A Public Policy Lens on Storage, Conveyance and Operations

Presentation to the Delta Stewardship Council Meeting
July 23, 2015

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Delta Reform Act (selected provisions)

• Coequal goals defined (section 85054)

• Elements of a “more reliable water supply for the state involves water use efficiency and conservation..., wastewater reclamation..., desalinization, and new and improved infrastructure, including water storage and Delta conveyance facilities.” (section 85004(b))

• Specified elements of the Delta Plan (section 85302, including ecosystem (c), (e) and a more reliable water supply (d))

• Section 85304. “The Delta Plan shall promote options for new and improved infrastructure relating to the water conveyance in the Delta, storage systems, and for the operation of both to achieve the coequal goals.”
Lots of Dams

DWR graphic
Largest reservoirs in California

The water bond on California’s November ballot contains $2.7 billion that could be used to build new reservoirs. Here are the state’s 10 largest reservoirs, which were built between 1927 and 1979.

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Year opened</th>
<th>Acre feet of water in millions</th>
<th>Dam height</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shasta</td>
<td>1945</td>
<td>4.5</td>
<td>521 feet</td>
<td>Shasta County</td>
</tr>
<tr>
<td>Oroville</td>
<td>1968</td>
<td>3.5</td>
<td>742</td>
<td>Butte County</td>
</tr>
<tr>
<td>New Melones</td>
<td>1979</td>
<td>2.4</td>
<td>578</td>
<td>Calaveras County</td>
</tr>
<tr>
<td>Trinity</td>
<td>1962</td>
<td>2.4</td>
<td>458</td>
<td>Trinity County</td>
</tr>
<tr>
<td>Don Pedro</td>
<td>1971</td>
<td>2</td>
<td>568</td>
<td>Tuolumne County</td>
</tr>
<tr>
<td>San Luis</td>
<td>1967</td>
<td>2</td>
<td>305</td>
<td>Merced County</td>
</tr>
<tr>
<td>Berryessa</td>
<td>1957</td>
<td>1.6</td>
<td>255</td>
<td>Napa County</td>
</tr>
<tr>
<td>Almanor</td>
<td>1927</td>
<td>1.3</td>
<td>130</td>
<td>Plumas County</td>
</tr>
<tr>
<td>Folsom</td>
<td>1956</td>
<td>1</td>
<td>275</td>
<td>Sacramento County</td>
</tr>
<tr>
<td>McClure</td>
<td>1967</td>
<td>1</td>
<td>479</td>
<td>Mariposa County</td>
</tr>
</tbody>
</table>

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Simple system
Single dam, simple conveyance (perhaps gravity only), single operator; little regulatory oversight
Complex system -
Multiple dams, interconnected conveyance, multiple operators; overlay of regulators

Figure 8. California’s Vast Intertied Water System

Source: Hanak et al. 2011
Figure 1.1

Water management in California has undergone several eras of change

- **Laissez-Faire Era**
  - Right of prior appropriation established (1850)
  - English common law adopted (1850)
  - Gold Rush begins (1848)

- **Local Organization Era**
  - Reclamation districts authorized (1887)
  - End of hydraulic mining (1884)
  - Great Flood of 1862

- **Hydraulic Era**
  - Reclamation Act authorizes Hetch Hetchy (1913)
  - Riparian rights held as superior to appropriative rights (1886)
  - Reclamation Act (1902)
  - Reasonable use doctrine (1928)

- **Era of Conflict**
  - Federal Flood Control Act (1928)
  - Delta Stewardship Council (2010)
  - Central Valley flood legislation (2011)
  - North Coast rivers declared wild and scenic (1981)

- **1840**
- **1900**
- **1950**
- **2000**

**Eras of Change**
- Laissez-Faire Era
- Local Organization Era
- Hydraulic Era
- Era of Conflict

**Key Events**
- SWP approved (1900)
- Federal takeover of CVP (1939)
- NEPA (1969)
- California Aqueduct (1968)
- Delta Stewardship Council (2010)
- Clean Water Act (1972)
- Federal ESA (1973)
- Mono Lake decision (1963)
- Relaxation of CVP (1935)
- O'Shaughnessy Dam (1923)
- Hoover Dam authorized (1928)
- Shasta Dam (1944)
- Central Valley flood legislation (2011)

**Agenda Item 10 - Presentation**
Meeting Date: July 23-24, 2015
Page 7

Courtesy of the Public Policy Institute of California
Physical Attributes of Storage and Conveyance

