

System Reoperation Study

June 2016



Legislation: Senate Bill X2 1 (Perata, 2008)

Directed DWR to conduct planning and feasibility studies to **identify potential options** for the reoperation of the state's flood protection and water supply systems that will optimize the use of existing facilities and groundwater storage capacity.

Objectives:

- Water supply reliability
- Flood hazard reduction
- Ecosystem protection and restoration

By:

- **Integrating** flood protection and water supply systems
- **Reoperating** in conjunction groundwater
- **Improving** existing water conveyance systems

Reoperation Options Considered

Shasta ↔ Groundwater Storage

Oroville ↔ Groundwater Storage

Folsom ↔ Groundwater Storage

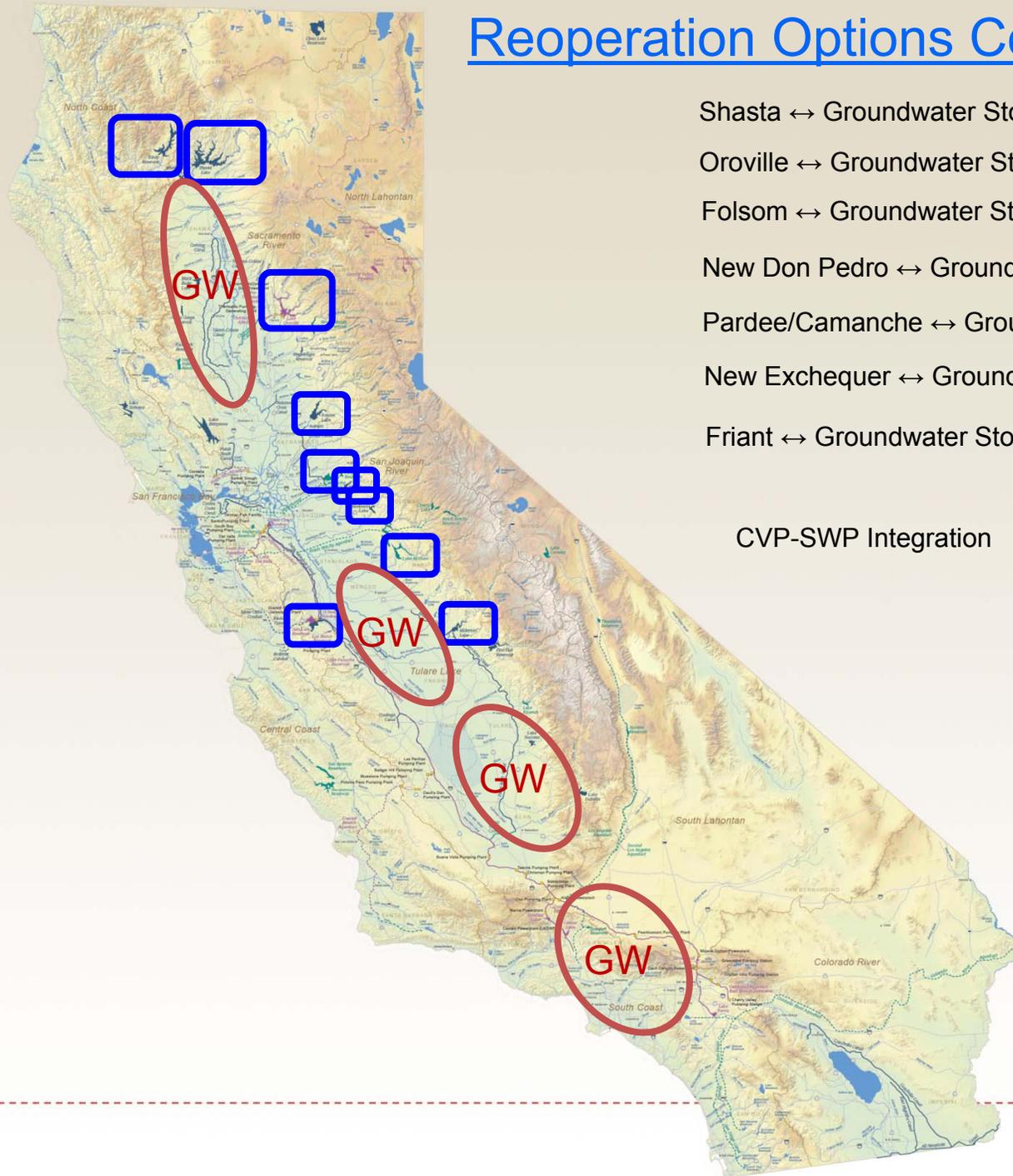
New Don Pedro ↔ Groundwater Storage

Pardee/Camanche ↔ Groundwater Storage

New Exchequer ↔ Groundwater Storage

Friant ↔ Groundwater Storage

CVP-SWP Integration



Agency Coordination - Vetting

Reservoir Owner and Operators

- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- SWP & CVP Operators
- Metropolitan Water District
- Friant Water Authority
- East Bay Municipal Utility District
- Merced Irrigation District
- Modesto Irrigation District
- Turlock Irrigation District

