Managed Groundwater Recharge & Integrated Water Management

MAR Public Forum
November 8, 2017
California’s Water Management
A Tale of Two Extremes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Drought Periods</td>
<td>1976-77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1987-92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2001-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012-16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOO LITTLE

Folsom Reservoir, 1976

TOO MUCH
Advancing a Comprehensive Approach for Sustainable Resource Management

Integrated Multi-Benefit Projects
<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realign Governance</td>
<td>Develop &amp; Adopt Groundwater Sustainability Plans</td>
<td>Prepare Water Budgets to Improve GW Management</td>
<td>Realize Sustainable Groundwater Management</td>
</tr>
<tr>
<td>Governance developed, adopted, and addressed by GWS agencies</td>
<td>GWS agencies prepare and adopt an acceptable groundwater sustainability plan</td>
<td>GWS agencies manage GW based on a water budget framework</td>
<td>GWS agencies achieve objectives in GW Sustainability Plans</td>
</tr>
<tr>
<td>(Years 1-3)</td>
<td>(Years 4-8)</td>
<td>(Years 6-10)</td>
<td>(Years 10-14)</td>
</tr>
</tbody>
</table>

*From 2014 sustainable groundwater management legislation, including provisions for State “backstop” measures*
Water Available For Replenishment

After 100 years, SGMA is Reconnecting California’s Water Cycle

Hydrologically & Institutionally

Best Estimate
Statewide 1.5 MAF/Year
Central Valley Flood Protection Plan 2017 Update

- Appraisal, feasibility and site specific assessments
  - Sacramento River Basin
  - San Joaquin River Basin

- Portfolio of Actions
  - New South Delta Bypass
  - Increased reservoir flood pool storage (Calaveras River)
  - Forecast Informed Operations
  - Larger downstream channel capacities for peak releases
  - Urban levee improvements
  - Levee setbacks
  - Transitory storage / groundwater recharge basins / flowage easement
  - Annual sediment removal
System ReOp Study Key Findings

- Benefits are limited
- System is fairly optimized & operators occasionally apply strategies
- Operating SWP & CVP as single project has marginal supply reliability & ecosystem benefits (100 – 150 TAF/year)
- Benefits are resilient – with new Delta conveyance and climate change.
Prop 1 Water Storage Investment Program

[CALFED surface storage projects]

• Local and regional surface storage projects
• Groundwater storage projects
• Groundwater contamination prevention or remediation projects with storage benefits
• Conjunctive use projects
• Reservoir reoperation projects

Groundwater Recharge is NOT counted as a Public Benefit
Flood~MAR -- An Integrated Strategy of Flood, Groundwater & Ecosystem Management

- Using high flows from, or in anticipation of, rainfall or snowmelt, for groundwater recharge on agricultural lands, working landscapes, and open space

- Inherently multi-benefit—flood risk reduction, drought preparedness, ecosystem & aquifer restoration, and climate change adaptation

- Epitomizes Integrated Water Management
Flood~MAR -- Using Flood Flows for MAR on Working Lands

Flood Protection, Drought Preparedness, Aquifer Remediation & Ecosystem Restoration

![Graph showing flood flows and related water management](graph.png)

- **Flood Water Available for Groundwater Recharge**
- **WAFR**
- **Diversion Capacity**
- **Min. Instream Flow**

**Legend:**
- Flow (cfs)
- Dec-1, Jan-1, Feb-1, Mar-1, Apr-1, May-1, Jun-1
Earlier and Higher Peak Flows
Under Changing Hydrology

American River at Folsom

Future Trend
2070 - 2099

Historical
1981 - 2010
Recharge Studies & Pilot Projects

- 2002 HEC, Consumptive Use for Flood Protection
- 2006-2015 UCSC Recharge Initiative & Pajaro Valley Pilot
- 2012 CVFPP, GW Recharge Opportunities (Attachmt 8L)
- 2015 RMC/CWF, GW Recharge thru Winter Flooding of Ag Lands in San Joaquin Valley
- 2017 Sustainable Conservation GW Recharge Assmt Tool
- PPIC Groundwater Recharge Study
- American Farmland Trust Groundwater Recharge Study
Recent & Upcoming Recharge Events

