Long-Term Operation – Biological Assessment

Attachment E.1 – CalSim II Model Assumptions Callouts

July 2024

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Attachment E.1 CalSim II Model Assumptions Callouts

Table E.1-1. CalSim II Model Assumptions Callouts

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Description	Run of the River	Maximize Storage – Prioritize Senior Deliveries, No Stored Water Release Except for Flood Control	Maximize Storage – Prioritize Flow and D-1641 Standards, No Stored Water Release Except for Flood Control	Maximize Storage – Prioritize Pass-Through for Senior Deliveries, Release Stored Water for Unmet for Flow and D-1641 Standards	Maximize Storage – Prioritize Pass-Through for Flow and D-1641 Standards, Release Stored Water for Unmet Flow and D-1641 Standards	Obligated Releases	Project Delivery and Export from Excess Flows – No ESA or ITP Actions	Project Delivery and Export from Excess Flows – No ESA or ITP Action Except OMR	Manage Stored Water – Fully meet ESA/ITP – Project Delivery to Health and Safety, Otherwise Export Excess Flows Only	Managed Stored Water – Full Operations Without Article 21 or LYRA	Manage Stored Water – Full Operations
GENERAL											
Planning Horizon	Year 2030	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Period of Simulation	82 years (1922–2003)	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
HYDROLOGY											
Climate Condition	2035_CT projected changes in temperature, and precipitation; sea level rise increased by 15 centimeters	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Inflows/ Supplies	Modified inflows based on historical hydrology and projected climate condition	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Level of Development	Projected 2030 level	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
DEMANDS, WATER RIGHTS											
Sacramento River Region (Excluding American River)											
CVP	Demands reflect land-use basis. Settlement contractors may divert up to full contract amounts, given hydrologic conditions, without CVP	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Demands reflect land-use basis. Deliveries to Settlement contractors are made, up to full contract amounts, with CVP facility operations.	Demands reflect land-use basis. Deliveries to Settlement contractors are made, up to full contract amounts, with CVP facility operations.	Same as EXP4v3	Same as EXP4v3	Demands reflect land-use basis. Deliveries to Settlement contractors are made, up to full contract amounts, with CVP facility operations.	Same as EXP5

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
	facility operations or hydraulic conditions consideration. No deliveries to CVP M&I or Ag service contractors.					No deliveries to CVP M&I or Ag service contractors.	Deliveries to CVP M&I and Ag service contractors, up to allocated contract amounts given hydrologic conditions without delivery of stored water.			Deliveries to CVP M&I and Ag service contractors, up to allocated contract amounts with operating CVP facilities to deliver stored water.	
SWP (FRSA)	Demands reflect land-use basis, limited by contract amounts. Deliveries to FRSA contractors are made as possible, up to full contract amounts, given hydrologic conditions, without SWP facility operations or hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Demands reflect land-use basis, limited by contract amounts. Deliveries to FRSA contractors are made, up to full contract amounts, with SWP facility operations.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Non-project	Land-use based, limited by water rights and Water Board Decisions for Existing Facilities. Deliveries to senior water rights are made as possible, given hydrologic conditions, without CVP facility operations or hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Land-use based, limited by water rights and Water Board Decisions for Existing Facilities. Deliveries to senior water rights are made with CVP facility operations.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Antioch Water Works	Pre-1914 water right	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1

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Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Federal refuges	Deliveries to refuges are made as possible, up to Level 1 supply needs, given hydrologic conditions, without CVP facility operations or hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Deliveries to refuges are made up to firm Level 2 supply needs with CVP facility operations.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Sacramento River Region – American River											
Water rights	Year 2025, full water rights and Water Board Decisions for Existing Facilities. Deliveries to water rights are made as possible, given hydrologic conditions, without CVP facility operations or hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Year 2025, full water rights and Water Board Decisions for Existing Facilities. Deliveries to water rights are made with CVP facility operations.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
CVP	Year 2025, demands reflect full contracts. No deliveries to CVP M&I service contractors.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Year 2025, demands reflect full contracts. No deliveries to CVP M&I service contractors.	Year 2025, demands reflect full contracts. Deliveries to CVP M&I service contractors, up to allocated contract, including Freeport Regional Water Project, amounts given hydrologic conditions without operating CVP facilities to deliver stored water.	Same as EXP4v3	Same as EXP4v3	Year 2025, demands reflect full contracts. Deliveries to CVP M&I service contractors, including Freeport Regional Water Project, up to allocated contract amounts with operating CVP facilities to deliver stored water.	Same as EXP5

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Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
San Joaquin River Region											
San Joaquin River and tributaries (except Stanislaus River)	Land-use based, based on district-level operations and constraints. Deliveries to water rights, Exchange Contractors, and refuges (up to Level 1) are made as possible, up to full contract amount, through San Joaquin River diversions, given hydrologic conditions, without CVP facility operations or hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Land-use based, based on district-level operations and constraints. Deliveries to water rights are made with CVP facility operations. Deliveries to CVP Exchange Contractors and refuges (firm Level 2) are made, up to full contract amounts, through San Joaquin River diversions, with CVP Friant facility operations but no hydraulic condition considerations.	Land-use based, based on district-level operations and constraints. Deliveries to water rights are made with CVP facility operations. Deliveries to Exchange contractors and refuges are first made through excess flow exports at Jones Pumping Plant as possible given hydrologic conditions, and second through San Joaquin River diversions, up to full contract amounts, with CVP Friant facility operations, as needed.	Same as EXP4v3	Same as EXP4v3	Land-use based, based on district-level operations and constraints. Deliveries to water rights are made with CVP facility operations. Deliveries to Exchange contractors and refuges are first made through exports at Jones Pumping Plant up to full contract amounts, with CVP facility operations, and second through San Joaquin River diversions, up to full contract amounts, with CVP Friant facility operations, as needed.	Same as EXP5
Friant Unit	No deliveries to Friant Unit CVP M&I or Ag service contractors.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Deliveries to Friant contractors are first made as possible given hydrologic conditions from the San Joaquin River after Exchange Contractors and refuges, up to full contract amounts, without CVP Friant facility operations.	Same as EXP4v3	Same as EXP4v3	Deliveries to Friant contractors are first made, up to allocated contract amounts, with CVP Friant facility operations (as available after Exchange Contractors, if needed).	Same as EXP5

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Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Stanislaus River	Land-use based, based on district-level operations and constraints. Deliveries to water rights are made as possible given hydrologic conditions, without CVP facility operations or hydraulic conditions consideration. No deliveries to Stanislaus Unit CVP M&I or Ag service contractors.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Land-use based, based on district-level operations and constraints. Deliveries to water rights are made with CVP facility operations. No deliveries to Stanislaus Unit CVP M&I or Ag service contractors.	Land-use based, based on district-level operations and constraints. Deliveries to water rights are made with CVP facility operations. Deliveries to CVP M&I and Ag service contractors up to allocated contract amounts, given hydrologic conditions, without CVP facility operations.	Same as EXP4v3	Same as EXP4v3	Land-use based, based on district-level operations and constraints. Deliveries to water rights are made with CVP facility operations. Deliveries to CVP M&I and Ag service contractors up to allocated contract amounts.	Same as EXP5
San Francisco Bay, Central Coast, Tulare Lake and South Coast Regions (CVP/SWP Project Facilities)											
CVP	No project deliveries.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Deliveries to CVP M&I and Ag service contractors up to full contract amounts, through exports of Delta excess (i.e., w/o NOD storage releases), after Exchange and Refuge demands are fully met. CVP San Luis operated to facilitate export of Delta excess flows.	Same as EXP4v3	Same as EXP4v3	Deliveries to CVP M&I and Ag service contractors up to allocated contract amounts, with CVP facility operations.	Same as EXP5
CCWD	Deliveries to water rights are made as possible given Delta hydrologic conditions, without CVP facility operations. No deliveries to	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	195 TAF/year CVP contract supply and water rights; Deliveries to CVP M&I service contracts up to allocated contract amounts, given Delta hydrologic	Same as EXP4v3	Same as EXP4v3	195 TAF/year CVP contract supply and water rights; including in-Delta transfers. Deliveries to CVP M&I service contractors up to	Same as EXP5

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Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
	CCWD M&I service contracts.						conditions, without CVP facility operations. Delivery operations now include in-Delta transfers.			allocated contract amounts.	
SWP	No project deliveries	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Demand based on Table A amounts. Deliveries to SWP M&I and Ag service contractors up to allocated contract amounts, given Delta hydrologic conditions, without SWP facility operations. SWP San Luis operated to facilitate export of Delta excess flows.	Same as EXP4v3	Same as EXP4v3	Demand based on Table A amounts. Deliveries to SWP M&I and Ag service contractors up to allocated contract amounts.	Same as EXP5
Article 56	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Based on 2001–2008 contractor requests	Same as EXP4.95	Same as EXP4.95
Article 21	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Metropolitan Water District demand up to 200 TAF/month from December to March subject to conveyance capacity, Kern County Water Agency demand up to 180 TAF/ month. and other contractor demands up to 34 TAF/month in all months, subject to conveyance capacity.

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
North Bay Aqueduct (NBA) SWP	No project deliveries	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	77 TAF/year demand under SWP contracts; deliveries to SWP M&I and Ag service contractors up to allocated contract amounts, given hydrologic conditions, without SWP facility operations.	Same as EXP4v3	Same as EXP4v3	77 TAF/year demand under SWP contracts; deliveries to SWP M&I and Ag service contractors up to allocated contract amounts.	Same as EXP5
North Bay Aqueduct (NBA) CVP Settlement	Not included	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Up to 43.7 cfs of excess flow under Fairfield, Vacaville, and Benicia Settlement Agreement	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Federal refuges	Deliveries to refuges are made as possible, up to Level 1 supply needs, through San Joaquin River diversions, given hydrologic conditions, without CVP facility operations or hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Deliveries to refuges are made as possible, up to firm Level 2 supply needs, through San Joaquin River diversions, with CVP Friant facility operations but no hydraulic condition considerations	Deliveries to refuges are first made through excess flow exports at Jones Pumping Plant, as possible given hydrologic conditions, and second through San Joaquin River diversions, up to firm Level 2 supply needs, with CVP Friant facility operations, as needed.	Same as EXP4v3	Deliveries to refuges are made through exports at Jones Pumping Plant, up to firm Level 2 supply needs, as exports allow, with CVP facility operations.	Same as EXP4.95	Same as EXP4.95
FACILITIES											
Trinity River Region											
Trinity Lake	Pass-through inflow, not limited to release capacity, subject to all other regulations and operation	Store water to extent possible, subject to all other regulations and operation assumption	Same as EXP2A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other regulations	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other	Store water and release stored water for non-discretionary obligations, subject to all other regulations and	Store water and release stored water subject to all other regulations and operation assumption	Store water and release stored water subject to all other regulations and operation assumption	Store water and release stored water subject to all other regulations and operation assumption	Store water and release stored water subject to all other regulations and operation assumption	Store water and release stored water subject to all other regulations and operation assumption

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
	assumption callouts for this scenario. Release stored water as quickly as possible, limited by downstream channel capacity.	callouts for this scenario.		and operation assumption callouts for this scenario.	regulations and operation assumption callouts for this scenario.	operation assumption callouts for this scenario.	callouts for this scenario.	callouts for this scenario.	callouts for this scenario.	callouts for this scenario.	callouts for this scenario.
Clear Creek Tunnel	Not Operated	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Operated up to existing capacity of 3300 cfs	Same as EXP4.95	Same as EXP4.95
Whiskeytown Lake	Pass-through inflow, limited to release capacity, operated to dead pool capacity of 10 TAF.	Operated up to existing capacity of 240 TAF.	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A
Spring Creek Tunnel	Not Operated	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Operated up to existing capacity of 4200 cfs	Same as EXP4.95	Same as EXP4.95
Sacramento River Region											
Shasta Lake	Pass-through inflow, not limited to release capacity, subject to all other regulations and operation assumption callouts for this scenario. Release stored water as quickly as possible, limited by downstream channel capacity.	Store water to extent possible, subject to all other regulations and operation assumption callouts for this scenario. No summer draw down.	Same as EXP2A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other regulations and operation assumption callouts for this scenario. No summer draw down.	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other regulations and operation assumption callouts for this scenario. No summer draw down.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Full operations under D-1641 and 2019 Biological Opinions, subject to all other regulations and operations assumptions callouts for this scenario.	Same as EXP5, subject to all other regulations and operations assumptions callouts for this scenario.
Keswick Reservoir	Pass-through inflow, limited to release capacity, operated to dead pool capacity of 0.014 TAF.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Operated up to existing capacity of 23.8 TAF.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Red Bluff Diversion Dam	No pumping	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Pumping Plant operated	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3

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Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Stony Creek River Region											
East Park Reservoir	Existing Storage Operated	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Stony Gorge Reservoir	Existing Storage Operated	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Black Butte Lake	Existing Storage Operated	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Fremont Weir	Notched Fremont Weir as represented in Yolo Bypass Salmonid Habitat Restoration and Fish Passage EIS/EIR Alternative 1 (preferred alternative).	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Colusa Basin	Existing conveyance and storage facilities, water rights and Settlement Contractor and Refuge Level 1 diversions, given hydrologic conditions, without CVP facility operations or hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Existing conveyance and storage facilities, water rights and Settlement Contractor and refuge firm Level 2 diversions, with CVP facility operations.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Feather River											
Lake Oroville	Pass-through inflow, not limited to release capacity, subject to all other regulations and operation assumptions callouts for this scenario. Release stored water as	Store water to extent possible, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2.5A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Full operations under D-1641, 2019 Biological Opinions, and 2020 ITP, subject to all other regulations and operations assumptions callouts for this scenario.	Full operations under D-1641, 2019 Biological Opinions, and 2020 ITP, subject to all other regulations and operations assumptions callouts for this scenario.	Same as EXP5, subject to all other regulations and operations assumptions callouts for this scenario.

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Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
	quickly as possible, limited by downstream channel capacity.										
Thermalito Complex	Pass-through inflow not limited to outlet works release capacity, no storage capacity assumed.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Operated up to existing capacity of 55 TAF.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
American River											
Upper American River	Placer County Water Agency American River Pump Station, water rights diversions only, given hydrologic conditions, and without hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Placer County Water Agency American River Pump Station, full water rights diversions, diversions to CVP M&I and Ag service contractors, up to allocated contract amounts, given hydrologic conditions without CVP facility operations.	Same as EXP4v3	Same as EXP4v3	Placer County Water Agency American River Pump Station, water rights diversions and diversions to CVP M&I and Ag service contractors, up to allocated contract amounts.	Same as EXP5
Folsom Lake	Pass-through inflow, not limited to release capacity, subject to all other regulations and operation assumption callouts for this scenario. Release stored water as quickly as possible, limited by downstream channel capacity.	Store water to extent possible, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2.5A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP4v3	Full operations under D-1641 and 2019 Biological Opinions, subject to all other regulations and operations assumptions callouts for this scenario.	Same as EXP4.95, subject to all other regulations and operations assumptions callouts for this scenario.	Same as EXP4.95, subject to all other regulations and operations assumptions callouts for this scenario.

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Folsom South Canal	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Operated up to existing capacity	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
Lake Natoma	Pass-through inflow, limited to release capacity, operated to dead pool capacity of 1.75 TAF.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Operated up to existing capacity of 8.8 TAF.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Lower Sacramento River	Water rights diversions only given hydrologic conditions, and without hydraulic conditions consideration. Freeport Regional Water Project not operated.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Freeport Regional Water Project, full water rights diversions, diversions to CVP M&I and Ag service contractors, up to allocated contract amounts, given hydrologic conditions without CVP facility operations.	Same as EXP4v3	Same as EXP4v3	Freeport Regional Water Project, diversions for water rights and CVP M&I and Ag service contractors up to allocated contract amounts.	Same as EXP5
San Joaquin River Region											
Millerton Lake (Friant Dam)	Pass-through inflow, not limited to release capacity, subject to all other regulations and operation assumption callouts for this scenario. Release stored water as quickly as possible, limited by downstream channel capacity.	Store water to extent possible, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2.5A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations. Subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP4v3	Full operations meet San Joaquin River Restoration flows and Friant Unit allocations.	Same as EXP4.95, subject to all other regulations and operations assumptions callouts for this scenario.	Same as EXP4.95, subject to all other regulations and operations assumptions callouts for this scenario.
Lower San Joaquin River	City of Stockton Delta Water Supply Project, 30 million gallon per day capacity	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
New Melones	Pass-through inflow, not limited to release capacity, subject to all other regulations and operation assumption callouts for this scenario. Release stored water as quickly as possible, limited by downstream channel capacity.	Store water to the extent possible, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary flow and D-1641 standards, subject to all other regulations and operation assumption callouts for this scenario.	Same as EXP2.5A, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumption callouts for this scenario.	Store water and release stored water for non-discretionary obligations, subject to all other regulations and operation assumptions callouts for this scenario.	Same as EXP4v3	Full operations under D-1641 and 2019 Biological Opinions, subject to all other regulations and operations assumptions callouts for this scenario.	Same as EXP4.95, subject to all other regulations and operations assumptions callouts for this scenario.	Same as EXP4.95, subject to all other regulations and operations assumptions callouts for this scenario.
CVP and SWP San Luis	No storage operation	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	San Luis operated to manage export of excess flows given Delta hydrologic conditions.	Same as EXP4v3	Same as EXP4v3	San Luis operated to manage all exports.	Same as EXP5
SWP Banks Pumping Plant (South Delta)	No pumping	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Physical capacity is 10,300 cfs but 6,680 cfs permitted capacity in all months. Pumping can be up to 10,300 cfs during Dec 15–Mar 15 depending on Vernalis flow conditions. Only pumping of excess flows that cannot otherwise be stored, given hydrologic conditions. SWP San Luis operated.	Same as EXP4v3	Same as EXP4v3	Physical capacity is 10,300 cfs but 6,680 cfs permitted capacity in all months. Pumping can be up to 10,300 cfs during Dec 15–Mar 15 depending on Vernalis flow conditions; additional capacity of 500 cfs (up to 7,180 cfs) allowed Jul–Sep for reducing impact of OMR action on SWP exports.	Same as EXP5

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
CVP C.W. Bill Jones Pumping Plant (Tracy Pumping Plant)	No pumping	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Permit capacity is 4,600 cfs in all months (allowed for by the Delta-Mendota Canal–California Aqueduct Intertie). Only pumping of excess flows that cannot otherwise be stored, given hydrologic conditions. CVP San Luis operated.	Same as EXP4v3	Same as EXP4v3	Permit capacity is 4,600 cfs in all months (allowed for by the Delta-Mendota Canal–California Aqueduct Intertie).	Same as EXP5
Upper Delta-Mendota Canal Capacity	Not operated	Not operated	Not operated	Not operated	Not operated	Not operated	Existing plus 400 cfs Delta-Mendota Canal–California Aqueduct Intertie	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
CCWD Intakes	No pumping to store in Los Vaqueros Reservoir; only water right diversions for direct use by CCWD; no CVP M&I contract diversions.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Los Vaqueros Reservoir with existing storage capacity (160 TAF), and existing intakes except for Mallard Slough Intake; intake water quality conditions updated based on DSM2. For storage, only pumping of excess flows that cannot otherwise be stored, given hydrologic conditions.	Same as EXP4v3	Same as EXP4v3	Los Vaqueros Reservoir with existing storage capacity (160 TAF), and existing intakes except for Mallard Slough Intake; intake water quality conditions updated based on DSM2.	Same as EXP5
Montezuma Slough (Suisun Marsh) Salinity Control Gates	Not operated	Operate to meet Water Board D-1641 water quality standards in Montezuma Slough during salinity control season October	Same as EXP2A	Same as EXP2A	Same as EXP2A	Operate to meet Water Board D-1641 water quality standards in Montezuma Slough during salinity control season October	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
		through May, as possible, given hydrologic conditions.				through May, as necessary with stored water release.					
San Francisco Bay Region											
South Bay Aqueduct (SBA)	Not operated	Not operated	Not operated	Not operated	Not operated	Not operated	SBA rehabilitation, 430 cfs capacity from junction with California Aqueduct to Alameda County Flood Control & Water Conservation District Zone 7 diversion point.	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
South Coast Region											
California Aqueduct East Branch	Not operated	Not operated	Not operated	Not operated	Not operated	Not operated	Existing capacity	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
REGULATORY STANDARDS											
North Coast Region											
Trinity River											
Minimum flow below Lewiston Dam	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Trinity EIS Preferred Alternative (369-815 TAF/year)	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
Trinity River Fall Augmentation Flows	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	420 cfs August 1 through September 30 in all but wet years	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
Trinity Reservoir end of September minimum storage	No target	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Trinity EIS Preferred Alternative (600 TAF as able)	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
Sacramento River Region											
Clear Creek											

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Minimum flow below Whiskeytown Dam	Downstream water rights	Downstream water rights 1960 MOA with the CDFG and 1963 USFWS Proposed flows, as possible.	Same as EXP2A	Downstream water rights, as possible. 1960 MOA with the CDFG and 1963 USFWS Proposed flows with stored water as necessary.	Same as EXP2.5A	Downstream water rights 1960 MOA with the CDFG and 1963 USFWS Proposed flows with stored water as necessary.	Downstream water rights 1960 MOA with the CDFG and 1963 USFWS Proposed flows with stored water as necessary.	Same as EXP4v3	Downstream water rights 1960 MOA with the CDFG and 1963 USFWS Proposed flows with stored water as necessary. 200 cfs October through May or 150 cfs in critical years and 150 cfs June through September with 10 TAF for channel maintenance in February of below normal, above normal, and wet years and 10 TAF for spring pulse flows in June of all years.	Same as EXP4.95	Same as EXP4.95
Upper Sacramento River											
Minimum flow below Keswick Dam	None	Water Board WR 90-5, 3250 cfs, as possible	Same as EXP2A	Water Board WR 90-5, 3250 cfs with stored water as necessary	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A
Managed flow below Keswick Dam	None	None	None	None	None	None	None	None	Stabilize fall flows (if Sept Carryover > 2.2 million acre-feet) to reduce redd dewatering and rebuild cold water pool; and spring pulse flow up to 150 TAF if projected May 1 storage > 4.1 million acre-feet.	Same as EXP4.95	Same as EXP4.95
Feather River											
Minimum flow below Thermalito	None	2006 Settlement Agreement	Same as EXP2A	2006 Settlement Agreement (700/800	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Diversion Dam (LFC)		(700/800 cfs), as possible		cfs) with stored water as necessary							
Minimum flow below Thermalito Afterbay outlet (HFC)	None	1983 DWR, DFG Agreement (750–1,700 cfs), as possible	Same as EXP2A	1983 DWR, DFG Agreement (750–1,700 cfs) with stored water as necessary	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A
Yuba River											
Minimum flow below Daguerre Point Dam	D-1644 Operations (Lower Yuba River Accord)	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
American River											
Minimum Flow at H Street Bridge	None	Water Board D-893, as possible	Same as EXP2A	Water Board D-893 with stored water as necessary	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A
Managed flow below Nimbus Dam	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	American River Flow Management Standard, per 2017 Water Forum Agreement with a planning minimum end of September storage target of 275 TAF.	Same as EXP4.95	Same as EXP4.95
Lower Sacramento River											
Minimum flow near Rio Vista	None	Water Board D-1641, as possible	Same as EXP2A	Water Board D-1641 with stored water as necessary	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A
Mokelumne River											
Minimum flow below Camanche Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (100–325 cfs)	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Minimum flow below Woodbridge Diversion Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25–300 cfs)	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Stanislaus River											

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Minimum flow below Goodwin Dam	None	1987 USBR, DFG agreement, as possible	Same as EXP2A	1987 USBR, CDFG agreement with stored water as necessary	Same as EXP2.5A	Flows according to SRP	Same as EXP2.5A	Same as EXP2.5A	Flows according to SRP	Same as EXP4.95	Same as EXP4.95
Minimum dissolved oxygen	None	Water Board D-1422, as possible	Same as EXP2A	Water Board D-1422 with stored water as necessary	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A
Merced River											
Minimum flow below Crocker-Huffman Diversion Dam	Cowell Agreement	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Minimum flow at Shaffer Bridge	FERC 2179 (25–100 cfs) with 12.5 TAF in October based on 2002 Merced ID and CDFW Memorandum of Understanding	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Tuolumne River											
Minimum flow at Lagrange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94–301 TAF/year)	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
San Joaquin River											
San Joaquin River below Friant Dam/ Mendota Pool	None (flow capacity for San Joaquin River to Mendota pool changed to 2,600 cfs to accommodate deliveries to Exchange and Refuge contractors).	5 cfs Gravelly Ford (flow capacity for San Joaquin River to Mendota pool changed to 2,600 cfs to accommodate deliveries to Exchange and Refuge contractors).	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	San Joaquin River Restoration-full flows, not constrained by current river capacity, including recapture/ recirculation.	Same as EXP4.95	Same as EXP4.95
Maximum salinity near Vernalis	None	Water Board D-1641, as possible	Same as EXP2A	Water Board D-1641 with stored water as necessary	Same as EXP2.5A	Stanislaus contribution to Water Board D-1641 per New Melones SRP	Same as EXP2.5A	Same as EXP2.5A	Stanislaus contribution to Water Board D-1641 per New Melones SRP	Same as EXP4.95	Same as EXP4.95
Minimum flow near Vernalis	None	Feb–Jun Water Board D-1641 Bay	Same as EXP2A	Feb–Jun Water Board D-1641 Bay-	Same as EXP2.5A	Stanislaus contribution to	Same as EXP2.5A	Same as EXP2.5A	Stanislaus contribution to	Same as EXP4.95	Same as EXP4.95

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
		Delta flows (non-pulse), as possible		Delta flows (non-pulse), with stored water as necessary		Water Board D-1641 per New Melones SRP			Water Board D-1641 per New Melones SRP		
Sacramento River–San Joaquin Delta Region											
Delta Outflow (EC, NDOI, Spring X2)	None	Water Board D-1641 (SMSCG D-1641 Ops), as possible	Same as EXP2A	Water Board D-1641 (SMSCG D-1641 Ops) with stored water as necessary	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Water Board D-1641 and SWP to allow up to 150 TAF of Delta outflow in April and May. Spring outflow block shall not exceed 150 TAF and is subject to a 44,500 cfs Delt Outflow off-ramp. SWP to release 100 TAF block of water in Jun through Sep of wet and above normal years.	Same as EXP4.95	Same as EXP4.95
Delta Outflow (Fall X2)	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Summer/Fall Delta Smelt habitat-Projects operate to meet X2 of 80 kilometers for September and October of wet and above normal years with transitional flows in second half of August.	Same as EXP4.95	Same as EXP4.95
Delta Cross Channel gate operation	Gates closed	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Water Board D-1641	Water Board D-1641	Water Board D-1641; Gate operations per 2019 Biological Opinions (modeled same as Multi-Year Study Program).	Same as EXP4.95	Same as EXP4.95
South Delta exports (Jones Pumping Plant	No exports	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Water Board D-1641	Water Board D-1641	Water Board D-1641; and additional 500 cfs	Same as EXP4.95	Same as EXP4.95

Study Name Nickname	Exploratory 1 (EXP1)	Exploratory 2A (EXP2A)	Exploratory 2B (EXP2B)	Exploratory 2.5A (EXP2.5A)	Exploratory 2.5B (EXP2.5B)	Exploratory 3 (EXP3)	Exploratory 4v3 (EXP4v3)	Exploratory 4v6 (EXP4v6)	Exploratory 4.95* (EXP4.95)	Exploratory 5 (EXP5)	Exploratory 5 Plus (EXP5P)
and Banks Pumping Plant)									allowed for Jul–Sep for reducing impact on SWP.		
Combined Flow in Old and Middle River (OMR)	No requirements	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	OMR target of -5,000 cfs January through June except for 5 days of -2,000 cfs when turbidity bridge occurs and 7 days of -6,000 cfs when increased pumping due to storm is possible, followed by “first flush” action only if it occurs in December (14 days of -2,000 cfs), OMR target of -3,500 cfs in March, April, and May of non-critical years.	Same as EXP4v6	Same as EXP4v6	Same as EXP4v6
OPERATIONS CRITERIA: RIVER-SPECIFIC											
Sacramento River Region											
Upper Sacramento River: Flow objective for navigation (Wilkins Slough)	None	Assume 3,250 cfs, given hydrologic condition at priority over diversion to storage	Same as EXP2A	Assume 3250 cfs	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Flow objective for Wilkins Slough based on month, CVP allocation, and Shasta storage condition to reflect CVP operations for local delivery.	Same as EXP4.95	Same as EXP4.95
American River: Folsom Dam flood control	Variable 400/600 flood control diagram	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
Feather River: Flow at Mouth of Feather River (above Verona)	None	Assume 2,800 cfs, given hydrologic condition at priority over diversion to storage	Same as EXP2A	Maintain CDFG/DWR flow target of 2,800 cfs for Apr–Sep dependent on Oroville inflow and FRSA allocation	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A	Same as EXP2.5A

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
Sacramento River–San Joaquin Delta Region											
Suisun Marsh Salinity Control Gates	Not operated	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Operate to meet Water Board D-1641 water quality standards in Montezuma Slough during salinity control season October through May, as necessary with stored water release. Operate for Summer/Fall Delta Smelt habitat up to 60 days June through October of below normal, above normal, and wet years (2019 Biological Opinion), and dry years (2020 ITP) as necessary with stored water release.	Same as EXP4.95	Same as EXP4.95
South Delta barriers	Head of Old River Barrier is not installed.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1
OPERATIONS CRITERIA: SYSTEMWIDE											
CVP Water Allocation											
Settlement / Exchange	Settlement and Exchange Contractors allocated at 100% (75%/77% in Shasta critical years). Deliveries without CVP facility operations.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Settlement and Exchange Contractors allocated at 100% (75%/77% in Shasta critical years).	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3
Refuges	Delivery of water supply needs, up to Level 1, given	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Water supply needs, up to firm Level 2 allocated	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
	hydrologic conditions, without CVP facility operations or hydraulic conditions consideration.					at 100% (75% in Shasta critical years).					
Agriculture Service	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	No allocations; pumping/ diversions limited to flows given hydrologic conditions. No preference for type.	Same as EXP4v3	No allocations.	100%–0% based on supply, south of Delta allocations are additionally limited due to D-1641 and OMR actions.	Same as EXP5
Municipal & Industrial Service	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	No allocations; pumping/ diversions limited to flows given hydrologic conditions. No preference for type.	Same as EXP4v3	Health and Safety only (25% allocation)	100%–50% based on supply, south of Delta allocations are additionally limited due to D-1641 and OMR actions.	Same as EXP5
Friant allocation	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	No allocations; diversions limited to available inflow after delivery to Exchange/ Refuge.	Same as EXP4v3	Class 1, Class 2, and 215 water deliveries as allocated given water supply.	Same as EXP4.95	Same as EXP4.95
SWP Water Allocation											
North of Delta (FRSA)	FRSA and water rights diversions off the river, contract specific conditions. Deliveries limited to given hydrologic conditions, without SWP facility operations and hydraulic conditions consideration.	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	FRSA and water rights diversions off the river, contract specific conditions.	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3	Same as EXP3

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
South of Delta (including North Bay Aqueduct)	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	No allocations; pumping/ diversions limited to flows given hydrologic conditions. No preference for type.	No allocations; pumping/ diversions limited to flows given hydrologic conditions. No preference for type.	Allocations; pumping/ diversions limited to flows given hydrologic conditions. No preference for type.	Based on supply; equal prioritization between Ag and M&I based on Monterey Agreement.	Same as EXP5
CVP-SWP Coordinated Operations											
Sharing of responsibility for in-basin-use	None	Revised Coordinated Operations Agreement (1986 COA w/ 2018 amendment)	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A	Same as EXP2A
Sharing of UWFE flows	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Revised Coordinated Operations Agreement (1986 COA w/ 2018 amendment)	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
Sharing of restricted export capacity for project- specific priority pumping	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Revised Coordinated Operations Agreement (1986 COA w/ 2018 amendment)	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
Water transfers	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Acquisitions by SWP contractors are wheeled at priority in Banks Pumping Plant over non-SWP users; LYRA included for SWP contractors.
Sharing of export capacity for lesser priority and wheeling-related pumping	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Cross Valley Canal wheeling (max of 128 TAF/year), CALFED ROD defined JPOD; given hydrologic conditions.	Same as EXP4v3	Cross Valley Canal wheeling (max of 128 TAF/year), CALFED ROD JPOD.	Same as EXP4.95	Same as EXP4.95

Study Name	Exploratory 1	Exploratory 2A	Exploratory 2B	Exploratory 2.5A	Exploratory 2.5B	Exploratory 3	Exploratory 4v3	Exploratory 4v6	Exploratory 4.95*	Exploratory 5	Exploratory 5 Plus
Nickname	**(EXP1)**	**(EXP2A)**	**(EXP2B)**	**(EXP2.5A)**	**(EXP2.5B)**	**(EXP3)**	**(EXP4v3)**	**(EXP4v6)**	**(EXP4.95)**	**(EXP5)**	**(EXP5P)**
San Luis Reservoir	Not operated	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	San Luis Reservoir is allowed to operate to a minimum storage of 100 TAF.	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3	Same as EXP4v3
WATER MANAGEMENT ACTIONS											
Water Transfer Supplies (Long-Term Programs)											
Lower Yuba River Accord	None	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Same as EXP1	Yuba River acquisitions for reducing impact of D-1641 and OMR Action export restrictions on SWP

Ag = agriculture; CCWD = Contra Costa Water District; CDFG = California Department of Fish and Game; CDFW = California Department of Fish and Wildlife; cfs = cubic feet per second; COA = Coordinated Operations Agreement; CVP = Central Valley Project; D-1641 = State Water Resources Control Board Water Right Decision 1641; DSM2 = Delta Simulation Model II; EC = electrical conductivity; EIR = environmental impact report; EIS = environmental impact statement; FERC = Federal Energy Regulatory Commission; FRSA = Feather River Service Area; HFC = High Flow Channel; ITP = incidental take permit; JPOD = Joint Point of Diversion; LFC = Low Flow Channel; LYRA = Lower Yuba River Accord; COA = Coordinated Operating Agreement; M&I = municipal and industrial; Merced ID = Merced Irrigation District; MOA = Memorandum of Agreement; NBA = North Bay Aqueduct; NDOI = Net Delta Outflow Index; OMR = Old and Middle River; Ops = operations; ROD = record of decision; SBA = South Bay Aqueduct; SMSCG = Suisun Marsh Salinity Control Gates; SRP = Stepped Release Plan; Water Board = State Water Resources Control Board; SWP = State Water Project; TAF = thousand acre-feet; USFWS = U.S. Fish and Wildlife Service.