• Overview of Hydrology and Storage (four following slides from Lund, et. al., 2014)
  ➢ Surface and ground water both important
  ➢ Surface and ground water commonly used for different purposes and managed differently

• Three systems of conveyance (distinguished in State Water Plan Update, 2013):
  ➢ Regional (includes emergency interconnects among local systems)
  ➢ Interregional (e.g., CVP and SWP; EBMUD, SFPUC/Hetch Hetchy, LADWP)
  ➢ Sacramento-San Joaquin Delta (in Delta uses, plus roles in interregional conveyance)
Table 1. Surface and Groundwater Storage Serves Many Purposes in California

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Roles of Storage</th>
<th>Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water supply delivery</td>
<td>Seasonal and short-term storage in surface reservoirs and groundwater;</td>
<td>Local and regional water deliveries, South of Delta and Bay Area deliveries (for major Central Valley reservoirs), Economic production from deliveries (or economic losses from un-met deliveries)</td>
</tr>
<tr>
<td></td>
<td>Annual and long-term storage mostly in groundwater</td>
<td></td>
</tr>
<tr>
<td>Flood Management</td>
<td>Storage of flood peaks in surface reservoirs</td>
<td>Average annual flood damage (or avoided damage), Flood stage reduction</td>
</tr>
<tr>
<td>Energy production</td>
<td>Seasonal and peaking energy storage; Energy production from streamflow</td>
<td>Hydropower revenues; Kilowatt-hours generated</td>
</tr>
<tr>
<td>Water Quality</td>
<td>Reservoir flow regulation of temperature, contaminants, and Delta salinity; aquifer disposal of contaminants</td>
<td>Temperature, salinity, and other water quality metrics</td>
</tr>
<tr>
<td>Ecosystem support</td>
<td>Dams interrupt habitat and alter flow patterns; Reservoirs provide cold water downstream and regulate environmental flows; Groundwater supports overlying wetlands and riparian corridors</td>
<td>Temperature targets; Area of habitat type provided; Meeting prescribed salinity, temperature, depth, flooding pattern requirements; Delta flow patterns; San Joaquin river flow patterns; Fish production/populations</td>
</tr>
<tr>
<td>Recreation</td>
<td>Lakes and regulated streamflow for boating, fishing, and aesthetics</td>
<td>Recreation days, Recreation revenues, Quality of life indicators</td>
</tr>
</tbody>
</table>

Figure 1. Historical Development of Surface Storage in California

[Graph showing historical development of surface storage in California with two lines representing number of dams and storage capacity over years from 1870 to 2000. The graph includes a source note: Source: California Division of Safety of Dams data.]

*Figure 3. Cumulative Change in Groundwater Storage in the Central Valley*

Source: C2VSIM simulations (TNC, 2014)
Public Policy Context

• Multiple actors and actions to capture, convey, store and use water over many decades

• Attention to ecosystem effects and efforts to protect species and to restore ecosystems follows passage of CESA (1970) and ESA (1973); addressed through regulations vs. physical structures

• What is “normal?” Possible long-term drought—or destructive floods – likely reduction in snow pack – understanding of atmospheric rivers

• Regional variation in context and initiatives
Increased Complexity, Conflict and Uncertainty

• More complex physical systems moving water longer distances
• Climate/weather variability
• Demand hardened (permanent agriculture, some conservation gains already taken)
• Allocation discretion reduced (e.g., Monterey Agreement)
• More species listed or at greater risk
• Conflict fault lines visible
Evidence from tree rings shows that drought was historically much more widespread in the American West than now, while the 20th century was wetter than normal. Percentage of the West affected by drought from 800 A.D. to 2000:

**A 200-year drought?**

Medieval megadroughts: The West experienced two abnormally dry periods lasting close to 200 years each during the Middle Ages.

Source: E.R. Cook et al, Earth-Science Reviews

1850: California becomes state

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Identify, Assess and Pursue Promising Actions, Statewide (selected examples)

- “Reoperation” – DWR. *System Reoperation Study*. Focused on Central Valley. Phase 2 report, 2014
- Increased storage in regions, e.g.: MWD, Diamond Valley (2000); CCWD, Los Vaqueros expansion, 2012.
- Addressing old conflicts also promising: e.g., Freeport Regional Water Project (2010) (EBMUD and SCWA)
- Habitat/ecosystem restoration: very little progress over decades. Increased detail re Yolo Bypass actions in recent plan.
- Administration proposal re Delta conveyance using tunnels at front of queue with other ideas behind, including dual conveyance (DVSP), western intake concept or through Delta with strengthened levees (DPC).
Most of MWD’s Customers Plan to Reduce Their Reliance on MWD

Southern California’s Local Water Supply Development Plans (2012 - 2035)

Up to 1.2 Million Acre-Feet
Does not include 650,000 AF of planned and state-mandated conservation.

