

RECLAMATION

Managing Water in the West

Central Valley Project Cost Allocation Study

Public Meeting
May 17, 2013



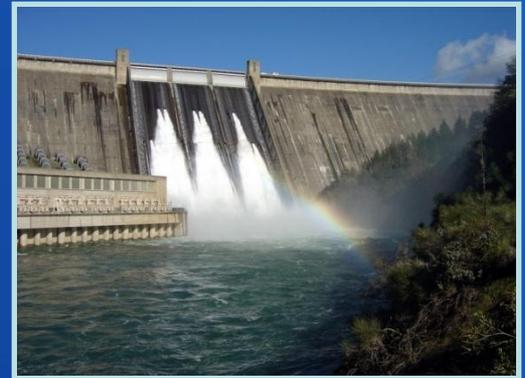
U.S. Department of the Interior
Bureau of Reclamation

CVP-CAS

Central Valley Project Cost Allocation Study

Meeting Purpose

- Water Supply Modeling Analysis Approach



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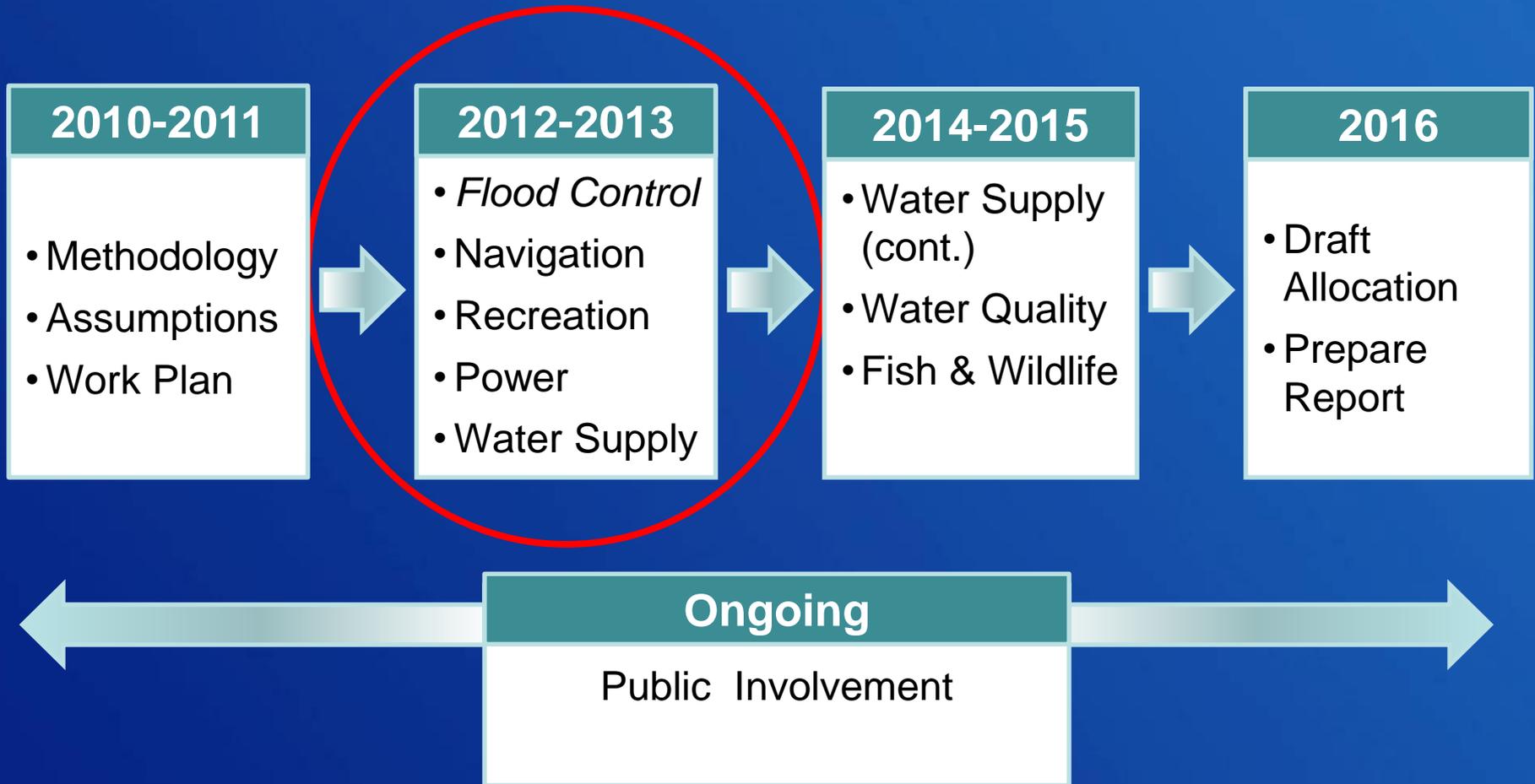
Central Valley Project Cost Allocation Study

Background

- Cost Allocation Study Purpose and Process
 - www.usbr.gov/mp/cvp/cvp-cas/index.html
- Summary of 1/18/13 Meeting
 - Power Benefits Methodology and Assumptions
 - PLEXOS Model Demonstration



CVP-CAS *Next Steps: Process, Budget & Schedule*



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Hydrology Modeling for the Water Supply Purpose – Presentation Outline

- Cost Allocation Study terms and concepts
 - Defining “Water Supply”
 - CVP facilities with a water supply purpose
 - Single-purpose facility sizing to meet the water supply purpose
- Use of CalSim2 model in water supply analysis
- Development and use of a “Sizing Model”

Cost Allocation Study Terms & Concepts

- The Central Valley Project serves multiple purposes
- Water supply is one of the CVP purposes
- Each project facility serves one or more project purposes
- Hydrology analysis goal – size project facilities to meet the water supply purpose
 - This is different from the final allocation of project facilities among project purposes

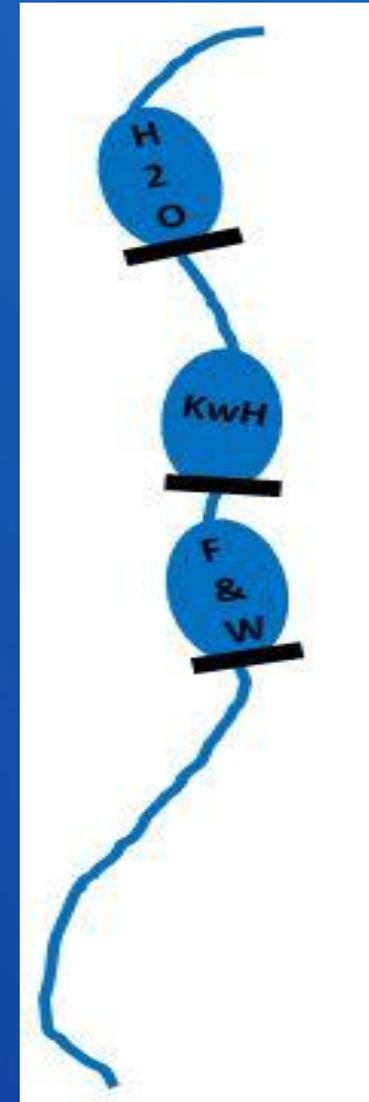
Cost Allocation Study Terms & Concepts

Facilities with a Water Supply Purpose

- Conveyance and Pumping Facilities – serve only the water supply purpose
- Storage Facilities – multi-purpose – also serve flood control, power, water quality, fish & wildlife

