Using Scenarios in the California Water Plan

Uncertain Trends

- Historical
- Current Trends
- Less Resource Intensive
- More Resource Intensive

Y-axis: 0, 10, 20, 30, 40

Graph showing trends from 1960 to 2040.
Overview

- Background
- Update 2005 scenario narratives
- Analysis performed for Update 2005
- Scenarios in Update 2009
Background

- In a scenario process, managers invent and then consider, in depth, several varied stories of equally plausible futures. The stories are carefully researched, full of relevant detail, oriented towards real-life decisions, and designed (one hopes) to bring forward surprises and unexpected leaps of understanding.

  - Peter Schwartz, “The Art of the Long View, Planning for the Future in an Uncertain World”
Schwartz’ View of Scenarios

- Serve as a tool for ordering one’s perceptions
- Evaluate different actions or responses based on different plausible futures
- Do not want to pick one preferred future or the most likely future
- Make strategic decisions that will be sound for all plausible futures
Water Plan Scenarios Represent Baseline Conditions

- Water Plan Scenarios only consider conditions that:
  - are plausible during planning horizon under consideration
  - affect future water demands or supplies
  - the water community has little control over
Multiple Quantitative Views

- **Water Portfolios**
  - Describe where water originates, where it flows, and what it is used for based on recent data

- **Future Baseline Scenarios**
  - Describe expected changes by 2030 if water managers do not take additional action

- **Alternative Response Packages**
  - Describe packages of promising actions, predict expected outcomes, and compare performance under each scenario
Scenario Narratives
Used in Update 2005

- Scenario 1 – Current Trends
- Scenario 2 – Less Resources Intensive
- Scenario 3 – More Resources Intensive
Scenario 1
Current Trends

- Recent trends continue for the following:
  - Population growth and development patterns
  - Agricultural and industrial production
  - Environmental water dedication
  - Naturally occurring conservation (like plumbing code changes, natural replacement, actions water users implement on their own)
Scenario 2
Less Resource Intensive

- Includes the following:
  - Recent trends for population growth
  - Higher agricultural and industrial production
  - More environmental water dedication
  - Higher naturally occurring conservation than Current Trends (but less than full implementation of all cost-effective conservation measures available)
Scenario 3
More Resource Intensive

- Includes the following:
  - Higher population growth rate
  - Higher agricultural and industrial production
  - No additional environmental water dedication (year 2000 level)
  - Lower naturally occurring conservation than Current Trends
## Table of Scenario Factors

### Scenario 1: Current Trends
- **Factor 1: Total Population**
- **Factor 2: Population Density**
- **Factor 3: Population Distribution**
- **Factor 4: Total Commercial Activity**
- **Factor 5: Commercial Activity Mix**
- **Factor 6: Total Industrial Activity**
- **Factor 7: Industrial Activity Mix**
- **Factor 8: Irrigated Crop Area (Includes Irrigated Land Area and Multi-cropped area)**
- **Factor 9: Crop Unit Water Use**
- **Factor 10: Environmental Water-Flow Based**
- **Factor 11: Environmental Water-Land Based**
- **Factor 12: Naturally Occurring Conservation**
- **Factor 13: Urban Water Use Efficiency**
- **Factor 14: Ag Water Use Efficiency**
- **Factor 15: Per Capita Income**
- **Factor 16: Ratio of Seasonal to Permanent Crop Mix**
- **Factor 17: Hydrology**
- **Factor 18: Climate Change**
- **Factor 19: Colorado River Supply**
- **Factor 20: Existing Inter-Regional Import Projects**
- **Factor 21: Flood Management**
- **Factor 22: Energy Costs**
- **Factor 23: Ambient Water Quality**
- **Factor 24: Drinking Water Standards**
- **Factor 25: Ag Discharge Requirements**
- **Factor 26: Urban Runoff Mgmt.**
- **Factor 27: Recreation**
- **Factor 28: Desalting**
- **Factor 29: Recycled Water**
- **Factor 30: Water Transfers Within Regions**
- **Factor 31: Water Transfers Between Regions**
- **Factor 32: Conjunctive Use and Groundwater Management**
- **Factor 33: Surface Water Storage**
- **Factor 34: Conveyance Facilities**
- **Factor 35: Rate Structure**

