American River Basin Study (ARBS)

ARBS Update

ARB IRWM

April 27,2020

CITY OF FOLSOM DISTINCTIVE BY NATURE

PCWA water • energy • stewardship

City of SACRAMENTO

RWA Regional Water Authority

CITY OF ROSEVILLE CALIFORNIA

EL DORADO COUNTY WATER AGENCY

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

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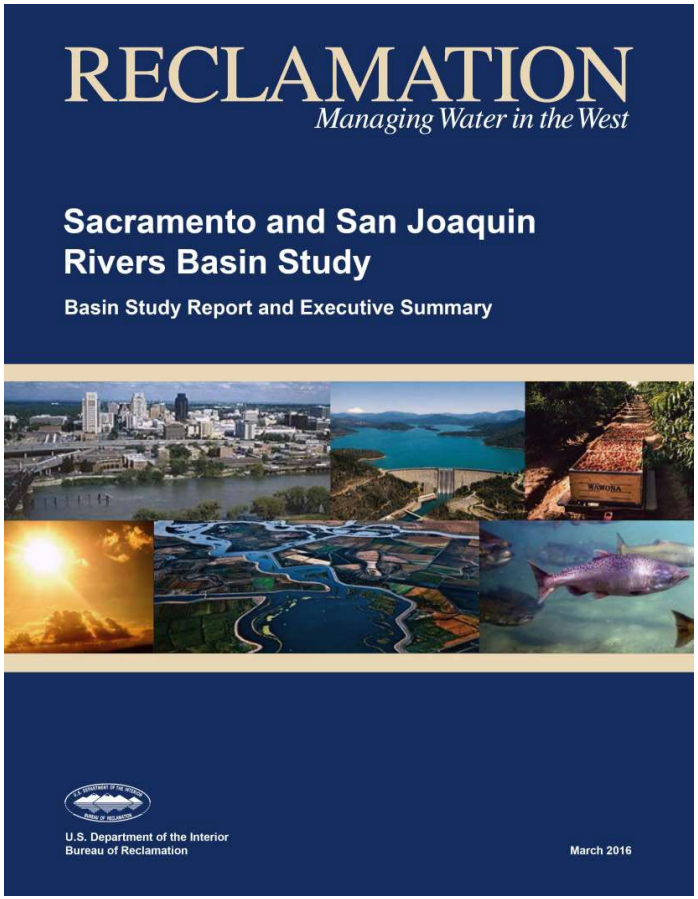
WaterSMART Basin Studies

Focus

- Evaluate the impacts of **climate change** and help ensure sustainable water supplies by identifying strategies to address **imbalances** in water supply and demand.
- Basins and subbasins in the 17 western states.

Benefits

- The resulting **recommendations** DO NOT constitute Federal decisions or authorization; however, further feasibility studies for such purposes are possible under the authorizing legislation.



- Sac-San Joaquin Basin Study completed in 2016
- Reclamation released funding in 2016 to perform studies at local watershed scales

Local Partners Pursued Funding Opportunity for American River Basin

- City of Folsom
- City of Roseville
- City of Sacramento
- El Dorado County Water Agency
- Placer County Water Agency
- Regional Water Authority