Cost Allocation Study Terms & Concepts

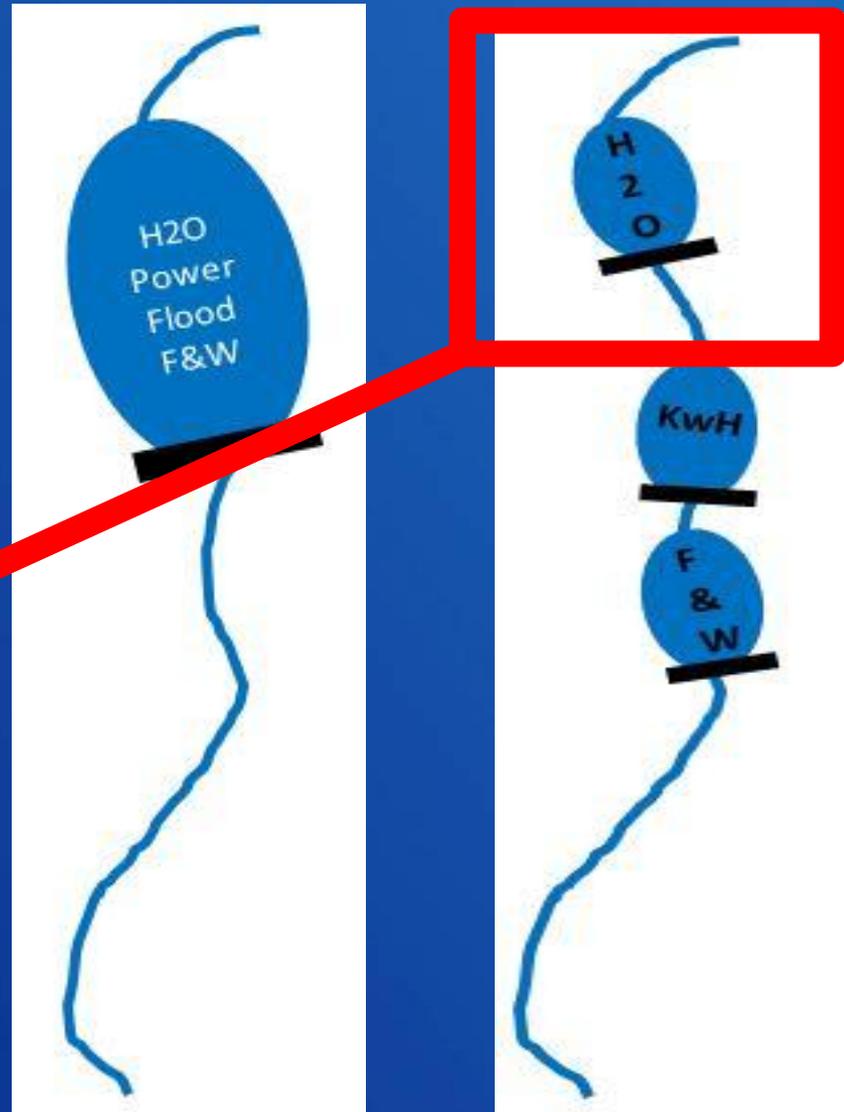
A single-purpose facility must provide the same level of benefit as a multi-purpose facility



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Cost Allocation Study Terms & Concepts

“How big does a reservoir need to be to satisfy only the water supply purpose?”



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Cost Allocation Study Terms & Concepts

Single-Purpose Facility Sizing to Meet the Water Supply Purpose

- Single-facility scenarios – geographical limits
 - i.e. Shasta cannot serve American River deliveries
- Multiple-facility scenarios – develop a matrix of facility sizing combinations

	1	2	3
Trin	a	b	c	##
Wktn	d	e	e	##
Shsta	f	g	h	##
Folsm	i	i	j	##
Nmbs	k	k	l	##
NM	m	m	m	##
Friant	n	n	n	##
SLuis	o	o	p	##

Cost Allocation Study Terms & Concepts

The Water Supply Purpose

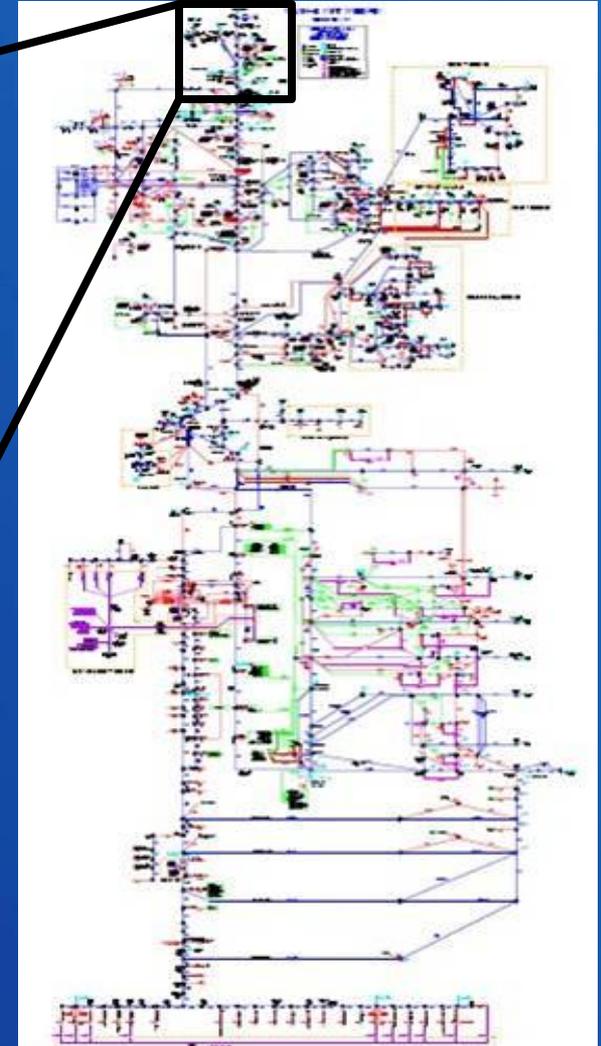
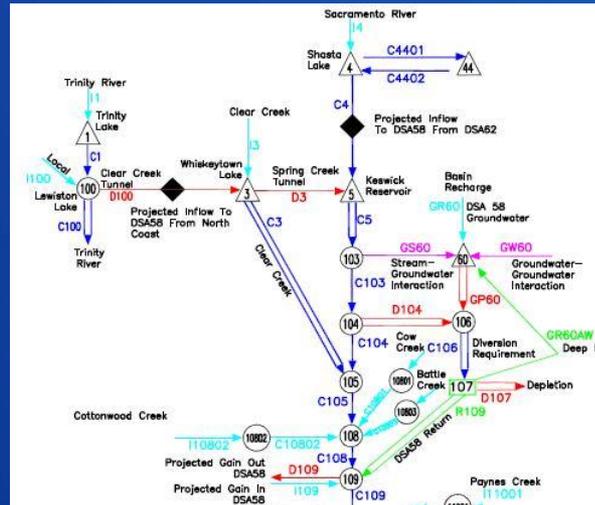
- Water Supply Purpose = Water Delivery
 - Agricultural (irrigation)
 - Municipal/Industrial (urban)
 - Refuge (wetland/irrigation)
- Historical water deliveries define CVP water supply purpose abilities of the past
- Current and projected water delivery capability is depicted by modeling
 - Modeled deliveries implicitly reflect system regulations
 - Model hydrology (inflows/demands) reflects a specific level of land development

Modeling for The Water Supply Purpose

- Delivery Representation – Use CalSim2 Results
 - Reflect a particular regulatory environment
 - Reflect a particular level of development
- Storage Sizing – Develop a Sizing Model
 - Analyze storage required to satisfy project deliveries

Hydrology Modeling – CalSim2

- What is CalSim2?
- What is a level of development?
- How does CalSim2 calculate deliveries?
- How does CalSim2 represent operations?