Fish Agency

- National Marine Fisheries Service

Other Stakeholders

- The Nature Conservancy
- California Water Plan – Stakeholder groups
- Water Research Foundation

Sacramento Valley

- Glenn-Colusa Irrigation District
- RD 108

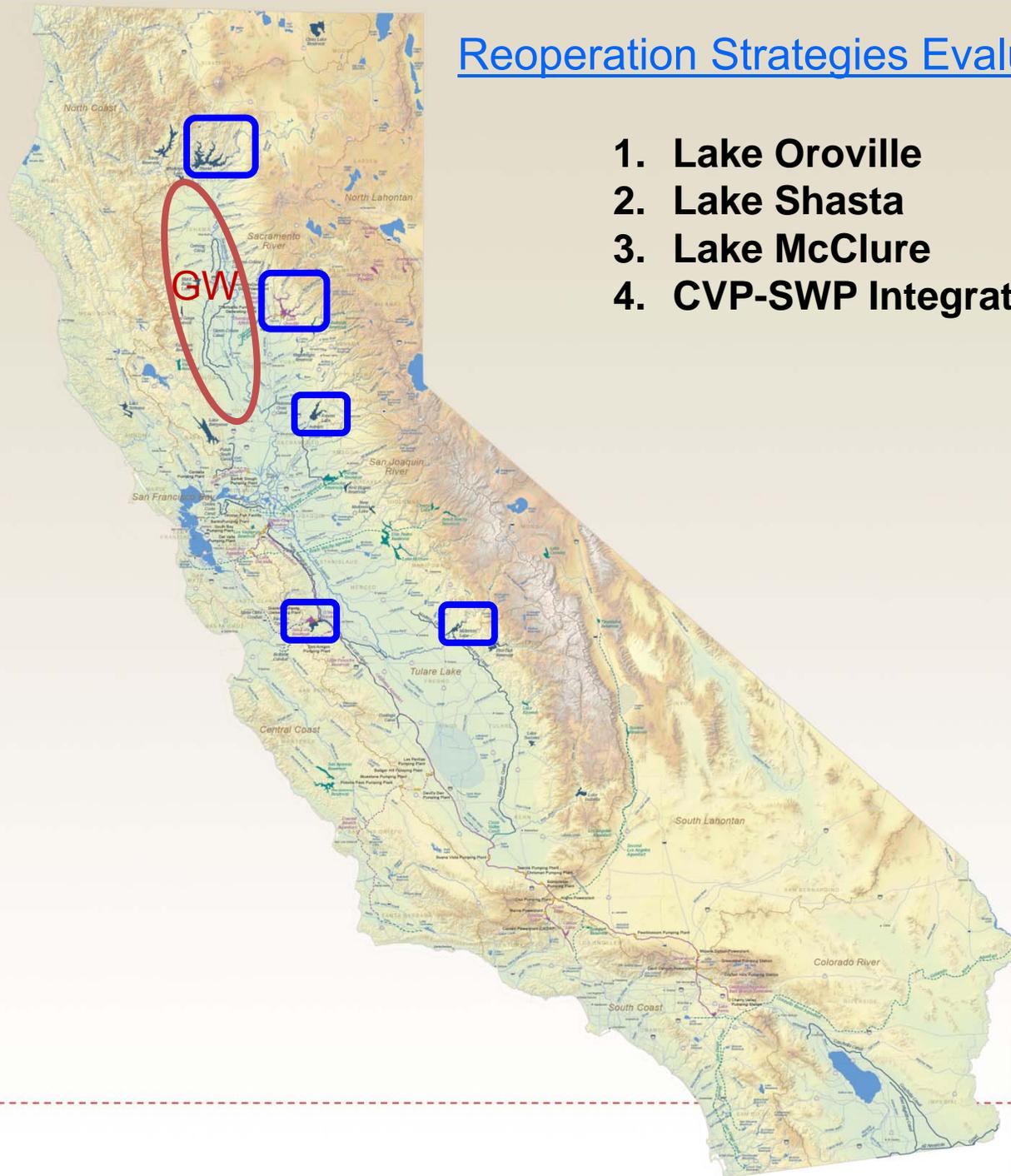
Ground Water Districts

- Madera Irrigation District
- Merced Irrigation District
- Modesto Irrigation District
- Turlock Irrigation District
- North San Joaquin Water Conserv. Dist.
- Kern Water Bank Authority
- Arvin-Edison Waters Storage District
- Semitropic-Rosamond Water Bank Authority
- Metropolitan Water District
- Orange Co. Water District
- Water Replenishment District
- Three Valleys Municipal Water District
- Calleguas Municipal Water District
- Raymond Basin Management Board
- San Gabriel Basin Water Qual. Authority
- Inland Empire Utilities Agency



