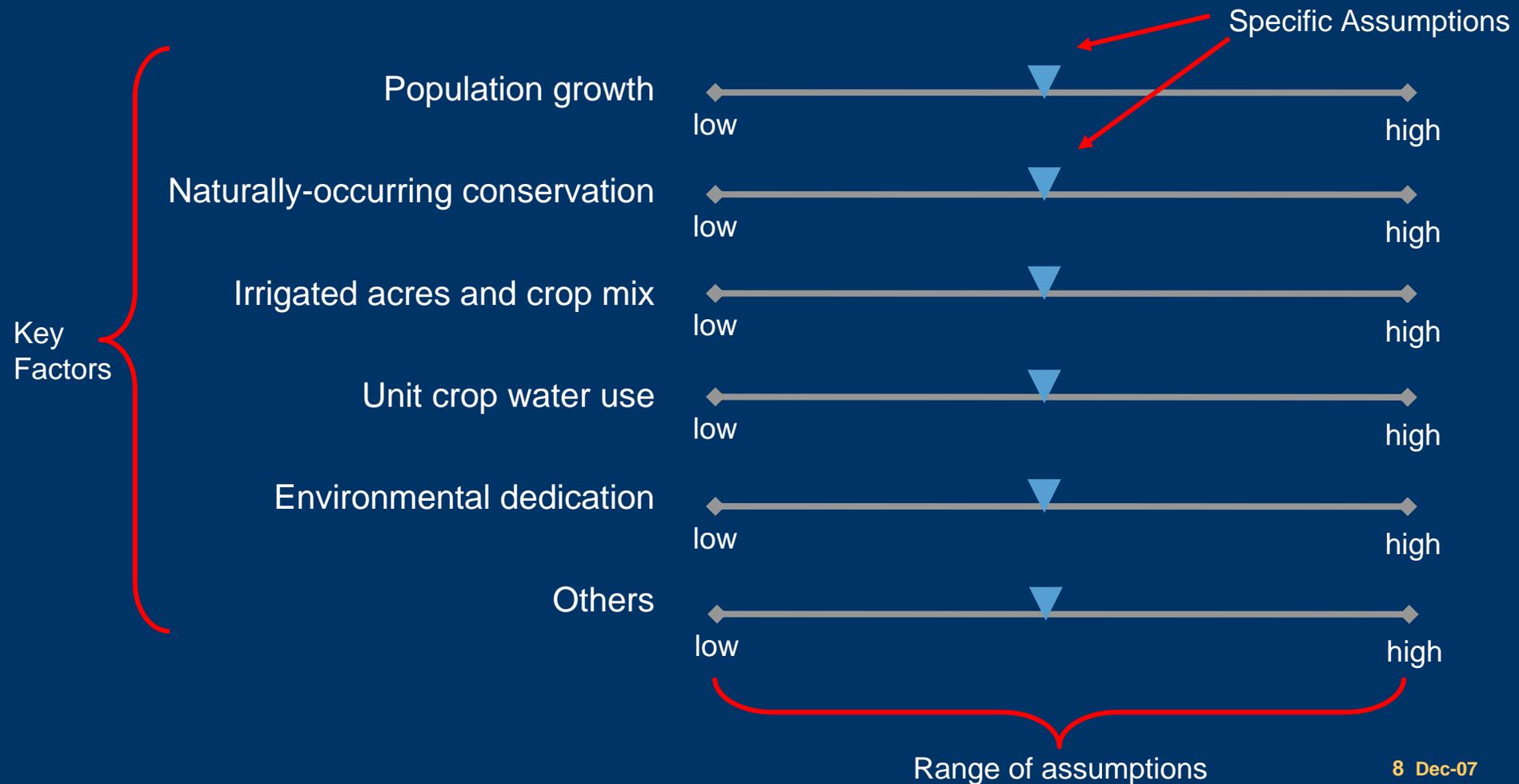
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CWP 2009 Update Scenario Analysis Will Have Four Key Components