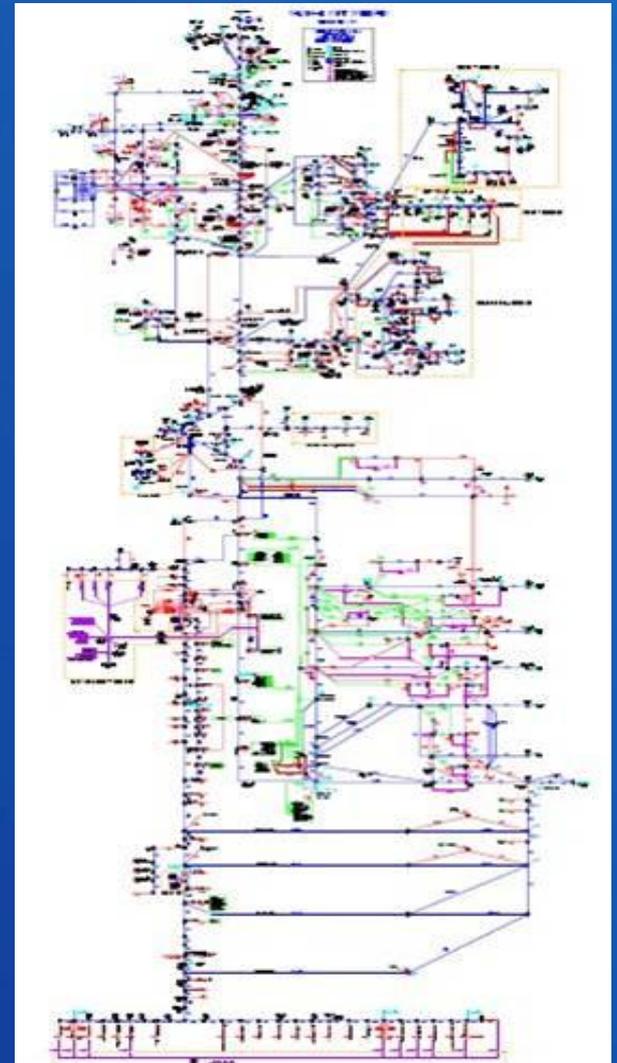


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Hydrology Modeling – CalSim2

Overview

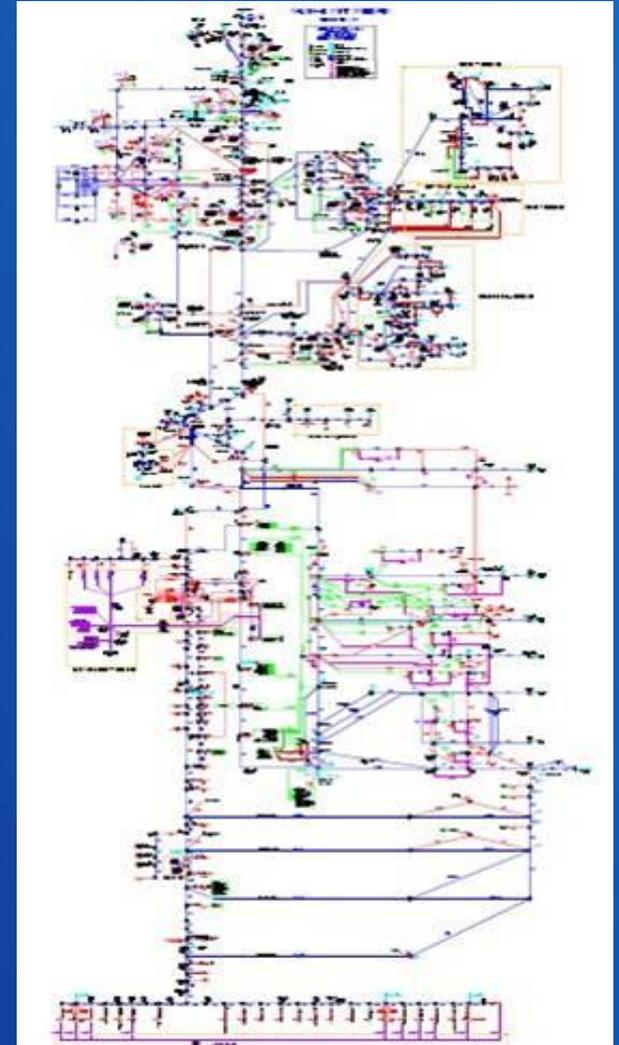
- Evaluates water supply reliability of the CVP/SWP
 - At current /future level of development
 - With/without assumed future facilities
 - Under specified regulatory criteria
- Large user community includes State and Federal Agencies, Water Users, NGO's, Consultants
- Subject of two academic peer review efforts
- Ongoing development and improvement through application



Hydrology Modeling – CalSim2

Applications (abridged list)

- OCAP Studies 2004 & 2008
- CALFED Studies
- Delivery Reliability Report
- Storage Investigations – Shasta, NODOS, Upper San Joaquin, Los Vaqueros
- Climate change studies
- San Joaquin River Restoration
- DMC/CAA Intertie
- Bay Delta Conservation Plan



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CalSim2 Hydrology and Delivery

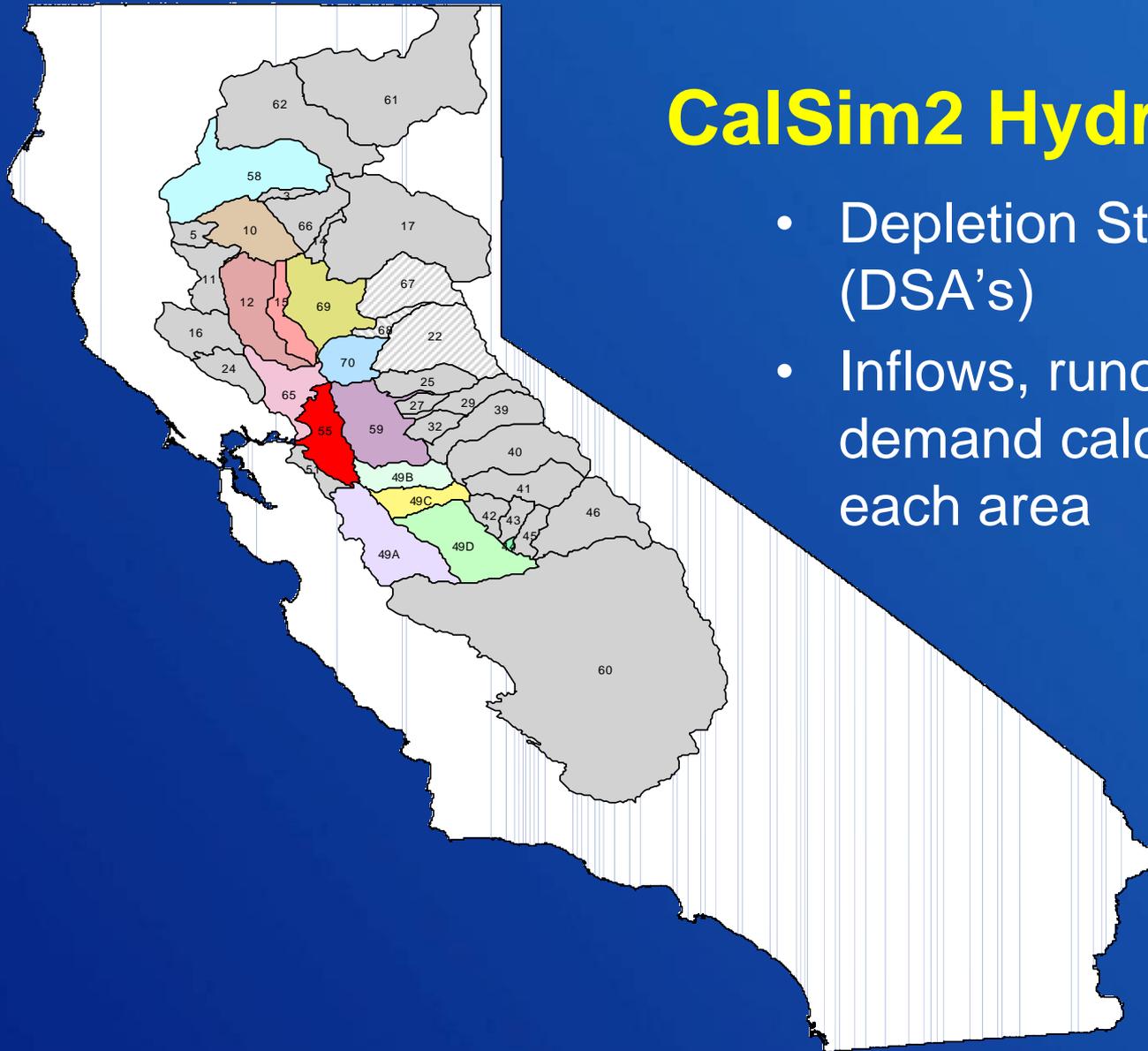
- **Hydrology** - Inflow and Demand
 - Level of Development
 - Land-Use based demands
 - Rim Inflows and Accretions/Depletions
- **Delivery** - Contracts and Allocations
 - Demand categories
 - Representation of Contracts
 - Allocation determination