Long-Term Operation – Biological Assessment

Attachment E.2 – Model Results

July 2024

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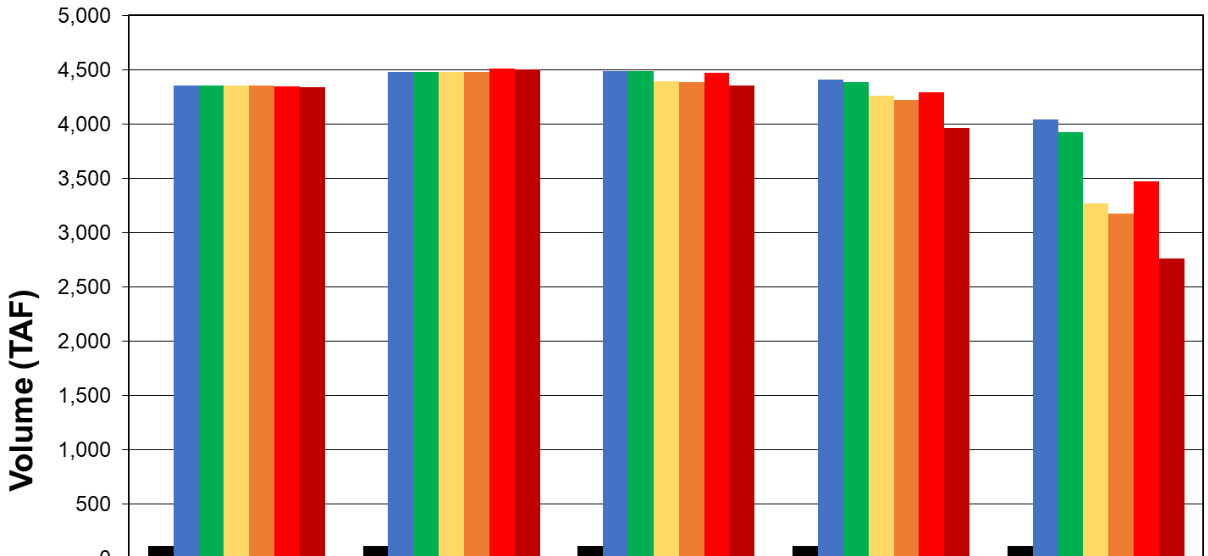
Attachment E.2 Model Results

E.2.1 Introduction

This attachment provides a summary of the results that were previously shared as outreach on the exploratory modeling. All water year types are Sacramento (40-30-30) Index, unless otherwise noted.

E.2.2 Storage

E.2.2.1 Sacramento River



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	116	116	116	116	116
EXP2	4,351	4,477	4,487	4,411	4,039
EXP2.5A	4,351	4,477	4,487	4,386	3,925
EXP3	4,351	4,477	4,396	4,257	3,266
EXP4v6	4,351	4,477	4,387	4,224	3,175
EXP4.95	4,344	4,507	4,471	4,293	3,469
EXP5P	4341	4499	4351	3964	2762

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-1. End of April Shasta Storage by Water Year Type

End of April Shasta storage shows little to no difference in wet, above normal (AN), and below normal (BN) years, slight differences in dry years, and substantial and progressively lower storage across the suite of models in critically dry years.

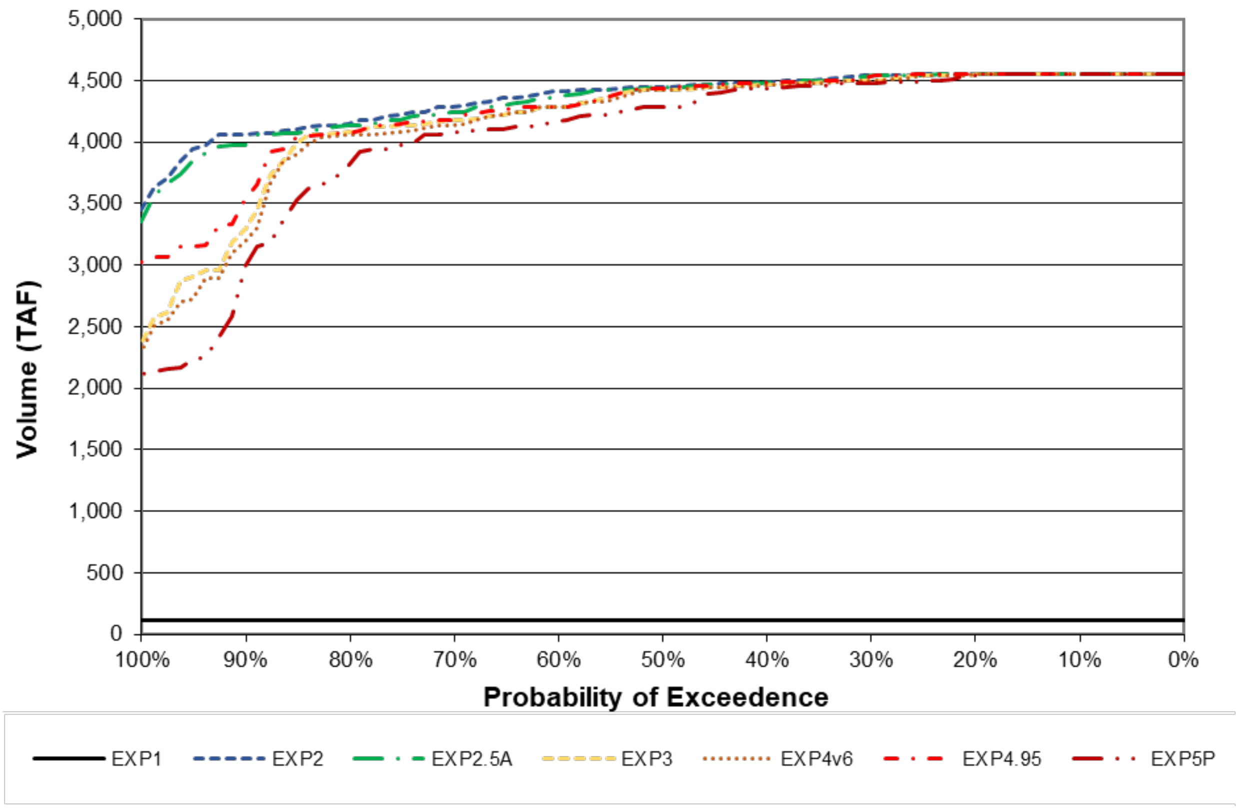
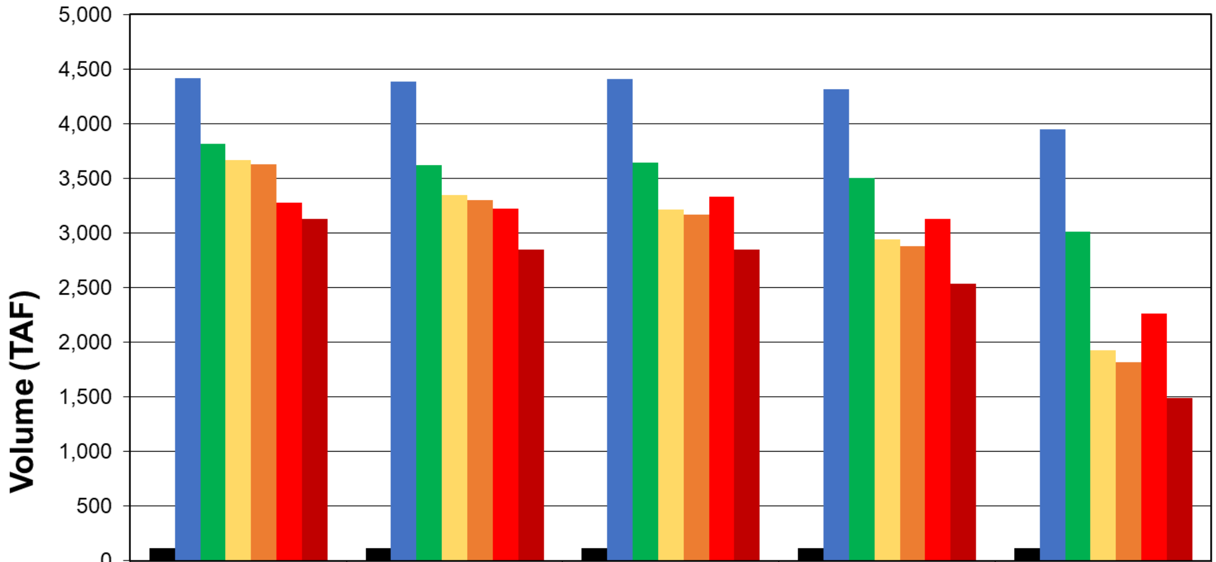


Figure E.2-2. End of April Exceedance for Shasta Storage

The difference in end of April Shasta storage across the exploratory modeling suite significantly increases in the 20% of driest years.



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	116	116	116	116	116
EXP2	4,416	4,387	4,411	4,315	3,948
EXP2.5A	3,819	3,620	3,645	3,500	3,009
EXP3	3,667	3,350	3,217	2,938	1,924
EXP4v6	3,628	3,304	3,170	2,876	1,817
EXP4.95	3,281	3,220	3,334	3,130	2,260
EXP5P	3129	2847	2847	2536	1488

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-3. End of September Shasta Storage by Water Year Type

The differences of end of September Shasta storage show the effects of increased use of storage across the exploratory modeling suite.

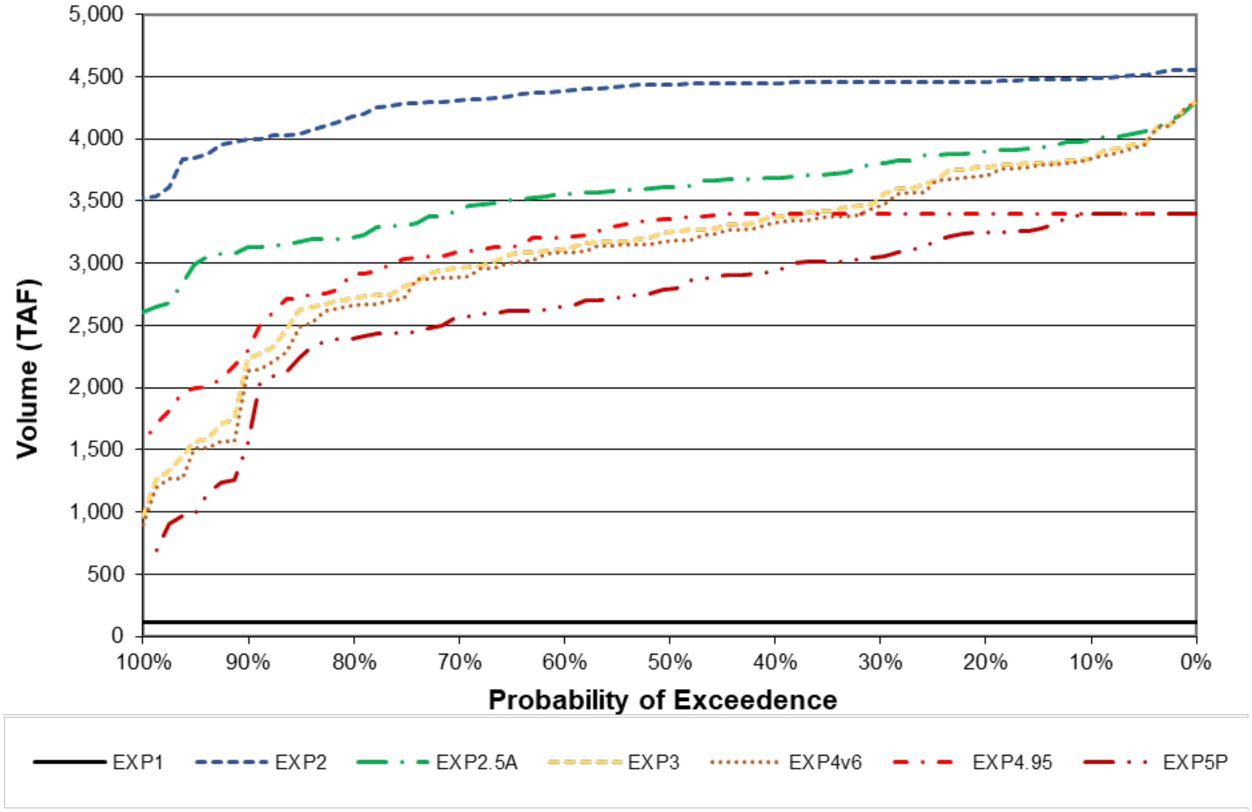


Figure E.2-4. End of September Exceedance for Shasta Storage

The most pronounced difference in storage occurs between EXP2.5B and EXP3, which correlates with the introduction of stored water releases to meet senior water rights.

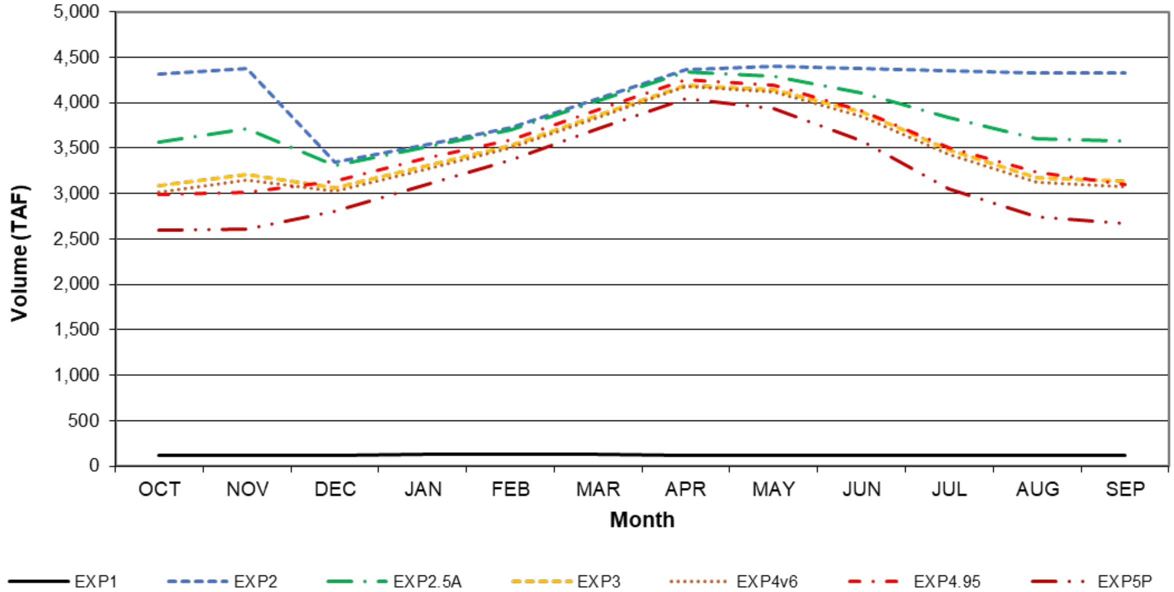


Figure E.2-5. Shasta Storage Monthly Pattern (Long-Term Average)

The monthly pattern of Shasta storage shows the gain in storage during the fill season and progressively larger use of storage across the exploratory modeling suite in the management season. EXP2A and EXP2.5B have pronounced decrease in storage in December due to flood control releases.

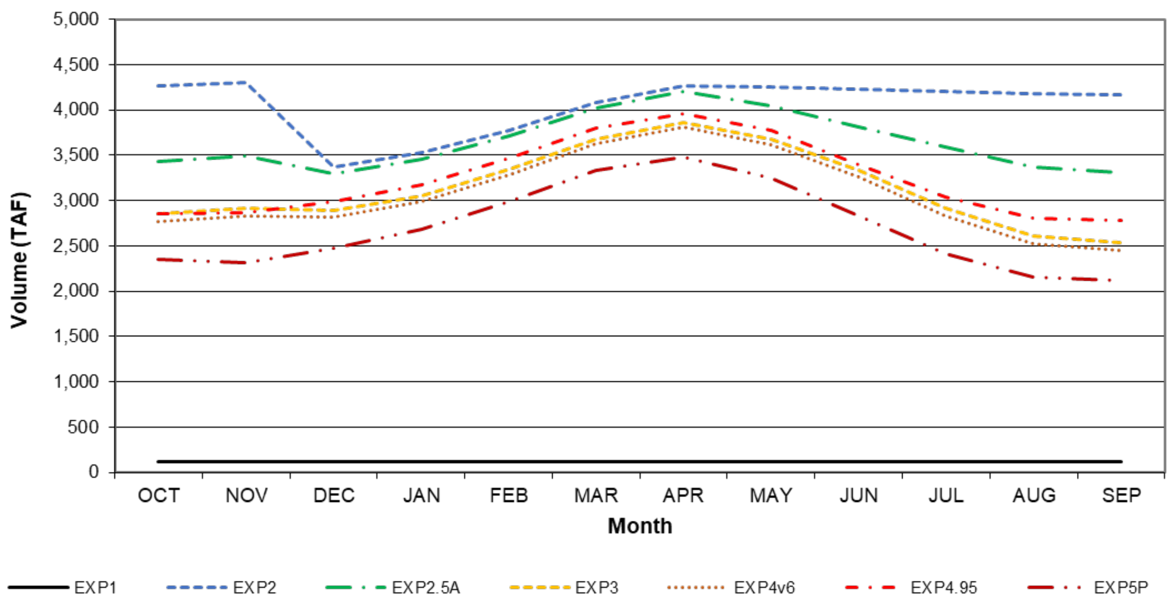
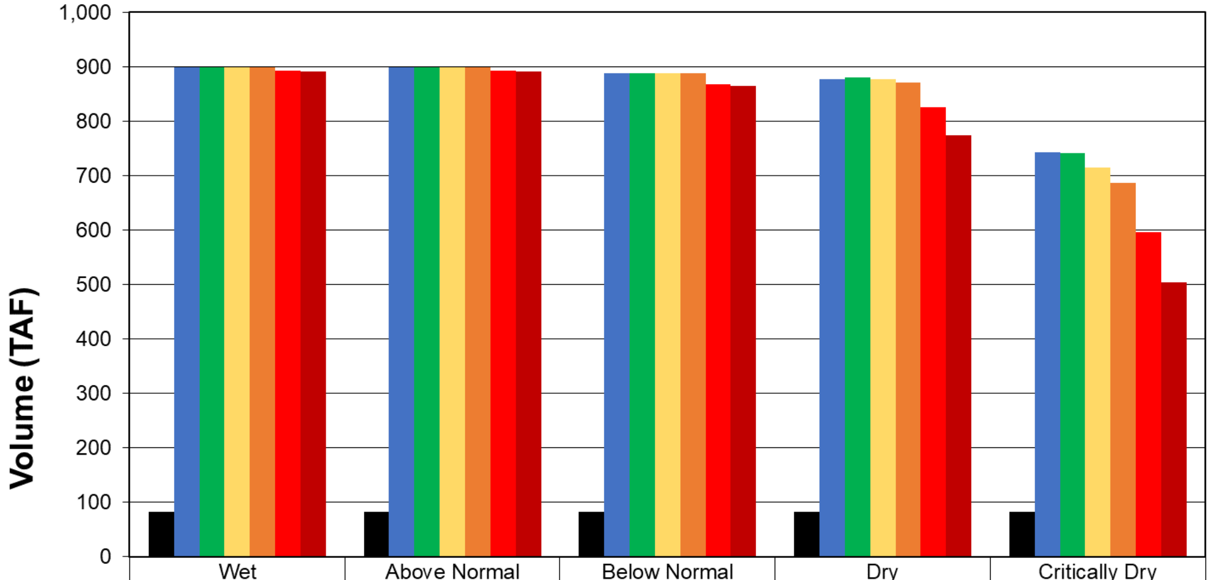


Figure E.2-6. Shasta Storage Monthly Pattern (Dry and Critically Dry Years)

Despite having lower storage levels, the monthly pattern for Shasta storage in dry and critically dry years is like the long-term averages.

E.2.2.2 American River



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	83	83	83	83	83
EXP2	898	899	889	878	743
EXP2.5A	898	899	889	880	741
EXP3	898	899	889	878	715
EXP4v6	898	899	889	871	687
EXP4.95	892	892	868	826	595
EXP5P	891	891	865	774	503

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-7. End of April Folsom Storage by Water Year Type

End of April Folsom storage shows little to no difference in wet, AN, and BN years, some difference in EXP5 for dry years, and substantial and progressively lower storage across the suite of models in critically dry years.

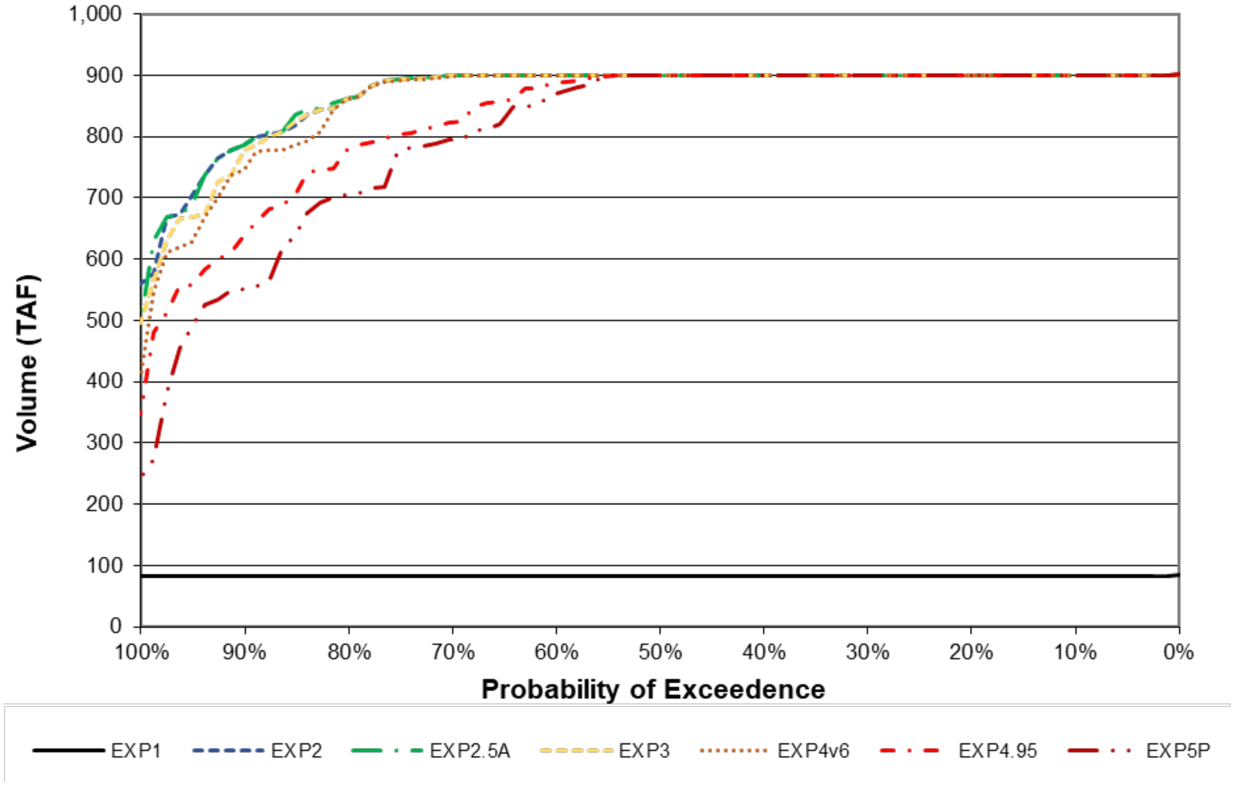
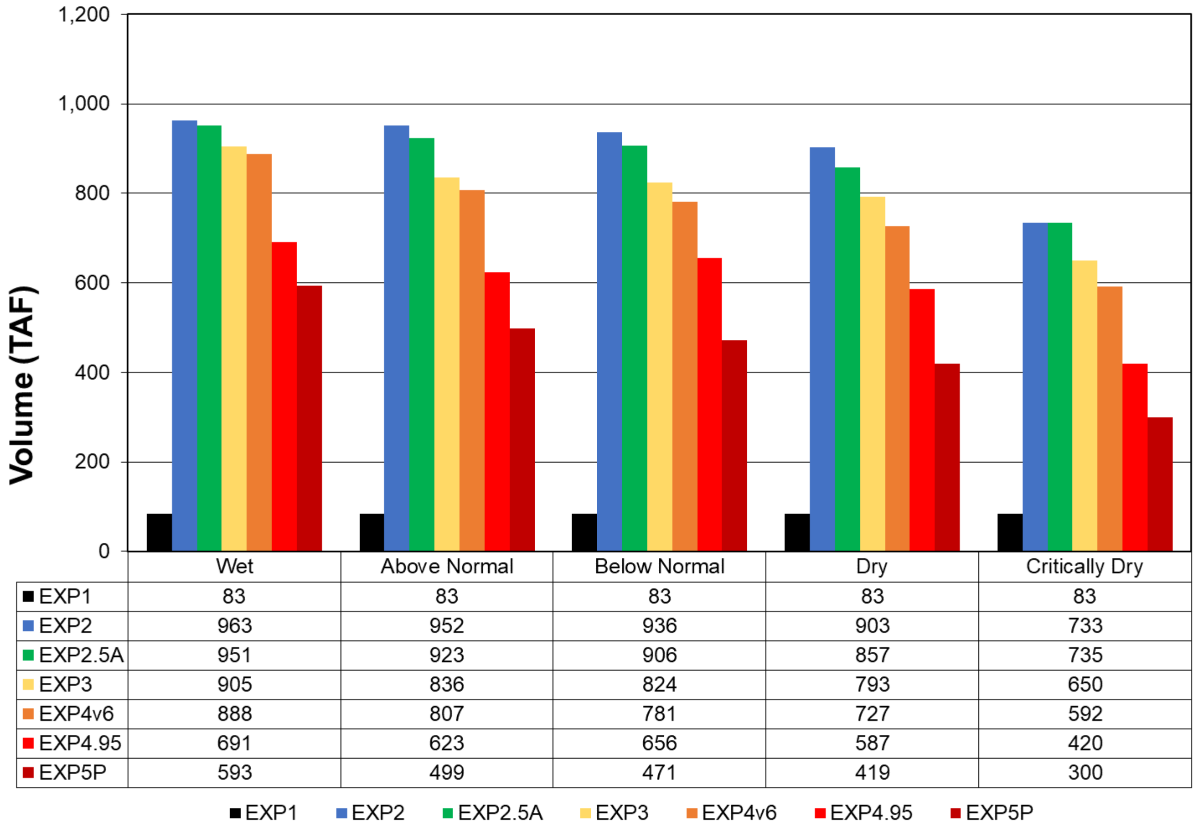


Figure E.2-8. End of April Exceedance for Folsom Storage

The only significant differences between the models is due to introduction of storage releases for discretionary purposes in EXP5.



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	83	83	83	83	83
EXP2	963	952	936	903	733
EXP2.5A	951	923	906	857	735
EXP3	905	836	824	793	650
EXP4v6	888	807	781	727	592
EXP4.95	691	623	656	587	420
EXP5P	593	499	471	419	300

Figure E.2-9. End of September Folsom Storage by Water Year Type

The differences of end of September Folsom storage show the effects of increased use of storage across the exploratory modeling suite. The additional releases from EXP4v6 and EXP5 are similar in all water year types, depicting the role that Folsom plays in meeting full project obligations.

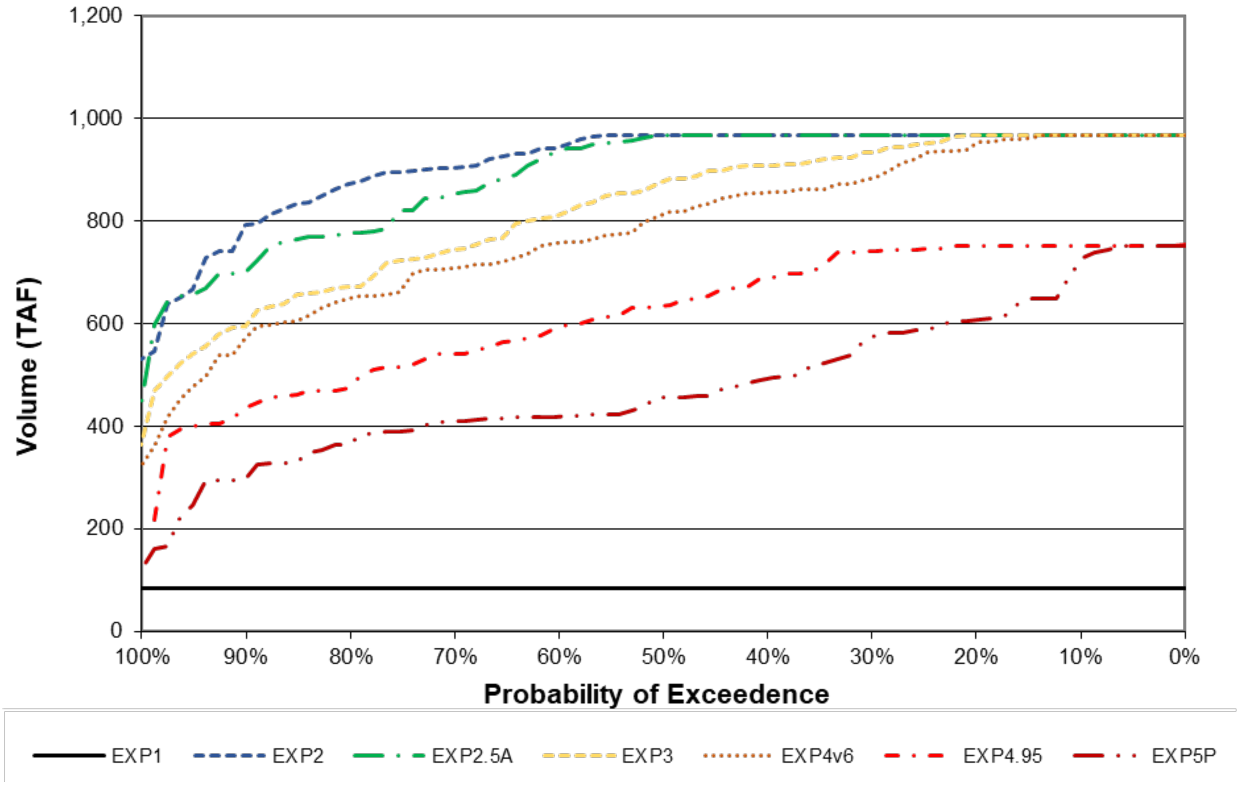


Figure E.2-10. End of September Exceedance for Folsom Storage

The most pronounced and consistent difference in storage occurs between EXP4v6 and EXP5, which correlates with the introduction of stored water releases to meet discretionary purposes.

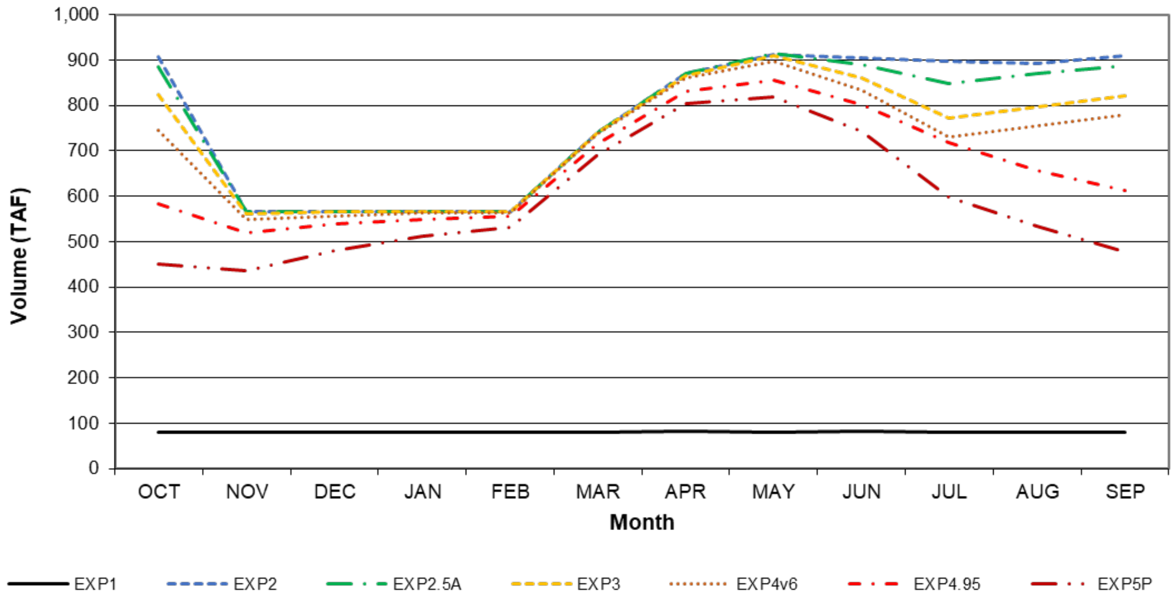


Figure E.2-11. Folsom Storage Monthly Pattern (Long-Term Average)

The monthly pattern of Folsom storage shows the gain in storage during the fill season and progressively larger use of storage across the exploratory modeling suite in the management season. All but EXP5 show a sharp decline in storage in November due to flood control releases.