Reoperation Strategies Evaluated

1. Lake Oroville
2. Lake Shasta
3. Lake McClure
4. CVP-SWP Integration



Reoperation Components

Supplemental Ecosystem Flows



GW Conjunctive Management



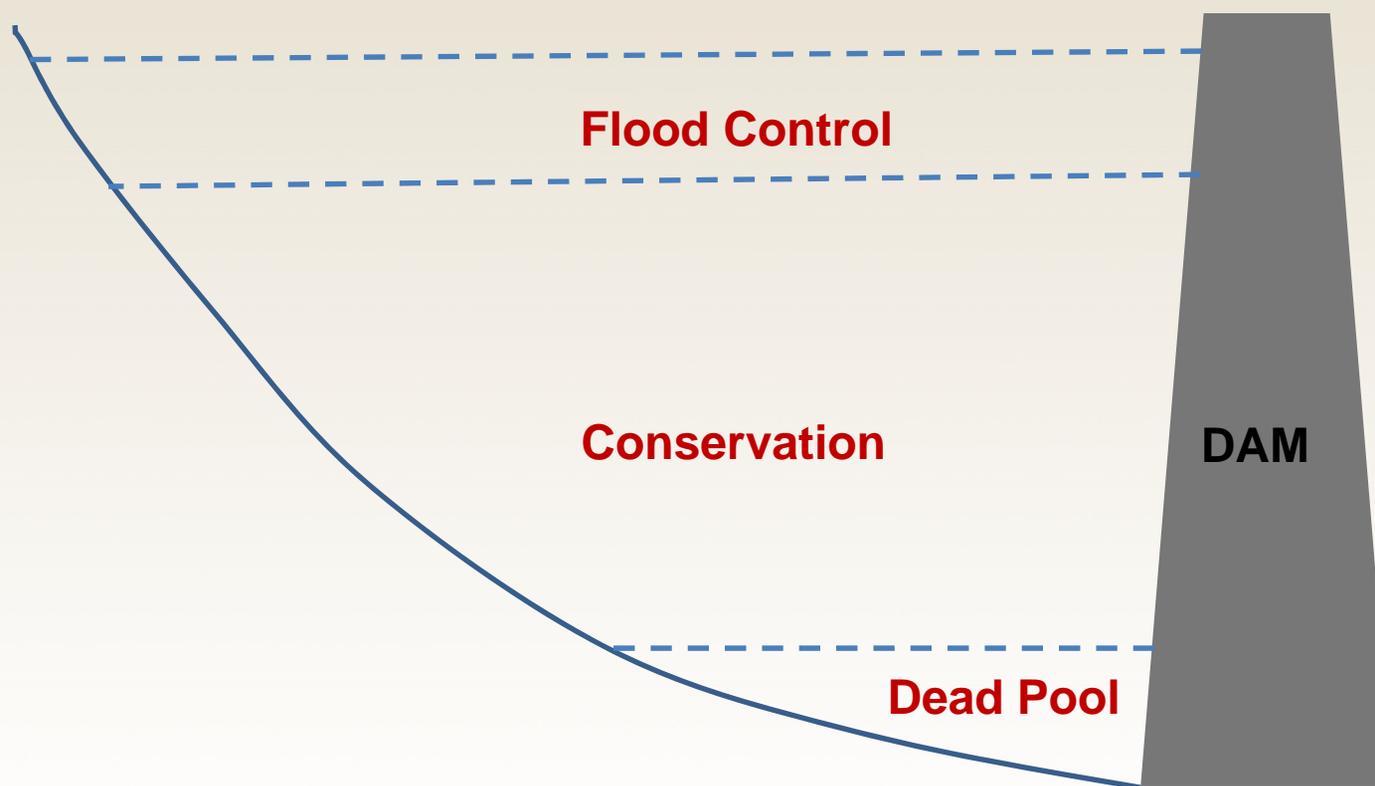
Forecast Based Operations (FBO)