CalSim2 Hydrology - Level of Development

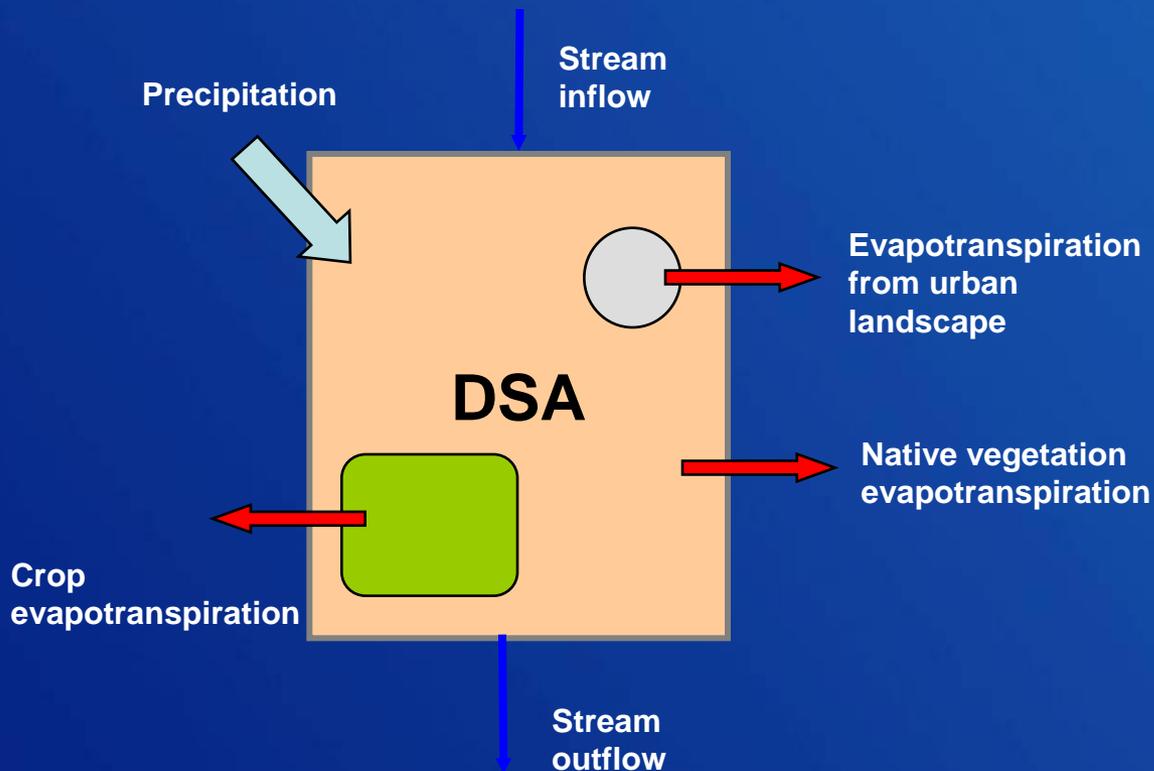
- Start with the historical record
- Period of record → data from 1922 - 2003
- Assume that precipitation would occur in the same quantity at the same locations as historical
- Un-impair the historical record to remove historical influences
- Develop projection of land use at a future date
- Re-impair the unimpaired hydrology to reflect projected future conditions

CalSim2 Hydrology

- Depletion Study Areas (DSA's)
- Inflows, runoff, and demand calculated for each area



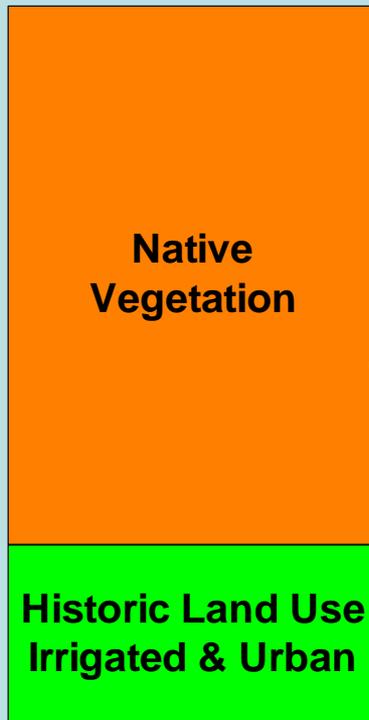
CalSim2 – Land-Use Based Hydrology



- Land within DSA mix of native vegetation and urban and agricultural development
- Development affects surface runoff.
- Irrigation water depleted through evapotranspiration
- Water supplies to downstream areas calculated by taking into account depletions of surface and groundwater supplies as represented by red arrows
- Demands calculated as water required to meet these depletions
- Depletions calculated by simulating monthly soil moisture conditions in the root zone for the different land use types using DWR's Consumptive Use model.

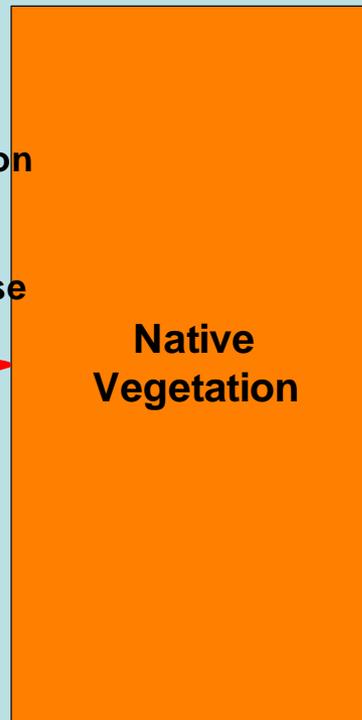
LAND USE ALTERATION

*HISTORIC
CONDITION*



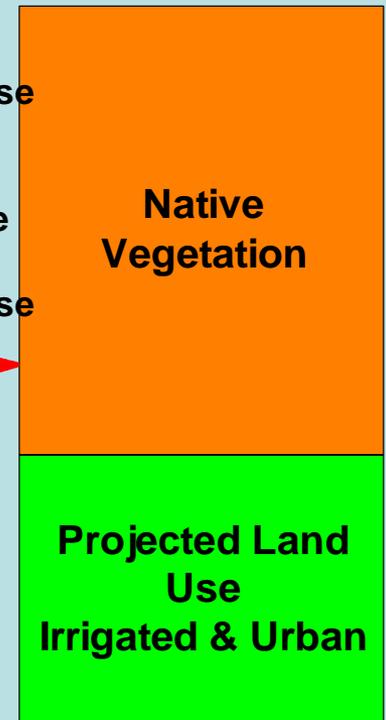
Remove
Historic Depletion
Add Replaced
Native Veg
Consumptive Use