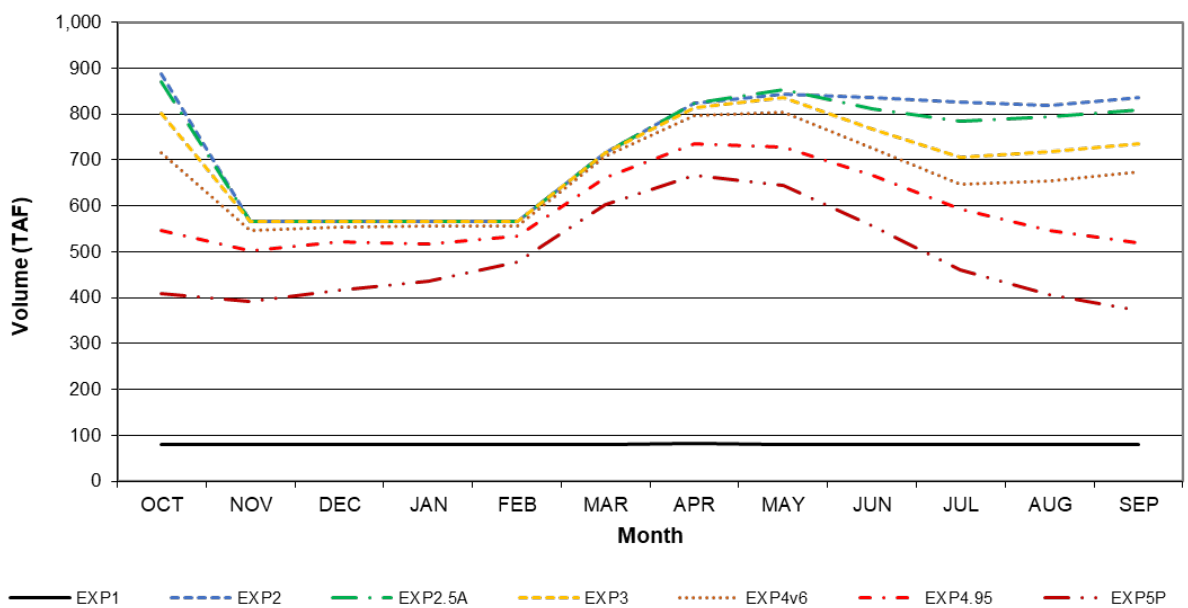
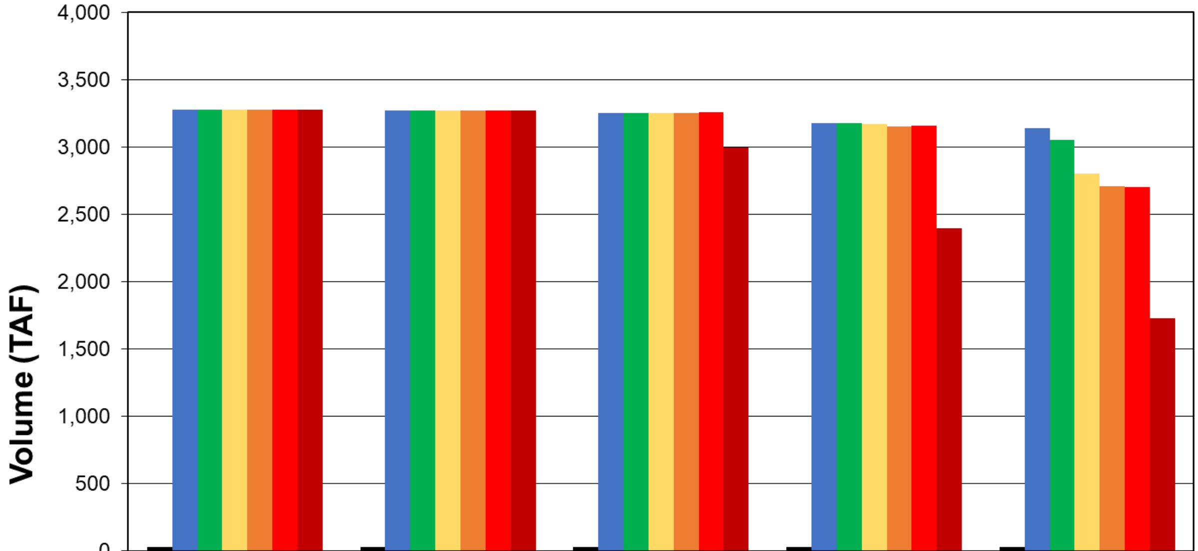


Figure E.2-12. Folsom Storage Monthly Pattern (Dry and Critically Dry Years)

Despite having lower storage levels while not at flood control, the monthly pattern for Folsom storage in dry and critically dry years is like the long-term averages.

E.2.2.3 Feather River



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	30	30	30	30	30
EXP2	3,276	3,273	3,255	3,180	3,138
EXP2.5A	3,276	3,273	3,254	3,178	3,052
EXP3	3,275	3,273	3,253	3,174	2,805
EXP4v6	3,275	3,273	3,253	3,153	2,710
EXP4.95	3,276	3,273	3,262	3,157	2,704
EXP5P	3275	3272	2998	2399	1730

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-13. End of April Oroville Storage by Water Year Type

End of April Oroville storage shows little to no difference in wet and AN years, significant lower storage in EXP5 for BN and dry years, and substantial and progressively lower storage across the suite of models in critically dry years.

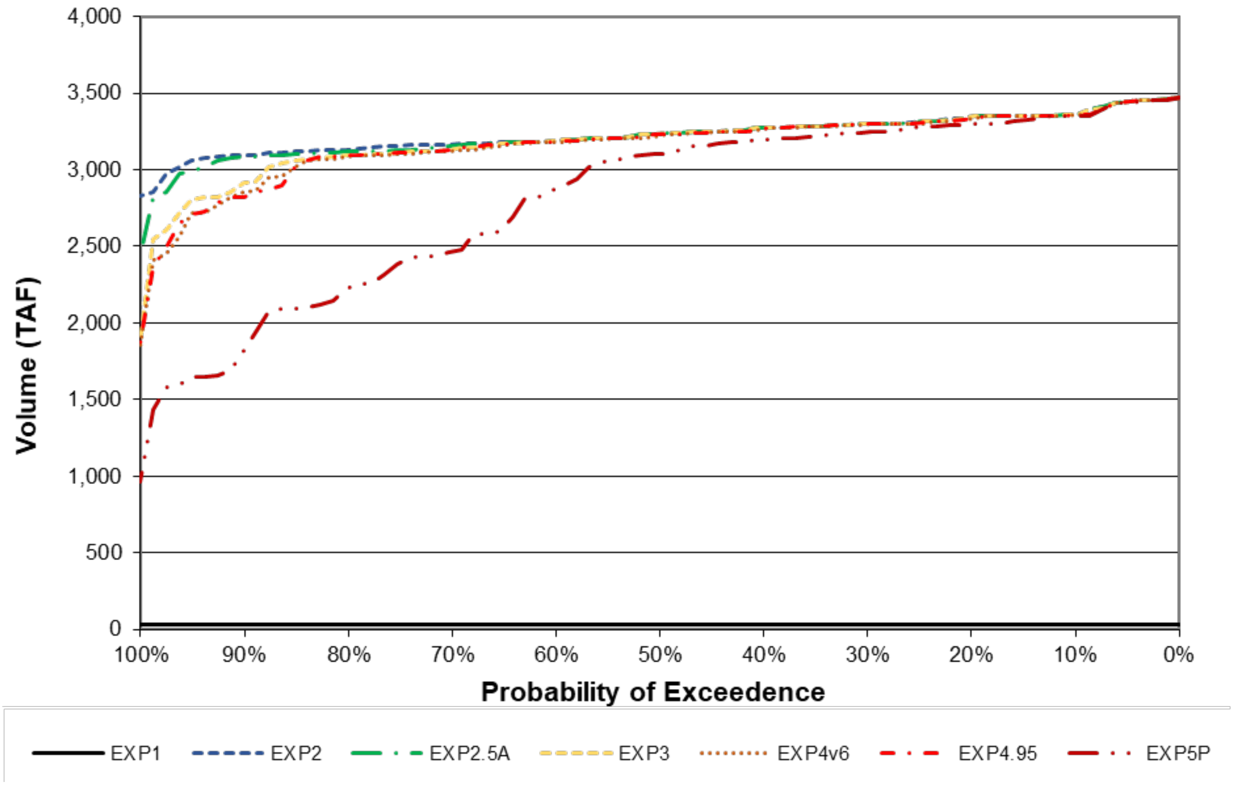
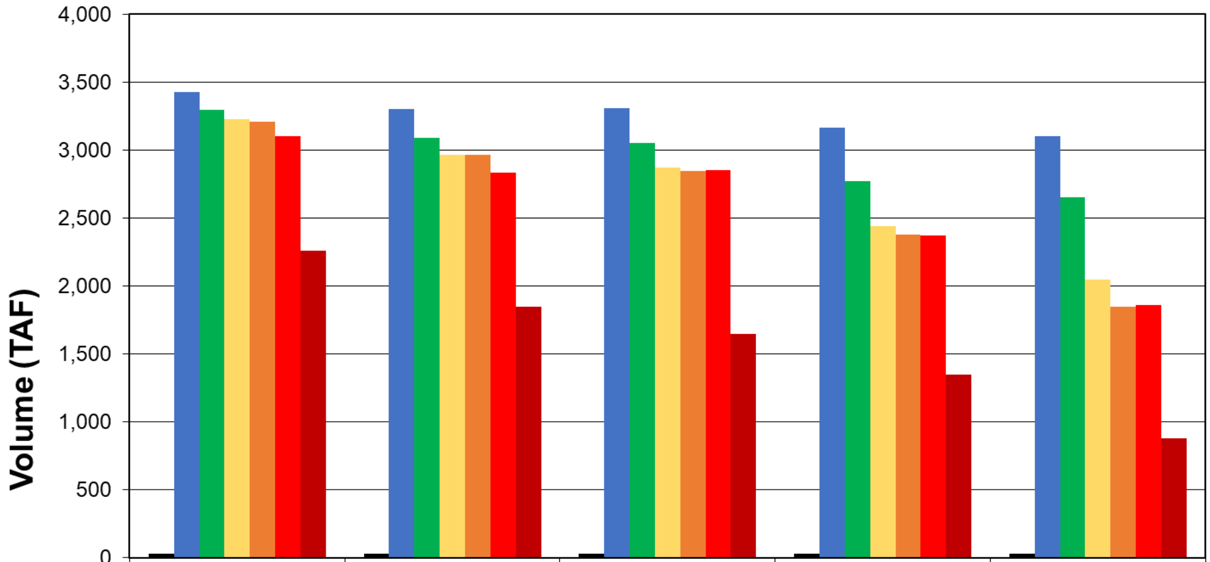


Figure E.2-14. End of April Exceedance for Oroville Storage

The most significant change in end of April Oroville storage between the models is due to introduction of storage releases for discretionary purposes in EXP5. There are some additional differences in the models in the 15% of driest years.



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	30	30	30	30	30
EXP2	3,425	3,303	3,310	3,163	3,105
EXP2.5A	3,294	3,091	3,053	2,774	2,653
EXP3	3,227	2,967	2,870	2,440	2,049
EXP4v6	3,209	2,963	2,848	2,377	1,850
EXP4.95	3,100	2,836	2,852	2,371	1,862
EXP5P	2257	1849	1647	1346	880

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-15. End of September Oroville Storage by Water Year Type

The differences of end of September Oroville storage show the effects of increased use of storage across the exploratory modeling suite.

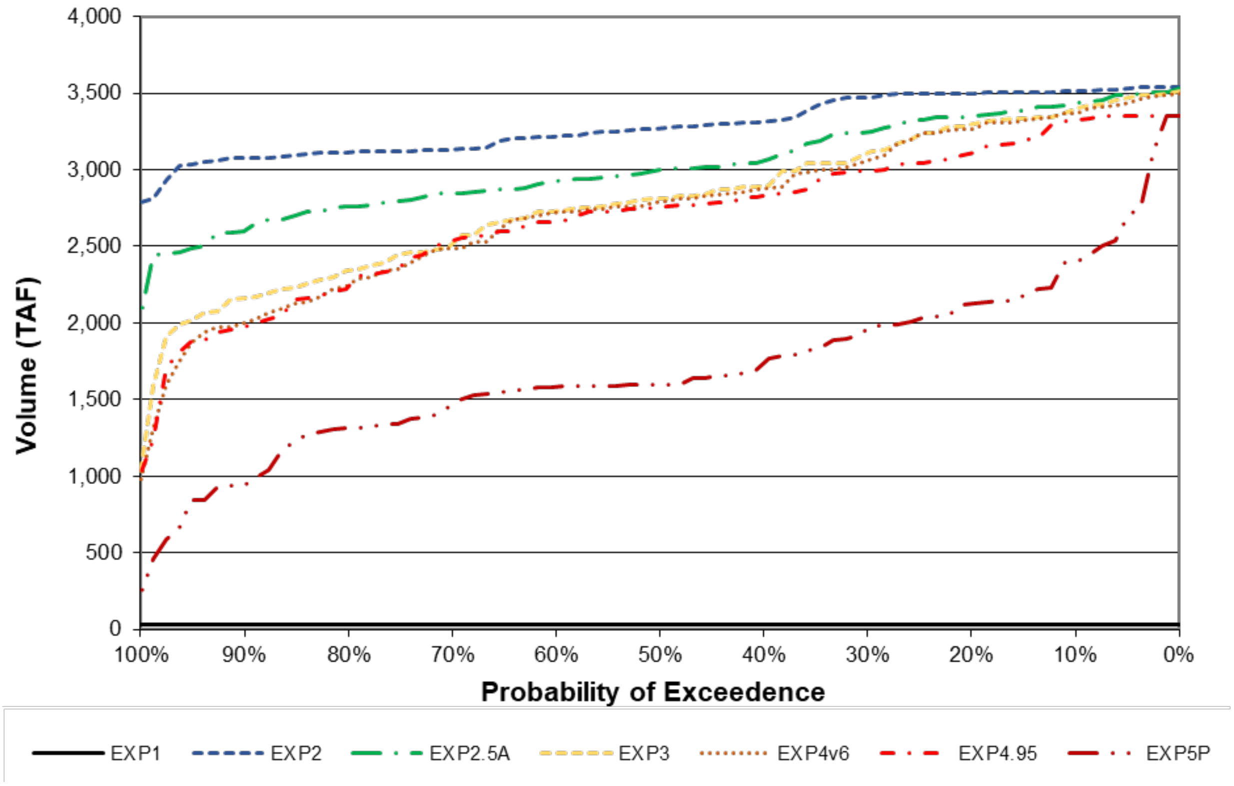


Figure E.2-16. End of September Exceedance for Oroville Storage

The most pronounced and consistent difference in storage occurs between EXP4v6 and EXP5, which correlates with the introduction of stored water releases to meet discretionary purposes. Also, the drier the year, the larger the effect from the introduction of stored water releases for senior water rights introduced in EXP3.

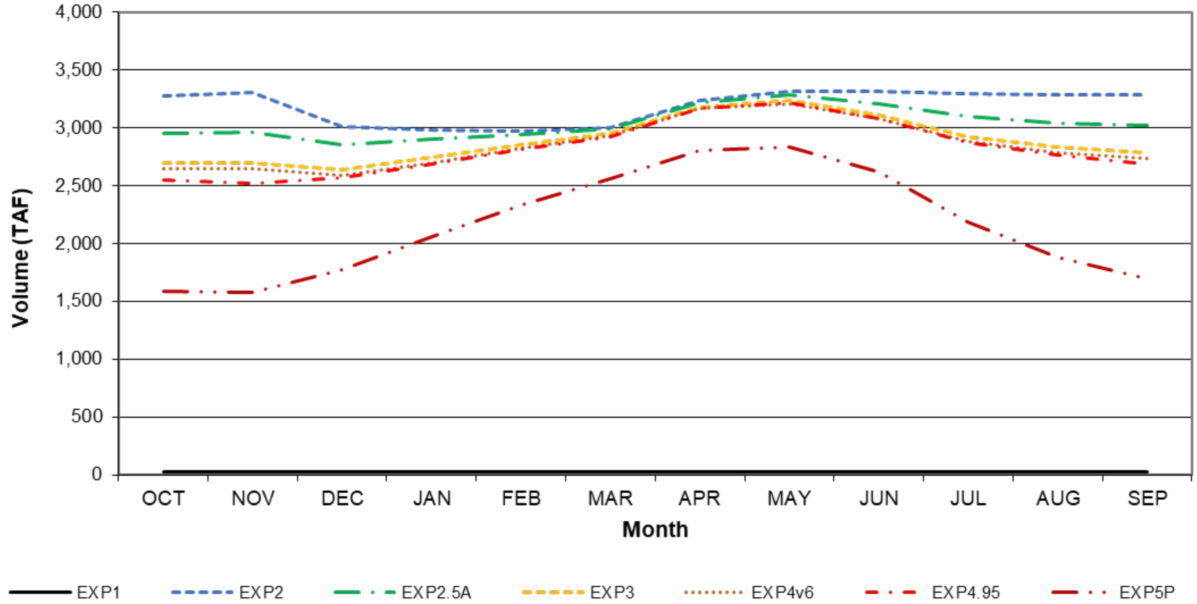


Figure E.2-17. Oroville Storage Monthly Pattern (Long-Term Average)

The monthly pattern of Oroville storage shows the gain in storage during the fill season and progressively larger use of storage across the exploratory modeling suite in the management season.

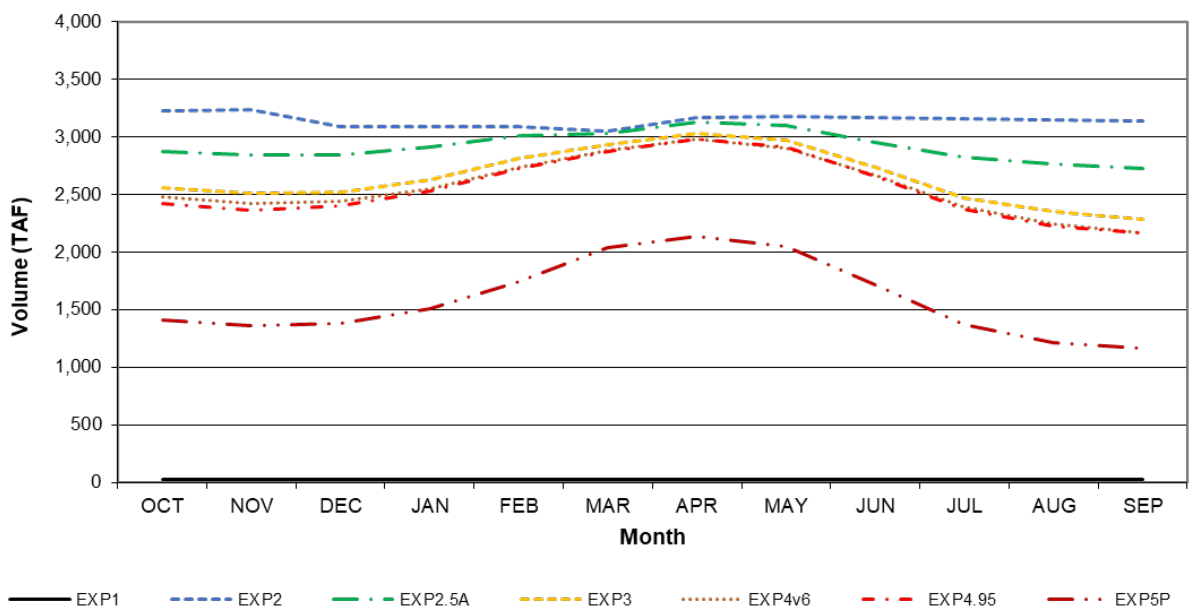


Figure E.2-18. Oroville Storage Monthly Pattern (Dry and Critically Dry Years)

Despite having lower storage levels, the monthly pattern for Oroville storage in dry and critically dry years is like the long-term averages.

E.2.3 Flow

E.2.3.1 Sacramento River

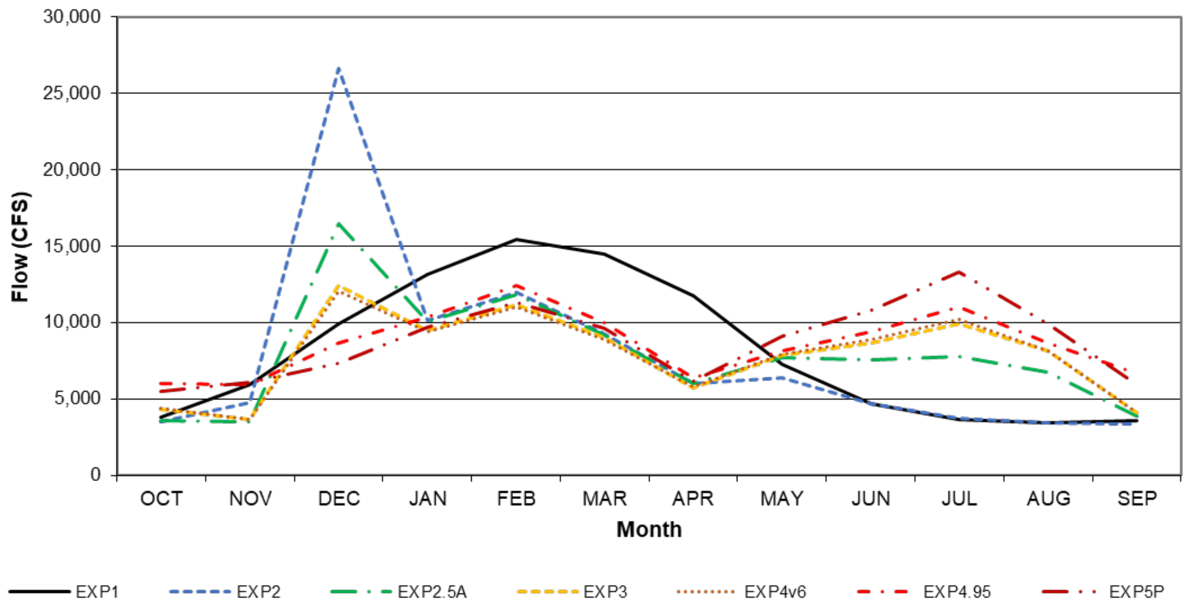


Figure E.2-19. Sacramento River Flow below Keswick Dam (Long-Term Average)

The monthly pattern for flow below Keswick Dam in EXP1 carries the same pattern as Shasta inflow. EXP2A and EXP2.5B have spikes in flow in December due to Shasta flood control releases, and the same, albeit smaller, flood control releases exist in EXP3 and EXP4v6. With increased operational capabilities in EXP3 and higher, there is greater flow in the management season due to releases for increased responsibilities.

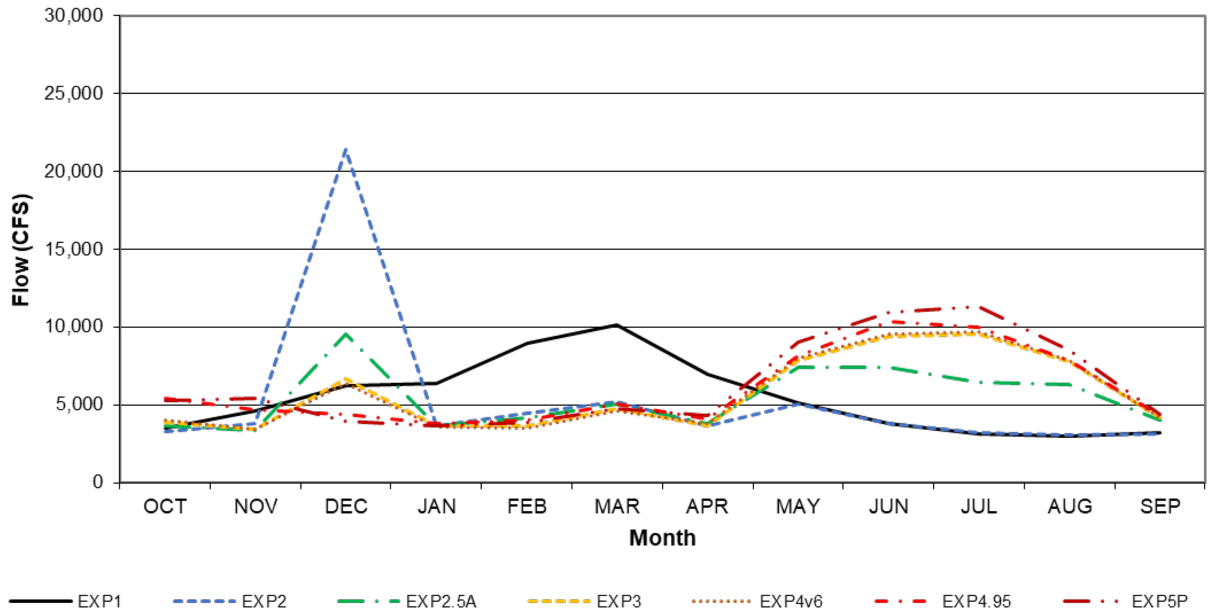


Figure E.2-20. Sacramento River Flow below Keswick Dam (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow below Keswick Dam are the same as those for the long-term averages.

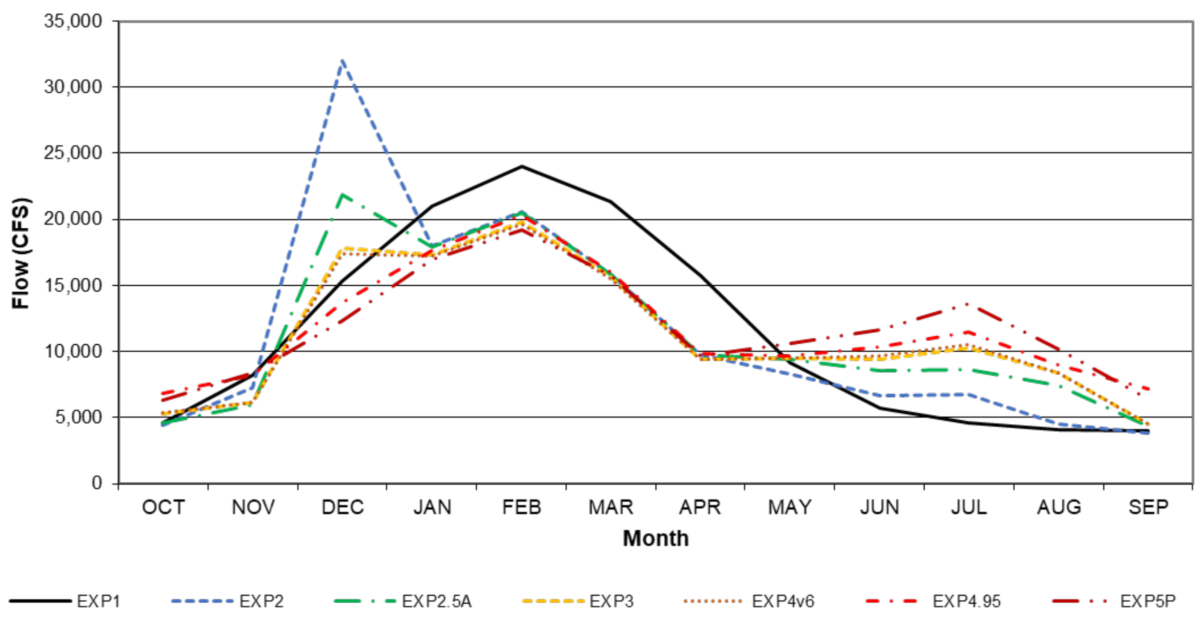


Figure E.2-21. Sacramento River Flow at Bend Bridge (Long-Term Average)

The monthly pattern of flow at Bend Bridge is like the one below Keswick Dam with the addition of local inflows.

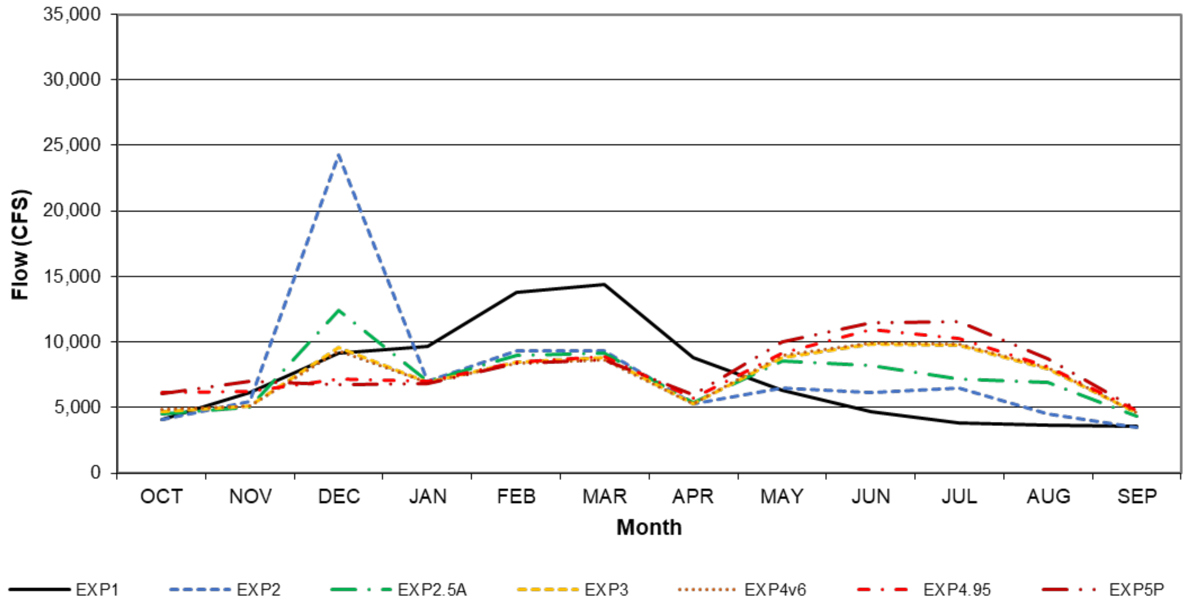


Figure E.2-22. Sacramento River Flow at Bend Bridge (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow at Bend Bridge are the same as those for the long-term averages.

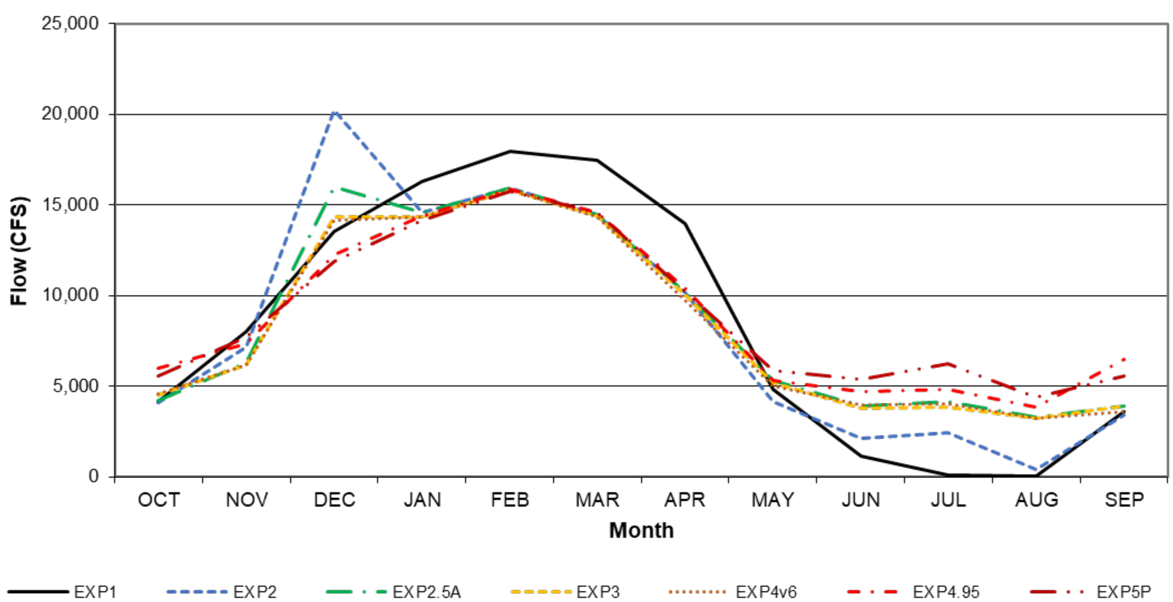


Figure E.2-23. Sacramento River Flow near Wilkins Slough (Long-Term Average)

The signal from Shasta flood control releases is muted by the time it gets to Wilkin's Slough. Flows at Wilkin's Slough sometimes zero out in EXP1 and EXP2, but water is released to meet Wilkin's Slough flow criteria in subsequent models.

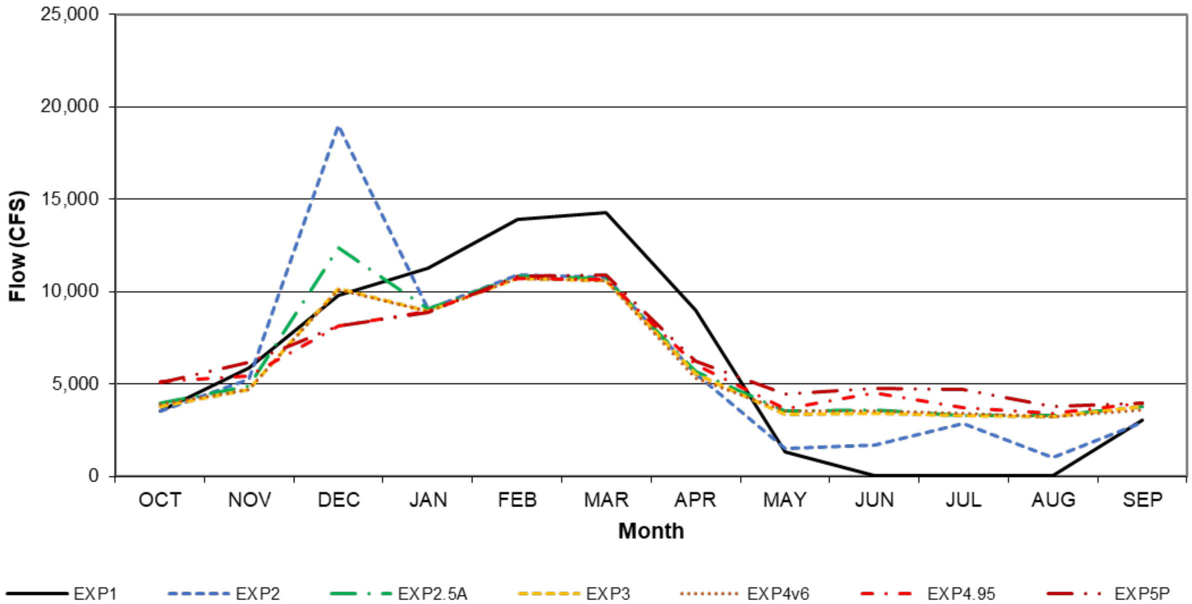


Figure E.2-24. Sacramento River Flow near Wilkins Slough (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow at Wilkin's Slough are the same as those for the long-term averages.

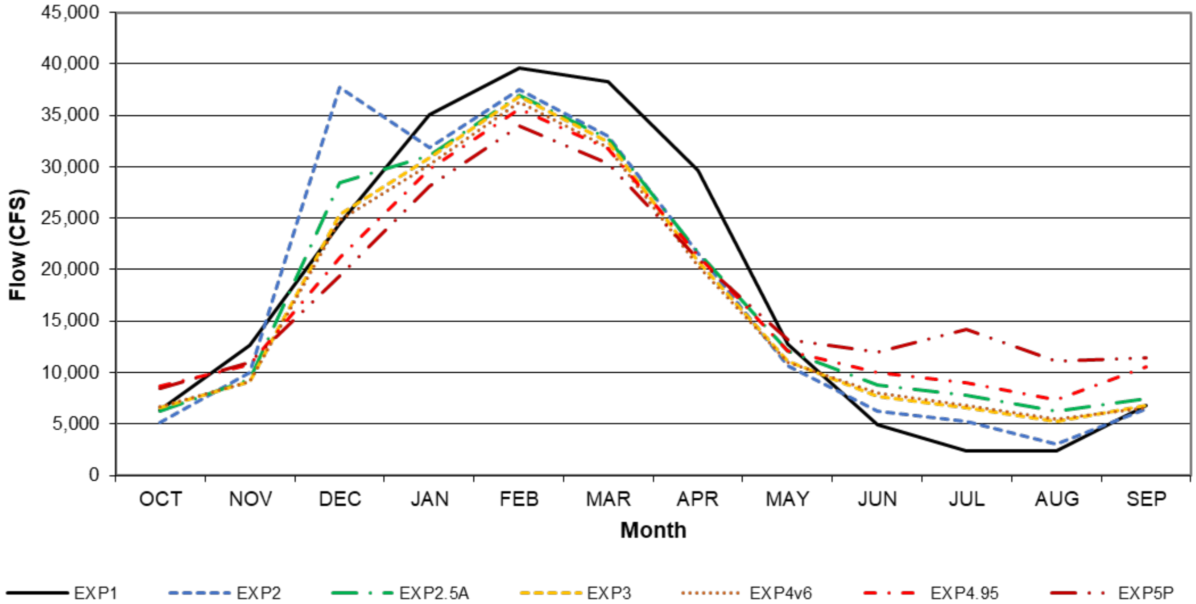


Figure E.2-25. Sacramento River Flow at Verona (Long-Term Average)

Flow at Verona continues to carry the same effects as at Wilkin's Slough, but now it is affected by inflow from the Feather River.