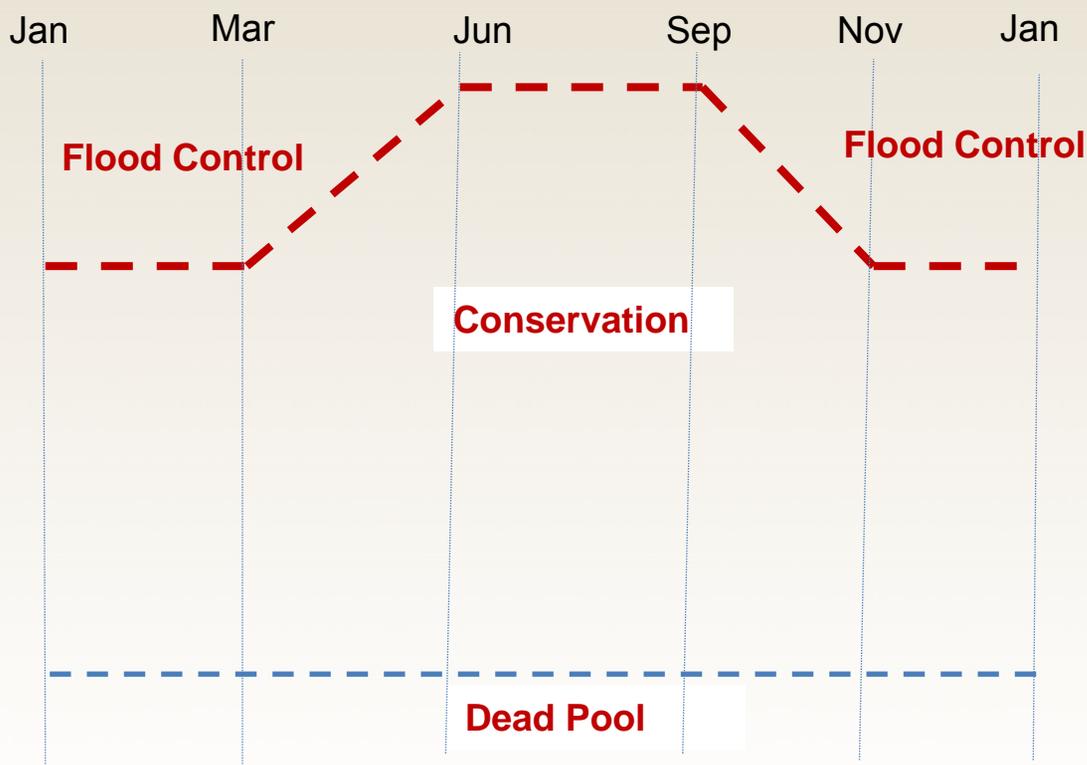
Water Resources System Integration



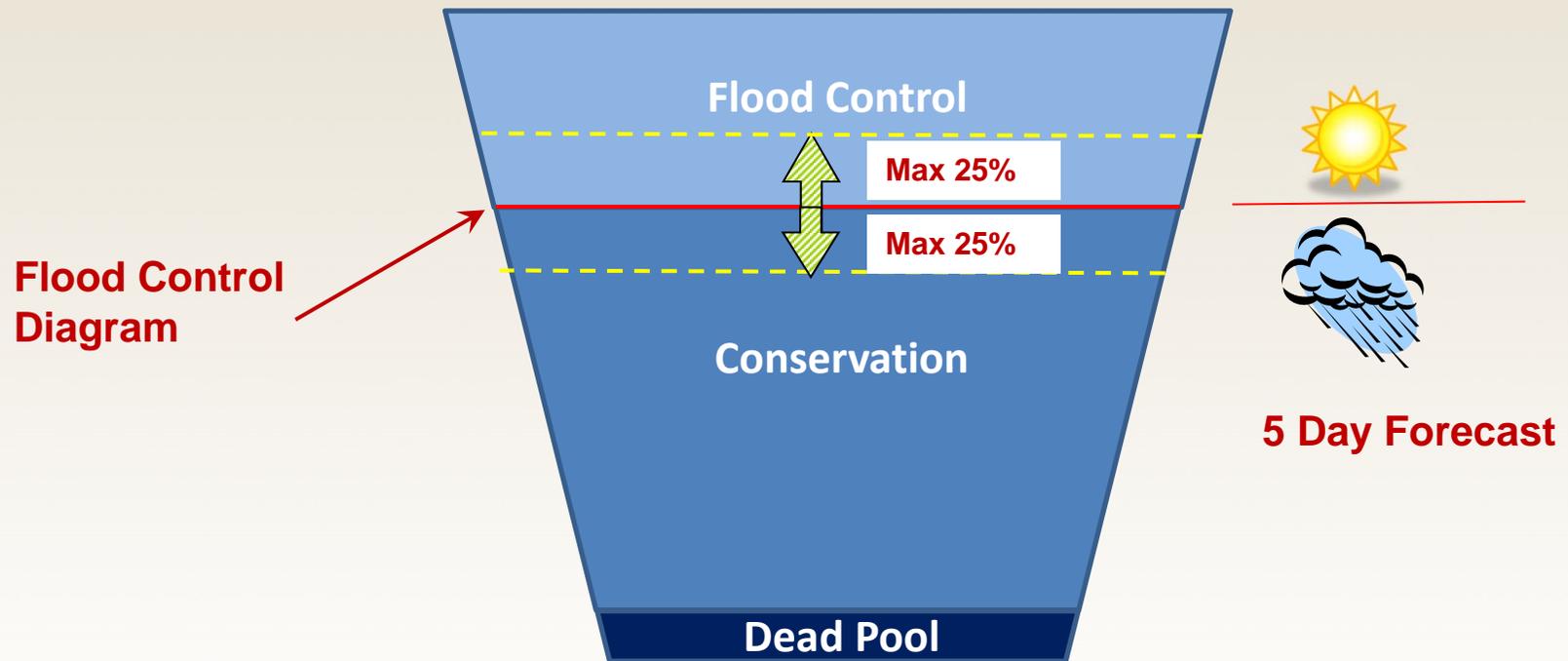
FBO: Reservoir Storage Space



FBO: Typical Flood Control Diagram



Forecast Based Operations



Tradeoff Analysis

Reoperation of Oroville



Reoperation of Shasta



Components

- Supplemental Eco Flows: 25 to 500 TAF/yr
- Conjunctive Management: 25 to 100 TAF/yr
- Eco Flows + Conjunctive Management