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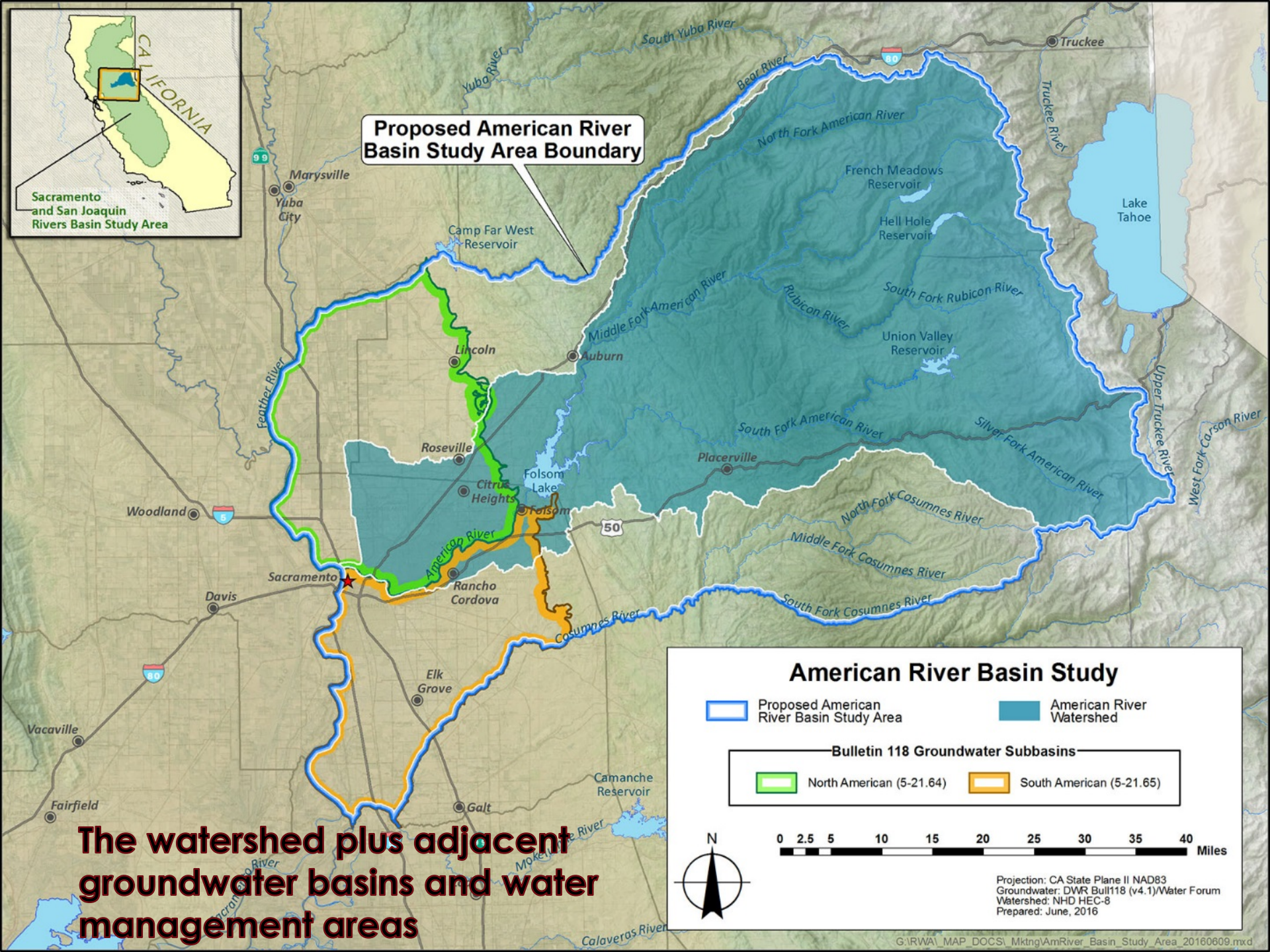

The watershed plus adjacent groundwater basins and water management areas

Study Objectives

1. Further refine the assessment of water supplies and demands for the American River Basin
2. Address regional **demand-supply imbalance** and infrastructure deficiencies under the existing and **future climate change conditions**.
3. Improve **coordination of local and Federal water management**.
4. Align water management tools, strategies, and planning efforts of Reclamation and water agencies in the basin.
5. Identify water management strategies and actions that remain functional across multiple future potential climate and socioeconomic conditions to 2100 AD.