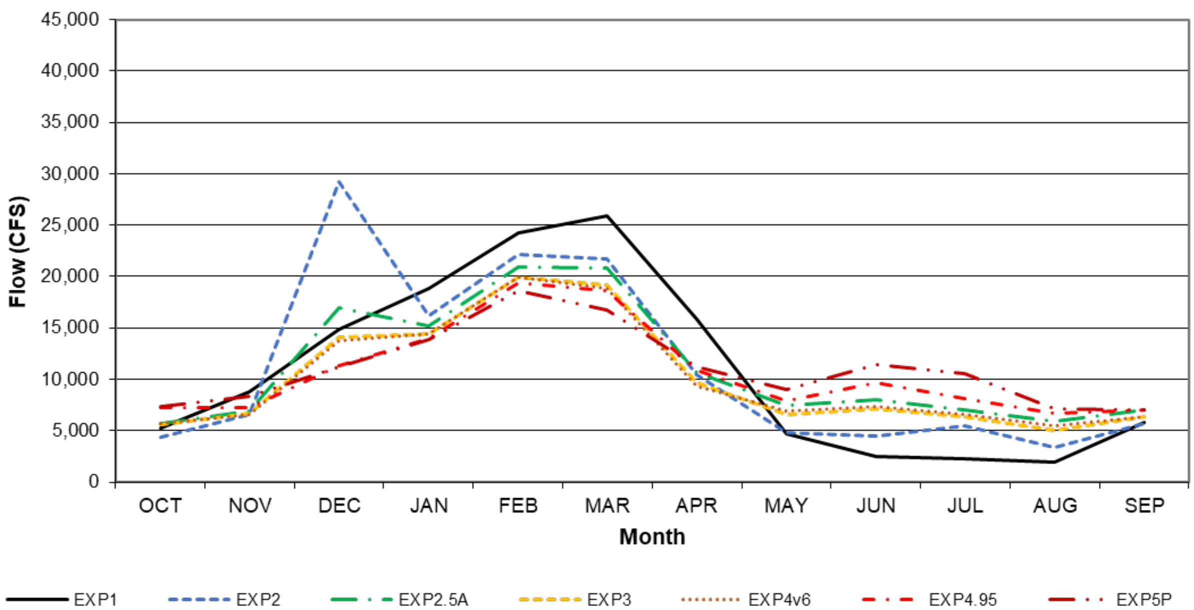


Figure E.2-26. Sacramento River Flow at Verona (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow at Verona are the same as those for the long-term averages.

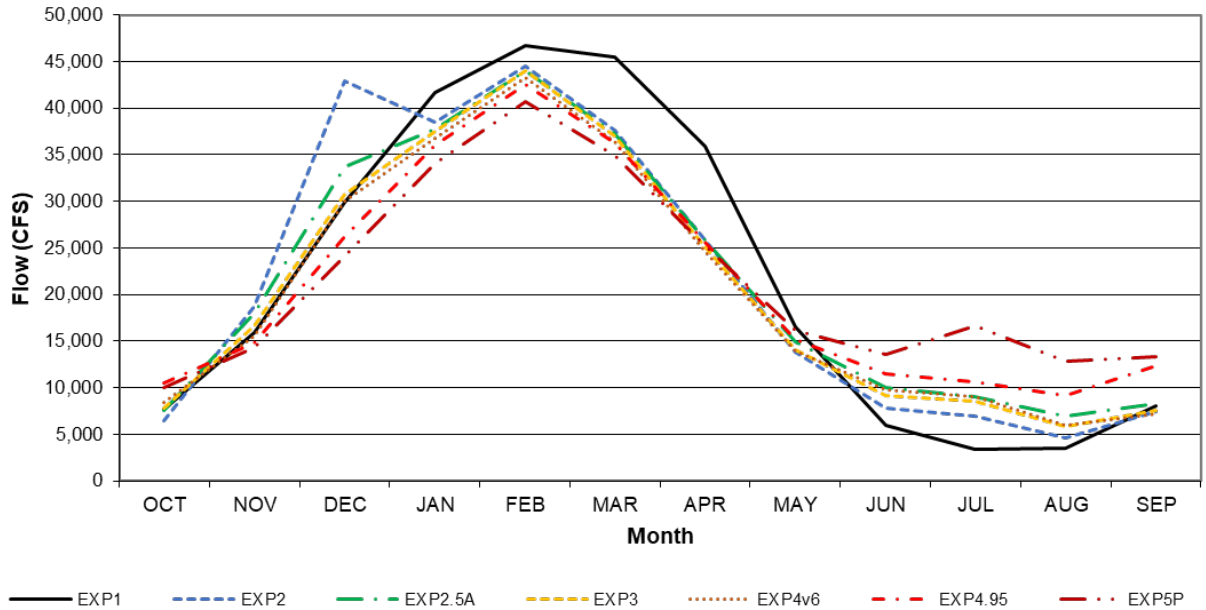


Figure E.2-27. Sacramento River Flow at Hood (Long-Term Average)

Flow at Hood continues to carry the same effects as at Verona, but now, it is affected by inflow from the American River.

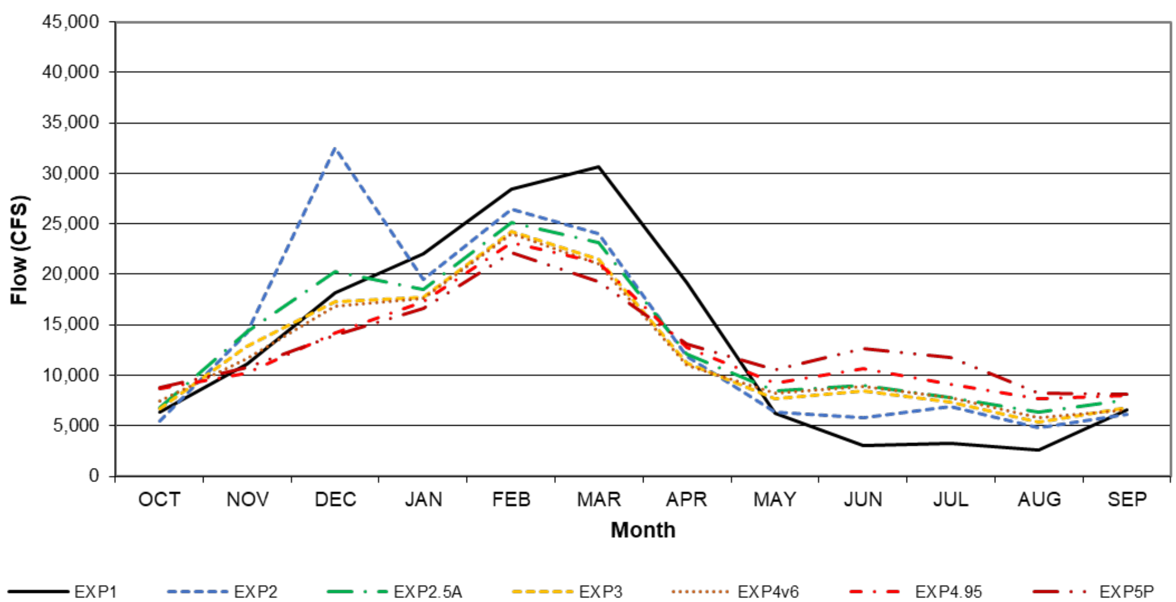


Figure E.2-28. Sacramento River Flow at Hood (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow at Hood are the same as those for the long-term averages.

E.2.3.2 Sacramento River FlowTracker Flow Type

Table E.2-1. Summary of Flow Tracker Flow Type below Keswick

Annual Total[a]	EXP1	EXP2	EXP2.5	EXP3	EXP4v6	EXP5
Shasta Pass-Through Inflow	5,796	4,575	4,596	4,295	4,275	4,133
Shasta Stored Water Releases for Flood Control	0	1,092	442	313	297	100
Shasta Stored Water Release	34	0	630	1,084	1,121	1,472
Trinity Pass-Through Inflow	0	0	0	0	0	250
Trinity Stored Water Releases	0	0	0	0	0	343

[a] In thousand acre-feet.

Shasta pass-through inflow and flood control releases generally decreases in subsequent models while releases of previously stored water increases. Trinity imports are not introduced until EXP5.

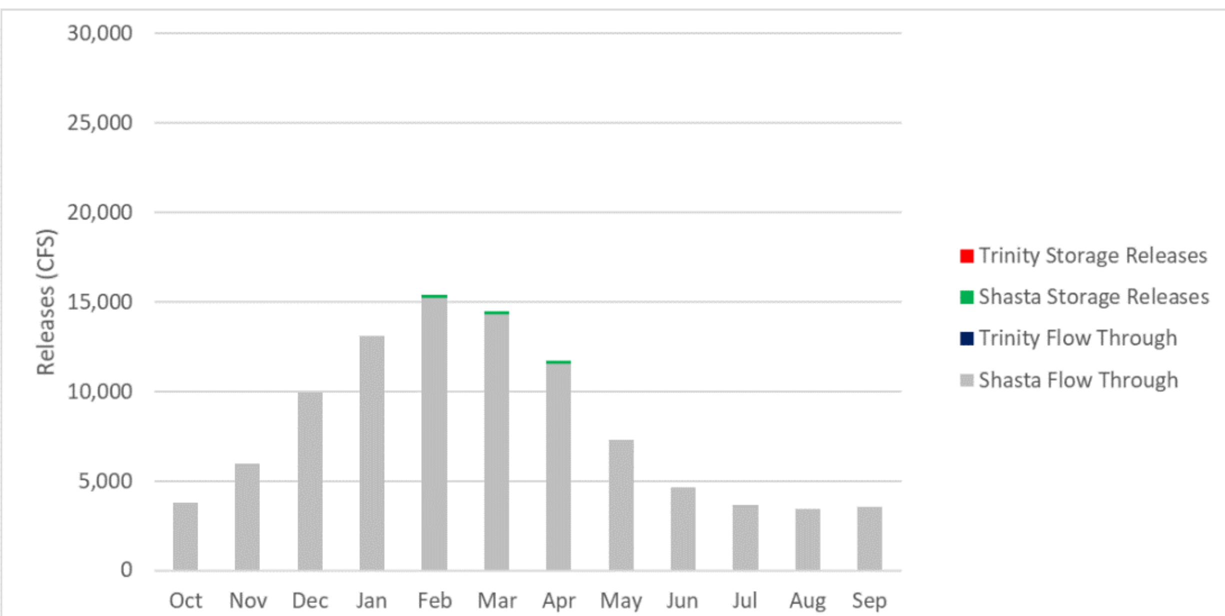


Figure E.2-29. FlowTracker Flow Type Below Keswick for EXP1

In a handful of occasions, water is backed up into Shasta due to downstream channel capacities and released later as storage releases. Otherwise, the flow through releases mirror Shasta inflow.

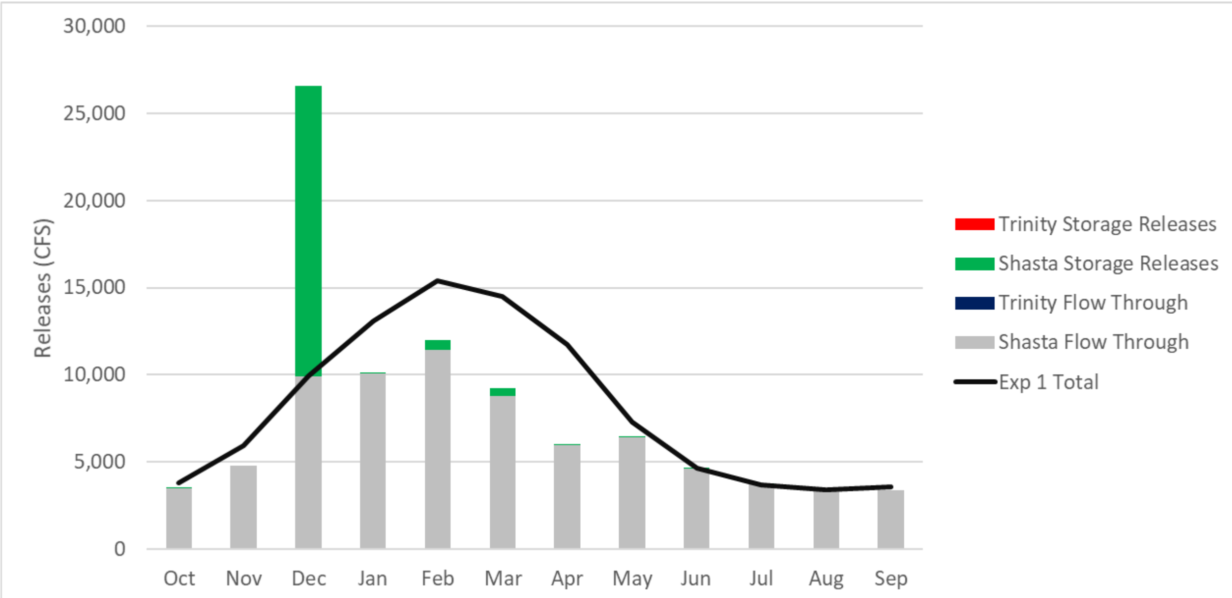


Figure E.2-30. FlowTracker Flow Type Below Keswick for EXP2

A sharp reduction in the flood control level in December results in a large flood control release. Storage is regained through the fill season, resulting in less releases during the rest of the fill season.

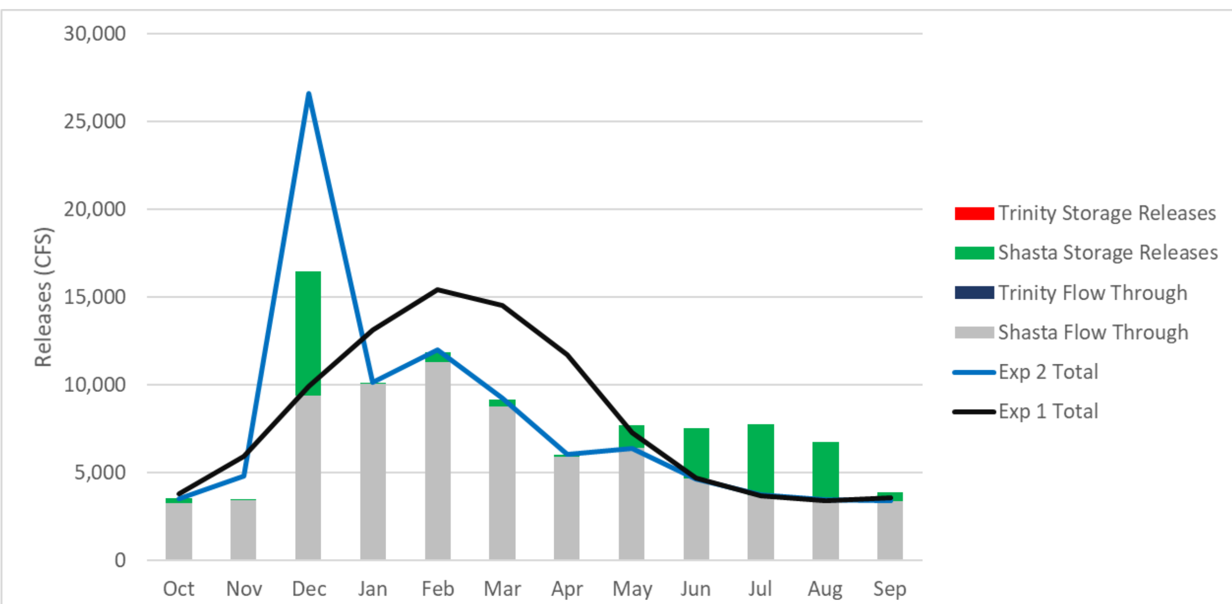


Figure E.2-31. FlowTracker Flow Type Below Keswick for EXP2.5

In EXP2.5, additional storage releases are made in the fill season to meet D-1641 requirements.

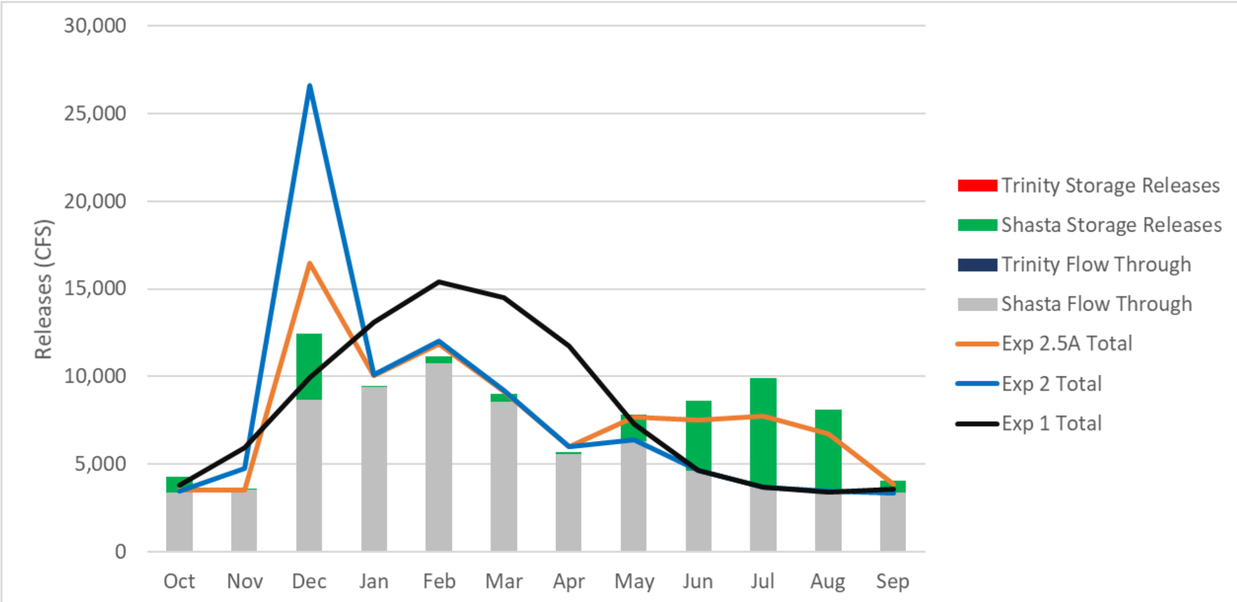


Figure E.2-32. FlowTracker Flow Type Below Keswick for EXP3

In EXP3, storage releases in the management season increase flows and deplete storage, which greatly reduces flood control releases in December.

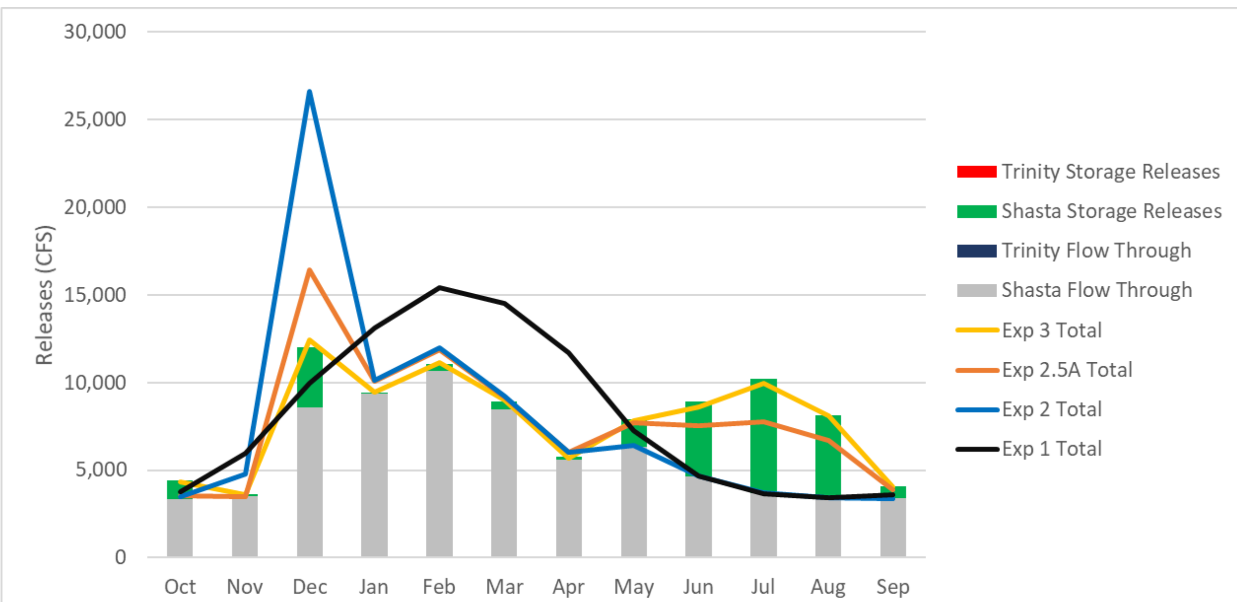


Figure E.2-33. FlowTracker Flow Type Below Keswick for EXP4v6

In EXP4v6, there are only slight increases in flow because of storage releases for Delta water quality requirements, which are increased due to exports of excess water.

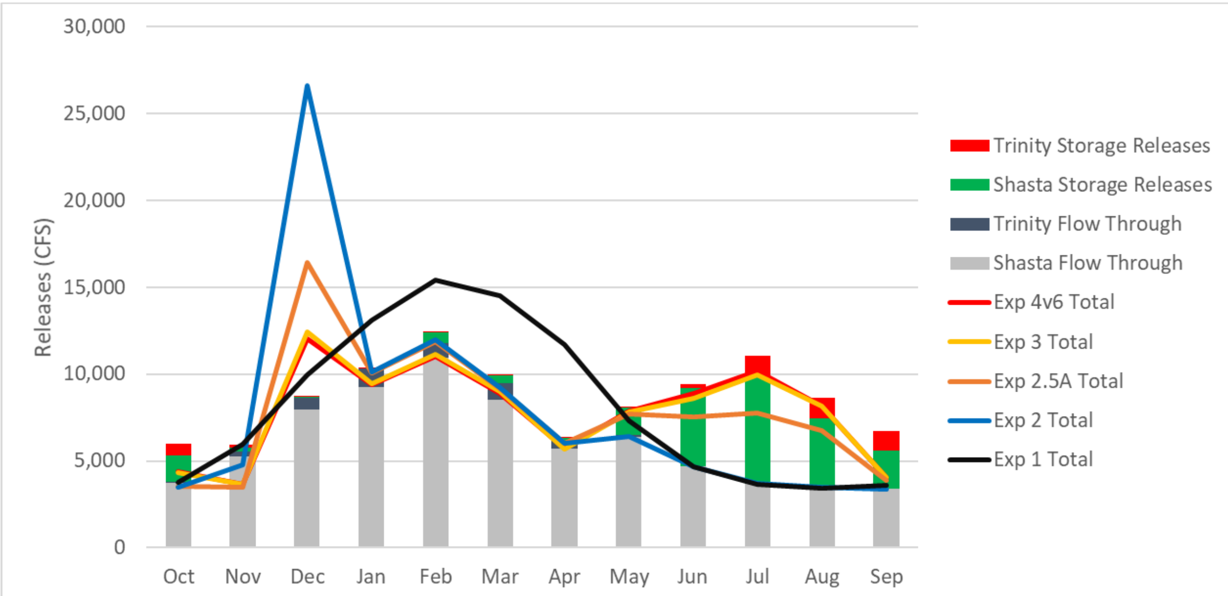


Figure E.2-34. FlowTracker Flow Type Below Keswick for EXP4.95

EXP4.95 introduces supplemental flows from the Trinity basin to supplement releases from Shasta.

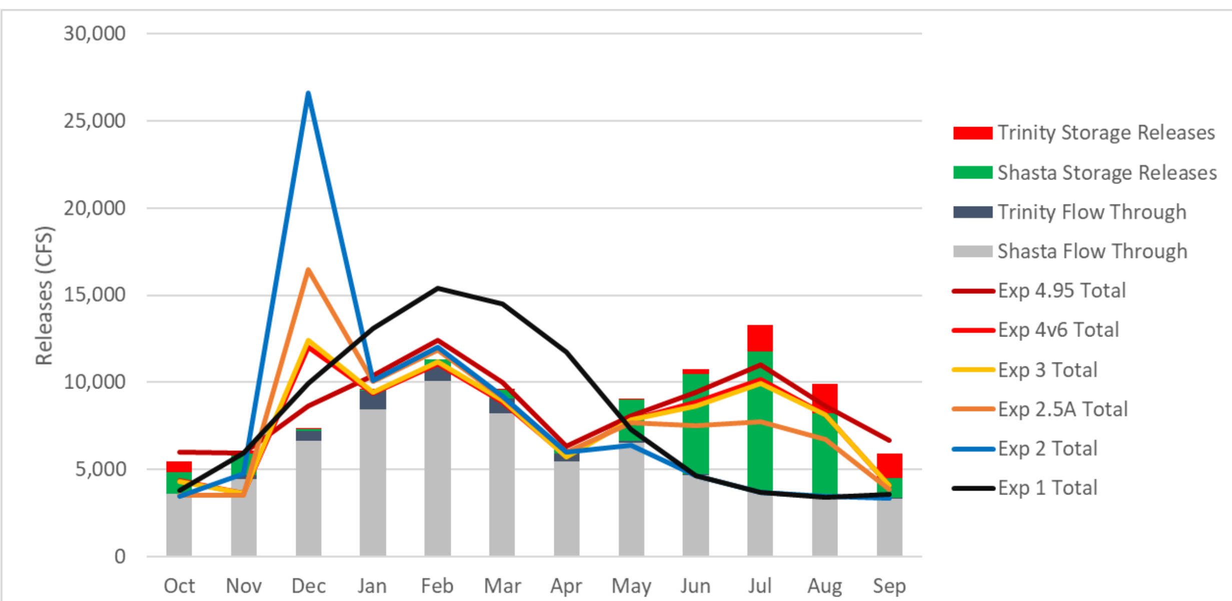


Figure E.2-35. Flow Tracker Flow Type Below Keswick for EXP5

Increased flows during the management season in EXP5 are due to storage releases for discretionary purposes.

E.2.3.3 American River

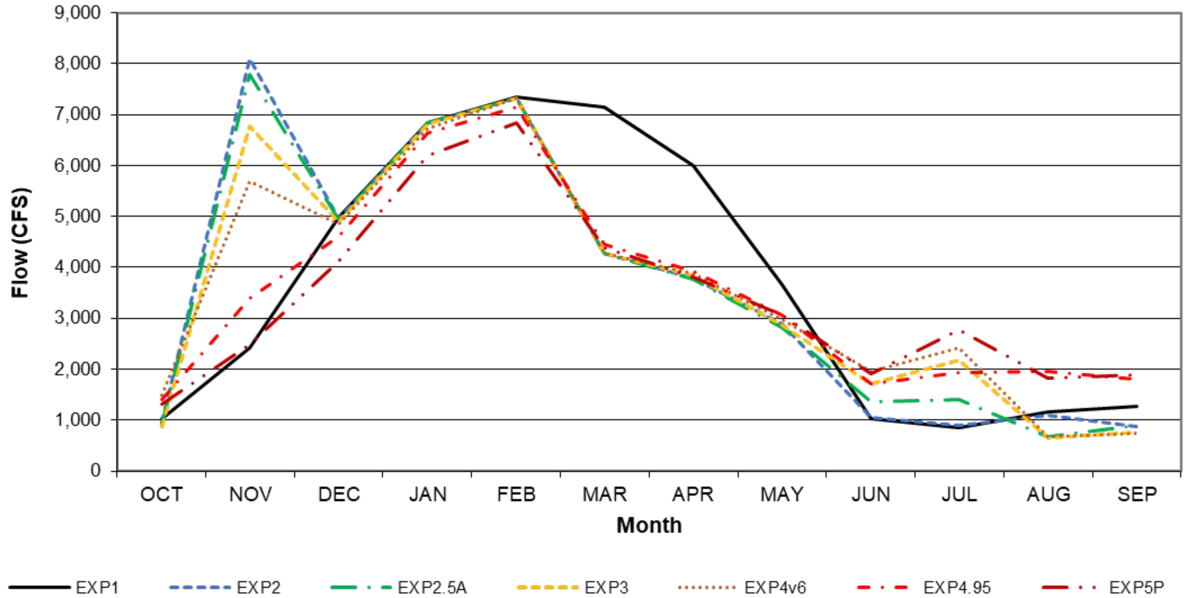


Figure E.2-36. American River Flow below Nimbus Dam (Long-Term Average)

The monthly pattern for flow below Nimbus Dam in EXP1 carries the same pattern as Folsom inflow. EXP2A, EXP2.5B, EXP3, and EXP4v6 have spikes in flow in November due to Folsom flood control releases. With increased operational capabilities in EXP3 and higher, there is greater flow in the management season due to releases for increased responsibilities, which results in lower flood control releases in November.

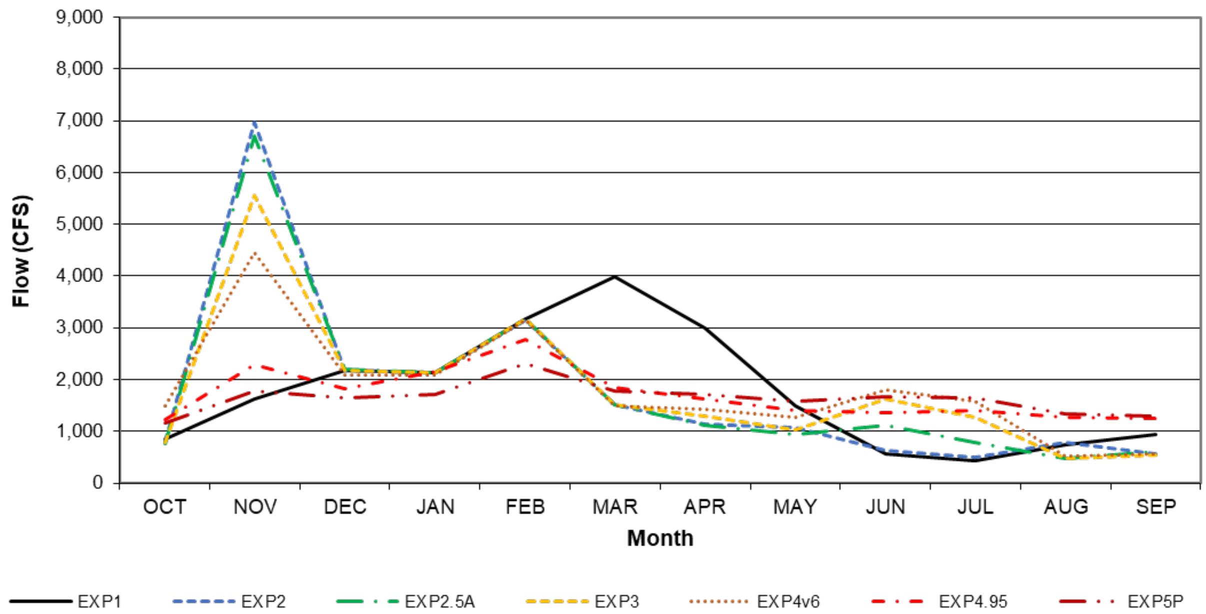


Figure E.2-37. American River Flow below Nimbus Dam (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow below Nimbus Dam are the same as those for the long-term averages.

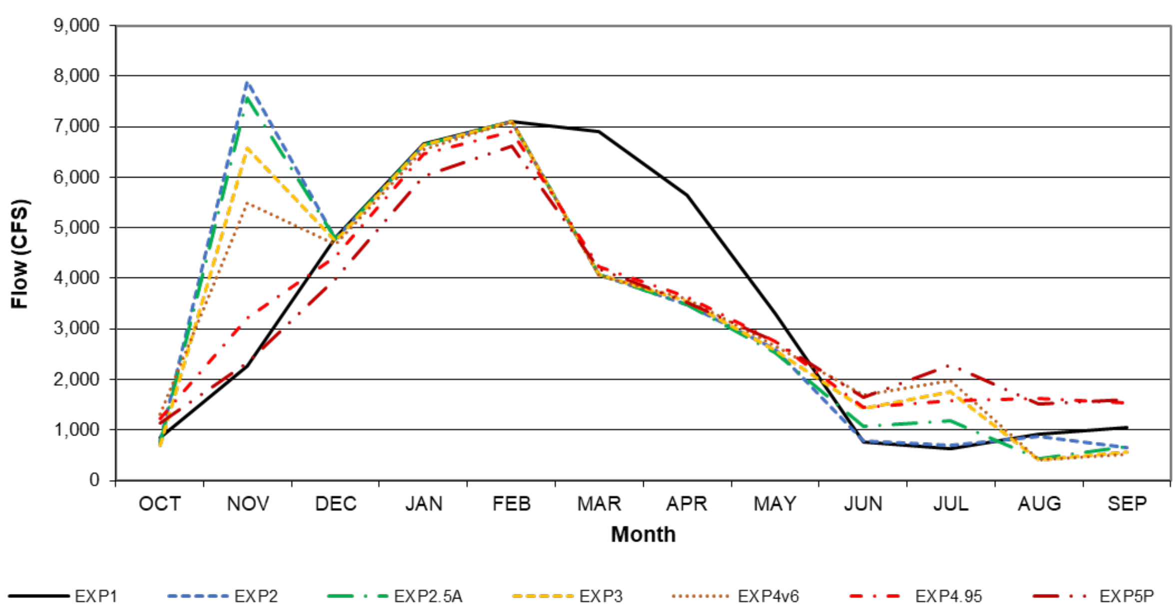


Figure E.2-38. American River Flow at H Street (Long-Term Average)

The same monthly flow patterns exist at H Street as below Nimbus Dam.