### Scenario 2: Less Resource Intensive
- **Factor 1: DOF**
- **Factor 2: Current Trend**
- **Factor 3: Current Trend**
- **Factor 4: Increase in Trend**
- **Factor 5: Decrease in High Water Using Activities**
- **Factor 6: Increase in Trend**
- **Factor 7: Increase in High Water Using Activities**
- **Factor 8: Level Out at Current Crop Area**
- **Factor 9: Decrease in Crop Unit Water Use**
- **Factor 10: High Environmental Protection**
- **Factor 11: High Environmental Protection**
- **Factor 12: Higher than NOC Trend in MOUs**

### Scenario 3: More Resource Intensive
- **Factor 1: DOF**
- **Factor 2: Current Trend**
- **Factor 3: Increase in Trend**
- **Factor 4: Increase in High Water Using Activities**
- **Factor 5: Increase in Trend**
- **Factor 6: Increase in High Water Using Activities**
- **Factor 7: Level Out at Current Crop Area**
- **Factor 8: Increase in Crop Unit Water Use**
- **Factor 9: Year 2000 Level of Use**
- **Factor 10: Lower than NOC Trend in MOUs**

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Update 2005

All Cost Effective BMP's in Existing MOU's Implemented by Current Signatories (present commitments)

All Cost Effective EWMIP's in Existing MOU's Implemented by Current Signatories (present commitments)

Current Trends
- Current Trends
- Currently Planned
- Essentially a Repeat of History
- Essentially a Repeat of History
- Equal to 4.4 Plan
- Current Conditions

Current capacities, management practices and operations
- As Projected From Current Trends
- Current Conditions
- Current and Planned
- Current Level of Use
- Present Demand Trends Continued
- Current Level + Permitted/Financed
- Currently Approved Transfers
- Currently Approved Transfers
- Current Level + Permitted/Financed
- Current Level + Permitted/Financed
- Current Practices - pricing constrained to cost recovery
Scenario Analysis
Performed for Update 2005

Quantified Scenarios of 2030
California Water Demand
By David Groves, Pardee RAND Graduate School and Scott Matyac and Tom Hawkins, DWR
## Update 2005 Scenarios

### Urban Water Demand Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Growth</td>
<td>Number of single and multiple family housing units</td>
</tr>
<tr>
<td>Number of commercial and industrial employees</td>
<td>Changes in water conservation</td>
</tr>
<tr>
<td>Household income</td>
<td>Household size</td>
</tr>
<tr>
<td>Water price</td>
<td></td>
</tr>
</tbody>
</table>
Update 2005 Scenarios
Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Current Trends</th>
<th>Less Resource Intensive</th>
<th>More Resource Intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>25</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>2010</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>2020</td>
<td>35</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>2030</td>
<td>40</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>2040</td>
<td>45</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>2050</td>
<td>50</td>
<td>60</td>
<td>70</td>
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</tbody>
</table>
Update 2005 Scenarios
Housing Units

- Year 2000
- Current Trends
- Less Resource Intensive
- More Resource Intensive

- Single Family Houses
- Multiple Family Houses

Housing Units (Millions)
Update 2005 Scenarios Employees

Year 2000

Current Trends

Less Resource Intensive

More Resource Intensive

Employees (Millions)

Commercial Employees

Industrial Employees

Employees

0
5
10
15
20
25
30
35

0
5
10
15
20
25
30
35

Commercial

Industrial

Employees

Employees
### Update 2005 Scenarios

#### Agricultural Water Demand Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact Factor</th>
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</thead>
<tbody>
<tr>
<td>Irrigated land area</td>
<td>Crop yield</td>
</tr>
<tr>
<td>Multiple crop area</td>
<td>Irrigation practices</td>
</tr>
<tr>
<td>Changes in water conservation</td>
<td>Water price</td>
</tr>
<tr>
<td>Agricultural economic markets</td>
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</table>
Update 2005 Scenarios
Crop Area