ARBS Anticipated Outcomes

- **Consistent modeling data and tools** for Federal and Regional planning in the American River Basin (climate change hydrology, upper watershed operations, and temperature).
- **Supply-demand imbalance** at build-out under climate change conditions
- **Evaluation of adaptations** ability to reduce imbalances (includes long-term projects listed in RWRP such as RiverArc, regional groundwater bank)

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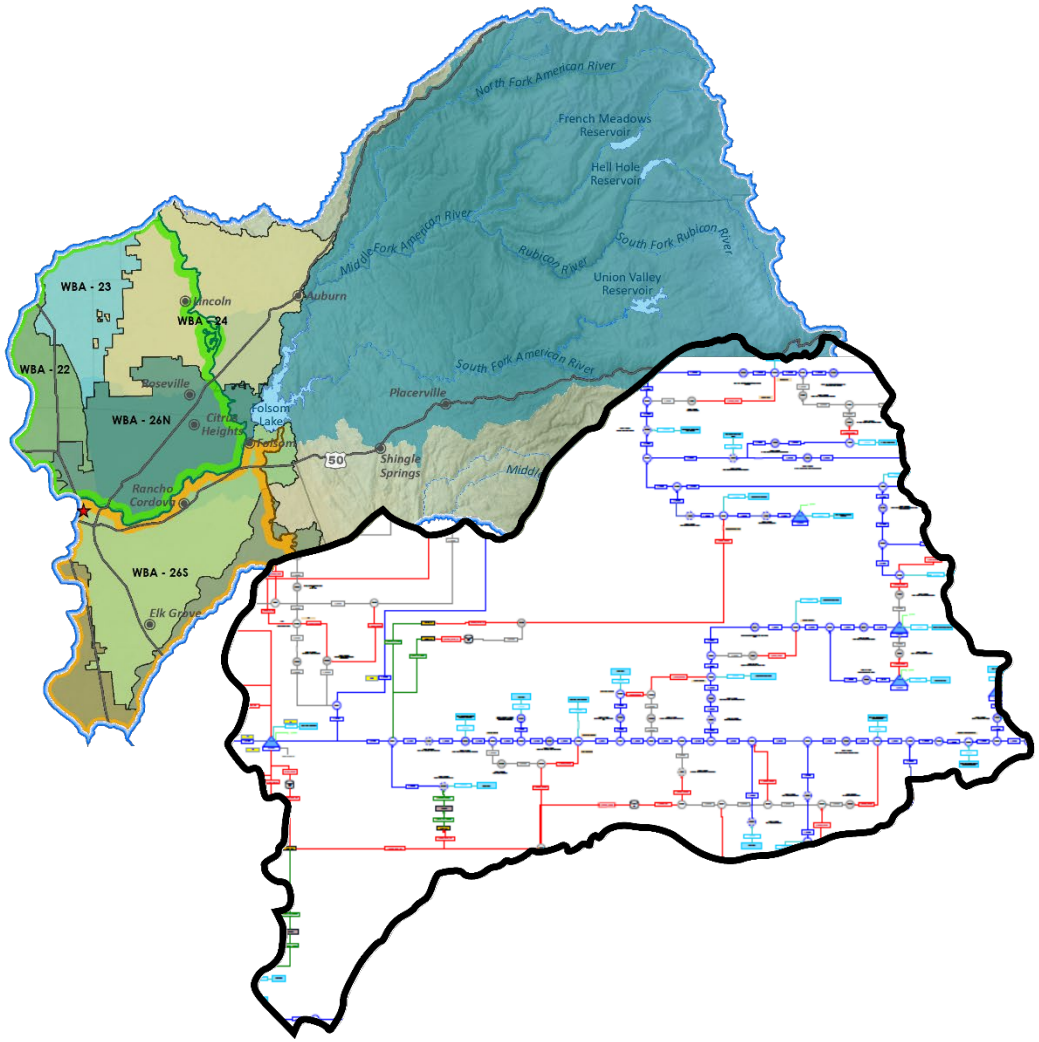
The ARBS is the First Major Application of CalSim 3.0.



CalSim 3.0 can directly incorporate **land use** and **climate change** projections in calculating future demands.

CalSim 3.0 incorporates a **Groundwater** Module, which allows for the simulation of conjunctive use.

CalSim 3.0 allows for the integrated modeling of **systemwide operations**, including the American River Basin.