Tradeoff Analysis - Findings



Supplemental Eco Flows

- Cold water pool
- Water supply
- Hydropower

Reoperation Strategies Analyzed

- Oroville
- Shasta
- Oroville and Shasta
- Lake McClure
- Improved Integration of CVP/SWP

Assumed Operations of Reoperation Components

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ecosystem Flows			(W, AN, BN Years)									
Conjunctive Management					(Dry/Critical Years)							
FBO												



Shasta + Oroville: Reoperation (Average Annual)

Ecosystem Flows	300 TAF (target)
Conjunctive Mgmt	200 TAF (limit)
FBO (incl. Folsom)	Up to 25% encroachment

	Existing Delta Conv.	Climate Ch – ELT Q5	WaterFix
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	Yield (TAF)
Eco Flows	80
Water Supply	37
Groundwater Pumping	55
Delta Outflow	19

	Change in Carryover Storage (TAF)
Shasta (4.5 MAF)	51
Trinity (2.5 MAF)	-2
Folsom (1 MAF)	16
Oroville (3.5 MAF)	-10

Shasta + Oroville: Reoperation (Average Annual)

Ecosystem Flows	300 TAF (target)
Conjunctive Mgmt	200 TAF (limit)
FBO (incl. Folsom)	Up to 25% encroachment

	Existing Delta Conv.	Climate Ch – ELT Q5	WaterFix
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	Yield (TAF)	
Eco Flows	80	75
Water Supply	37	54
Groundwater Pumping	55	74
Delta Outflow	19	9

	Change in Carryover Storage (TAF)	
Shasta (4.5 MAF)	51	12
Trinity (2.5 MAF)	-2	-1
Folsom (1 MAF)	16	6
Oroville (3.5 MAF)	-10	42

Shasta + Oroville: Reoperation (Average Annual)

Ecosystem Flows	300 TAF (target)
Conjunctive Mgmt	200 TAF (limit)
FBO (incl. Folsom)	Up to 25% encroachment

	Existing Delta Conv.	Climate Ch – ELT Q5	WaterFix
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	Yield (TAF)		
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Eco Flows	80	75	73
Water Supply	37	54	73

Groundwater Pumping	55	74	43
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Delta Outflow	19	9	-68
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	Change in Carryover Storage (TAF)		
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Shasta (4.5 MAF)	51	12	23
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Trinity (2.5 MAF)	-2	-1	-5
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Folsom (1 MAF)	16	6	5
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Oroville (3.5 MAF)	-10	42	13
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Lake McClure/ New Exchequer Dam Reoperation

Criteria	Scenario 6A
Ecosystem Flows (<i>Target</i>)	15 TAF
Conjunctive Mgmt (limit)	15 TAF
Forecast Based Operations	Up to 50 TAF encroachment

	Change in Storage (TAF)
Lake McClure (1 MAF)	34

	Yield (TAF)
Eco Flows	4
Water Supply	11

CVP/SWP Integrated Operations

- Operation of the CVP/SWP is highly integrated.
- Through expanded Joint Point of Diversion (JPOD) and sharing reservoir release obligations, there is potential of obtaining an additional 100-150 TAF of water supply.

Jones Pumping Plant



Banks Pumping Plant



System Reoperation Study – Phase 3 Findings

- Benefits of reoperation are limited
- Benefits improved with WaterFix and with climate change
- FBO, Conjunctive Management, CVP-SWP integrated operation already being applied informally