Exogenous Factors (X)	
Uncertain factors outside of the control of water managers — Basis for “Scenarios”	

A Single Scenario is Defined by Assumptions about the Key Uncertain Factors



A Single Scenario is Defined by Assumptions about the Key Factors

Update 2005
Scenarios

Current Trends

Less Resource Intensive

More Resource Intensive

Specific Assumptions

Population growth



Naturally-occurring conservation



Irrigated acres and crop mix



Unit crop water use



Environmental dedication



Others



Range of assumptions

Workshop Last Month Refined List of Uncertain Scenario Factors

- Began with CWP Update 2005 demand factors
- Added new uncertain factors pertaining to
 - Hydrology
 - Water supplies
 - Flooding
 - Water quality
- Organized them by “Uncertainty Category”
 - Economic and Financial (E/F)
 - Institutional and Political (I/P)
 - Natural System (NS)
 - Technological (Tech)
 - Cultural Practices (Cul)

X	L
R	M

Workshop Last Month Refined List of Uncertain Scenario Factors

Factors Affecting Regional and Statewide Water Demands and Supplies (w/ Nov.

FACTOR ¹	Types of Uncertainty (See key at bottom of page)							
	NSU	FU	PU	CU	TU	IU	EU	CEU
<i>Factors Primarily Affecting Water Demand (Demand/Supply dichotomy caused confusion and dispute, artifact from</i>								
Total Population				✓			✓	
Population Density			✓	✓		✓		
Population Distribution			✓	✓		✓	✓	
Total Commercial Activity							✓	
Commercial Activity Mix							✓	
Total Industrial Activity							✓	
Industrial Activity Mix							✓	
Irrigated Crop Area (Includes irrigated land area and multi-crop area)	✓	✓	✓	✓	✓	✓	✓	✓
Environmental Water-Flow Based	✓		✓	✓				
Environmental Water-Land Based	✓		✓	✓				
Per Capita Income				✓			✓	
Water Price		✓				✓		
Passive Conservation ²			✓		✓	✓	✓	
Temperature	✓							
Climate Change	✓							
Technical Innovation/Breakthrough					✓			
Floodplain development		✓	✓	✓		✓	✓	
Flood threat recognition	✓		✓	✓	✓	✓		
Flood system Integrity							✓	
Flood Damage Reduction Opportunities				✓			✓	
Aging Infrastructure								
Silting/Sedimentation of Facilities								
System Capacity								
Status of Endangered Species								
Catastrophic events	✓							



CWP 2009 Update Scenario Analysis Will Have Four Key Components

Exogenous Factors (X)	Management Levers (L)
Uncertain factors outside of the control of water managers — Basis for “Scenarios”	Water management options — “Response Packages”

Plenary Meeting in October Added to, Refined, and Augmented the 2005 Response Packages

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

X	L
R	M

CWP 2009 Update Scenario Analysis Will Have Four Key Components

Exogenous Factors (X)	Management Levers (L)
Uncertain factors outside of the control of water managers — Basis for “Scenarios”	Water management options — “Response Packages”
	Performance Measures (M)
	Water-related outcomes of interest — “Evaluation Criterion”

Evaluation Criterion Are Under Development

- **Criterion could include measures of:**
 - **Water needs**
 - **Urban**
 - **Agricultural**
 - **Environment**
 - **Water supply reliability over various hydrologic sequences and conditions**
 - **Frequency of water rationing**
 - **System performance during droughts of differing strength and duration**
 - **Performance of flood control system during wet periods**
 - **Water quality metrics**