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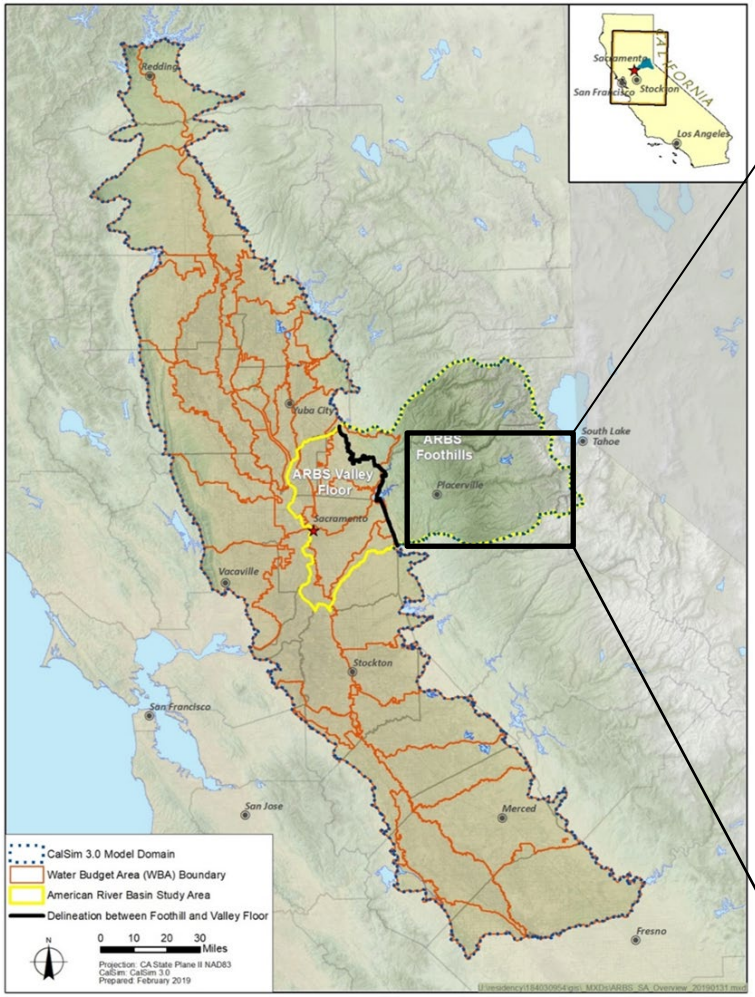
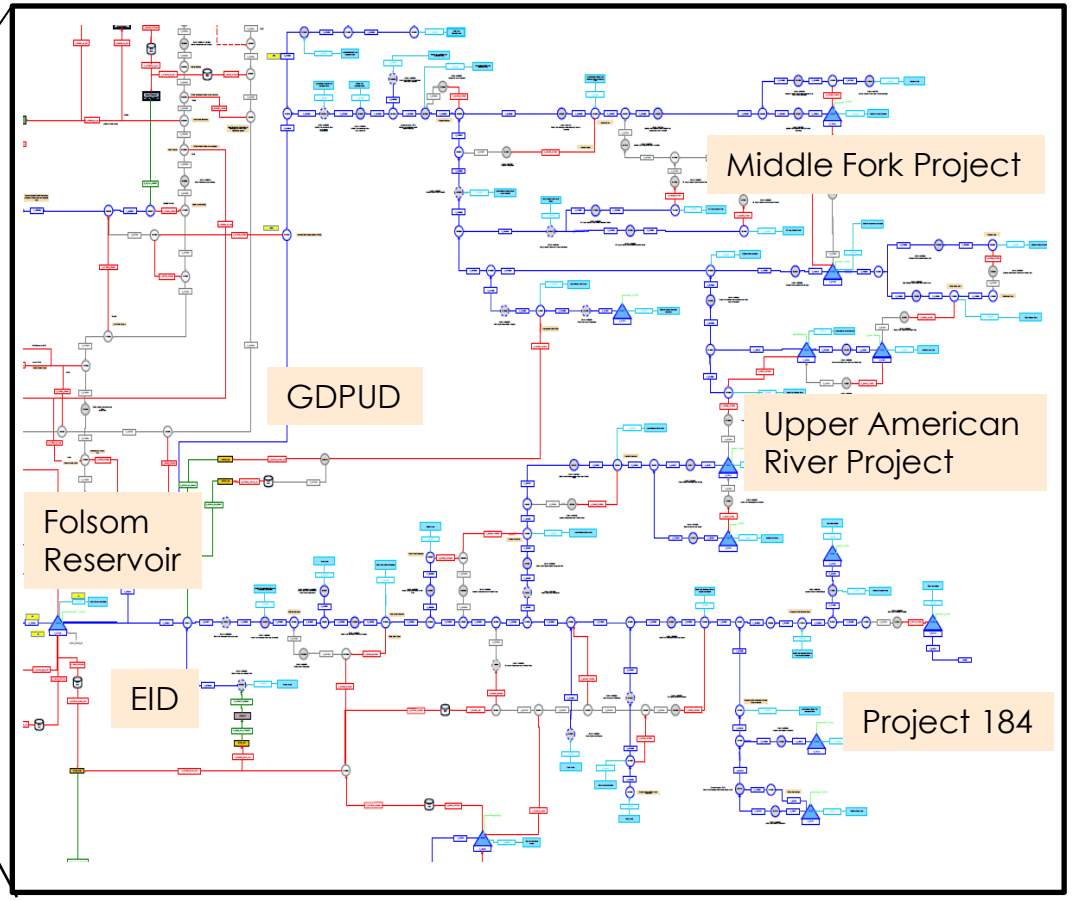
CalSim III Updates