*NATIVE
CONDITION*



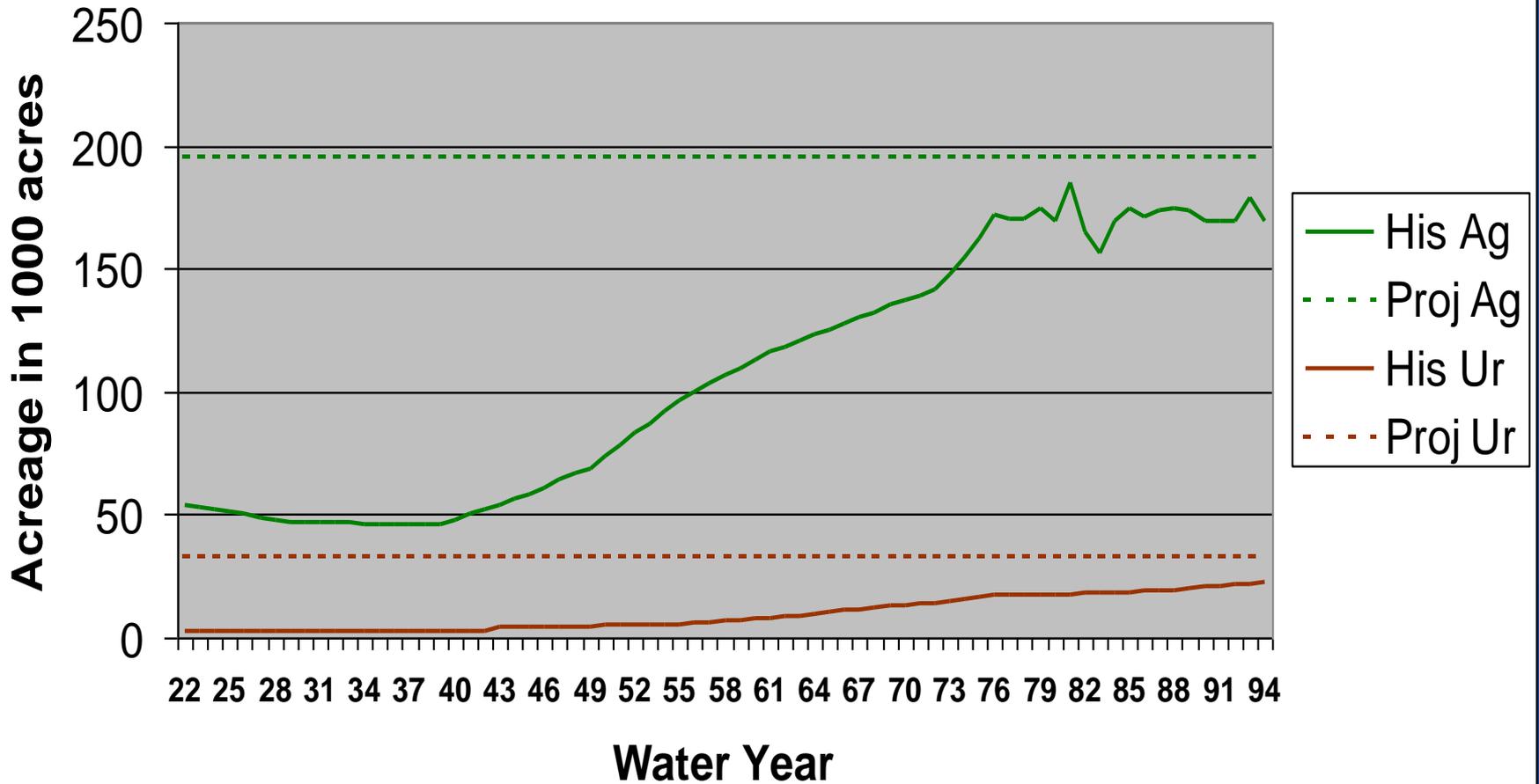
Add Projected
Consumptive Use
Remove
Projected
Replaces Native
Vegetation
Consumptive Use

*PROJECTED
CONDITION*



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DA10 Agricultural & Urban Acreage Historical and 2020 Projected (1000 acres)