X	L
R	M

Extreme Events Will Be Evaluated For Each Scenario

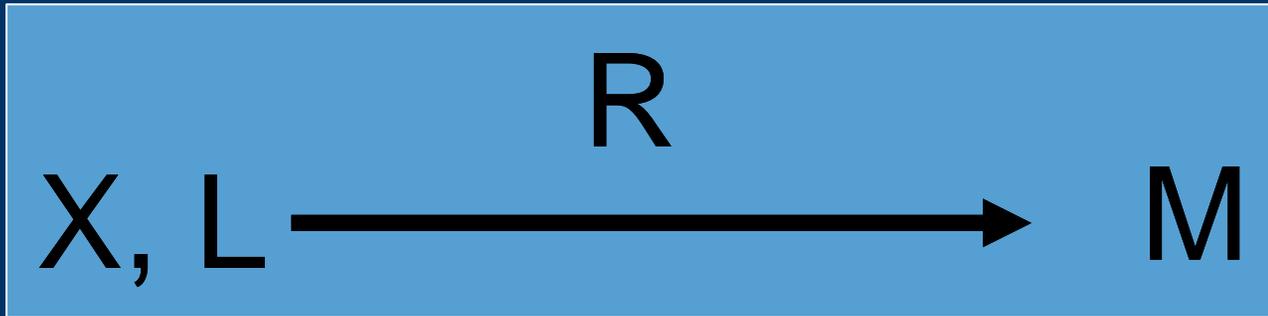
- **Climate-related trends treated as uncertain factors and form a basis for “scenarios”**
 - **Precipitation and temperature trends**
 - **Trends in frequency of severe storms and droughts**
 - **Mean sea level rise**
- **Performance of the system during specific types of “events” evaluated for each scenario**
 - **Average year**
 - **Single drought year**
 - **Recent historical drought / flood**
 - **Extreme drought / flood**
 - **Severe earthquake or infrastructure interruption**
 - **Others...**

X	L
R	M

CWP 2009 Update Scenario Analysis Will Have Four Key Components

Exogenous Factors (X)	Management Levers (L)
Uncertain factors outside of the control of water managers — Basis for “Scenarios”	Water management options — “Response Packages”
Relationships (R)	Performance Measures (M)
Model(s) that estimate outcomes (M) for response packages (L) and specific scenarios (X)	Water-related outcomes of interest — “Evaluation Criterion”

An Analytic Plan for Quantifying Scenarios Is Under Development



- Discussed during December SWAN workshop
- Will follow staged work plan
- Will discuss a proposal on some pilot analysis later this afternoon

X	L
R	M

Summary of CWP 2009 Update Scenario Framework

Exogenous Factors (X)	Management Levers (L)
<p>Economic and Financial Institutional and Political Natural System Technological Cultural Practices</p>	<p>Reduce Water Demand Improve Operational Efficiency & Transfers Increase Water Supply Improve Water Quality Practice Resource Stewardship</p>
Relationships (R)	Performance Measures (M)
<p>{Under development}</p>	<p>Performance during average conditions and extreme events</p> <ul style="list-style-type: none">– Demand– Reliability– Quality– Flood performance

Outline

- Recap scenario work done for CWP Update 2005
- Describe the framework for 2009 scenario analysis
- **Develop New Narrative Scenarios**

Today We Will Develop Narrative Scenarios for CWP Update 2009

- **Our goal is to define 3-5 scenarios for 2009 Update**
 - **“Current Trends”**
 - **Others reflecting “Challenging Conditions”**
 - **Others reflecting “Increasing Opportunities”**
- **Each table will create their own “Challenging Conditions” and “Increasing Opportunities” scenario**
 - **Each scenario can have it’s own unique name and focus on specific scenario factors**
- **Remember: each scenario only reflects factors out of the control of water managers**
 - **Response packages will be evaluated separately**
 - **Extreme events will be evaluated for each scenario**

Today We Will Develop Narrative Scenarios for CWP Update 2009

Main Ingredients

- 1. List and definitions of scenario factors by “Uncertainty Category”**
- 2. Example scenario narrative for “Current Trends”**
- 3. Worksheets for scenarios:**
 - “Current Trends”
 - “Challenging Conditions”
 - “Increasing Opportunities”