Next Phase: Reoperation Considerations

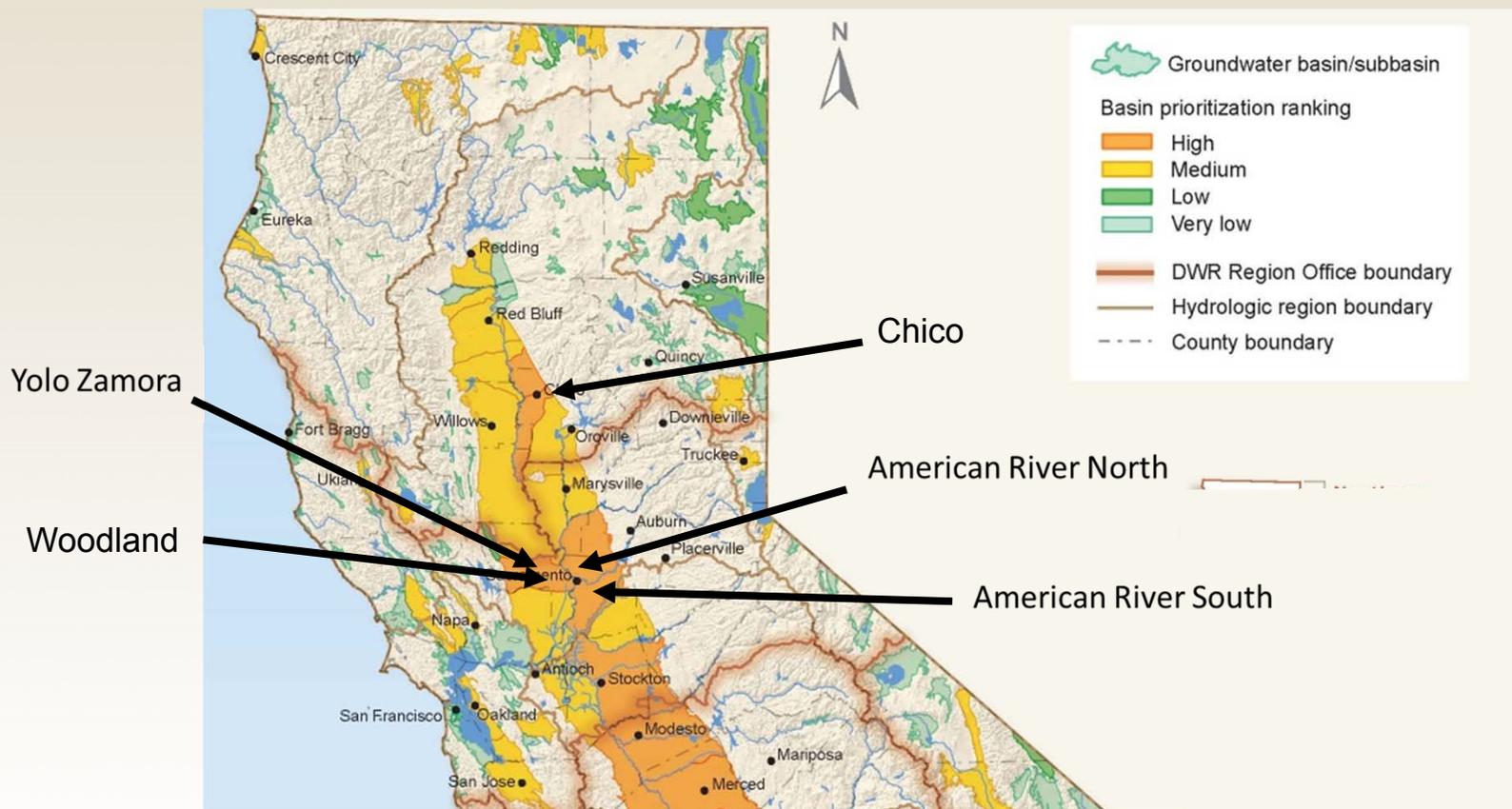
- Support sustainable groundwater management
- Include potential reservoirs that may be funded by Prop 1
- Maximize benefits with WaterFix
- Include recent drought operations in modeling

Sustainable
Groundwater Management

Prop1: Water Storage
Investment Program



GW Replenishment Thru Reoperation of: Shasta, Oroville, Folsom



Reoperation Concept – Stabilize GW Basins

Wet and Normal Years

Surface water to GW users
(Reservoir drawdown)