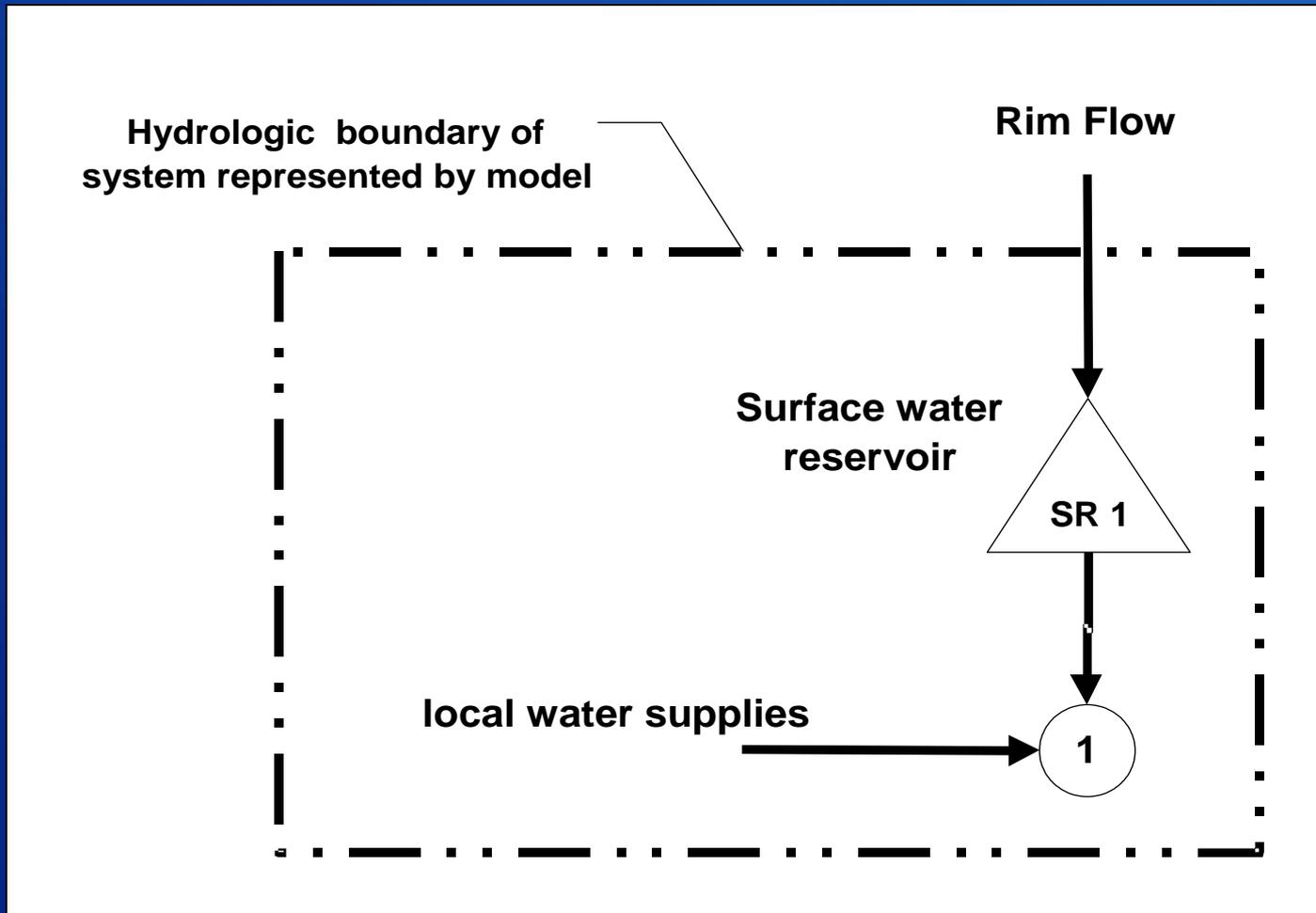


CalSim2 Hydrology - Demands

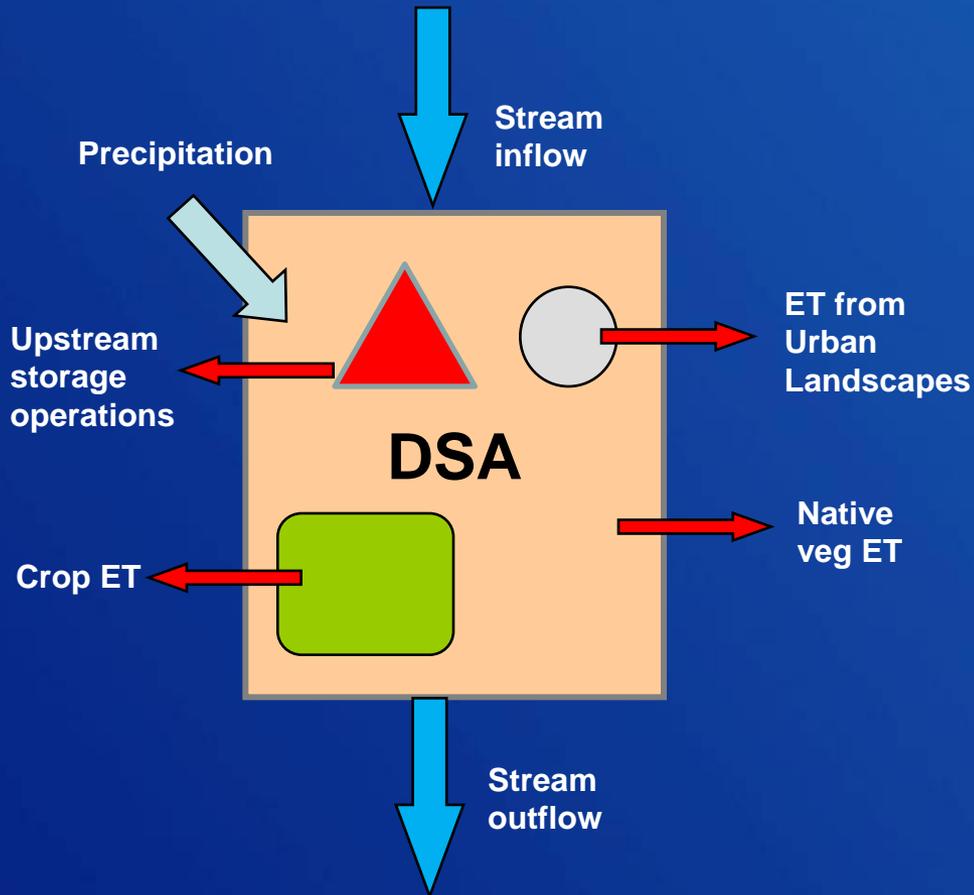
- Estimate acreage for each land use type
 - Specific crops, native vegetation, urban uses
- Calculate consumptive use needs

2020 PROJECTED LEVEL LANDUSE FOR THE VALLEY FLOOR AREAS "Bulletin 160-98" (acres)										
CROPS	DSA10	DSA12	DSA15	DSA54	DSA55	DSA58	DSA65	DSA69	DSA70	Totals
<i>Pasture</i>	34,500	14,500	1,200	11,940	14,100	24,700	13,100	26,100	30,600	170,740
<i>Alfalfa</i>	9,500	29,100	6,900	30,660	17,000	1,100	33,900	4,700	3,100	135,960
<i>Sugar Beets</i>	3,300	9,900	7,100	10,760	4,200		14,300	1,900	2,500	53,960
<i>Gen. Field</i>	17,200	29,600	40,400	103,580	40,100	500	45,900	19,700	4,800	301,780
<i>Rice</i>	4,500	153,700	88,600	200	700		10,400	170,500	48,600	477,200
<i>Misc. Truck</i>	5,300	21,300	18,500	33,960	8,100	1,600	-	6,900	500	96,160
<i>Tomato</i>	200	31,700	35,300	28,360	15,500	-	47,600	1,500	500	160,660
<i>Orchard</i>	88,900	48,100	32,100	9,700	12,600	4,000	31,000	128,400	10,700	365,500
<i>Grain</i>	11,500	30,900	46,600	57,640	12,700	1,300	57,400	19,950	6,600	244,590
<i>Vineyard</i>	200	5,700	-	7,060	1,400	100	2,000	-	200	16,660
<i>Cotton</i>	-	11,500	3,100	-	-	-	-	800	-	15,400
<i>Citrus/olive</i>	24,500	-	-	-	-	400	-	4,000	-	28,900
										-
Total Ag	199,600	386,000	279,800	293,860	126,400	33,700	255,600	384,450	108,100	2,067,510
Urban	33,300	12,800	4,800	24,440	35,700	110,000	61,100	81,000	284,600	647,740
Total Ag+Urban	232,900	398,800	284,600	318,300	162,100	143,700	316,700	465,450	392,700	2,715,250

CalSim2 Hydrology – Rim Flows vs. Local Water Supplies



CalSim2 Hydrology – Rim Inflows



- Time series of outflows from DSA's upstream of valley floor
- Historical outflow from gage data
- Historical and projected depletions from CU model
- Historical storage operations from records
- Unimpair
- Re-impair
- Projected storage regulation may require separate operations studies

CalSim2 Hydrology - Local Water Supplies

- Referred to as accretions and depletions
- Time series of inflows to each Valley floor DSA
- Represent direct runoff from precipitation
- Calculated as closure term in hydrologic mass balance on each DSA
- Flows separated into:
 - Time series of positive values (accretions)
 - Time series of negative values (depletions)

CalSim2 Delivery – Contracts

North of Delta

- Consumptive use demands based on land use
- Contract allocation limits surface delivery
 - Sacramento River Settlement Contracts
 - North of Delta Ag Service Contracts
 - American River Water Forum M&I
 - North of Delta Refuge

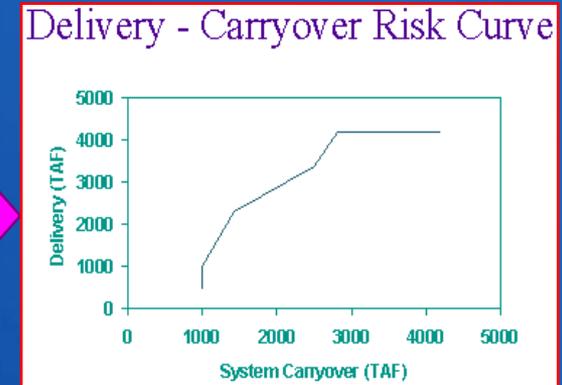
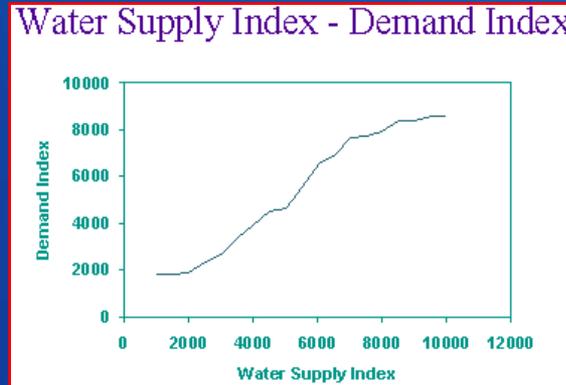
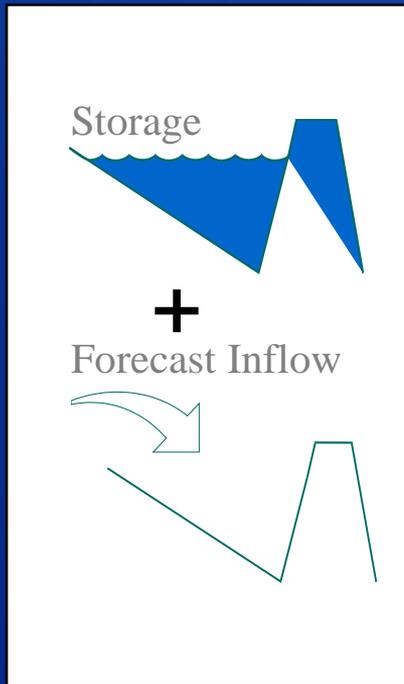
South of Delta

- Demands = Contracts
- Deliveries = Contract Allocation
 - San Joaquin River Exchange Contracts
 - South of Delta Ag Service Contracts
 - San Felipe and other SOD M&I
 - SJR Basin Refuge Contracts

CalSim2 Delivery – Allocation and Ops

- Deliveries to contractors are affected by
 - Storage in project reservoirs
 - Forecasted inflows
 - Environmental regulations
 - Contractual commitments
 - Demands
 - Export restrictions
 - Conveyance constraints
- Allocation determination considers these factors

CalSim2 – Allocation



Set
Delivery
Target



South of Delta allocation
also affected by export
limits

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CalSim2 – Allocation Decisions