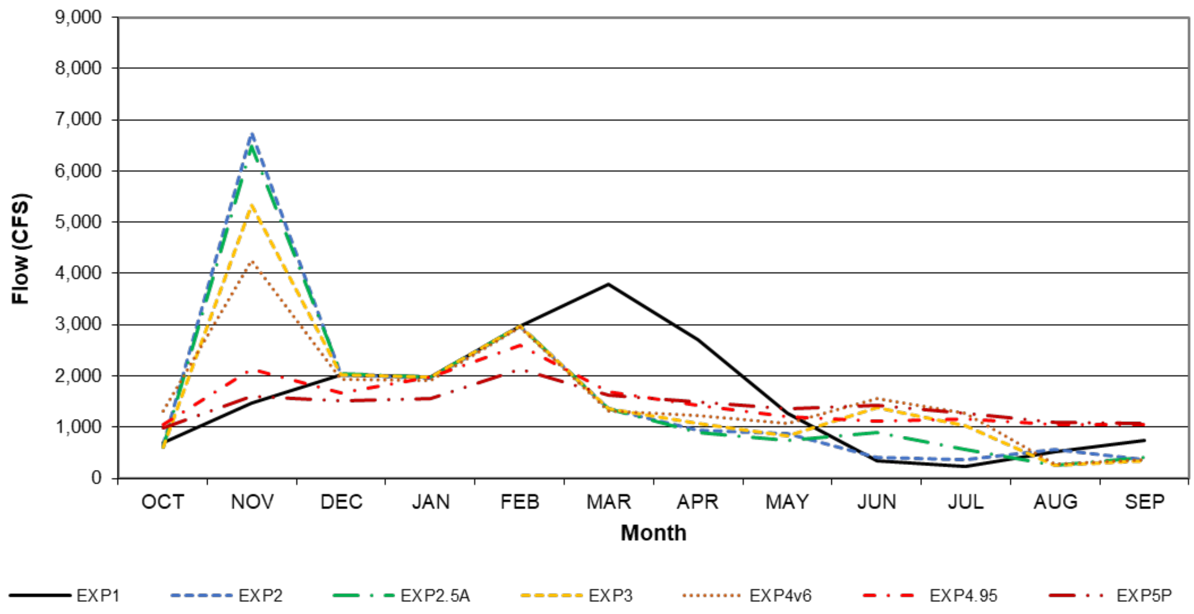


Figure E.2-39. American River Flow at H Street (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow at H Street are the same as those for the long-term averages.

E.2.3.4 American River FlowTracker Flow Type

Table E.2-2. Summary of Flow Tracker Flow Type below Folsom

Annual Total[a]	EXP1	EXP2	EXP2.5	EXP3	EXP4v6	EXP5
Folsom Pass-Through Inflow	2,618	2,229	2,219	2,175	2,169	2,066
Folsom Stored Water Releases for Flood Control	0	340	329	264	196	196
Folsom Stored Water Release	0	0	22	132	207	222

[a] In thousands of acre-feet.

Folsom pass-through and flood control releases decrease in each subsequent model in the exploratory modeling suite while releases of previously stored water increases. This is due to increased use of storage in the management season to satisfy increased responsibilities.

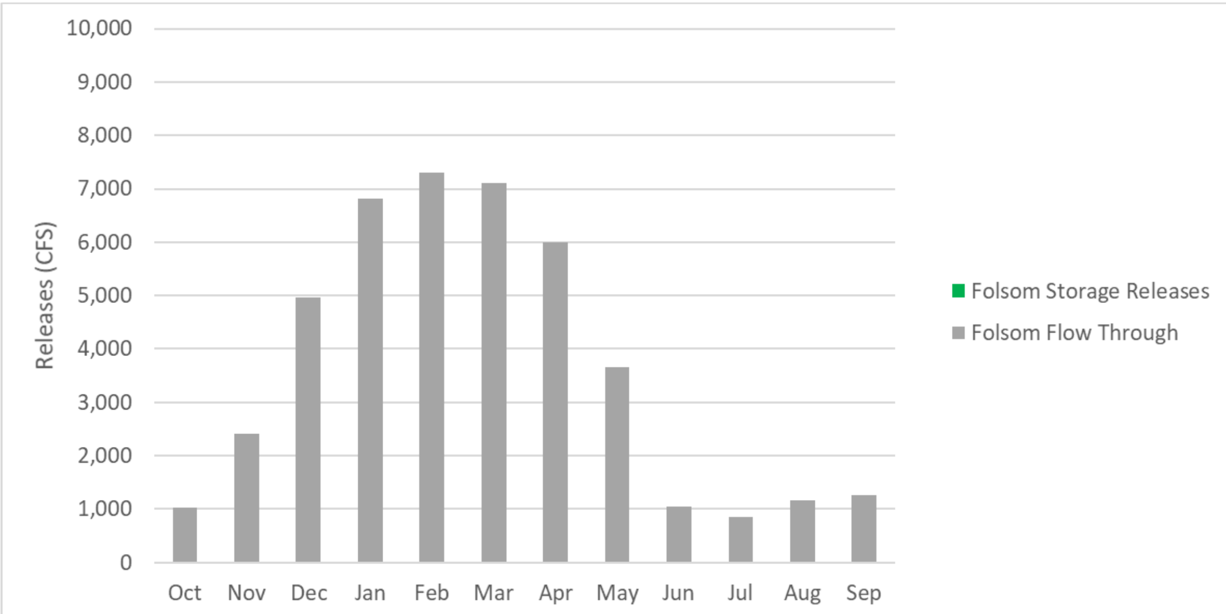


Figure E.2-40. FlowTracker Flow Type Below Nimbus for EXP1

Flows below Nimbus Dam in EXP1 reflect inflows into Folsom.

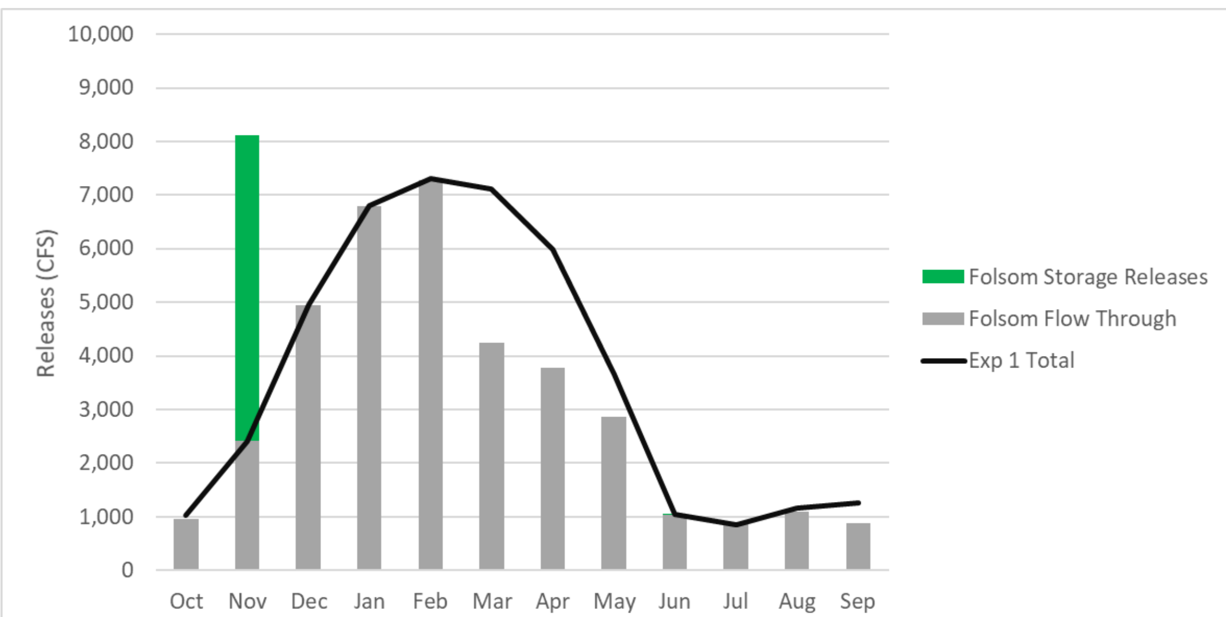


Figure E.2-41. FlowTracker Flow Type Below Nimbus for EXP2

A sharp reduction in the flood control level in November results in a large flood control release. Storage is regained through the fill season, resulting in less releases during the rest of the fill season.

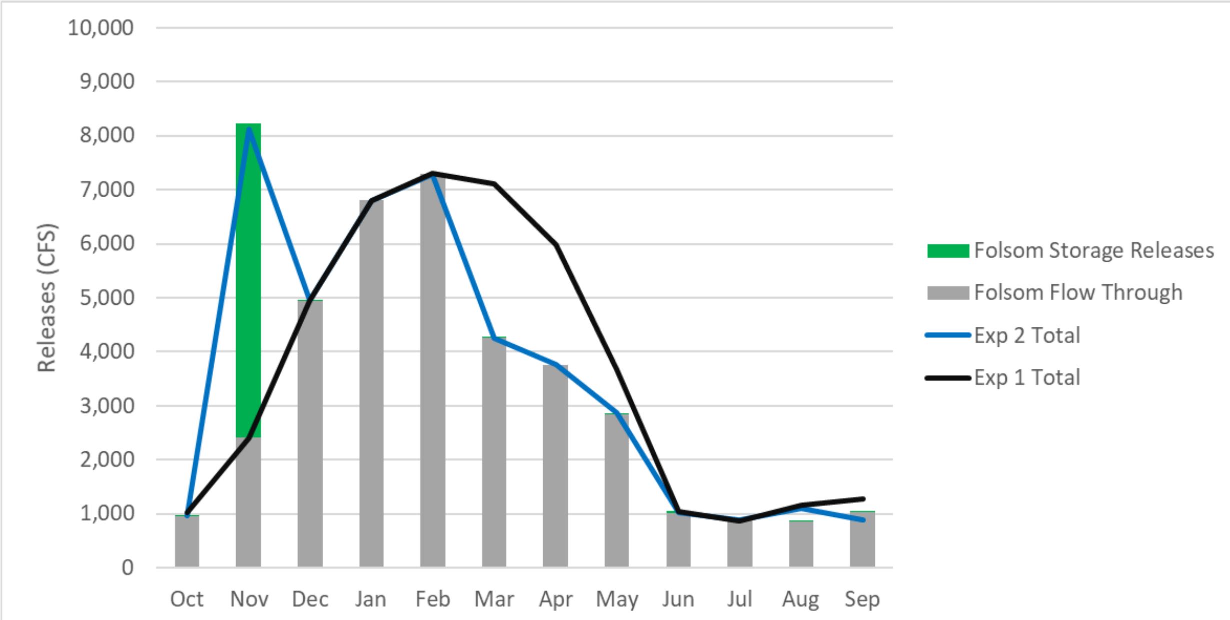


Figure E.2-42. FlowTracker Flow Type Below Nimbus for EXP2.5

Flow below Nimbus Dam in EXP2.5 has little difference from EXP2.

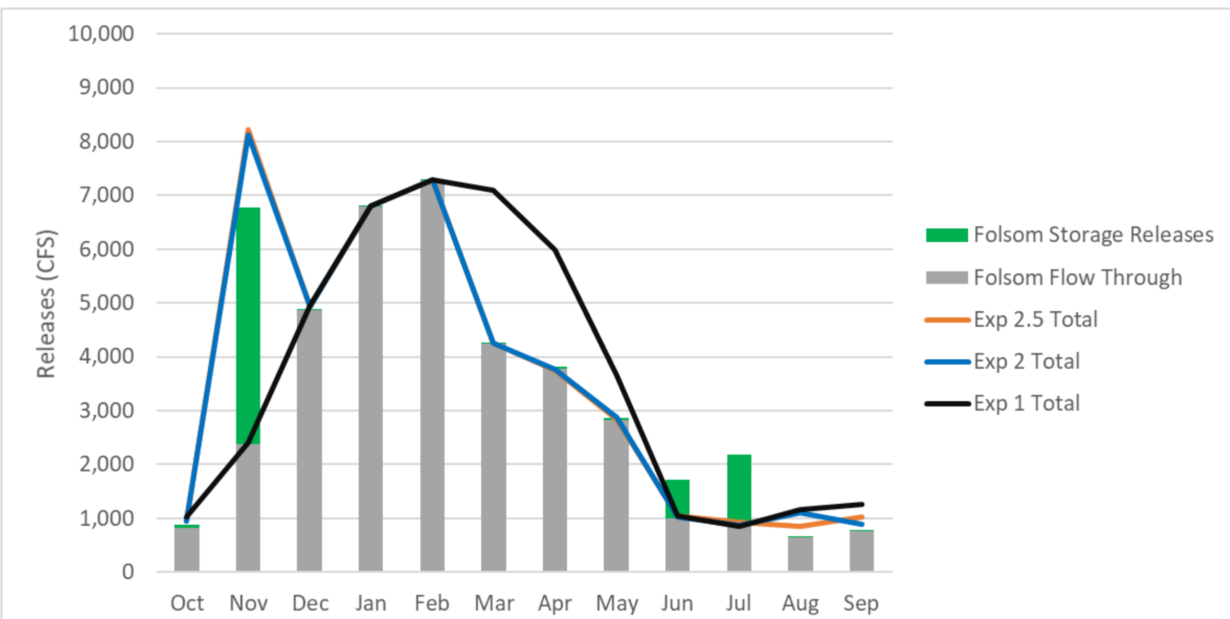


Figure E.2-43. FlowTracker Flow Type Below Nimbus for EXP3

In EXP3, storage releases in the management season increase flows and deplete storage, which reduces flood control releases in December.

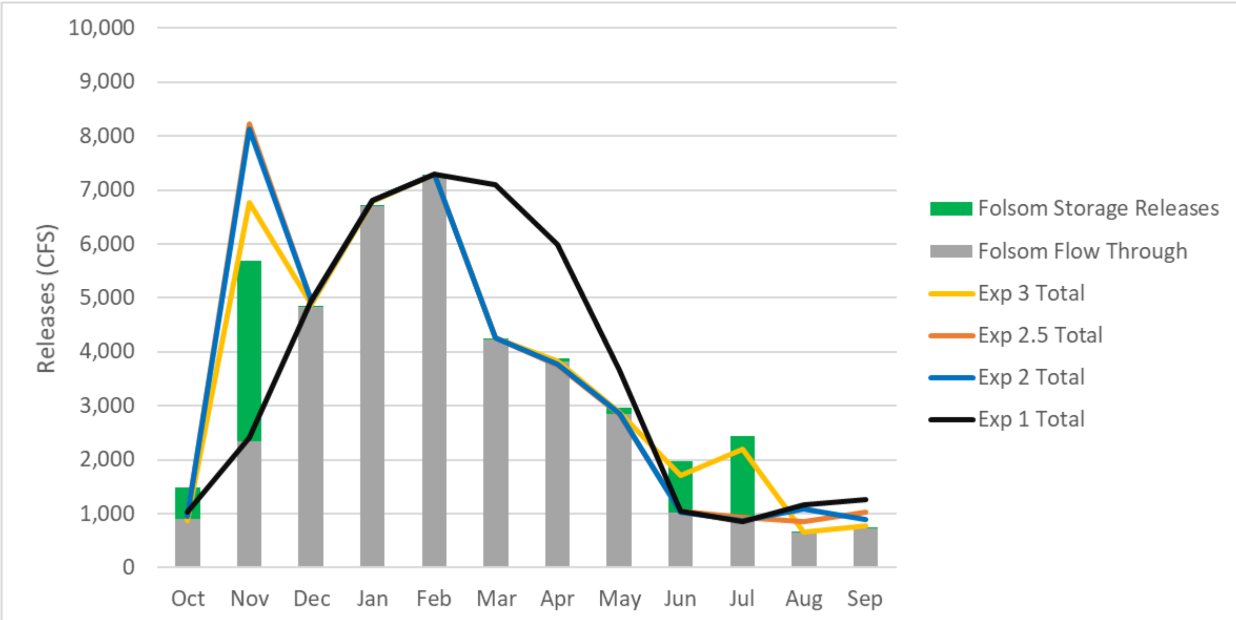


Figure E.2-44. FlowTracker Flow Type Below Nimbus for EXP4v6

In EXP4v6, there are increases in flow because of storage releases for Delta water quality requirements, which are increased due to exports of excess water.

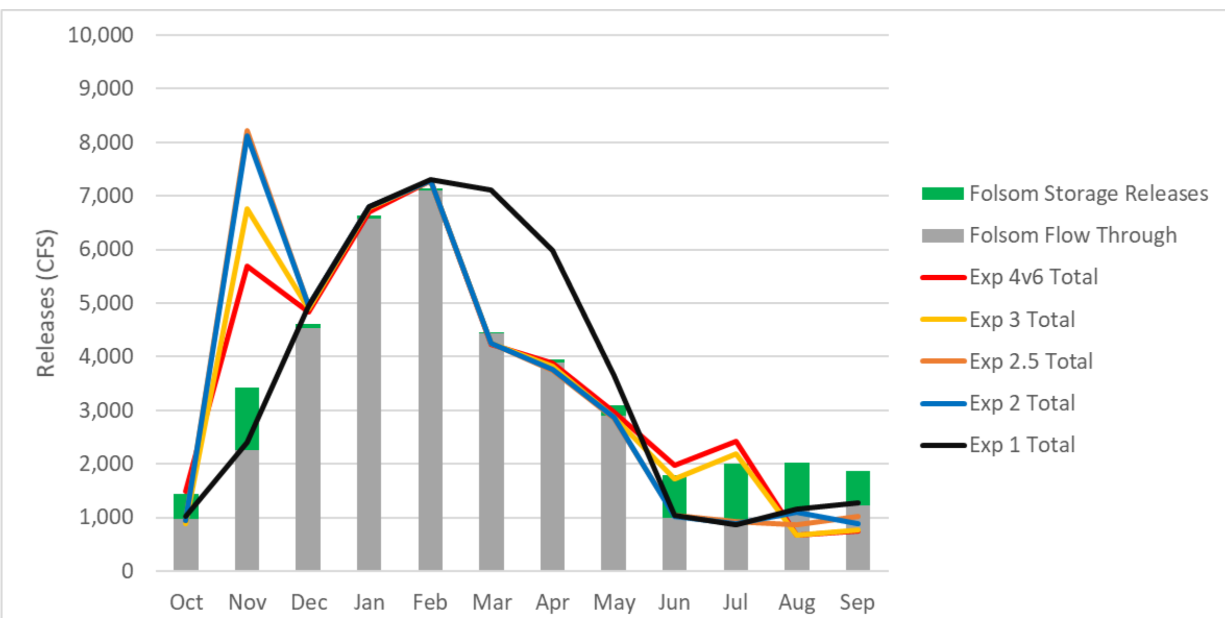


Figure E.2-45. FlowTracker Flow Type Below Nimbus for EXP4.95

In EXP4.95, Fall X2 requirements cause more releases from Folsom in August than in September.

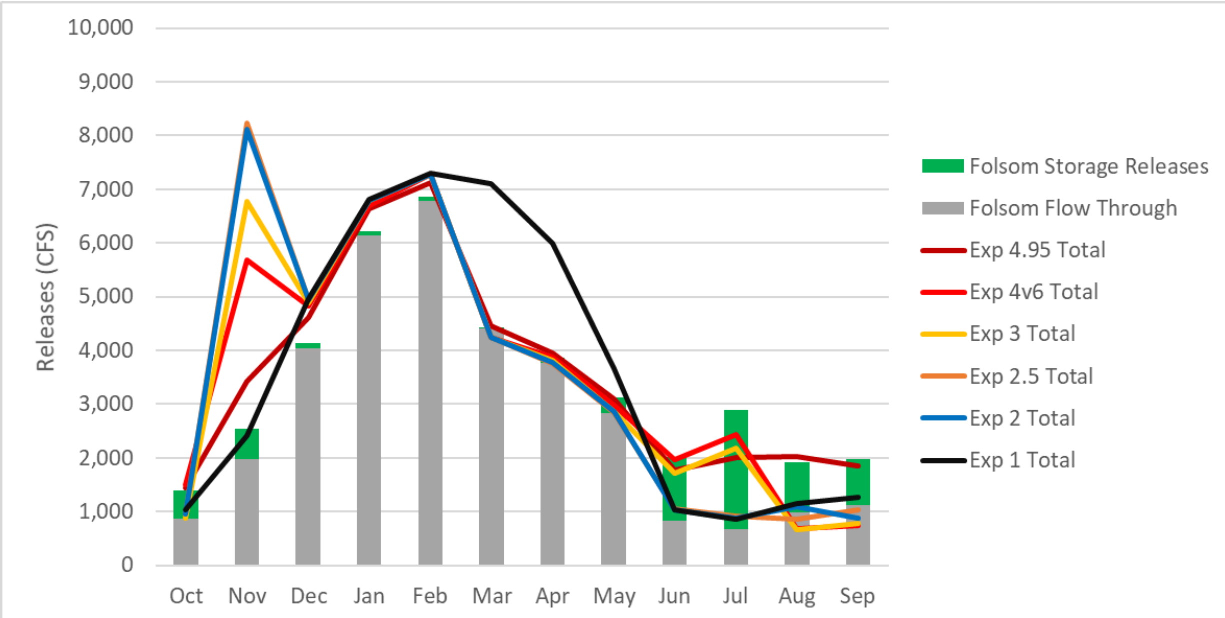


Figure E.2-46. FlowTracker Flow Type Below Nimbus for EXP5

In EXP5, storage releases for discretionary purposes increases flows in July.

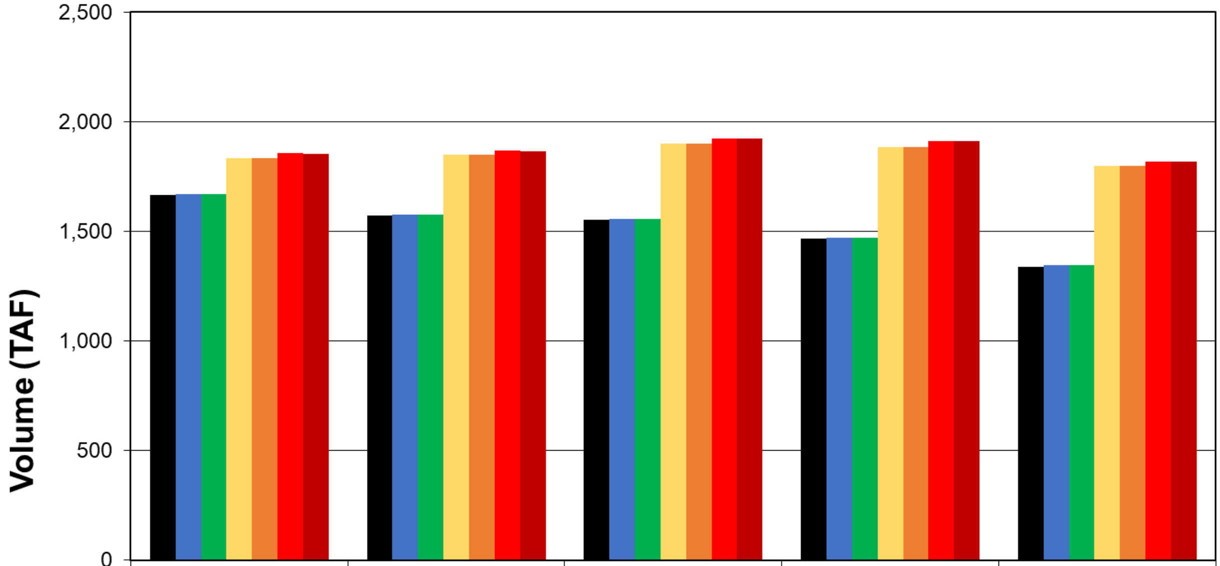
E.2.4 North of Delta CVP Deliveries

Table E.2-3. Total (Mar–Feb) NOD CVP Deliveries[a]

Runs	PMI	PAG	PSC	PRF
EXP1	0	0	1,542	0
EXP2	0	0	1,546	0
EXP2.5	0	0	905	0
EXP3	0	0	1,855	65
EXP4v6	71	71	1,855	65
EXP5	188	194	1,876	84

[a] In thousands of acre-feet.
PMI = Project Municipal and Industrial; PAG = Project Agricultural; PSC = Project Settlement Contractors; PRF = Project Refuge.

There are no CVP service deliveries until EXP4v6, which only uses excess water to make those deliveries. In EXP5, storage releases are made to satisfy those demands. Settlement Contract deliveries are made from pass-through inflow in EXP1, EXP2, and EXP2.5, but in EXP2.5, pass-through inflow is used to meet D-1641 requirements before being delivered to Settlement Contract demands. Storage releases are made for Settlement Contract demands in EXP3, EXP4v6, and EXP5. Level 2 refuge demands are introduced in EXP3.



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	1,667	1,573	1,553	1,466	1,339
EXP2	1,669	1,576	1,557	1,471	1,346
EXP2.5A	1,669	1,576	1,557	1,471	1,346
EXP3	1,835	1,848	1,899	1,884	1,797
EXP4v6	1,835	1,848	1,899	1,885	1,797
EXP4.95	1,855	1,868	1,925	1,911	1,819
EXP5P	1853	1865	1924	1911	1819

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-47. CVP NOD Deliveries to Settlement Contractors by Water Year Type

For EXP1, EXP2, and EXP2.5, Settlement Contractors are delivered from pass-through inflow, so there is less water available in drier years. In EXP3, EXP4v6, and EXP5, storage releases are made to meet Settlement Contract demands, and so the deliveries are the same unless shortages occur.

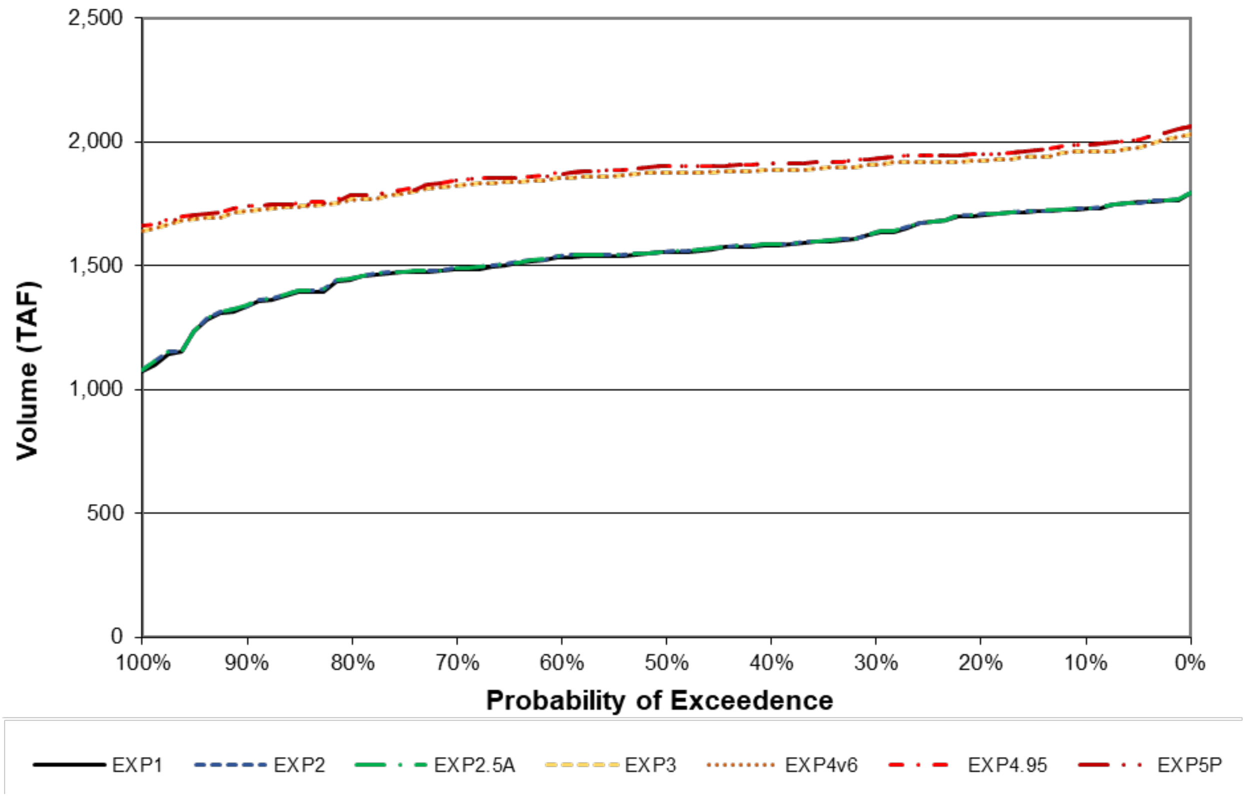


Figure E.2-48. Exceedance of CVP NOD Settlement Contractors Delivery

Deliveries decrease in drier years due to shortages.

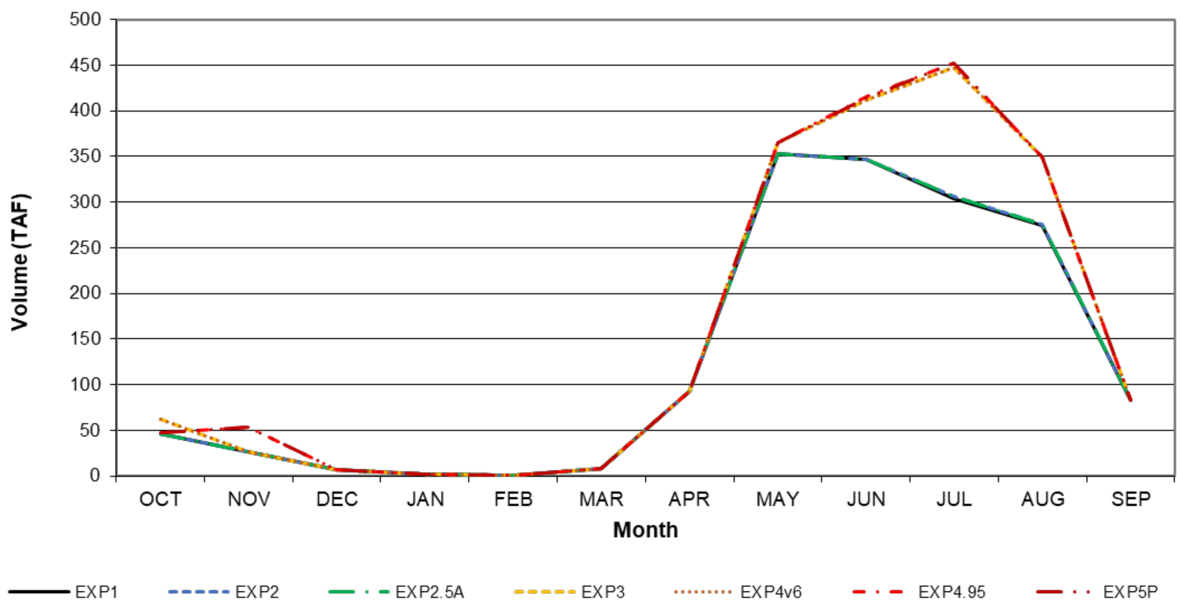
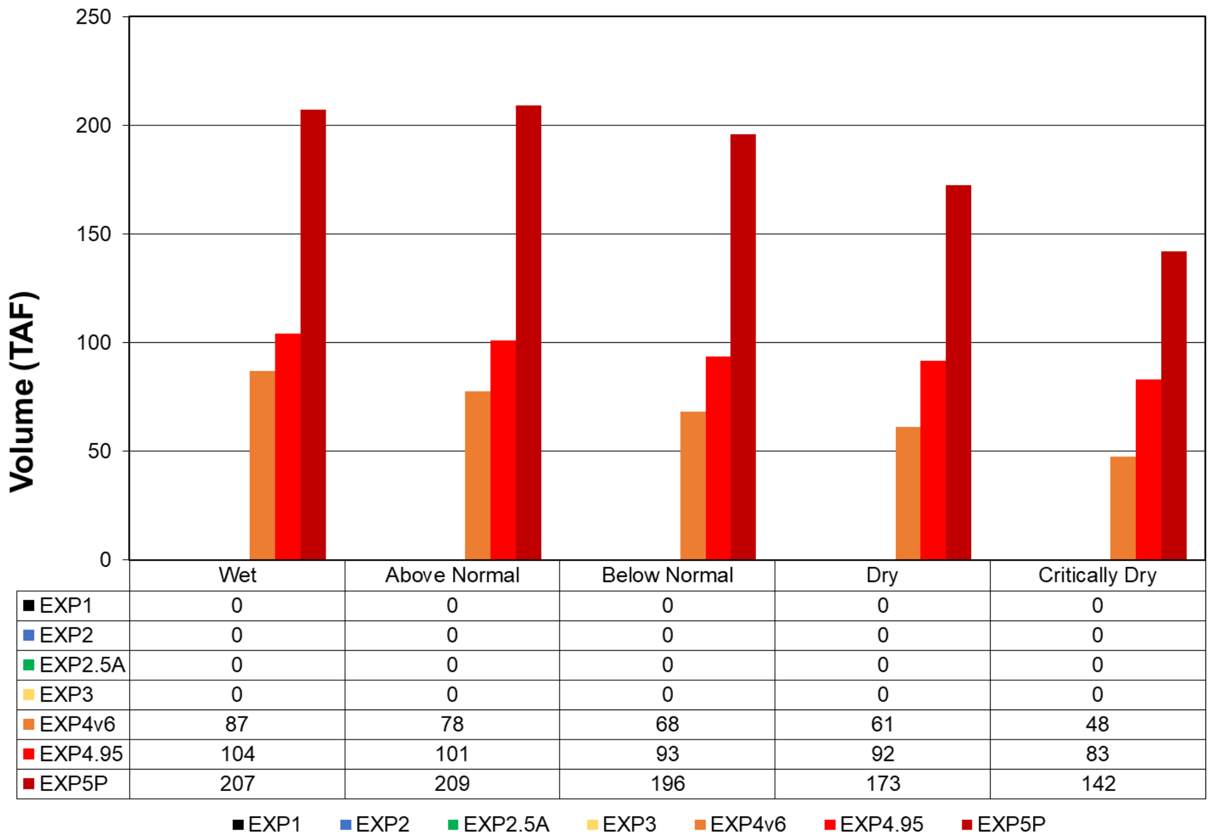


Figure E.2-49. CVP NOD Settlement Contractors Delivery Monthly Pattern

Storage releases to meet Settlement Contract demands in EXP3, EXP4v6, and EXP5 increase deliveries from May through September.



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	0	0	0	0	0
EXP2	0	0	0	0	0
EXP2.5A	0	0	0	0	0
EXP3	0	0	0	0	0
EXP4v6	87	78	68	61	48
EXP4.95	104	101	93	92	83
EXP5P	207	209	196	173	142

Figure E.2-50. CVP NOD Deliveries to M&I Contractors by Water Year Type

There are no CVP M&I deliveries before EXP4v6, which makes deliveries from excess water. Storage releases to meet those demands increase deliveries in EXP5. Allocations decrease in drier years, decreasing deliveries, but there are always at least Health and Safety deliveries made.