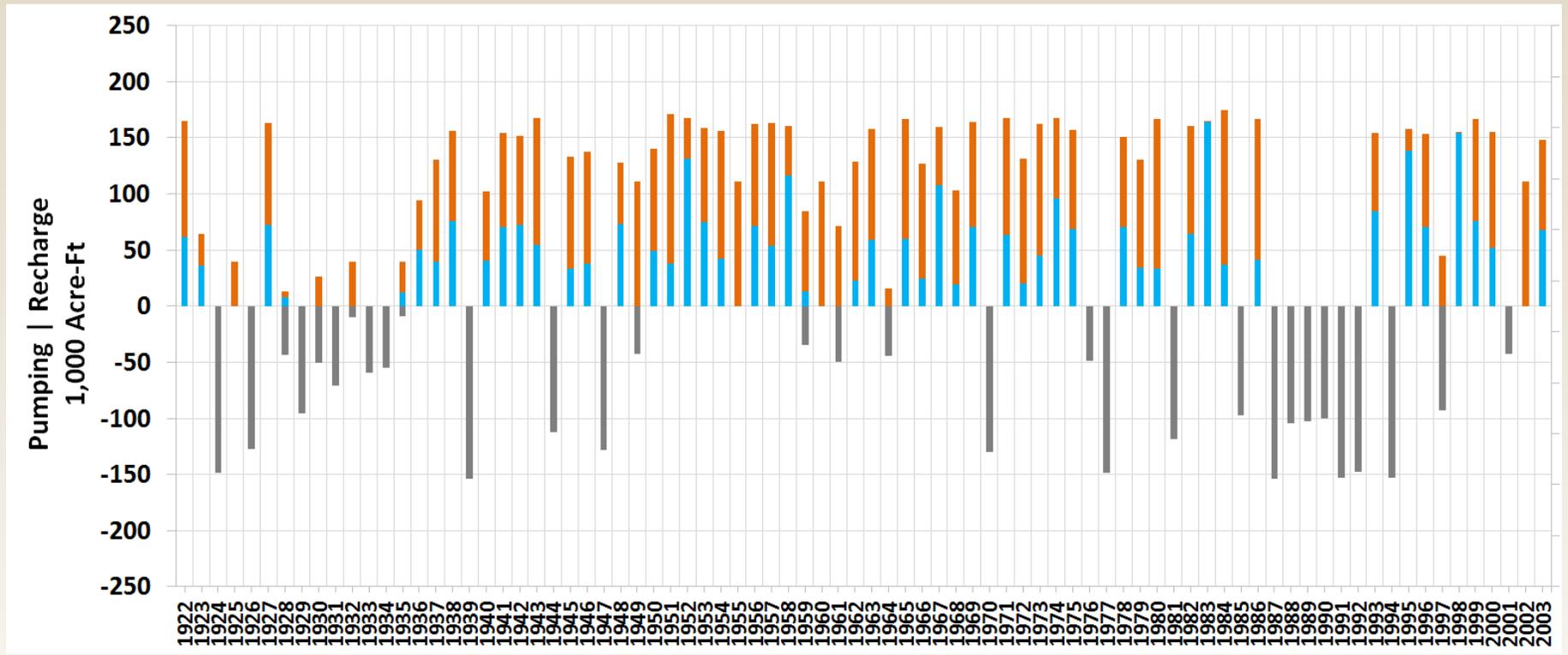
Decrease GW pumping

Drier Years

Protect reservoir storage

Increase GW pumping

Groundwater Operations

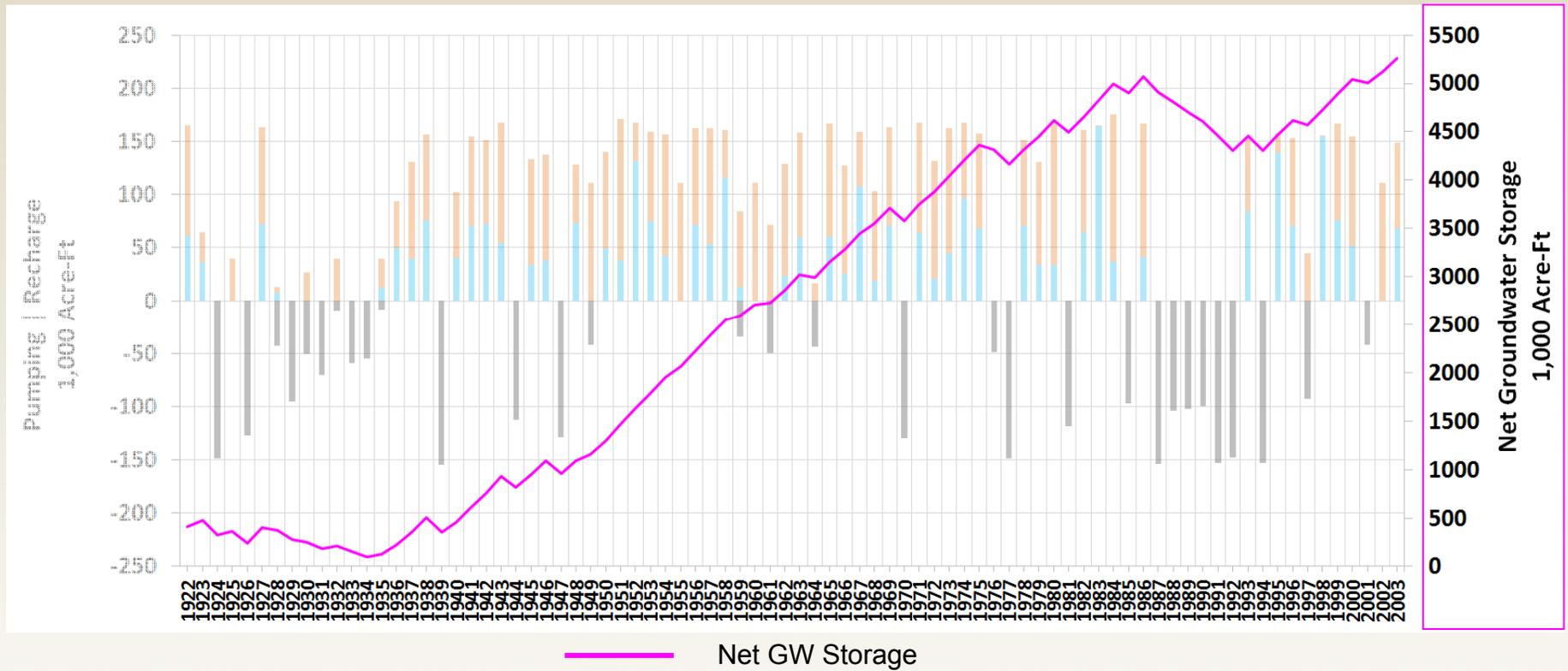


■ Recharge - Unappropriated Flows
 ■ Recharge - Reservoir Reop
 ■ GW Pumping

GW Recharge		GW Pumping
Unappropriated Flows	Reop. Shasta, Oroville, Folsom	35 TAF/yr
36 TAF/yr	57 TAF/yr	