CalSim2 Operations Criteria

- SWRCB Water Rights Decision 1641
- USFWS and NMFS BO RPA's
- CVPIA 3406(b)(2) Actions
- Coordinated Operations Agreement
- Flood Control Rules
- San Joaquin River Restoration
- Other scenario-specific operations

Single Purpose Facility Sizing Model

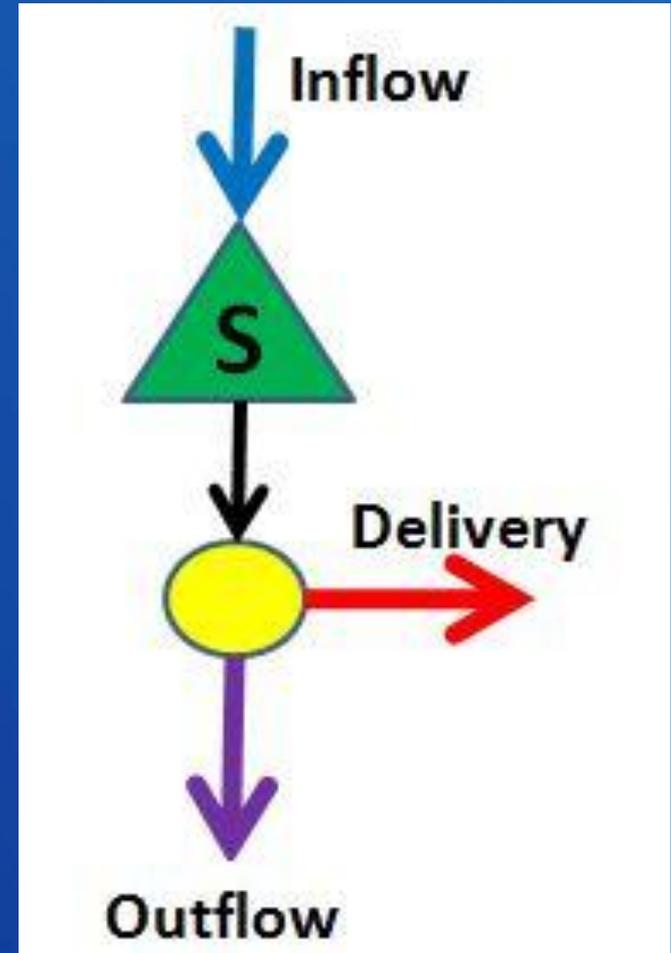
- Adapt CalSim2 schematic
- Inputs – CalSim2 hydrology
 - Inflows and Accretions/Depletions = Available Water
- Fix Deliveries and Exports
 - Hard-wire to CalSim2 model results
- Fix Non-Project and SWP effects
 - Allow CVP reservoirs to only address CVP demands
 - Ensure CVP demands do not use other project water

Single Purpose Facility Sizing Model

- No system regulation or other project purposes **explicitly** represented
- Regulatory criteria are **implicitly** reflected in the fixed deliveries and exports (CalSim2 results)
 - Flow requirements
 - Water quality standards
 - Flood control rules
 - Export limits
- Size reservoirs to satisfy fixed diversions
 - Single-reservoir scenarios
 - Multiple-reservoir scenarios

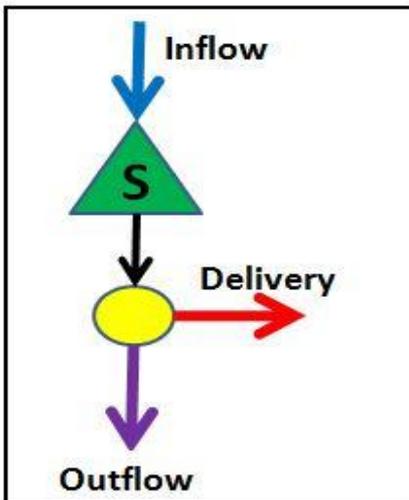
Sizing Model Conceptual Example

- Extremely simple schematic
- 8 year-run
- One Inflow, One Reservoir
- One Outflow
 - Represents all regulatory criteria
 - $\text{Outflow} = \text{Requirement} + \text{Spill}$
- One Delivery
 - Represents all deliveries/exports
- Demo
 - “Normal operation”
 - Sizing operation

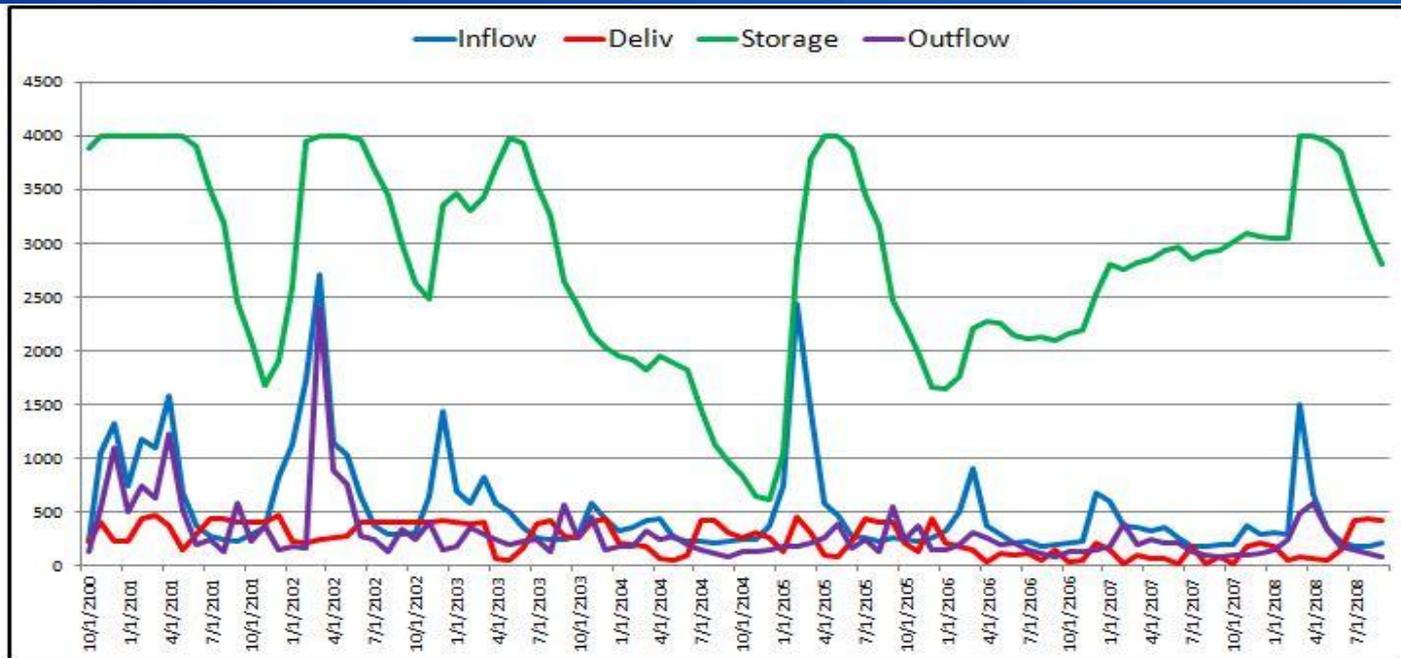


Sizing Model Example

- Normal operation – reservoir has 4 TAF capacity
- Inflow (hydrology) – max 10.8, min 3.9 taf/yr
- Outflow = Requirement + Spill (avg 2.5 & 1.8 taf/yr)
- Deliveries – max 4.1, min 1.0 taf/yr



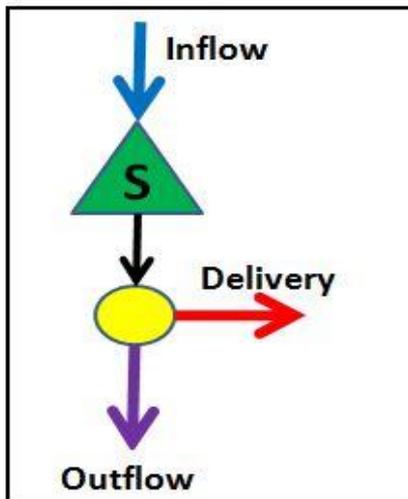
Storage Capacity	4000
Flow On/Off	1
Shortage	0