Complete representation of operations in the American River Basin

CalSim III Domain



CalSim III Model Schematic



Mapped OASIS (ARIOps) system operations to CalSIM3

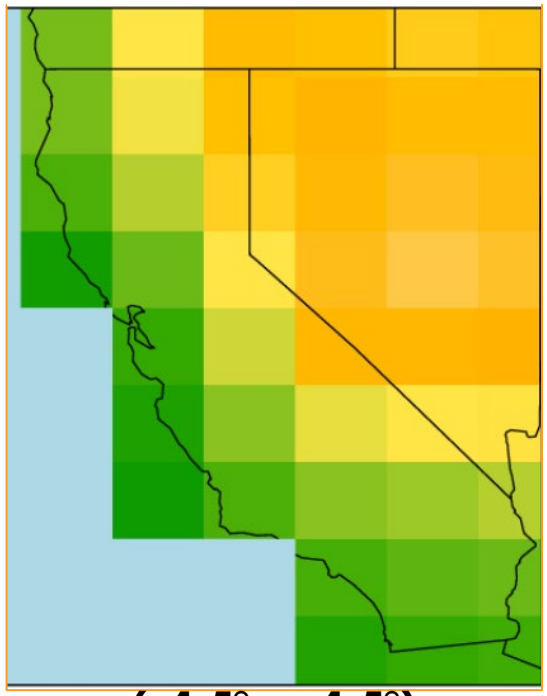
Downscaled Climate Projections

LOCA Multi-Model Dataset

- 32 Global Climate Models
- 2 long-term emissions scenarios
- Developed at Scripps, publicly available through web-portal
- Recommended by DWR and CWC for long-term planning in California

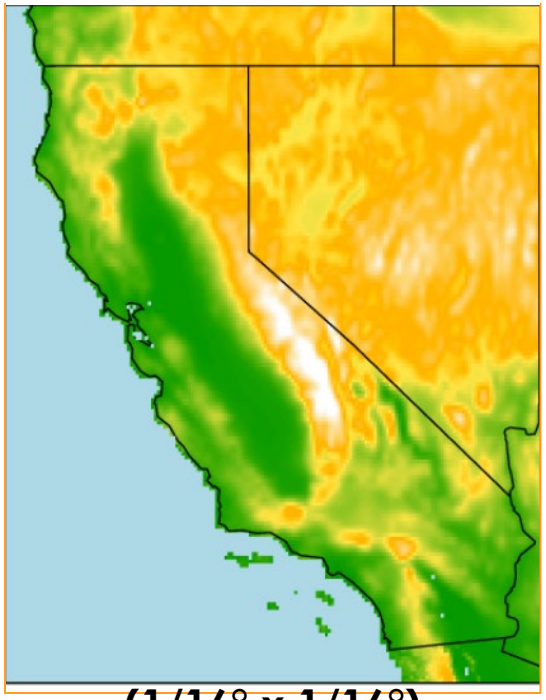
Spatial Downscaling

Typical GCM

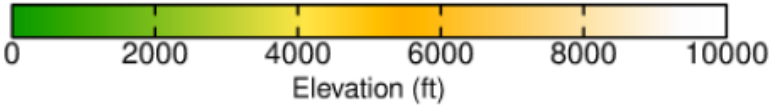


(~1.5° x ~1.5°)