• FMA Conference – Sept. 5-8, 2017
• CASQA Conference – Sept. 26, 2017
• Water Plan Update 2018 Plenary Meeting – Sept. 27, 2017
• Recharge Roundtable & GRA Conference – Oct. 2-4, 2017
• UC Davis Summit – Oct. 5, 2017
• CA Economic Summit – Nov. 2-3, 2017
• **CDFA Public Forum – Nov. 8, 2017**
• CA RCD Conference – Nov. 15-18, 2017
• ACWA Conference – Nov. 28-Dec. 1, 2017
• Smart Growth Conference – Feb. 1-3, 2018
• Biennial Groundwater Symposium – Mar. 5-7, 2018
Potential Benefits Using High Flows for Managed Groundwater Recharge

- Flood risk reduction
- Drought preparedness
- Groundwater replenishment
- Ecosystem restoration (e.g., reconnecting floodplains)
- Aquifer restoration / remediation
- Working landscape preservation and stewardship
- Climate change adaptation
Potential Barriers to Using High Flows for Managed Groundwater Recharge

• **Legal** – water rights, regulations, permitting
• **Policy** – public benefits, landowner benefits
• **Implementation** – land uses, recharge methods, conveyance, reservoir operations
• **Agronomics** – crop flood tolerance & productivity
• **Economics** – costs, benefits, compensation
• **Governance** – land owners, GSAs, IRWM, water agencies, flood managers, facility operators
• **Funding** – planning, R&D, and implementation
HEC - Conjunctive Use for Flood Protection

- 400 TAF/year flood storage in Sacramento Valley
  - New Bullards Bar
  - Oroville
  - Folsom

- 343 TAF/year flood storage in San Joaquin Valley
  - Millerton Lake,
  - New Don Pedro
  - Lake McClure
• **Recharge Net Metering Program** provides rebates to growers

• **Goals of Recharge Initiative**
  1) Delineate natural/managed recharge areas
  2) Analyze recharge areas
  3) Research/implement projects
  4) Education and outreach

Source: Pajaro Valley Water Management Agency
• Operational changes to existing reservoirs
• Groundwater recharge associated with capturing unappropriated flood flows
• Groundwater projects associated with potential floodplain storage
RMC/CWF – GW Recharge thru Winter Flooding of Agricultural Land in San Joaquin Valley

- Rivers - Merced, Chowchilla, Fresno, Kings
- Assumed existing infrastructure
- Potential average annual recharge - 80 to 130 TAF/year
- Many years no water available
- On-farm recharge cost-effective
Sustainable Conservation/EarthGenome
Groundwater Recharge Assessment Tool (GRAT)

- Decision-support for growers & GSAs to test scenarios
- Assigns available source water to best recharge sites
  - Dedicated basins
  - Fallow fields
  - On-farm recharge
- Estimates capital and O&M costs
- Pilot projects
  - Madera ID
  - Tulare ID
Scaling-Up Flood~MAR
Next Phase of System ReOp Study

• **Multi-Sector Engagement** (flood, groundwater, ecosystem)

• **White Paper** (multi-sector discussion & planning)
  - Document past work
  - Frame benefits & barriers
  - Identify information gaps

• **Plan of Study** (multi-sector R&D plan)
  - Interdisciplinary (agencies, academia, organizations)
  - Studies & pilot projects

• **Study Implementation** (multi-sector initiative)
  - Funding
  - Project management
  - Inform plans, regulations/permitting & investment decisions
    (GSPs, IRWMPs, Regional/State/Federal flood plans,
    Conservation plans, public & foundation funding, etc.)
Ways to Access Water Plan Information

➢ Visit the Water Plan Web Portal
www.water.ca.gov/waterplan/

➢ Subscribe to Water Plan eNews
www.water.ca.gov/waterplan/enews
Questions & Comments

Kamyar Guivetchi, PE
Statewide Integrated Water Mgmt
CA Department Water Resources

kamyar.guivetchi@water.ca.gov