<table>
<thead>
<tr>
<th>Year 2000</th>
<th>Current Trends</th>
<th>Less Resource Intensive</th>
<th>More Resource Intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigated</td>
<td>Multiple Crop Area</td>
<td>Irrigated</td>
<td>Multiple Crop Area</td>
</tr>
<tr>
<td>7.5</td>
<td>8</td>
<td>8.5</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>8.5</td>
<td>9.5</td>
<td>10</td>
</tr>
</tbody>
</table>
## Update 2005 Scenarios

**Information Sources for Environmental Objectives**

<table>
<thead>
<tr>
<th>Source</th>
<th>Information</th>
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</thead>
<tbody>
<tr>
<td>Trinity River Main stem Restoration Plan ROD</td>
<td>Final Restoration Plan for the Anadromous Fish Restoration Program</td>
</tr>
<tr>
<td>Central Valley Project Improvement Act “B2” fishery goals</td>
<td>San Joaquin River restoration goals</td>
</tr>
<tr>
<td>Central Valley Project Improvement Act “Level 4” Refuge requirements</td>
<td>CALFED Bay-Delta Program Ecosystem Restoration Program goals</td>
</tr>
<tr>
<td>San Joaquin River Vernalis flow goals</td>
<td></td>
</tr>
</tbody>
</table>

### Year 2000 unmet environmental water objectives

<table>
<thead>
<tr>
<th>Location</th>
<th>Unmet Objective (TAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trinity River (Lewiston)</td>
<td>344</td>
</tr>
<tr>
<td>American River (Nimbus)</td>
<td>55</td>
</tr>
<tr>
<td>San Joaquin River (Vernalis)</td>
<td>96</td>
</tr>
<tr>
<td>San Joaquin River (Below Friant)</td>
<td>268</td>
</tr>
<tr>
<td>Stanislaus River (Goodwin)</td>
<td>34</td>
</tr>
<tr>
<td>ERP Flow Objective</td>
<td>65</td>
</tr>
<tr>
<td>Level 4 Wildlife Refuge Supply</td>
<td>125</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>987</strong></td>
</tr>
</tbody>
</table>
Scenario Demand Changes Statewide

Changes by Sector

- Urban
- Agricultural
- Environmental

Million Acre-Feet Per Year

Current Trends
Less Resource Intensive
More Resource Intensive
Scenario Demand Changes by Region
Sample Response Packages

- Pacific Institute Study
  - “California Water 2030: An Efficient Future”
  - [www.pacinst.org/publications/](http://www.pacinst.org/publications/)

- UC Santa Barbara Bren School and RAND Corp Study
  - “Rethinking Water Policy Opportunities in Southern California”
  - [www.bren.ucsb.edu/academics/WaterPolicyProgram.htm](http://www.bren.ucsb.edu/academics/WaterPolicyProgram.htm)
Sample Response Packages

- RAND Corporation Study
  - “Presenting Uncertainty About Climate Change to Water Managers” (Draft)
Update 2009 Scenarios
Some Considerations

- Scenario themes and factors
- Planning horizon / Time step
- Climate change
- Drought conditions
- Flood management
- Others?
Next Steps on Scenarios

- Develop narrative scenarios
  - Advisory Committee, Regional Forums, and Plenary
- Identify options for quantifying scenarios
  - Statewide Water Analysis Network
- Include scenario narratives and factors in Assumptions and Estimates Report
Reference Information

- [http://www.waterplan.water.ca.gov](http://www.waterplan.water.ca.gov)
  - Chapter 4, Volume 1, Update 2005
  - Volume 4 Article, “Quantified Scenarios of 2030 Water Demand”

- Rich Juricich
  - [juricich@water.ca.gov](mailto:juricich@water.ca.gov)
  - (916) 651-9225
Questions?