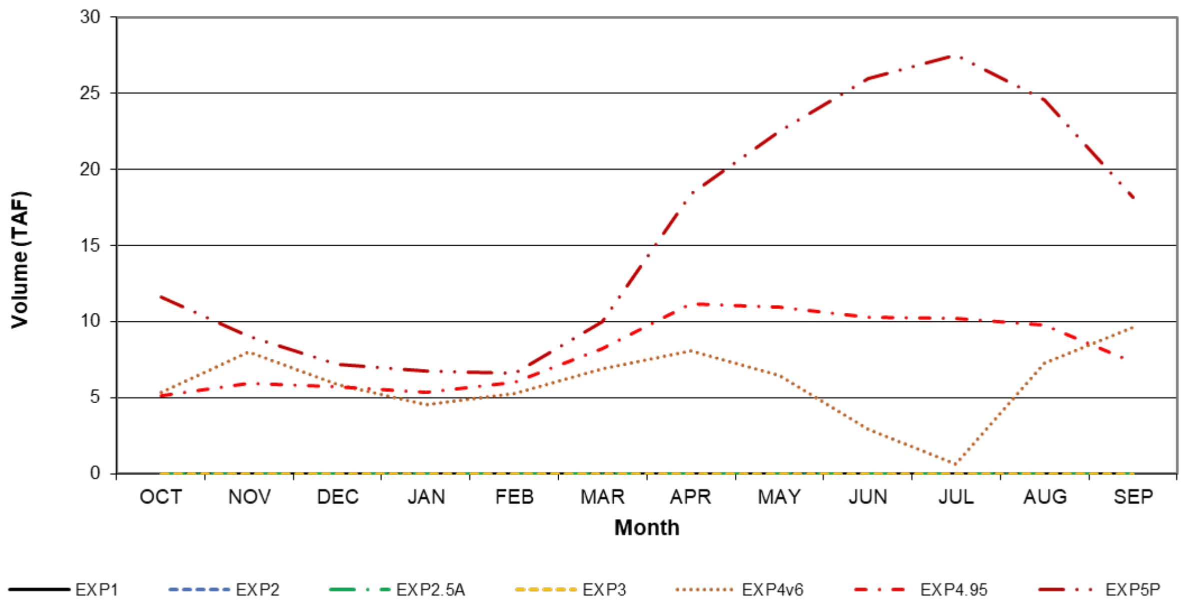
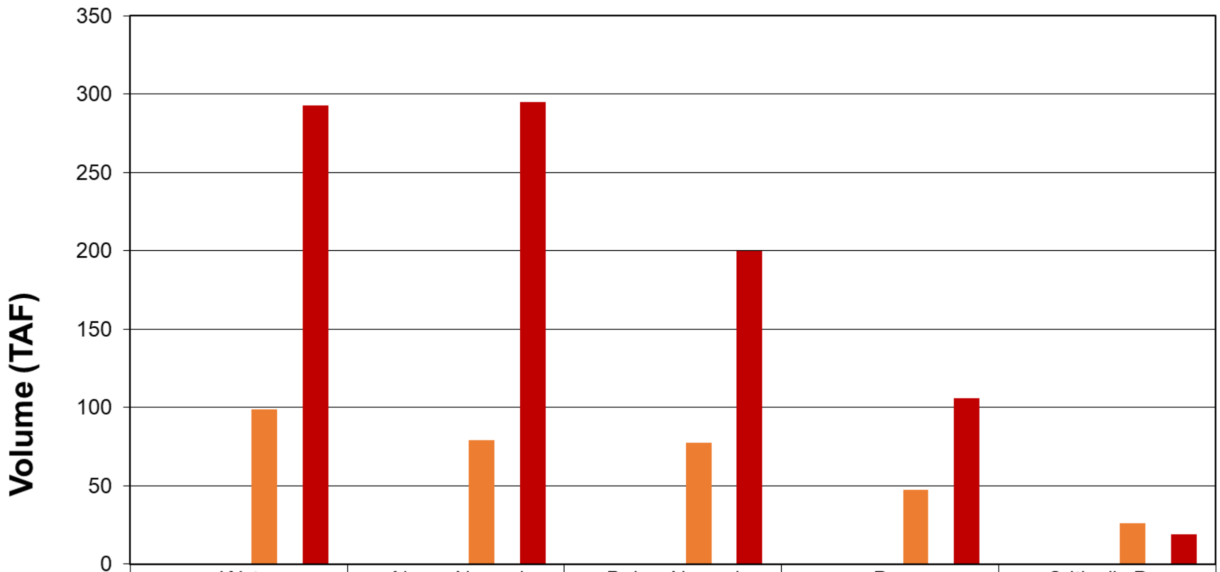


Figure E.2-51. CVP NOD M&I Contractors Delivery Monthly Pattern

CVP M&I deliveries above and beyond Health and Safety in EXP4v6 and EXP4.95 are made as hydrologically available, so there is less water available in the summer months. Storage releases to meet those demands increase deliveries in the summer months when the demands are higher.



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	0	0	0	0	0
EXP2	0	0	0	0	0
EXP2.5A	0	0	0	0	0
EXP3	0	0	0	0	0
EXP4v6	99	79	78	47	26
EXP4.95	0	0	0	0	0
EXP5P	293	295	200	106	19

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-52. CVP NOD Deliveries to Ag Contractors by Water Year Type

EXP4.95 does not make CVP NOD Ag deliveries while EXP4v6 uses excess water for those deliveries as available. EXP5P makes storage releases to meet those demands.

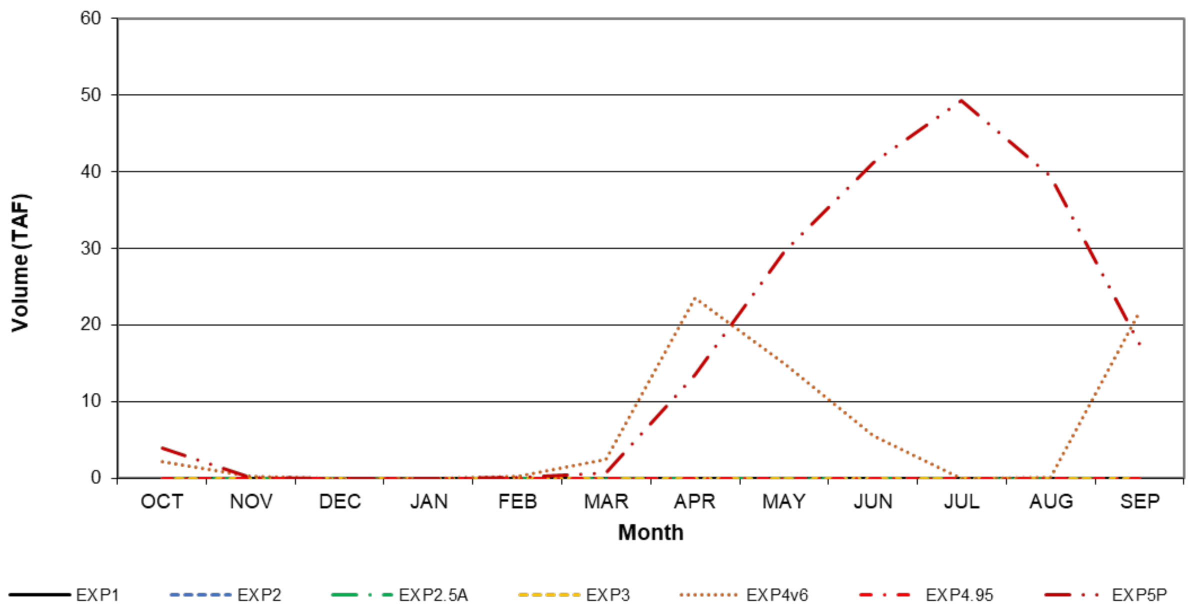


Figure E.2-53. CVP NOD Ag Contractors Delivery Monthly Pattern

CVP NOD Ag deliveries resemble the same monthly patterns that are in CVP NOD M&I deliveries except that EXP4.95 does not make CVP NOD Ag deliveries.

E.2.5 Delta

Table E.2-4. Average Delta Flow (Oct–Sep)[a]

Runs	Sacramento River Flow at Freeport	Yolo Bypass Flow	San Joaquin River Flow at Vernalis	Old and Middle River Combined Flow	Delta Outflow
EXP1	15,683	3,615	4,088	1,784	23,321
EXP2	15,089	3,780	3,979	1,715	22,790
EXP2.5	16,014	3,698	4,137	1,788	23,790
EXP3	14,698	3,371	3,598	1,530	21,599
EXP4v6	14,509	3,317	3,140	-1,963	17,242
EXP5	15,415	3,033	3,216	-2,956	16,829

[a] In thousands of acre-feet

E.2.5.1 Inflow

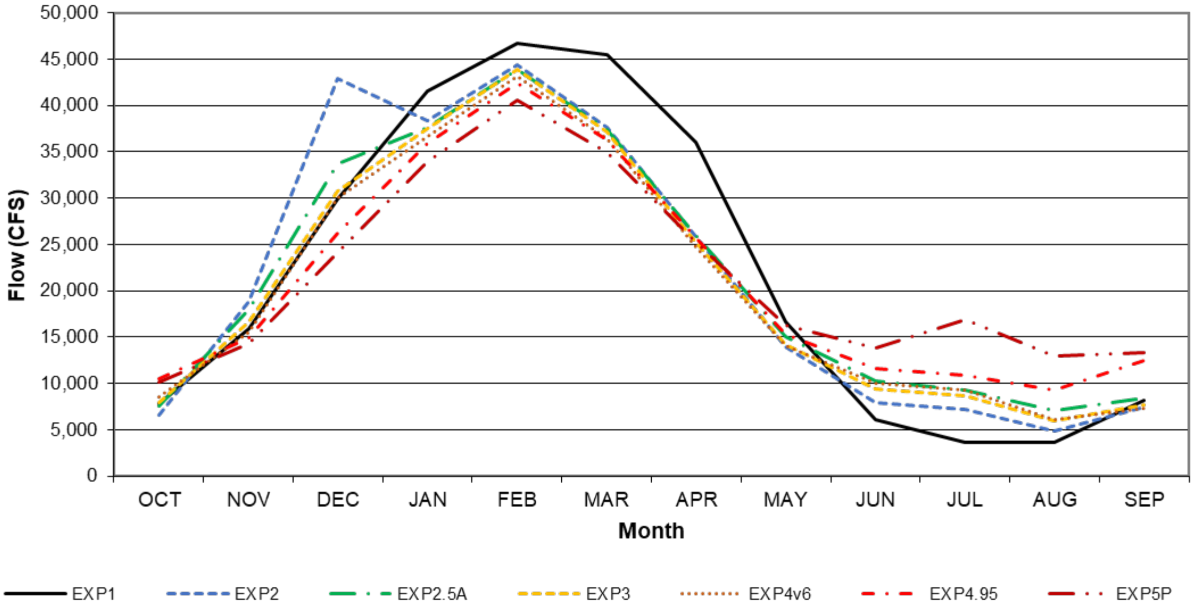


Figure E.2-54. Delta Inflow at Freeport Monthly Pattern (Long-Term Average)

Sacramento River flows at Freeport carry the same patterns as described at Hood.

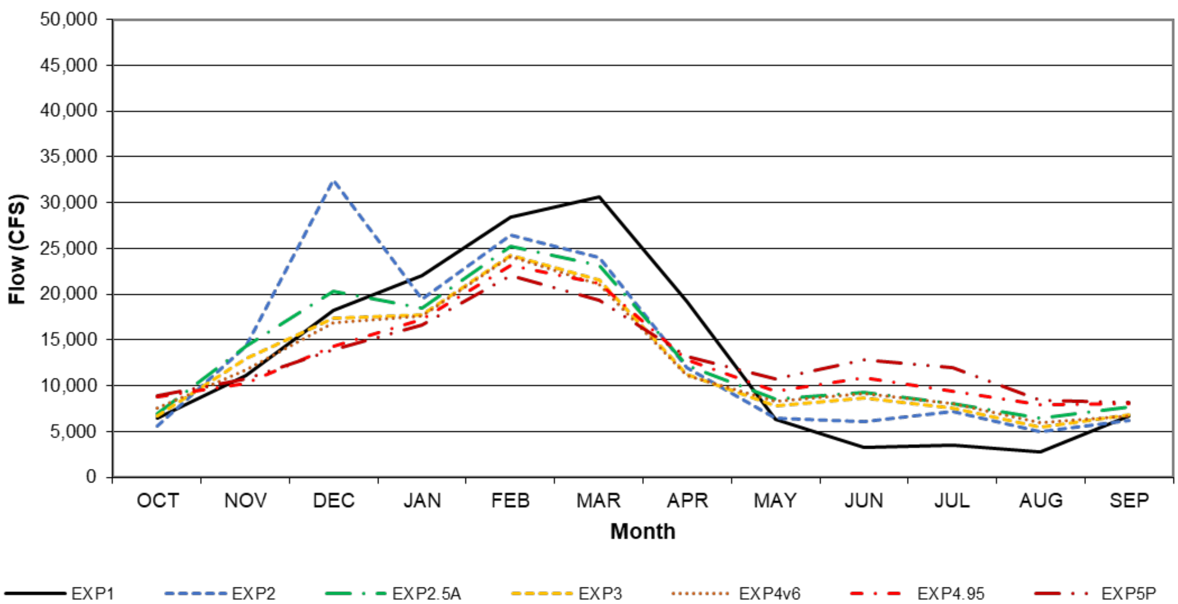


Figure E.2-55. Delta Inflow at Freeport Monthly Pattern (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow at Freeport are the same as those for the long-term averages.

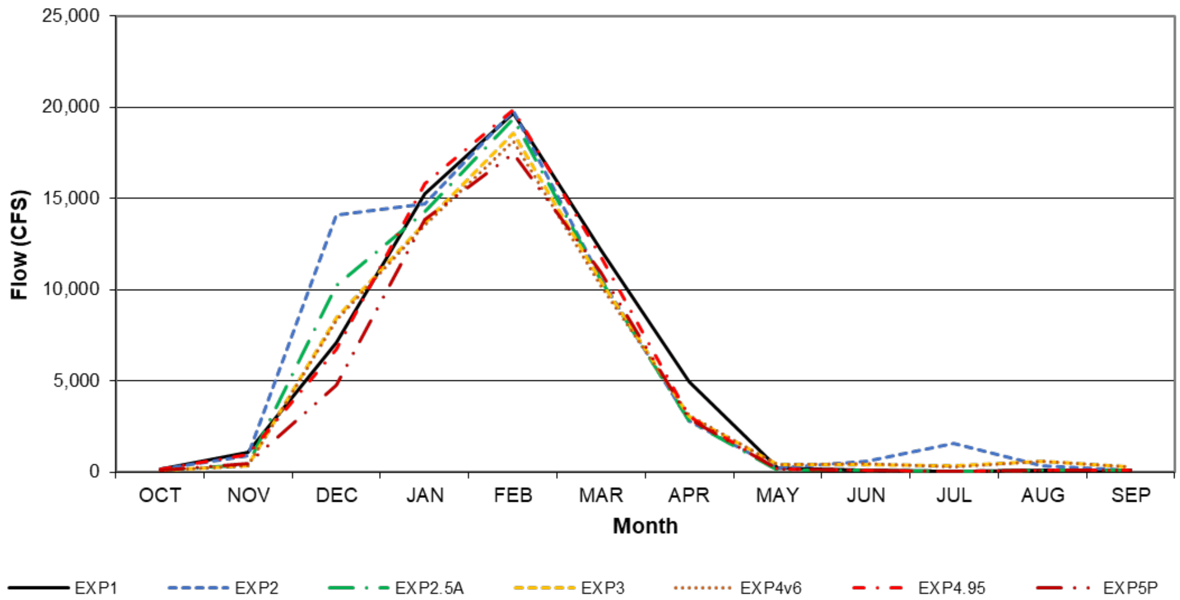


Figure E.2-56. Delta Inflow – Yolo Bypass Monthly Pattern (Long-Term Average)

Yolo Bypass flows reflect the layers of Shasta and Oroville operations, including spills and storage releases.

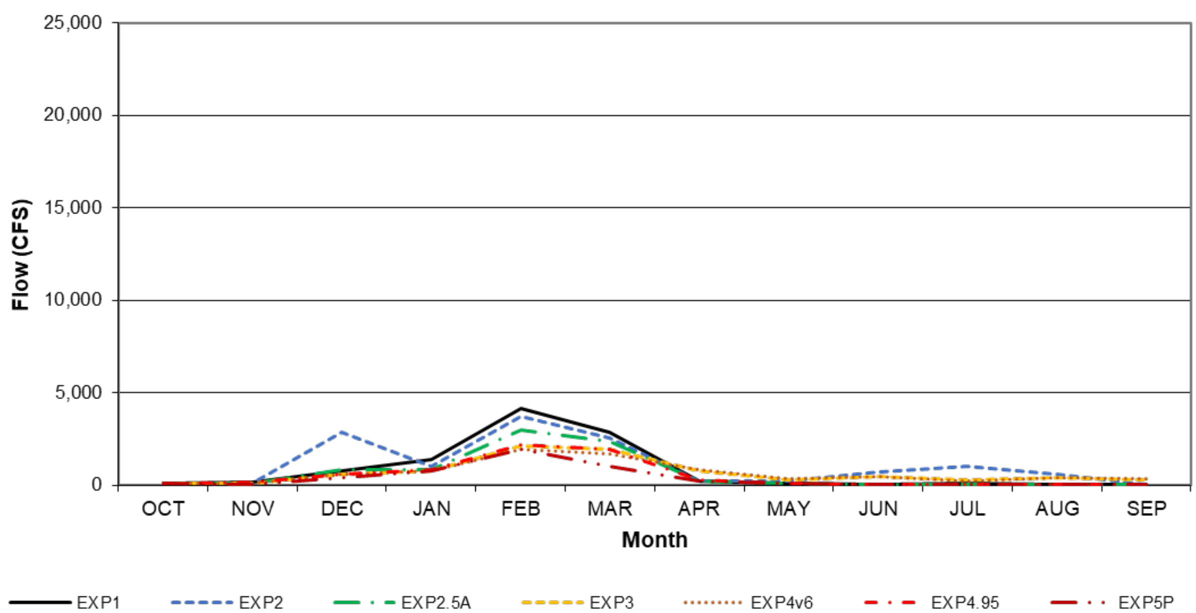


Figure E.2-57. Delta Inflow – Yolo Bypass Monthly Pattern (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for Yolo Bypass flow are the same as those for the long-term averages.

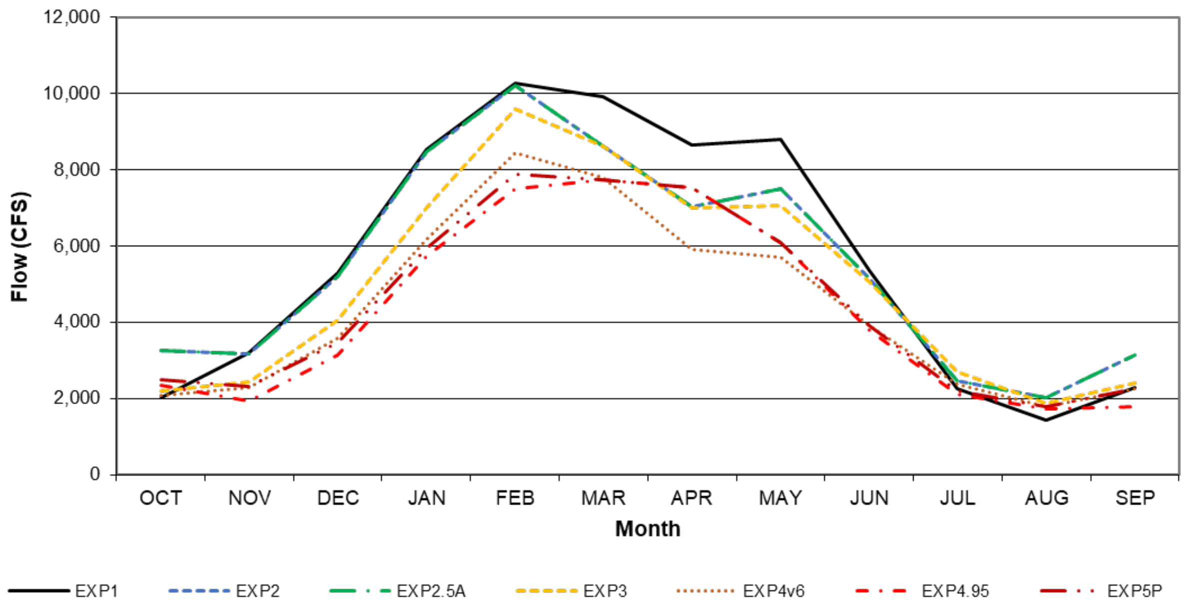


Figure E.2-58. Delta Inflow at Vernalis Monthly Pattern (Long-Term Average)

Flow at Vernalis in EXP1 reflects the hydrology and non-project operations upstream of inflows into the San Joaquin River. In EXP2 and EXP2.5, pass-through inflow is released for non-discretionary purposes. Vernalis flows decrease in EXP3 due to the use of Friant storage releases for delivery at Mendota Pool and Sack Dam, and flow is further reduced in EXP4v6 and EXP5 due to deliveries to the Friant Unit.

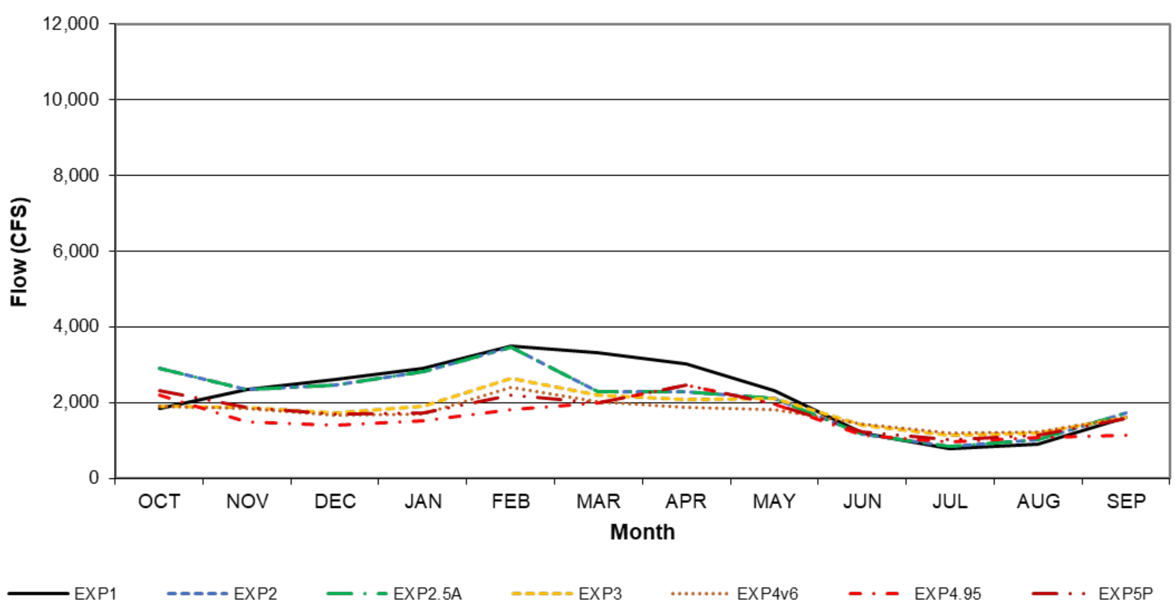


Figure E.2-59. Delta Inflow at Vernalis Monthly Pattern (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for flow at Vernalis are the same as those for the long-term averages.

E.2.5.2 Flows

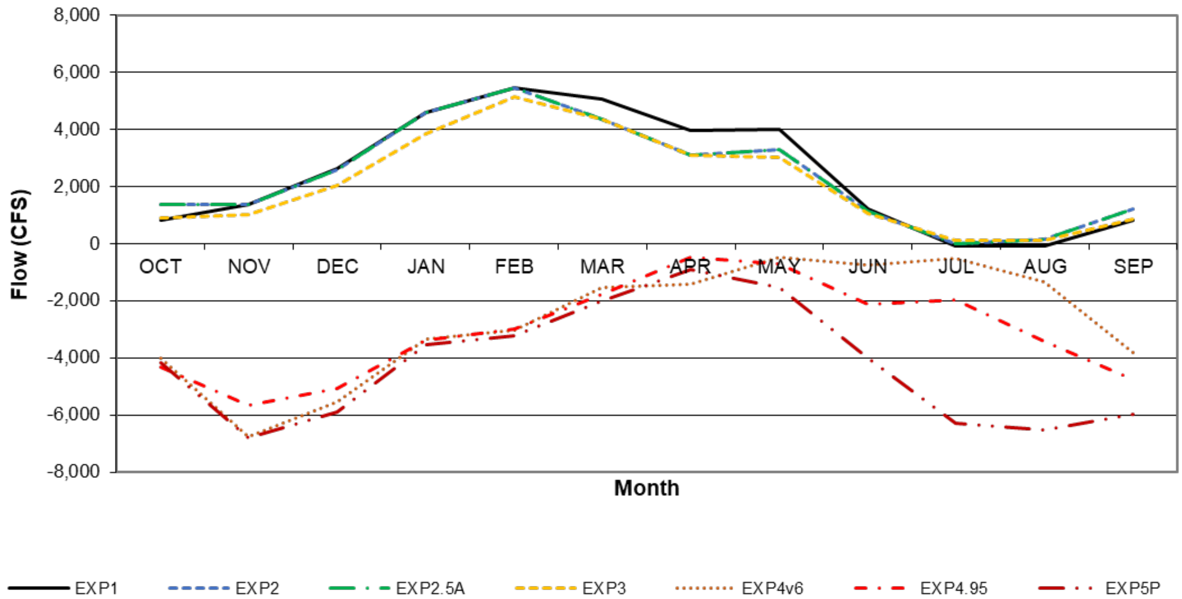


Figure E.2-60. Old and Middle River Combined Flow Monthly Pattern (Long-Term Average)

OMR combined flow is greatly affected by exports, which only exist in EXP4v6 and EXP5. More exports happen in the summer months in EXP5, causing more negative flows.

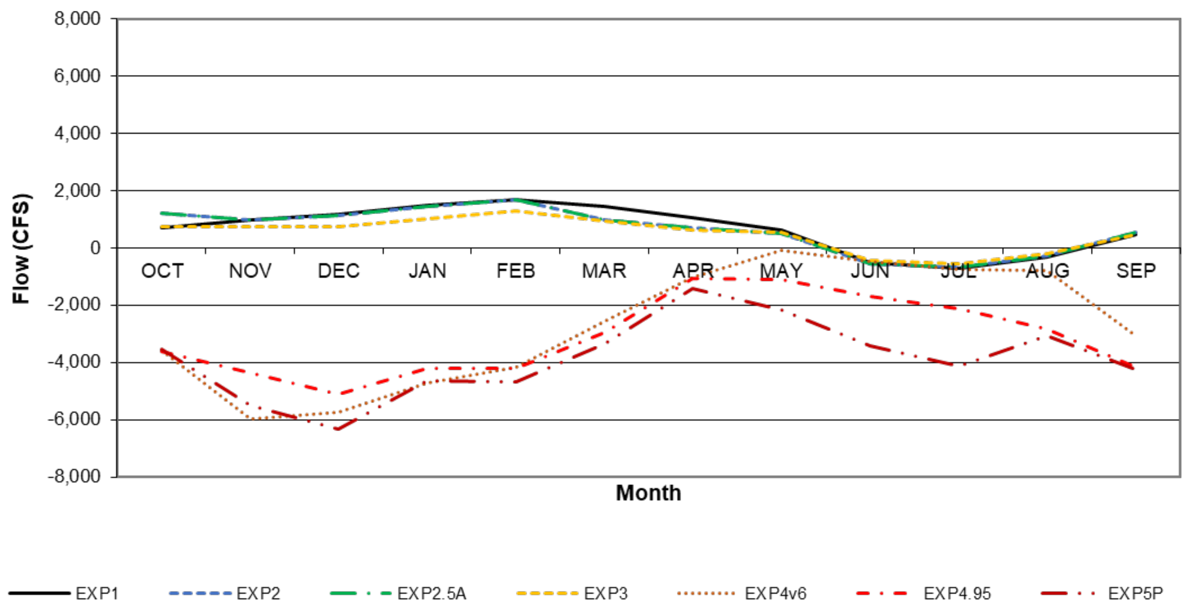


Figure E.2-61. Old and Middle River Combined Flow Monthly Pattern (Dry and Critically Dry Years)

In the driest years, OMR combined flow is negative, even in EXP1, which reflects the hydrology of the system with diverters taking water where they can.

E.2.5.3 Outflow

Table E.2-5. Delta Outflow Annual (Oct–Sep) Volume[a] by Water Year Type

Runs	Average	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critically Dry Years
EXP1	23,321	38,956	26,990	17,711	12,908	7,718
EXP2	22,790	37,809	26,163	17,455	12,596	8,147
EXP2.5	23,790	38,702	26,994	18,430	13,718	9,379
EXP3	21,599	36,832	24,158	16,047	11,361	7,490
EXP4v6	17,242	30,582	19,435	11,995	8,322	5,341
EXP5	16,829	30,580	19,179	10,896	7,604	5,186

[a] In thousands of acre-feet.

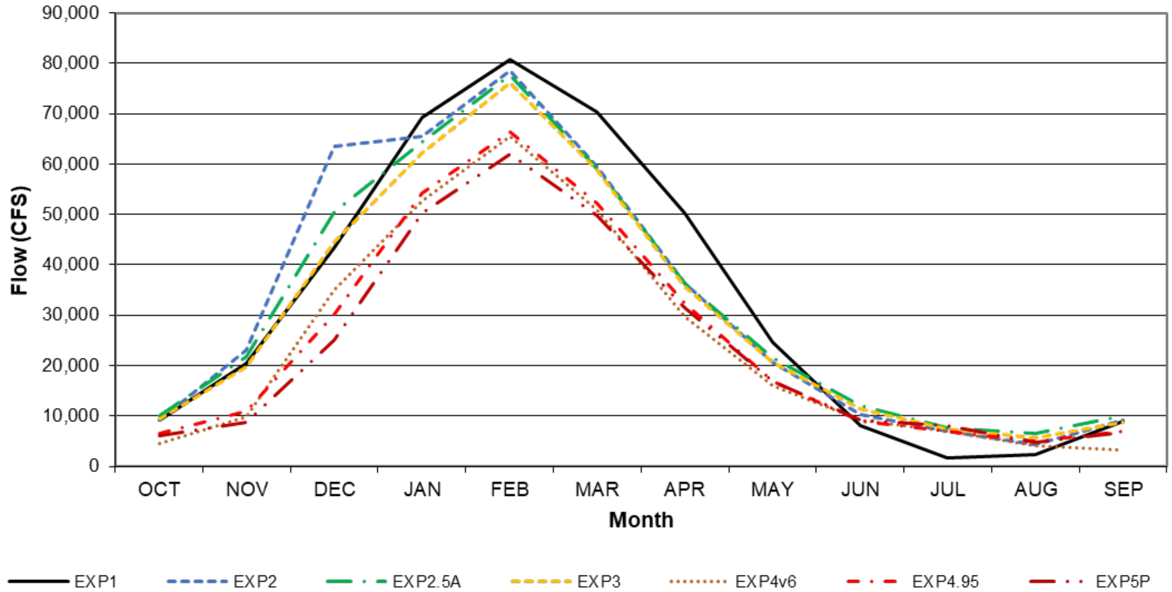


Figure E.2-62. Delta Outflow Monthly Pattern (Long-Term Average)

Delta outflow is mostly reflected by the layers of Shasta and Oroville operations, including spills and storage releases. The patterns resemble those at Hood on the Sacramento River.

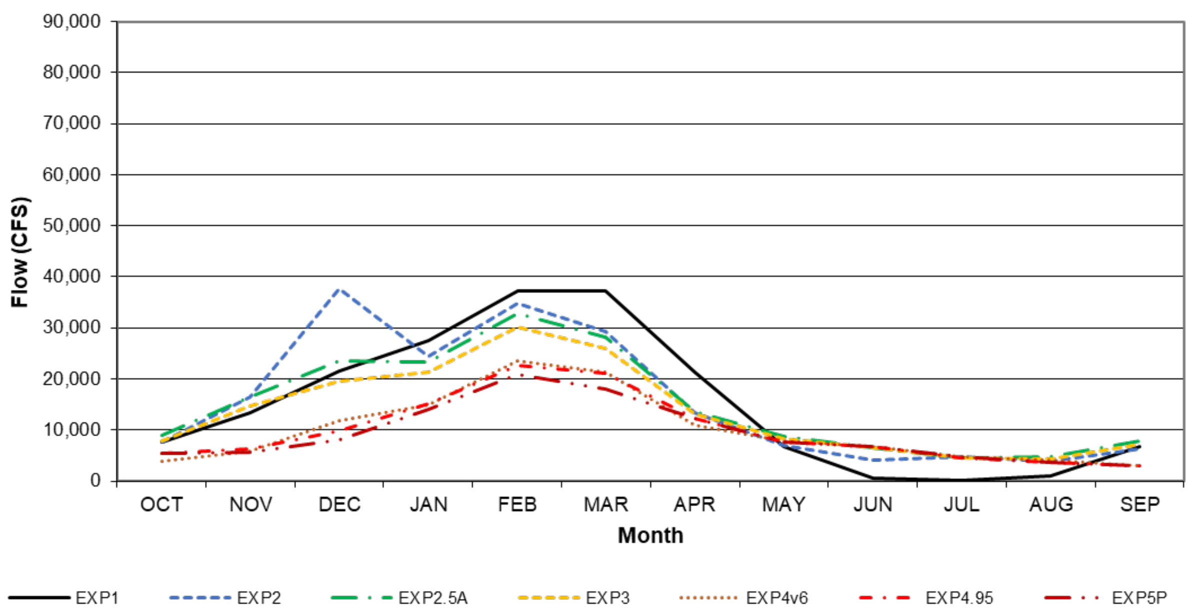
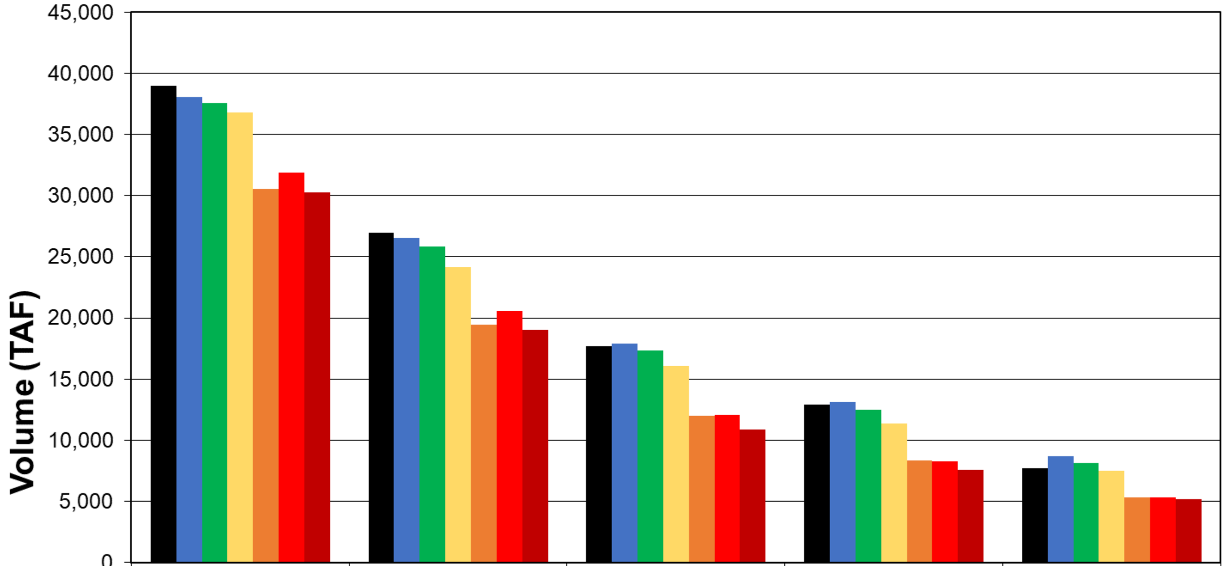


Figure E.2-63. Delta Outflow Monthly Pattern (Dry and Critically Dry Years)

Despite having significantly less flow in dry and critically dry years due to less inflow, the patterns for Delta outflow are the same as those for the long-term averages.