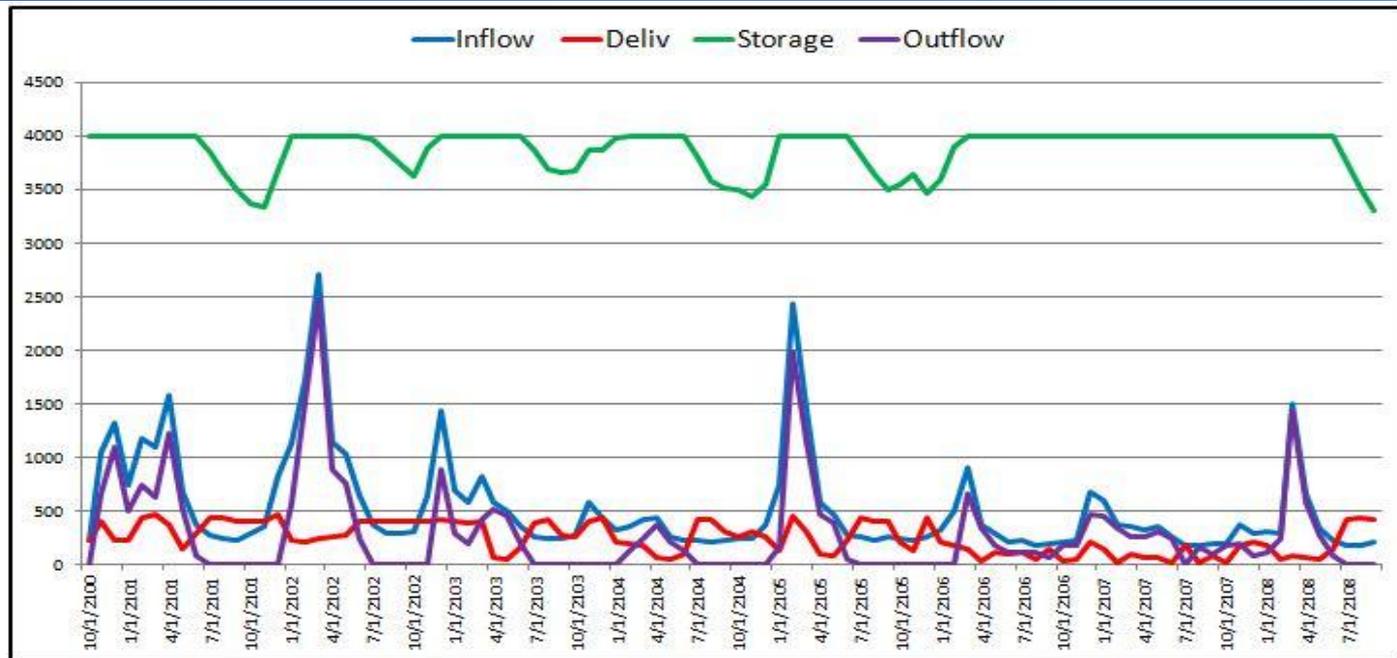
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Sizing Model Example

- Remove outflow “requirement”
- Outflow reflects “spill” only
- Deliveries met by inflow and reservoir release
- Reservoir capacity clearly more than enough

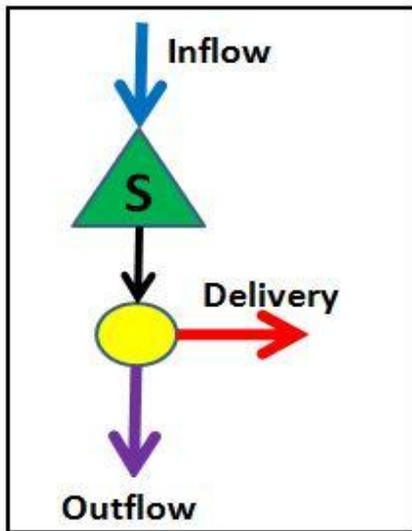


Storage Capacity	4000
Flow On/Off	0
Shortage	0

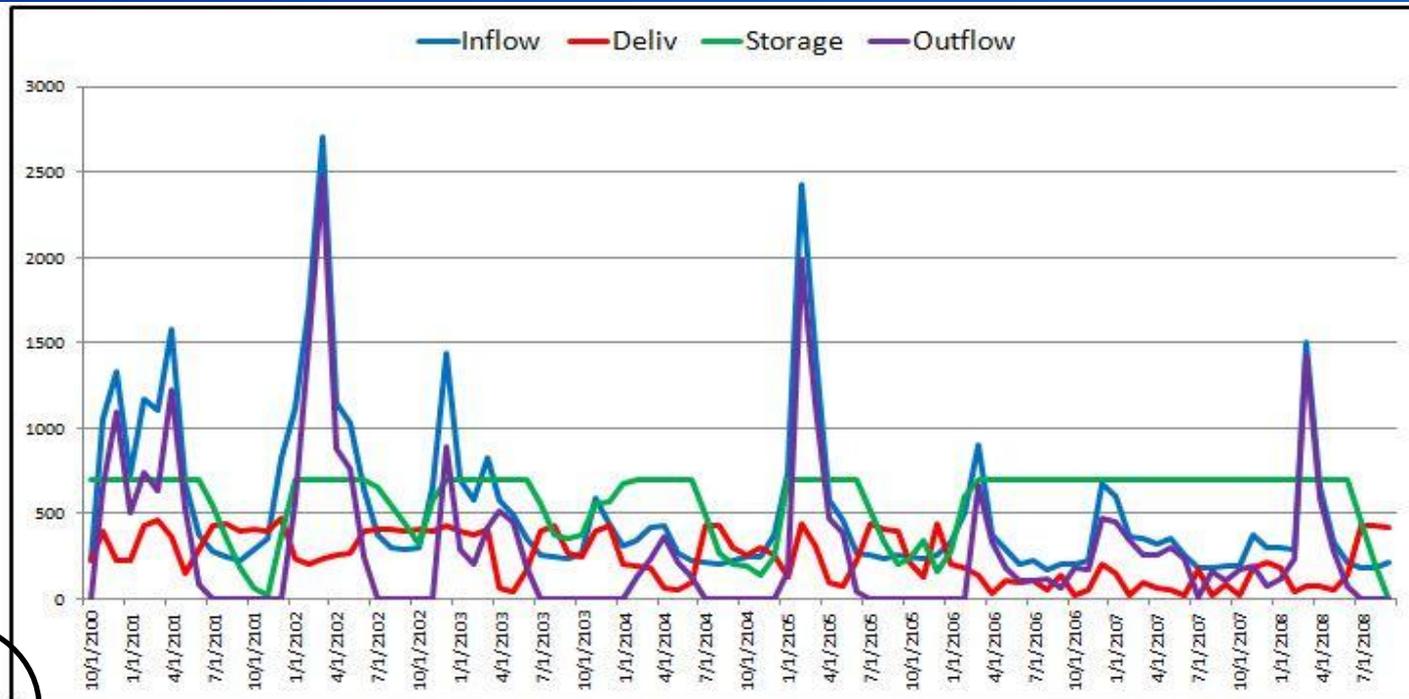


Sizing Model Example

- 697 AF is the reservoir size which **just** meets deliveries
- This is the single-purpose reservoir size for the water supply purpose



Storage Capacity	697
Flow On/Off	0
Shortage	0



Summary

- Analysis goal – size CVP reservoirs to meet the water supply purpose of Central Valley Project
- Water Supply = Delivery
- CVP delivery capacity reflected by modeled operations
- Use CalSim2 model to depict operations and deliveries
- Develop new sizing model to determine storage necessary to provide delivery

CVP-CAS *Next Steps*

- Document Comments and Responses
- Refinement of Process and Schedule
- Upcoming Public Meeting
 - July 19, 2013





CVP-CAS

www.usbr.gov/mp/cvp/cvp-cas/index.html

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