Estimated On Line Date
- 2012 - 2015
- 2016 - 2020
- 2021+
- Projects completed in two phases

County Boundaries
MWD Member Agency Boundaries

San Diego County Water Authority
4677 Overland Ave. - San Diego, California - 92123-1233
Increasing San Diego County's Water Supply Reliability through Supply Diversification

**1991**
- 28 TAF (5%)
- 550 TAF (95%)

**Total = 578 TAF**

**2013**
- 80 TAF (13%)
- 71 TAF (11%)
- 27 TAF (4%)

**Total = 645 TAF**

**2020**
- 103 TAF (13%)
- 44 TAF (6%)
- 27 TAF (4%)

**Total = 779 TAF**

Legend:
- Yellow: Metropolitan Water District
- Blue: Imperial Irrigation District Transfer
- Red: All American & Coachella Canal Lining
- Green: Conservation (existing and additional)
- Light Purple: Recycled Water
- Orange: Seawater Desalination
- Grey: Groundwater
- Light Blue: Local Surface Water

TAF = Thousand Acre-Feet
DSC in Only One of Relevant Policy Arenas (selected)

• Potential major changes: US Congress and President, federal or state courts, potentially California voters

• For Storage: California Water Commission allocation of Proposition 1 (2014) bond funds, local and regional combinations of districts

• For Delta Conveyance: Water agencies and water contractors, fish agencies, SWRCB, USACE, DSC

• For Delta Conveyance Operations:
  - Parameters: Fish agencies, SWRCB, permit terms (e.g., in Delta Water Fix)
  - Operations: Real Time Operators
Focus on action capacity and effectively matching actions to types of problem

• Action capacity is a long-standing problem in water/ecosystem/Delta policy making and implementation
  - Little Hoover Commission analysis of CalFed
  - Delays in making or implementing major decisions (e.g., BDCP, Fish Restoration Project, CalFed storage proposals)

• Understand impacts of conflict and uncertainty on addressing problems
  - Low conflict, low uncertainty => can use science or collaboration
  - All other combinations => need “politics”/authority to resolve
  - Delta Vision, an “extraordinary process” => legislative package of 2009, an extraordinary set of actions by legislature and Governor Schwarzenegger

• If paralysis, consider an extraordinary decision process again:
  - State led and financed
  - Transparent, consistent assessment of alternatives
  - Constitute a body to recommend decision for up or down action (e.g., like Base Realignment and Closure Commission)
<table>
<thead>
<tr>
<th>Agreement on goals/values</th>
<th>Disagreement on goals/values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Certainty regarding cause/effect relations</strong></td>
<td><strong>Uncertainty regarding cause/effect relations</strong></td>
</tr>
</tbody>
</table>
| Cell 1: Computational strategies (efficiency tests)  
WATER example: Southern California Coastal Water Research Project (SCCWRP) (a JPA of POTWs to comply w/CA & fed water quality regs, + $60 B of fed funds nationally) | Cell 2: Comparison strategies (instrumental tests)  
WATER example: Conflicts over water storage proposals of CalFed (vs. water from conservation or…); get resolved through formal policy decisions or access to financing |
| Cell 3: Judgmental strategies (improvement in performance tests)  
WATER example: Real time water operations (“rules”= ‘agreement”) | Cell 4: Authority strategies (legitimate decision maker and participation tests, especially of important constituencies)  
WATER example: Rule making of SWRCB |

Perspective of Delta Vision Blue Ribbon Task Force Worth Considering

“...Task Force’s conclusion that there are two co-equal goals that must drive water policy in California: restoration of the Delta ecosystem and creation of a more reliable state water supply. Co-equal means just that: not secondary, not an afterthought, not something to be ignored until a lawsuit or catastrophe forces water users to change, or government to act. No, the Task Force means co-equal in the most important sense of the word; requiring a coherent effort to join a desired Delta ecosystem together with the effort to provide water to Californians.”

(DVSP. 2008: page 6)