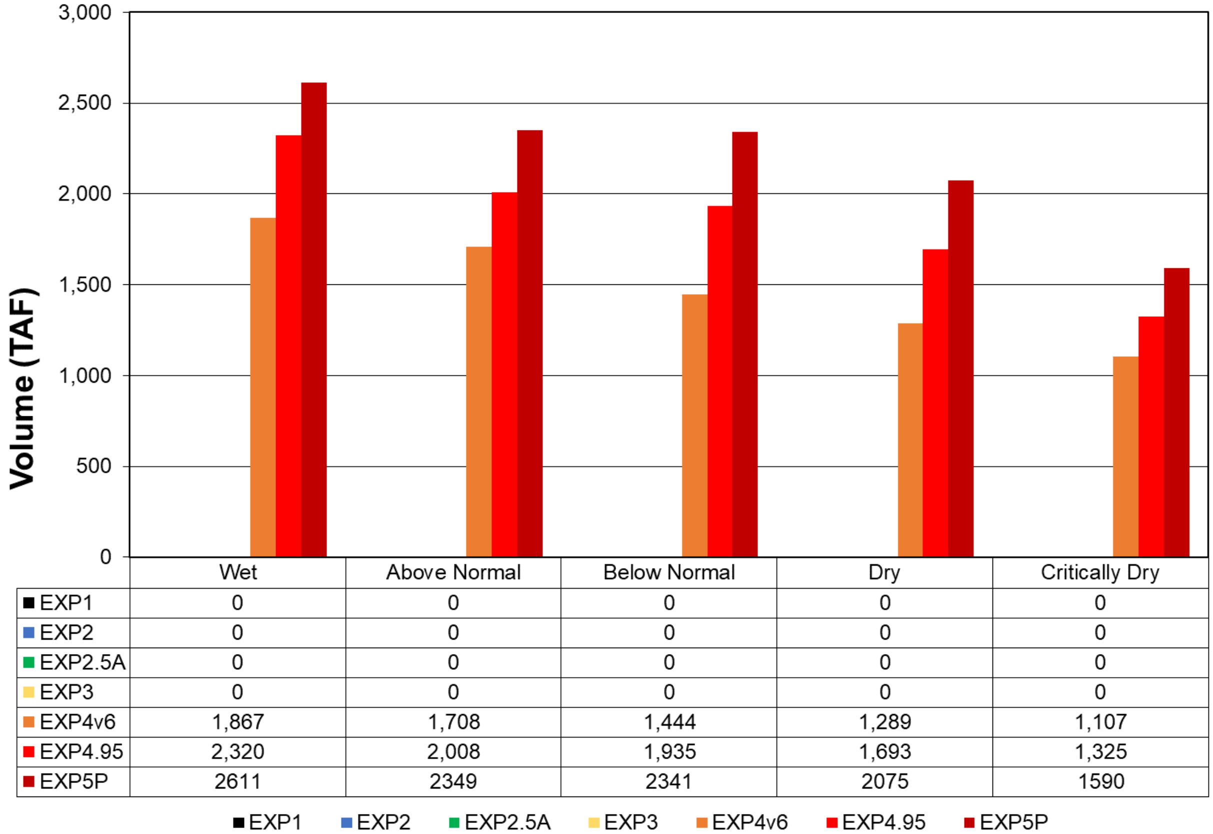
	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	38,956	26,990	17,711	12,908	7,718
EXP2	38,093	26,577	17,904	13,147	8,726
EXP2.5A	37,596	25,814	17,356	12,526	8,117
EXP3	36,832	24,158	16,047	11,361	7,490
EXP4v6	30,582	19,435	11,995	8,322	5,341
EXP4.95	31,880	20,580	12,062	8,283	5,318
EXP5P	30274	19034	10843	7569	5168

Figure E.2-64. Annual Delta Outflow by Water Year Type

EXP1 and EXP2 reflect the hydrology of the system, with diverters only taking water as is available. There is increased Delta outflow in EXP2.5 because storage releases are made to meet D-1641 requirements, including minimum required Delta outflow (MRDO). Each subsequent layer after EXP2.5 has reduced Delta outflow due to increased project responsibilities causing less excess Delta outflow.

E.2.6 South of Delta

E.2.6.1 Exports



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	0	0	0	0	0
EXP2	0	0	0	0	0
EXP2.5A	0	0	0	0	0
EXP3	0	0	0	0	0
EXP4v6	1,867	1,708	1,444	1,289	1,107
EXP4.95	2,320	2,008	1,935	1,693	1,325
EXP5P	2611	2349	2341	2075	1590

Figure E.2-65. Jones Export by Water Year Type

Both versions of EXP4 only export excess water, while EXP5 releases stored water for exports. EXP4v3 does not limit negative flow on the OMR while EXP4v6 does.

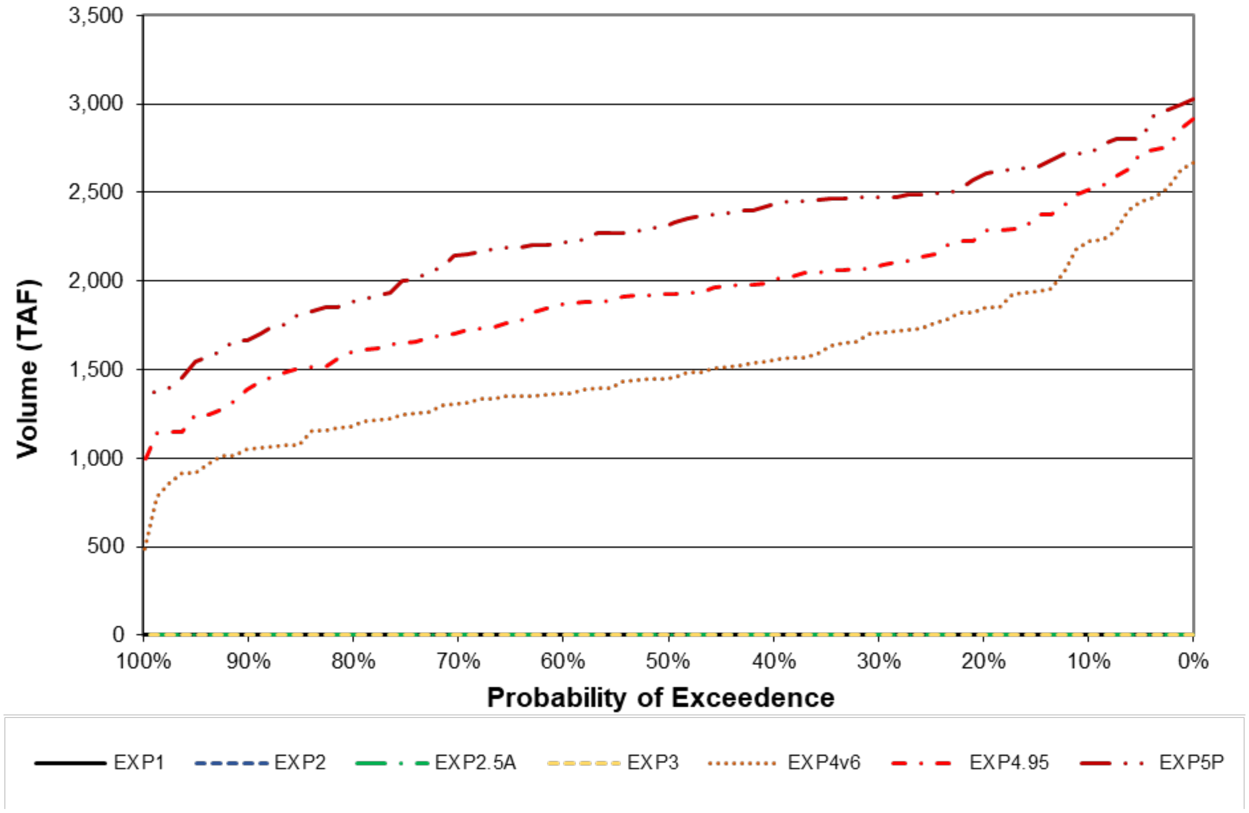


Figure E.2-66. Exceedance of Annual Jones Export (Oct–Sep)

The limits on OMR flows make little difference on the amount of water available for Jones export.

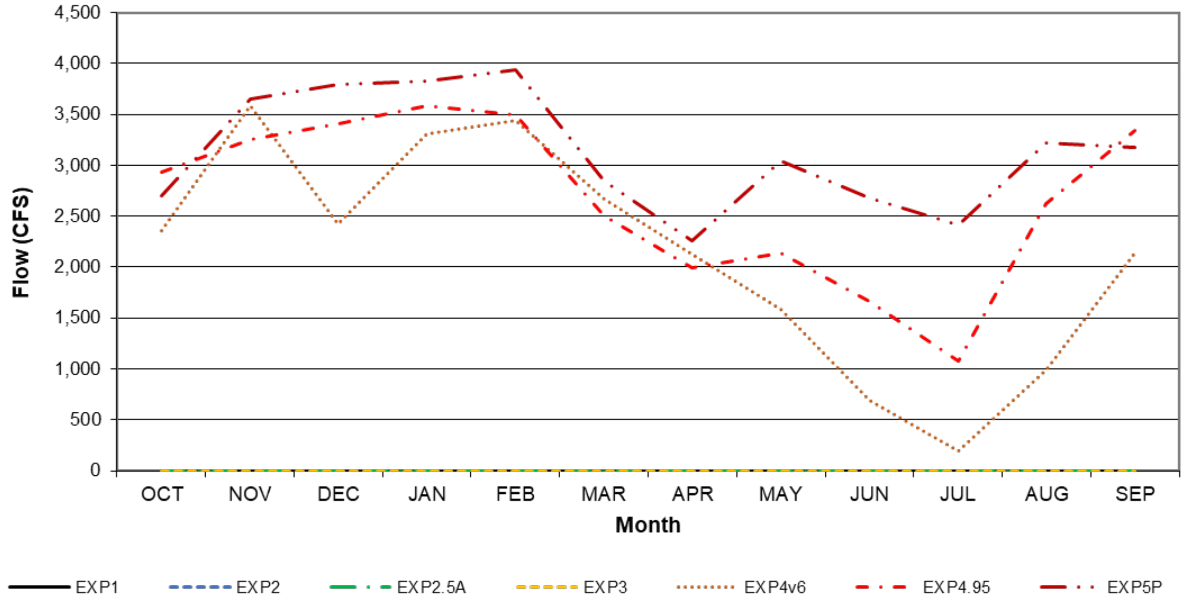
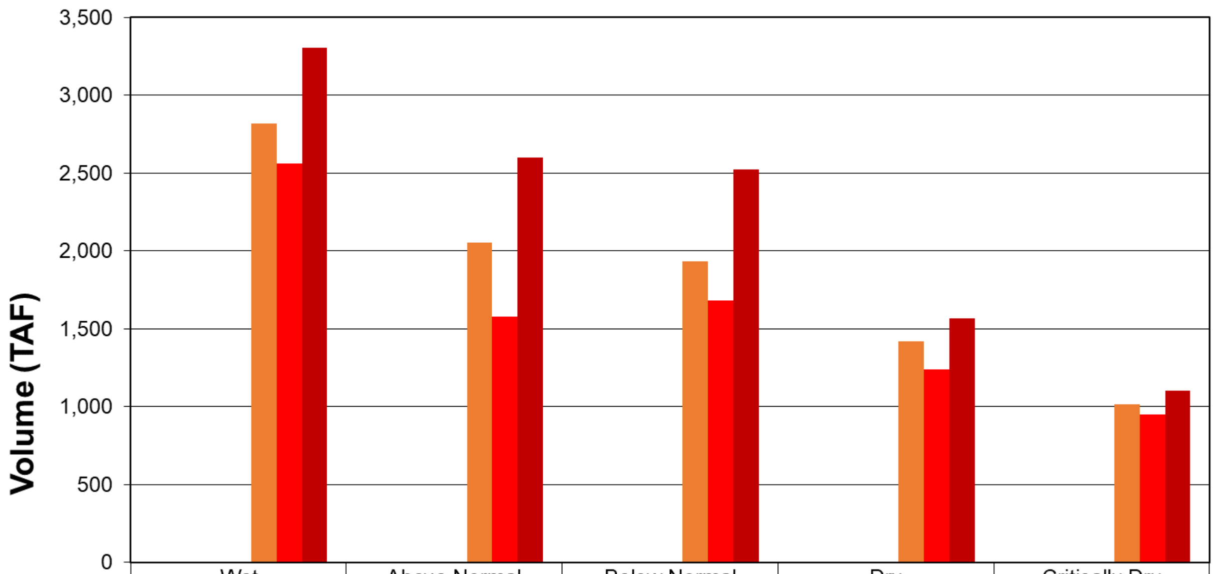


Figure E.2-67. Jones Export Monthly Pattern

The storage releases for Jones exports make additional water available in the summer months.



	Wet	Above Normal	Below Normal	Dry	Critically Dry
EXP1	0	0	0	0	0
EXP2	0	0	0	0	0
EXP2.5A	0	0	0	0	0
EXP3	0	0	0	0	0
EXP4v6	2,818	2,056	1,931	1,419	1,015
EXP4.95	2,561	1,579	1,685	1,237	947
EXP5P	3303	2599	2526	1568	1101

EXP1 EXP2 EXP2.5A EXP3 EXP4v6 EXP4.95 EXP5P

Figure E.2-68. Banks Export by Water Year Type

Greater EXP4v3 Banks export shows that limitations on negative flow in the OMR have a significant impact. Additional discretionary responsibilities in EXP5 decrease the amount of water available for Banks export.

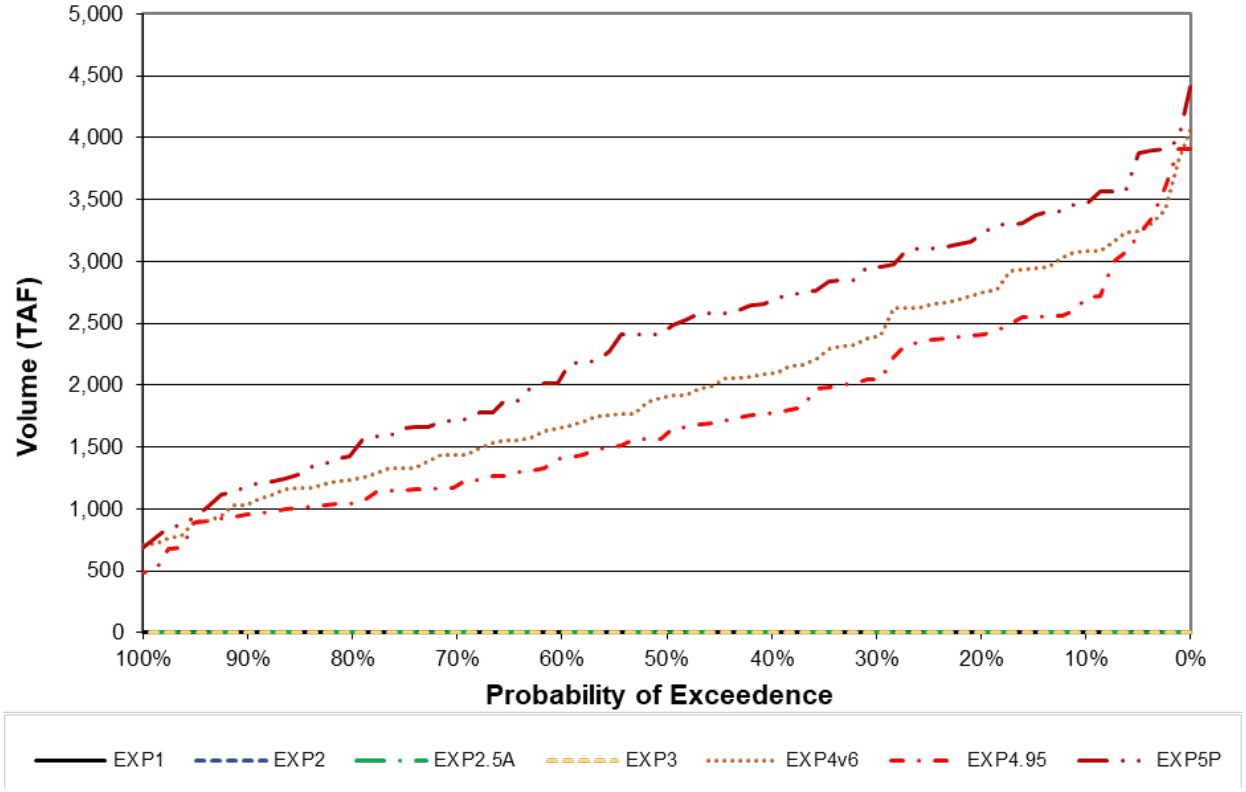


Figure E.2-69. Exceedance of Annual Banks Export (Oct–Sep)

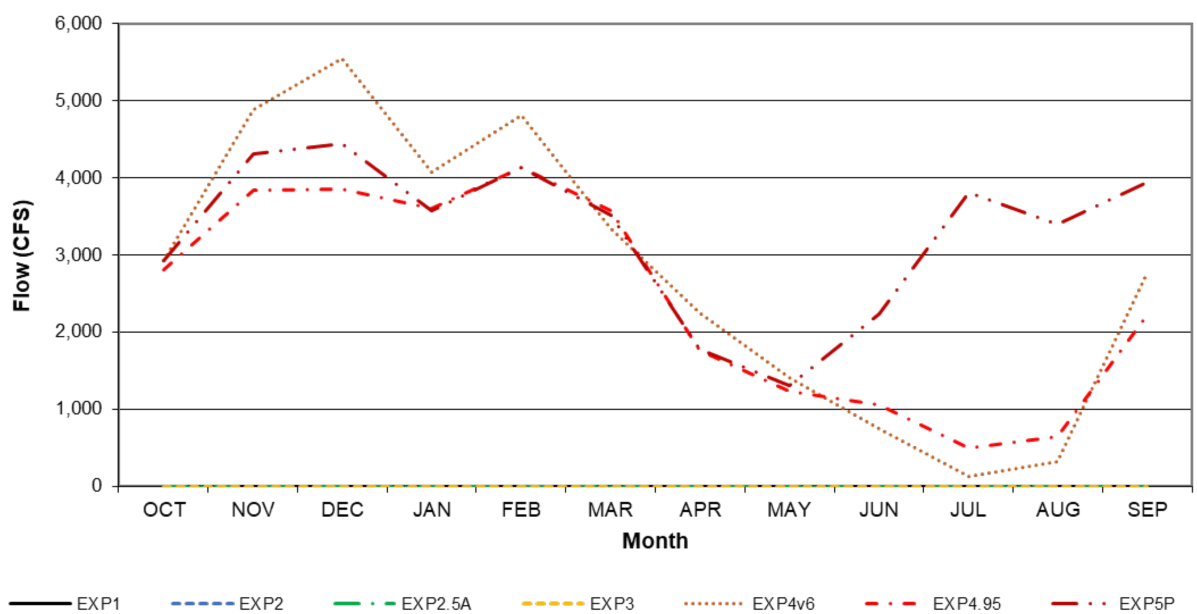


Figure E.2-70. Banks Export Monthly Pattern

EXP5 stores more water in the fill season, reducing the amount of water available for export, but then releases stored water for export in the management season.

E.2.6.2 Deliveries

Table E.2-6. Total (Mar–Feb) SOD CVP Deliveries[a]

Runs	PAG	PMI	PEX	PRF
EXP1	0	0	497	28
EXP2/2.5	0	0	506	40
EXP3	0	0	692	96
EXP4v3	406	36	850	268
EXP4v6	496	48	824	266
EXP5	960	118	855	268

[a] In thousands of acre-feet.
PMI: Project Municipal and Industrial; PAG: Project Agricultural; PSC: Project Exchange Contractors; PRF: Project Refuge.

Deliveries to SOD Project Agriculture (PAG) and Project M&I (PMI) demands are not made until EXP4. Increased exports in EXP4v6 versus EXP4v3 allow for additional deliveries, and full exports in EXP5 further increase the water available for those deliveries. Exchange and refuge deliveries increase as operational capabilities increase across subsequent layers.

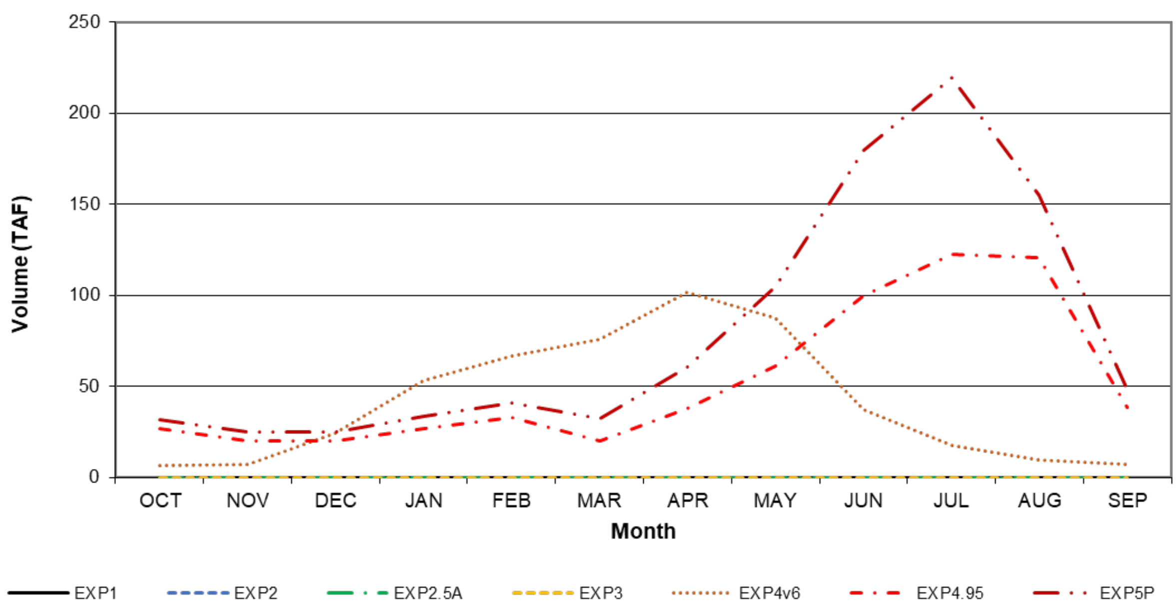


Figure E.2-71. CVP SOD Ag Contractors Delivery Monthly Pattern

Full exports and storage releases in EXP5 increase CVP SOD Ag deliveries in the management season. Decreased flows in the fill season decrease those deliveries.

E.2.7 Exploratory 2 Perspectives

Originally, EXP2 was one step in the exploratory framework that met obligations with inflow and stored everything else, and specifically met delivery to senior water rights first and then meets minimum flow and D-1641 requirements. Based on requests the original EXP2 is now EXP2A; an EXP2B was developed with a reverse order of meeting non-discretionary obligations of minimum flow and D-1641 first, and then delivery to senior water rights holders can be met with any remaining inflow.

EXP2.5—or halfway between EXP2 and EXP3—was also developed as a result of requests. EXP3 meets both delivery to senior water rights and minimum flow requirements and D-1641 by releasing stored water as necessary. EXP2.5 allows for the full satisfaction of D-1641 with releases of stored water, but still does not release stored water for senior deliveries. As with EXP2A and EXP2B, there is also a EXP2.5A and an EXP2.5B, where A first uses inflow for senior water rights and B first uses inflow for minimum flow and D-1641 requirements.

E.2.7.1 Storage

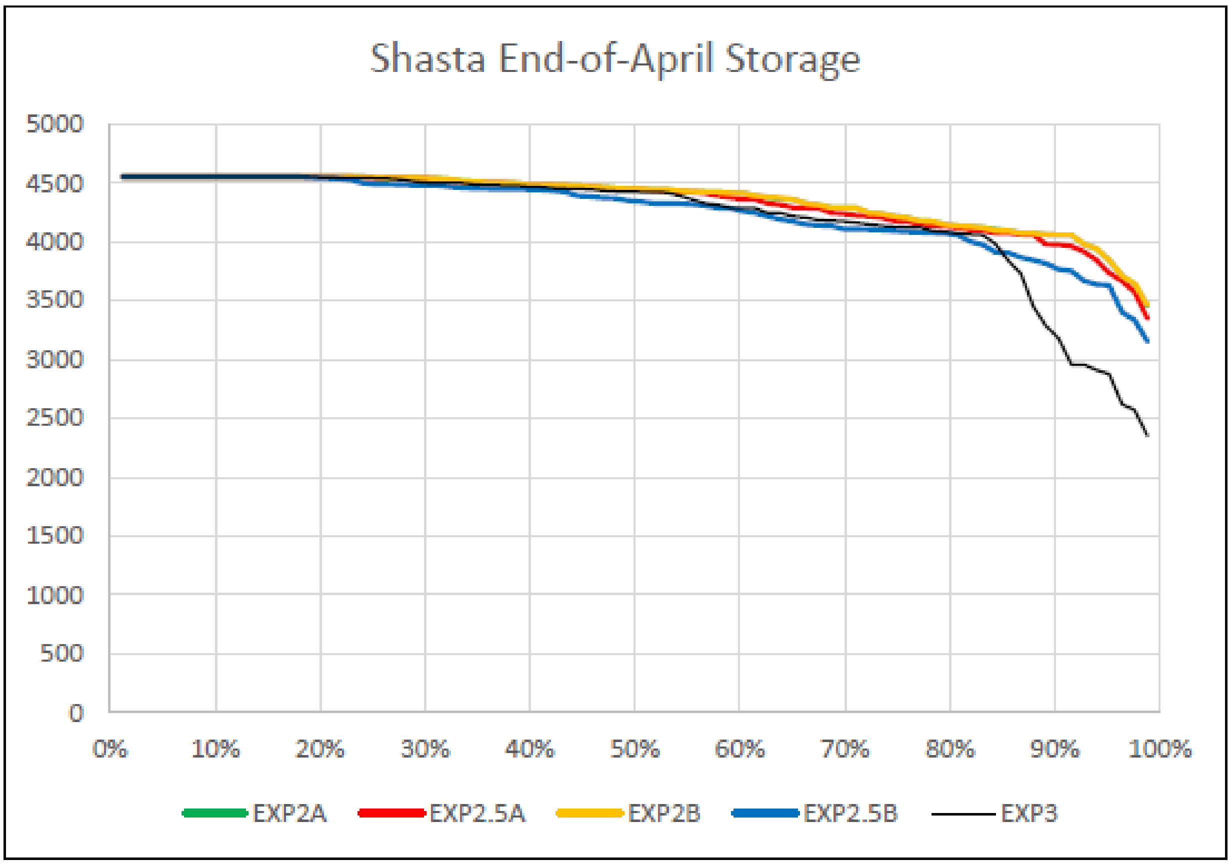


Figure E.2-72. End of April Exceedance for Shasta Storage

In EXP2A and EXP2B, the lines are on top of each other as releases are limited to pass-through inflow; differences will show in deliveries. Because EXP2.5A uses pass-thorough inflow to meet minimum flows and D-1641 first, there is less deficit that would need to be met with stored water than in EXP2.5B where pass-through inflow first goes to meet senior water right deliveries. EXP3 shows further need for storage when deliveries to senior water rights and minimum flow and D-1641 requirements are met.

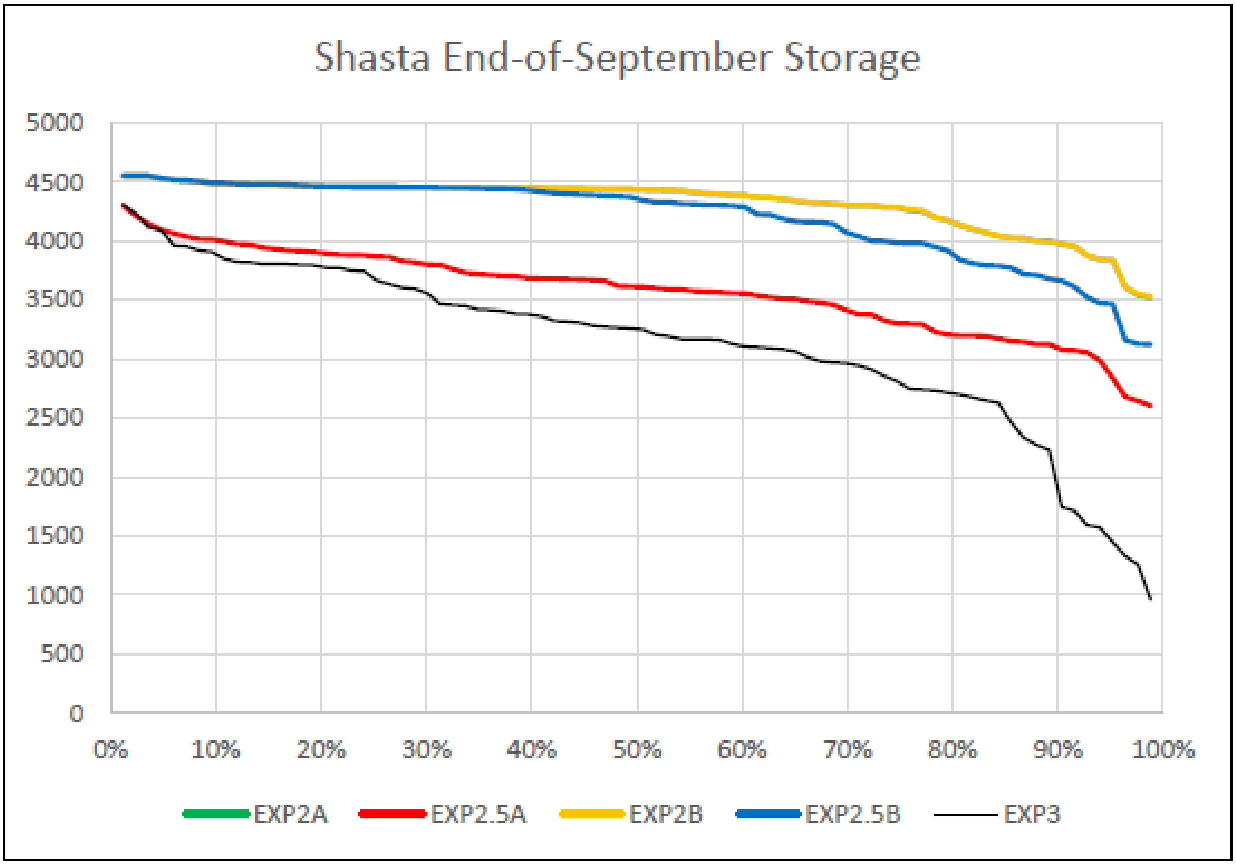


Figure E.2-73. End of September Exceedance for Shasta Storage

By the end of September, the trends described for the end of April still apply but are more pronounced.

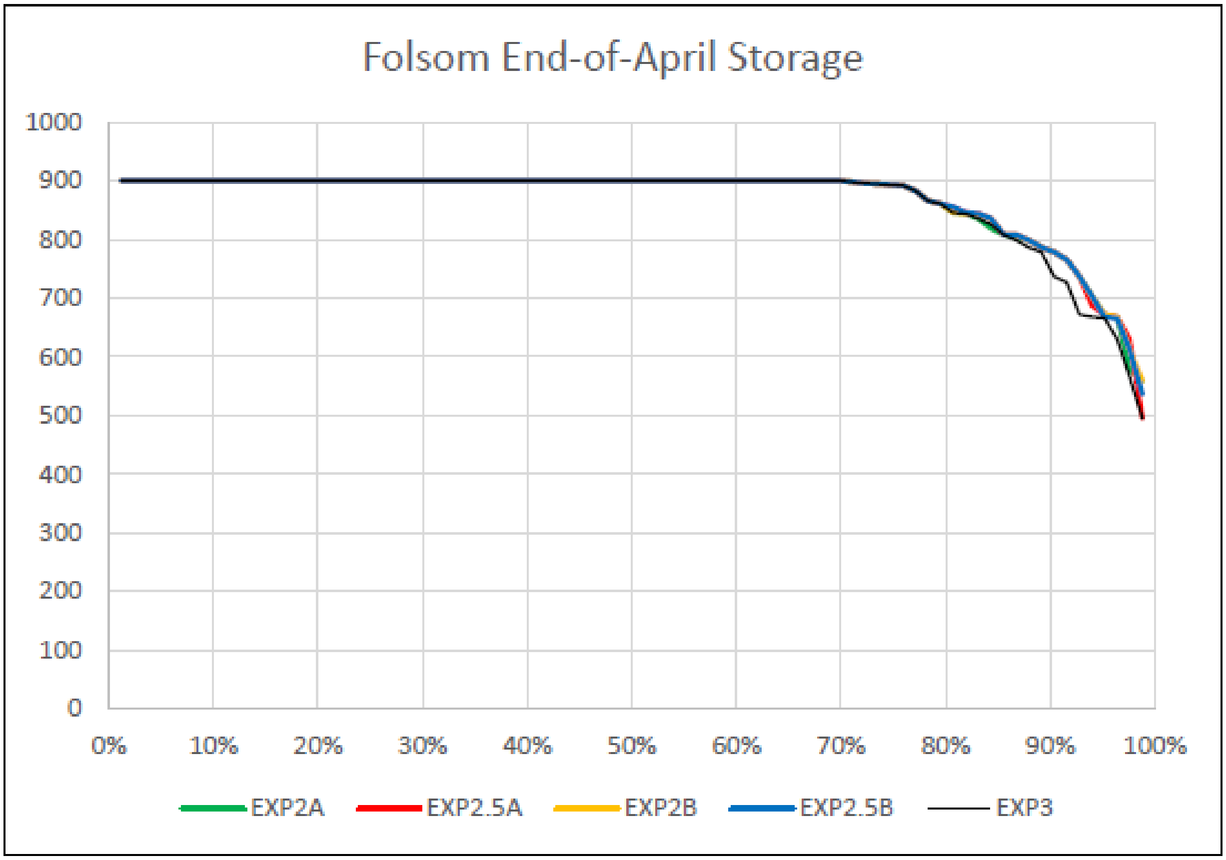


Figure E.2-74. End of April Exceedance for Folsom Storage

Due to Folsom's small size relative to inflow and the low demands on Folsom in the exploratory modeling runs, Folsom fill is mostly consistent in the variations of EXP2 and EXP3.