Recipe

- 1. Review and augment list of scenario factors**
- 2. Identify most important factors for each “Uncertainty Category”**
- 3. Review “Current Trends” narrative and make suggestions and/or additions**
- 4. Develop terse narrative about conditions leading to “Challenging Conditions” by “Uncertainty Category”**
- 5. Repeat step 4 for conditions leading to “Increasing Opportunities”**

Current Scenario Factors

Uncertainty Category	2009 Scenario Factors
Economic and Financial (E/F)	Total Population
	Per Capita Income
	Total Commercial Activity
	Commercial Activity Mix
	Total Industrial Activity
	Industrial Activity Mix
	Energy Costs
	Irrigated Crop Area - Irrigated land area
	Irrigated Crop Area - Multi-cropped land area
	Irrigated Crop Area - Permanent crop land area
	Irrigated Crop Area - Seasonal crop land area
	Availability of funding for water management and development
	Institutional and Political (I/P)
Population Distribution (Inst / Political)	
Passive Conservation (Inst/Political)	
Drinking Water Standards	
Irrigated Crop Area (Institutional/Political)	
Irrigation technology use	
Water Price - Rate Structure	
Water Price - Cost Recovery	
Managed wetlands - Irrigated land area	
Private wetlands - Irrigated land area	
Instream flow requirements / objectives	
Floodplain development	
Flood threat recognition	
Flood requirements	
Urban Runoff Regulations	
Ag Discharge Requirements	
Regulation of Delta Exports	
Colorado River Agreements (Inst/Political)	
Endangered species listing	

Natural System (NS)	Temperature variability
	Temperature trends
	Precipitation variability
	Precipitation trends
	Snowpack/melt (intermediate factor)
	Sea-level rise
	Colorado River flows
Technological (Tech)	Extent of invasive species
	Resilience of endangered aquatic species
	Membrane technology innovation
Cultural Practices (Cul)	Groundwater injection technology innovation
	Water use technology innovation
	Flood system integrity
	Infrastructure performance
Cultural Practices (Cul)	Demand for water-based recreation
	Population Density (Cultural)
	Population Distribution (Cultural)

Example Narrative for “Current Trends” Scenario

<p>Economic and Financial (E/F)</p>	<p>Population in growth increases as projected by the Department of Finance. The California economy continues to be robust, but with periodic downturns. The area of irrigated agricultural land continues to decline, although increases in agricultural intensity (e.g. multi-cropping) partially compensates.</p> <p>Funding continues to be available for water resource management and development.</p>
<p>Institutional and Political (I/P)</p>	<p>Population growth is greatest in the valley and along the California coast. Some efforts continue to maintain land in agricultural production through land conservation agreements and modest improvements to the Williamson Act. Environmental restoration projects receive modest support from the public and implementation continues to be gradual.</p> <p>Urban development along major rivers is protected by levees meeting or exceeding 200 year design and construction criteria.</p> <p>Moderate urban stormwater runoff regulations are implemented, and point source controls continue to be implemented.</p> <p>Runoff from irrigated lands and lands used for grazing and timber harvest, nonpoint sources of water pollution, is reduced moderately.</p>
<p>Natural System (NS)</p>	<p>Average temperatures increase according to average IPCC global climate model results.</p> <p>Precipitation patterns have changed from recent historical patterns. Some regions have gotten wetter, but other, particularly Southern California have become slightly drier. Precipitation events are more extreme and less frequent.</p> <p>Mean sea level rises according to IPCC 2007 projections.</p> <p>Invasive species continue to stress native Delta fish populations.</p>
<p>Technological (Tech)</p>	<p>Modest technological advancements makes desalination and recycled water less costly.</p> <p>The state's water infrastructure including Delta levy system continues to degrade due to age and deferred maintenance.</p>
<p>Cultural Practices (Cul)</p>	<p>Strong demand continues for recreational opportunities including water based recreation.</p> <p>Existing patterns of residential development continue, but on smaller lots, reflecting the increasing cost of buildable land.</p>

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