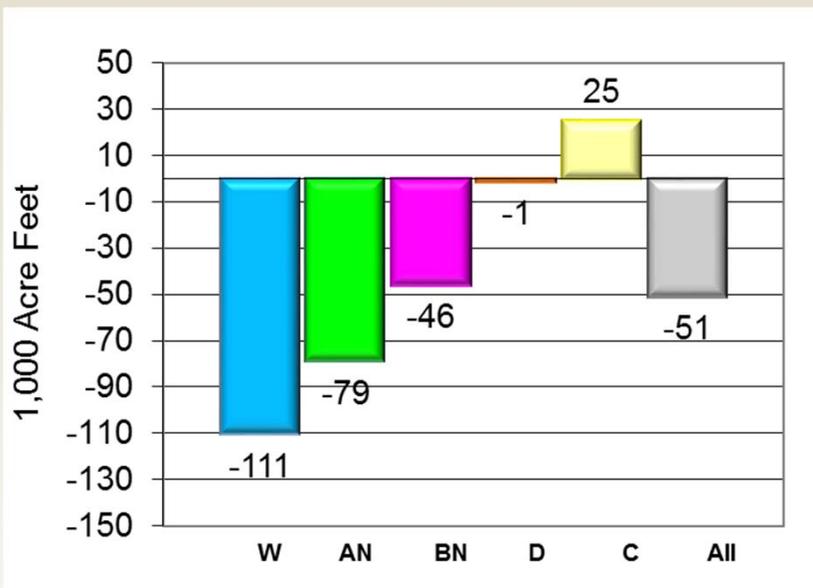
Groundwater Operations

SGMA Scenario

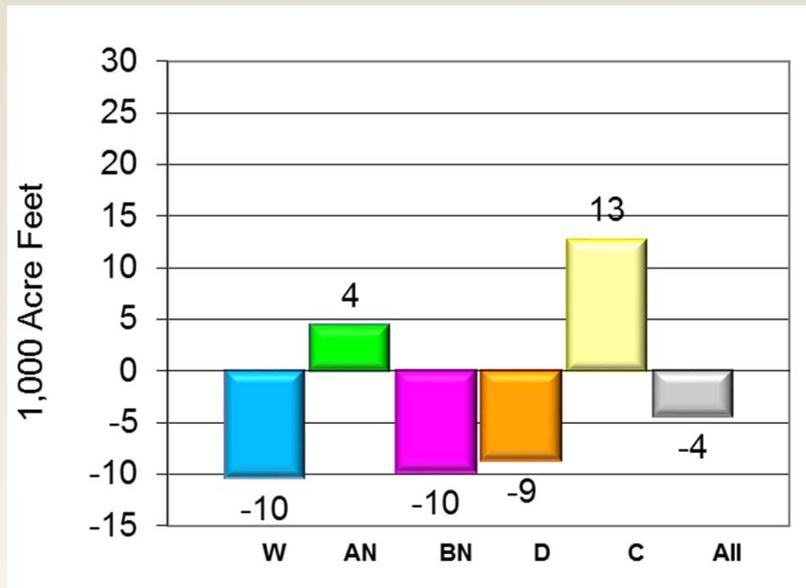


GW Recharge		GW Pumping	GW Storage
Unappropriated Flows	Reop. Shasta, Oroville, Folsom		
36 TAF/yr	57 TAF/yr	35 TAF/yr	58 TAF/yr

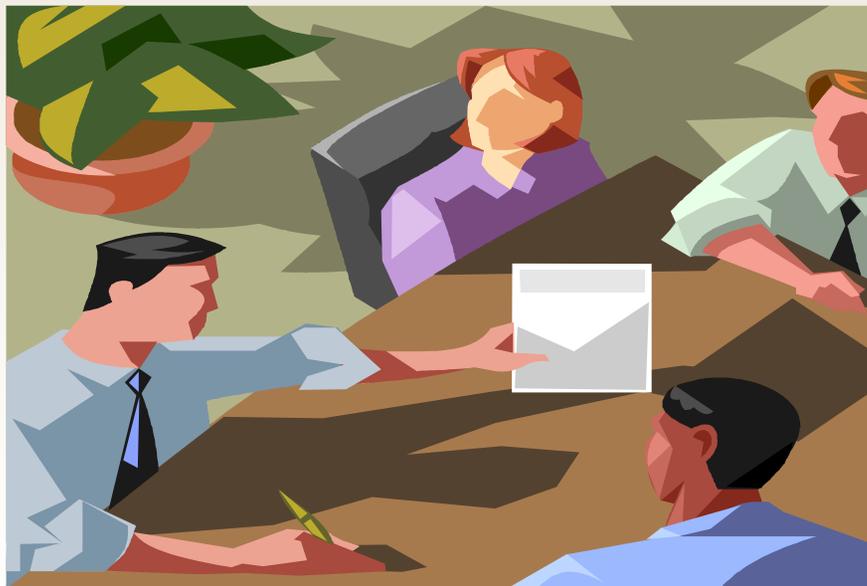
Change in Delta Outflow (Average Annual)



Change in Delta Exports (Average Annual)



Questions & Comments



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