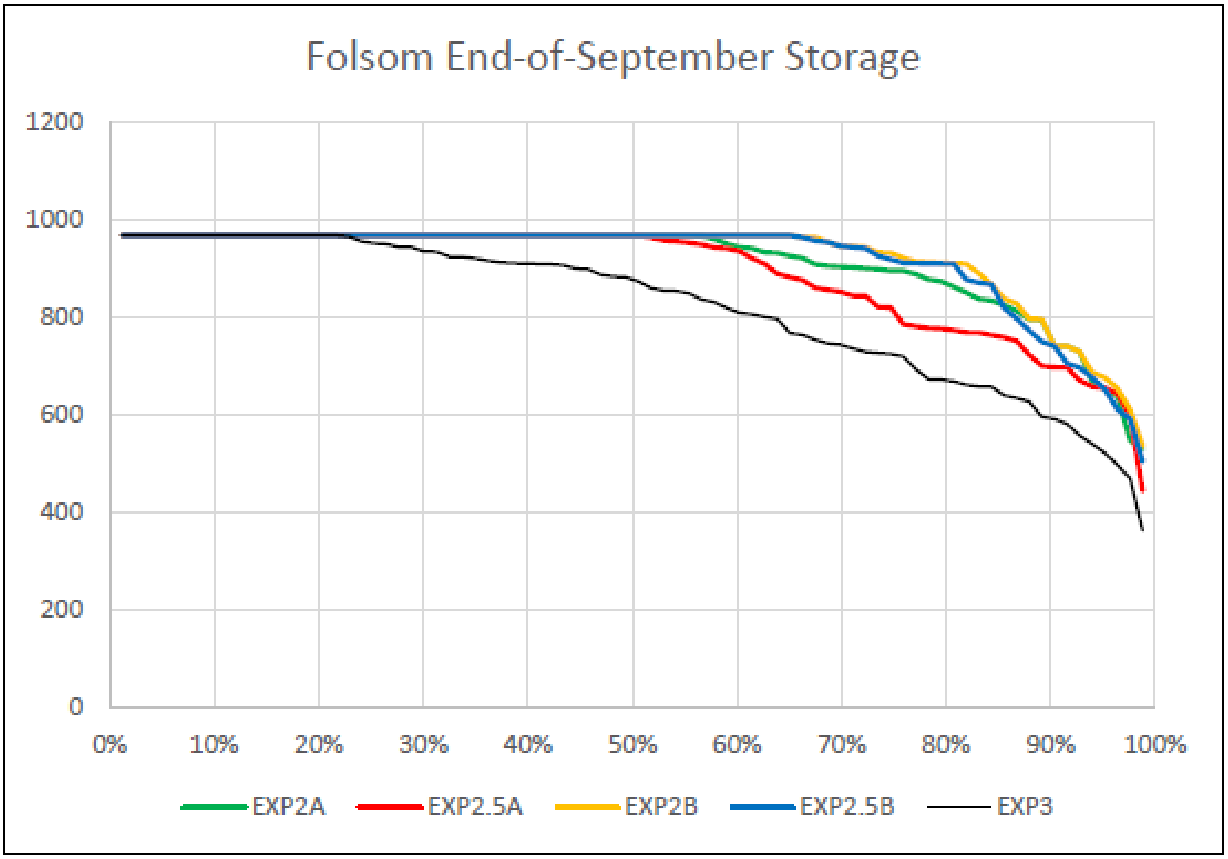


Figure E.2-75. End of September Exceedance for Folsom Storage

When pass-through inflow goes to meet flow and D-1641 first (EXP2B and EXP2.5B), Shasta releases water for requirements on the Sacramento River that only it can meet; this water often continues through the system, reducing the demand on other reservoirs to contribute to the downstream flow requirements. This is why EXP2B and EXP2.5B are generally higher than EXP2A. In EXP2.5A, where pass-through inflow goes to senior water right delivery first, there is enough demand in the system to meet flow and D-1641 requirements that the model can balance between Shasta and Folsom, which shows some additional drawdown to Folsom compared to the other EXP2 runs. EXP3 shows further need for storage when deliveries to senior water rights and minimum flow and D-1641 requirements are met.

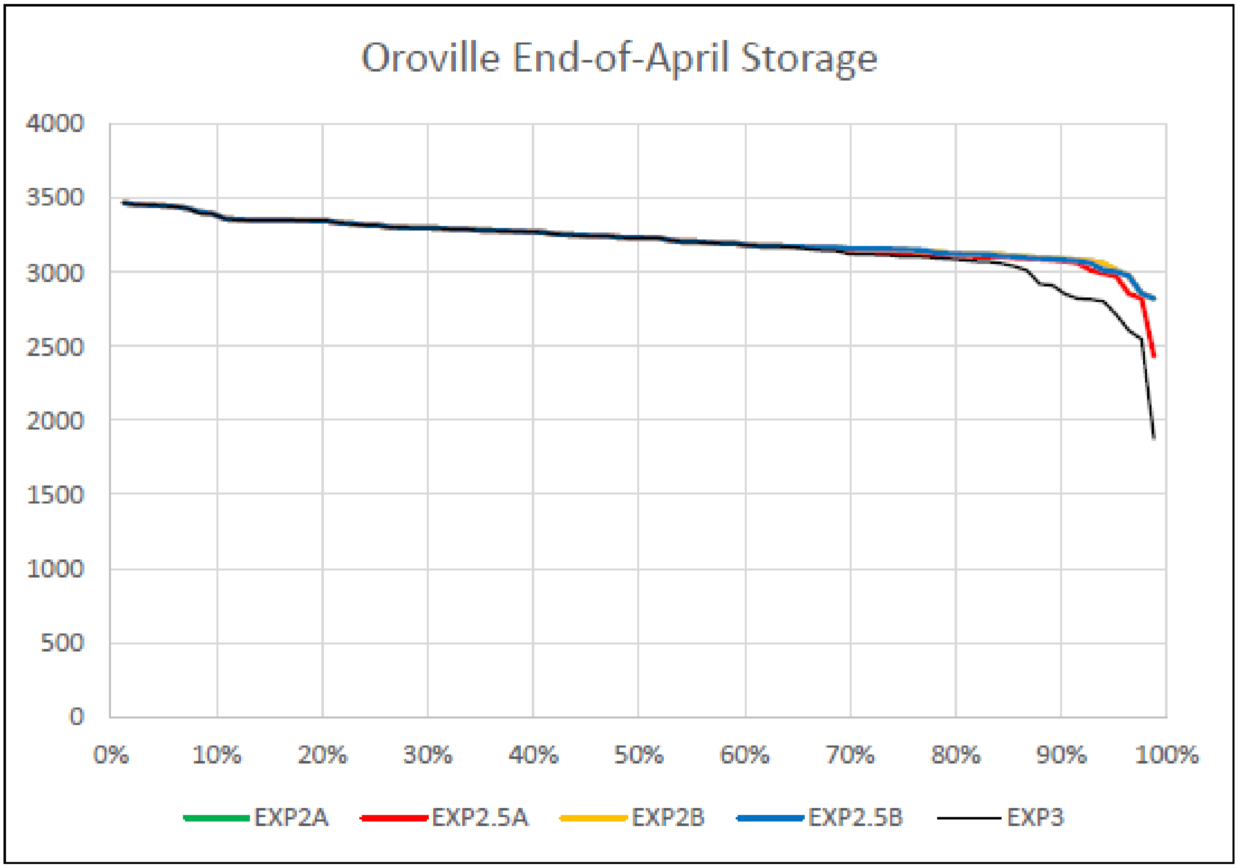


Figure E.2-76. End of April Exceedance for Oroville Storage

Oroville fill is mostly consistent in the variations of EXP2.

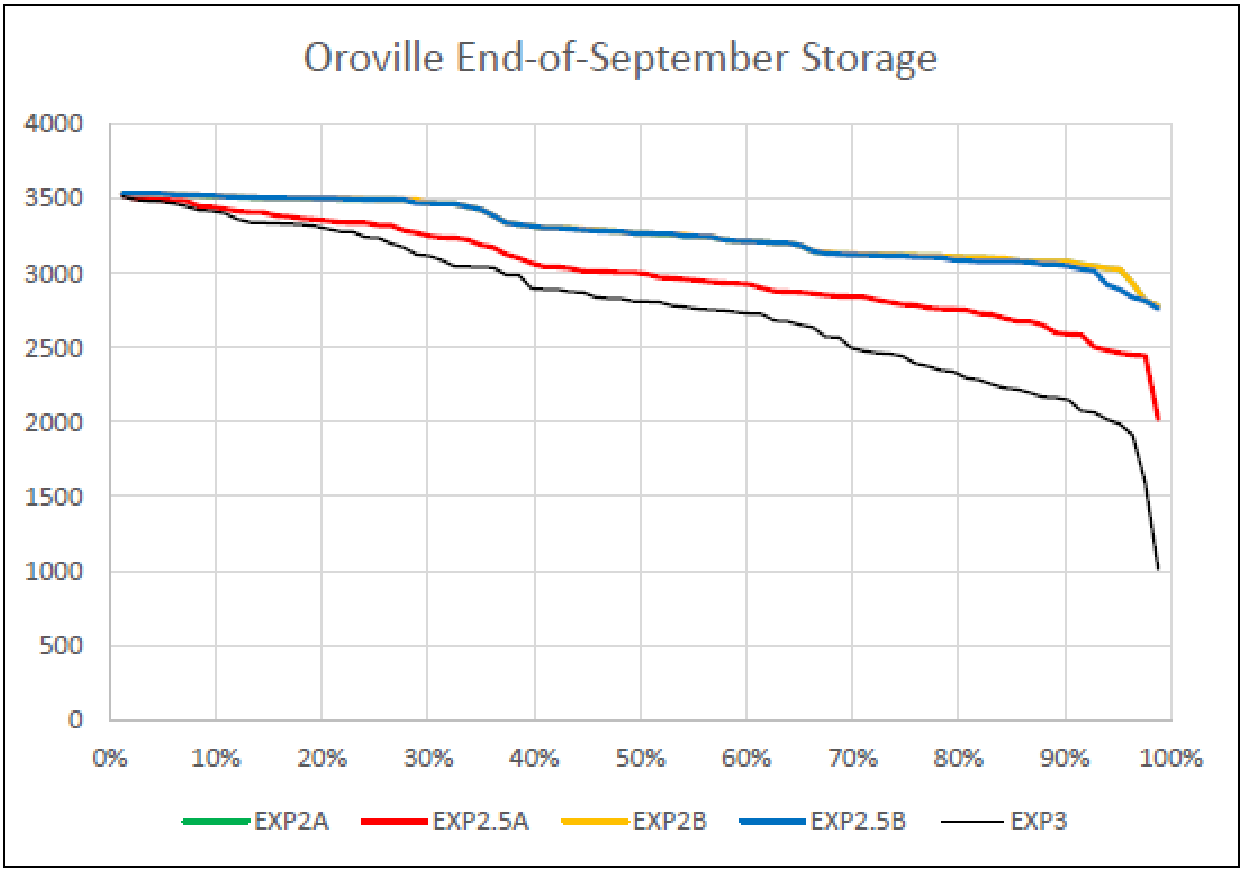


Figure E.2-77. End of September Exceedance for Oroville Storage

When pass-through inflow goes to meet flow and D-1641 first (EXP2B and EXP2.5B), Shasta releases water for requirements on the Sacramento River that only it can meet; this water often continues through the system, reducing the demand on other reservoirs to contribute to the downstream flow requirements. This is why EXP2B and EXP2.5B are very similar to EXP2A. In EXP2.5A, where pass-through inflow goes to senior water right delivery first, there is enough demand in the system to meet flow and D-1641 requirements that the model can balance between reservoirs, which shows some additional drawdown to Oroville compared to the other EXP2 runs. EXP3 shows further need for storage when deliveries to senior water rights and minimum flow and D-1641 requirements are met.

E.2.7.2 Delivery

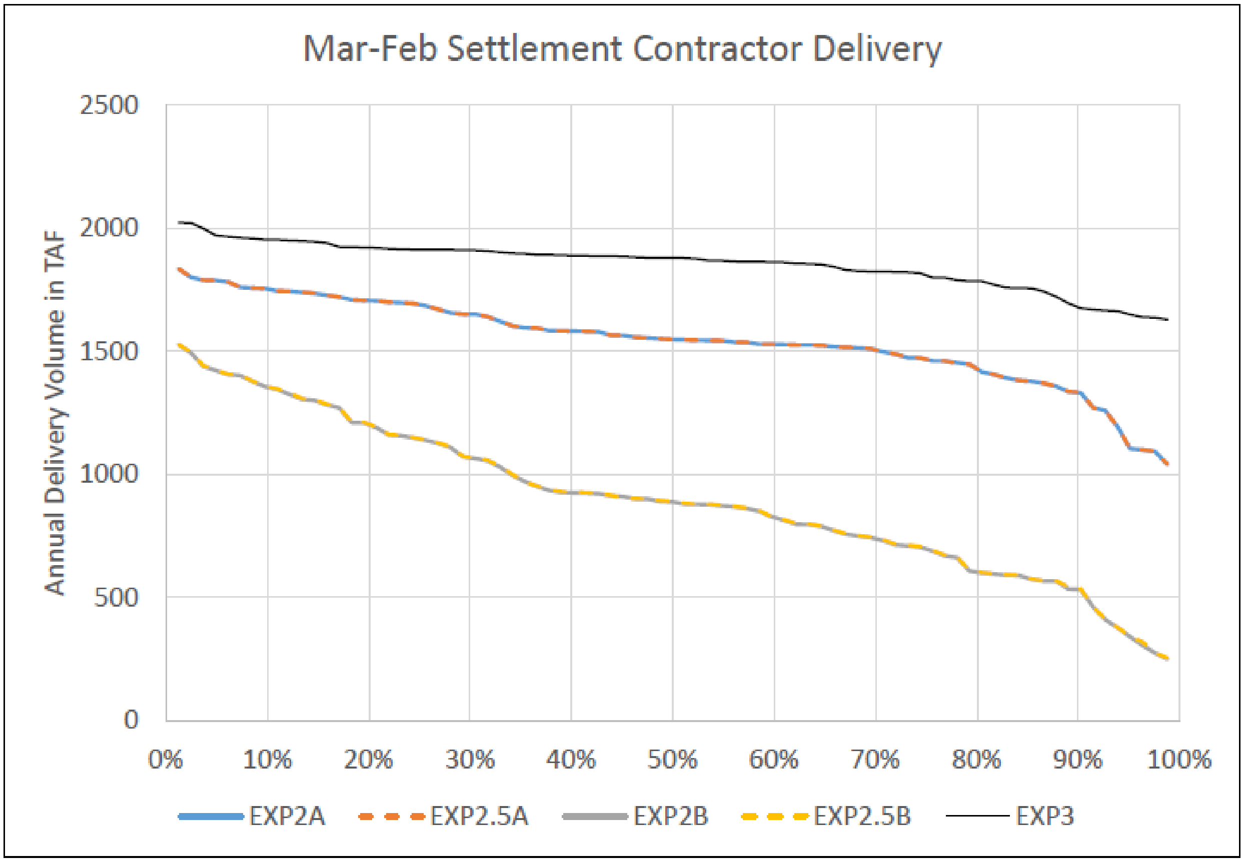


Figure E.2-78. Exceedance of CVP NOD Settlement Contractors Delivery

In EXP3, full CVP Settlement Contractor deliveries are made. In EXP2A and EXP2.5A, deliveries to CVP Settlement Contractors are limited to pass-through inflow, but these deliveries are given the highest priority, resulting in the middle line in the chart above. In EXP2B and EXP2.5B, deliveries to CVP Settlement Contractors are limited to pass-through inflow that is left over after inflow has gone to meet minimum flow and D-1641 requirements.

E.2.8 Exploratory 4 Perspectives

EXP4 informs project operations for water service contract delivery that do not rely upon using stored water. It provides for deliveries based on diversion of water in the system and water previously stored in San Luis Reservoir. Six sensitivities were run on EXP4 to examine different ways of considering how the water could be diverted and used:

- NoOMR_EXRFonly (EXP4v1) – Does not include OMR restrictions on exports. Exports delivered to Exchange Contractors and Refuge Level 2 and then stored in CVP San Luis.
- NoOMR_AllCVP (EXP4v2) – Does not include OMR restrictions on exports. Exports delivered to all water users and then stored in CVP San Luis.

- NoOMR_Reserve (EXP4v3) – Does not include OMR restrictions on exports. Based on the results from EXP4v1, reserve exports and CVP San Luis storage to meet Exchange Contractors and Refuge Level 2; CVP Ag and M&I can take exports and water stored in CVP San Luis that is not needed for Exchange Contractors and Refuge Level 2.
- WithOMR_EXRFonly (EXP4v4) – EXP4v1, but with OMR limits on exports.
- WithOMR_AllCVP (EXP4v5) – EXP4v2, but with OMR limits on exports.
- WithOMR_Reserve (EXP4v6) – EXP4v3, but with OMR limits on exports.

E.2.8.1 Exports

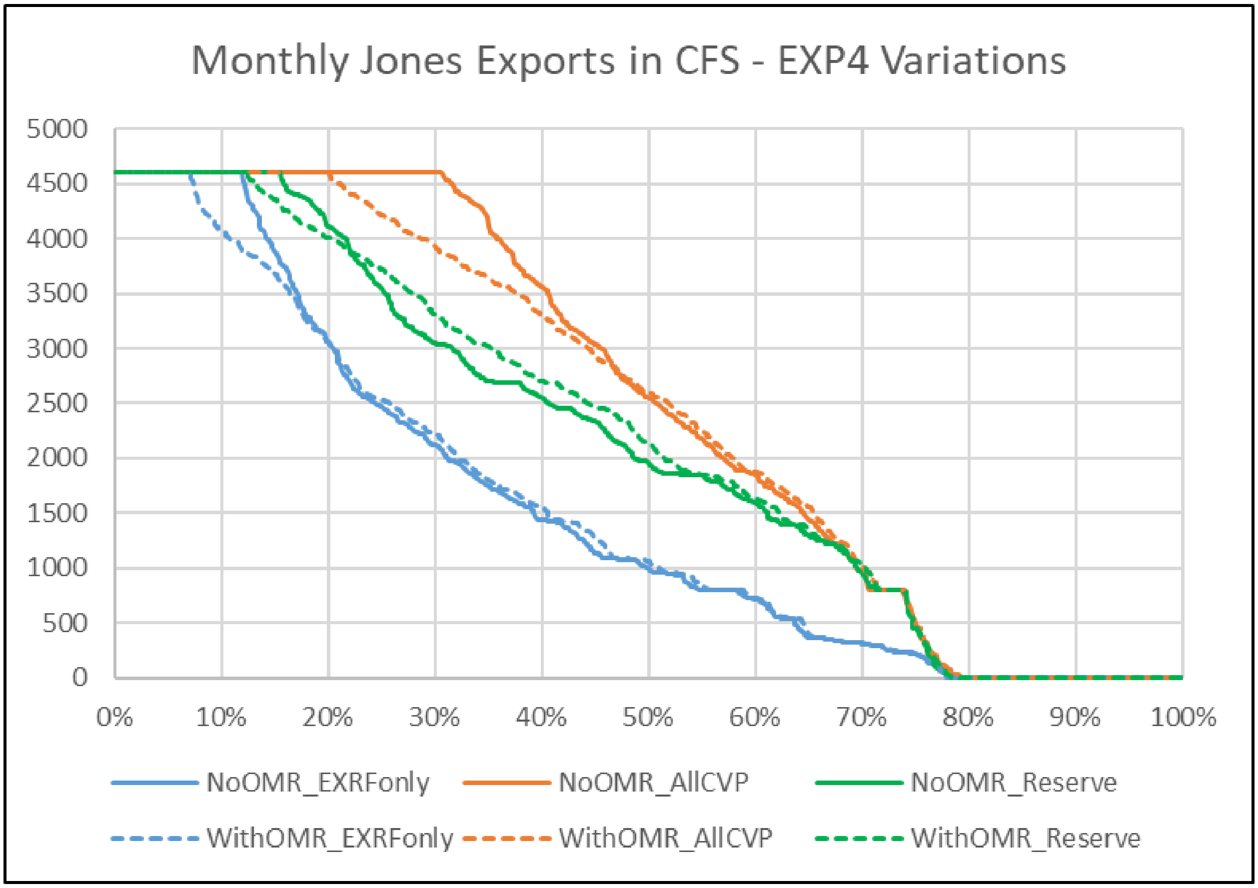


Figure E.2-79a. Monthly Jones Exports Exceedance

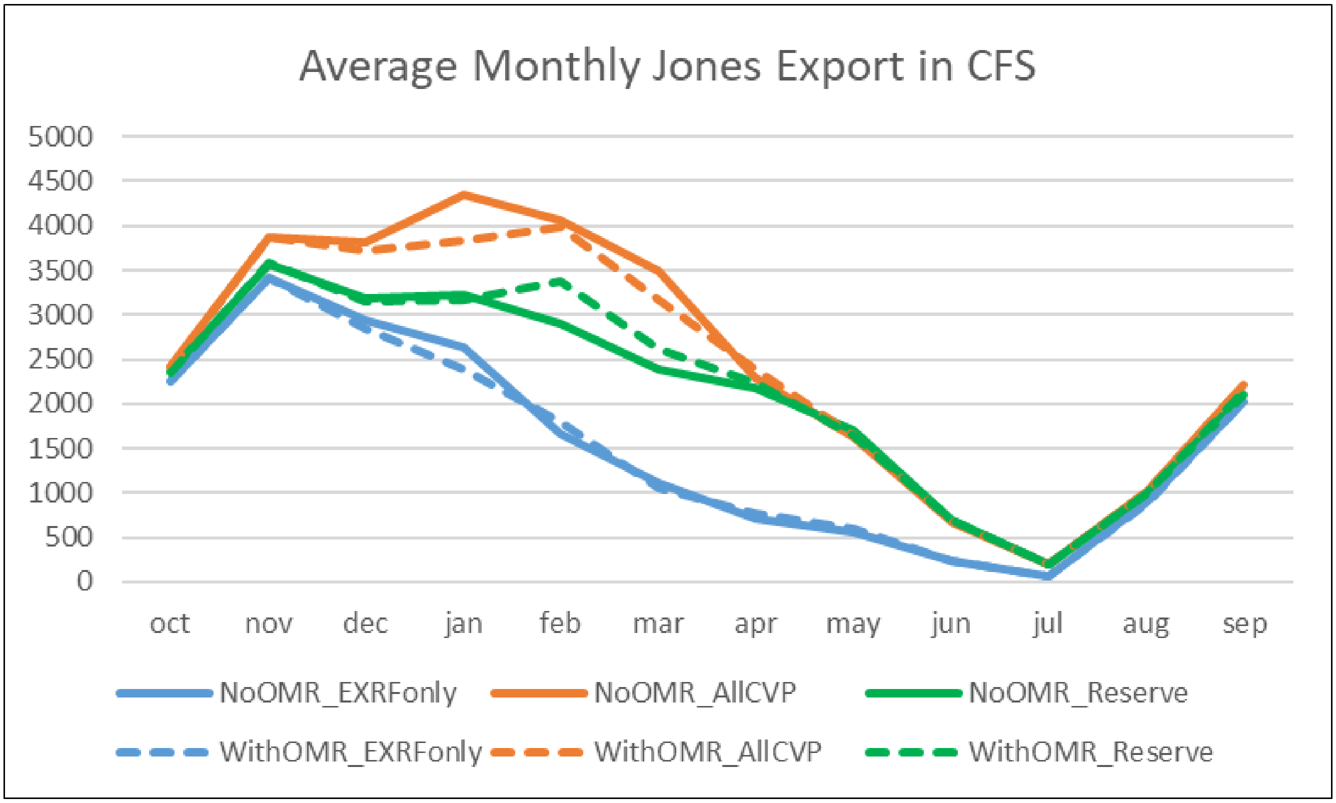


Figure E.2-80b. Jones Export Monthly Pattern (bottom)

The difference between the solid and striped lines is the impact of OMR. The _AllCVP runs have the highest export, because they have the most opportunities to use the water, the _Reserve runs are slightly lower because of the operation to reserve water to meet Exchange and Refuge, and the _EXRFonly runs have the lowest because there is less demand for the exported water.

E.2.8.2 Delivery

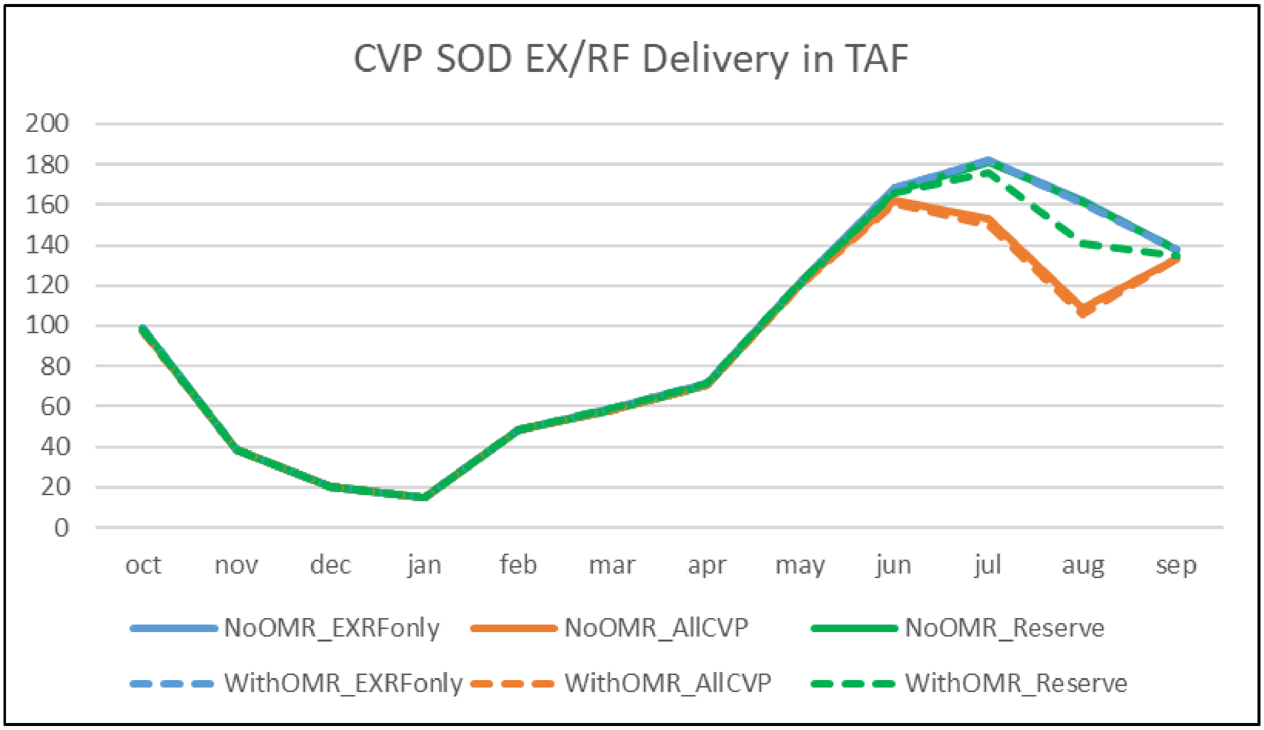


Figure E.2-81. CVP SOD Delivery to Exchange and Refuge Monthly Pattern

Exchange and Refuge deliveries are the same in the _EXRFonly and Reserve runs, as the Reserve runs are set based on the _EXRFonly runs. Deliveries to Exchange and Refuge are lower in the _AllCVP runs as there is more competition for the water.

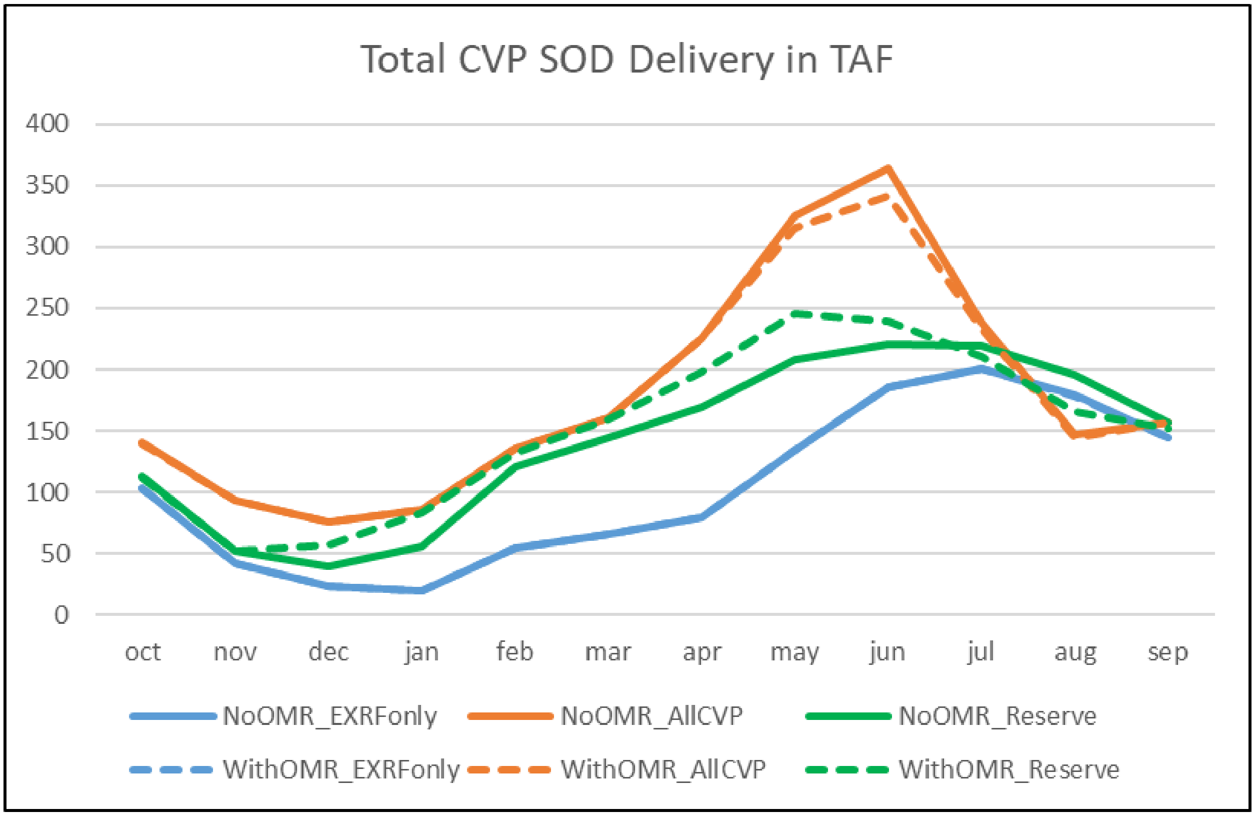
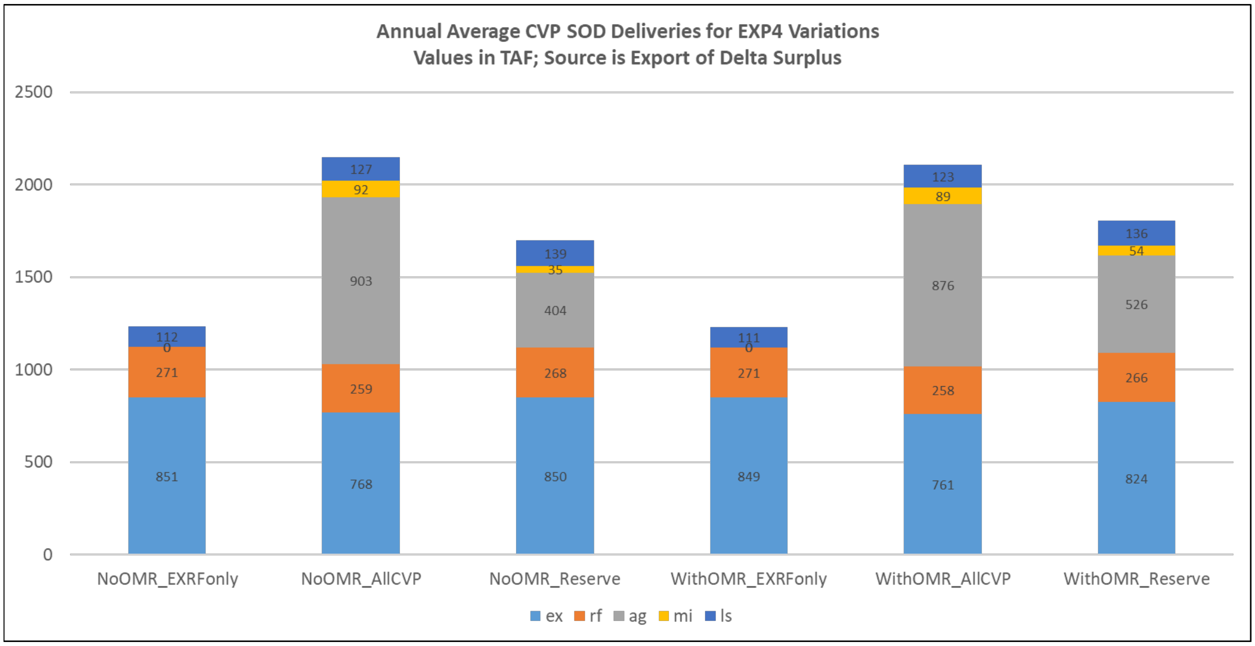


Figure E.2-82. CVP SOD Delivery Monthly Pattern



ex = Project Exchange Contractors; rf = Project Refuge; ag = Project Agricultural; mi = Project Municipal and Industrial; ls= losses

Figure E.2-83. CVP SOD Delivery by Type

The variations in EXP4 show the potential delivery SOD when just using water that would otherwise be Delta surplus. The model shows that Reclamation can mostly meet the SOD senior water rights to the Exchange Contractors and South of Delta Refuge demands with just surplus water. The _All CVP alternative does result in further reductions to the senior water rights, as water is not reserved to meet their needs.

E.2.9 References

State Water Resources Control Board. 2017. *Scientific Basis Report in Support of New and Modified Requirements for Inflows from the Sacramento River and its Tributaries and Eastside Tributaries to the Delta, Delta Outflows, Cold Water Habitat, and Interior Delta Flows*. Final. Sacramento, CA.