LOCA



(1/16° x 1/16°)



Future Climate Scenarios

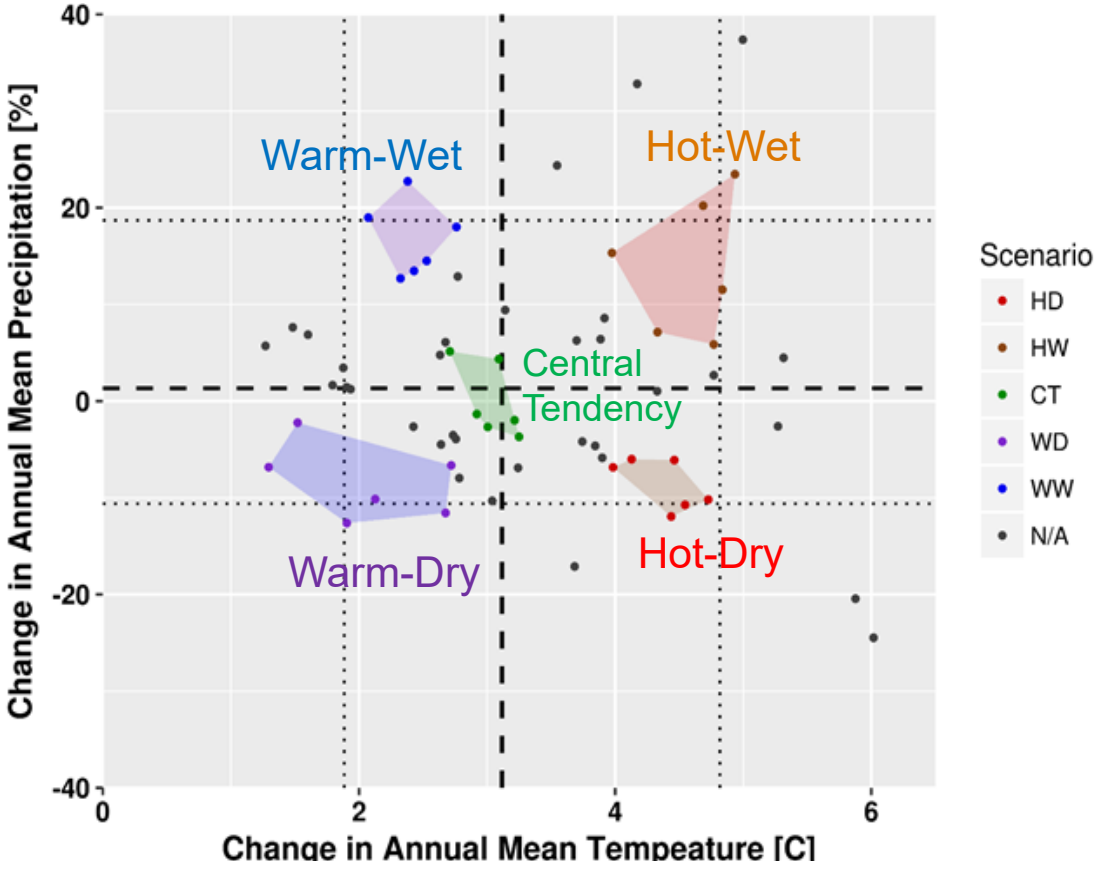
California future climate projections predict:

- Increase in temperature
- Uncertainty in amount of precipitations

Future climates reflect:

- 2 scenarios for global growth of greenhouse gases
- 32 global climate models
- Multiple initial climate conditions

To describe the full range of climate futures 5 scenarios are developed.



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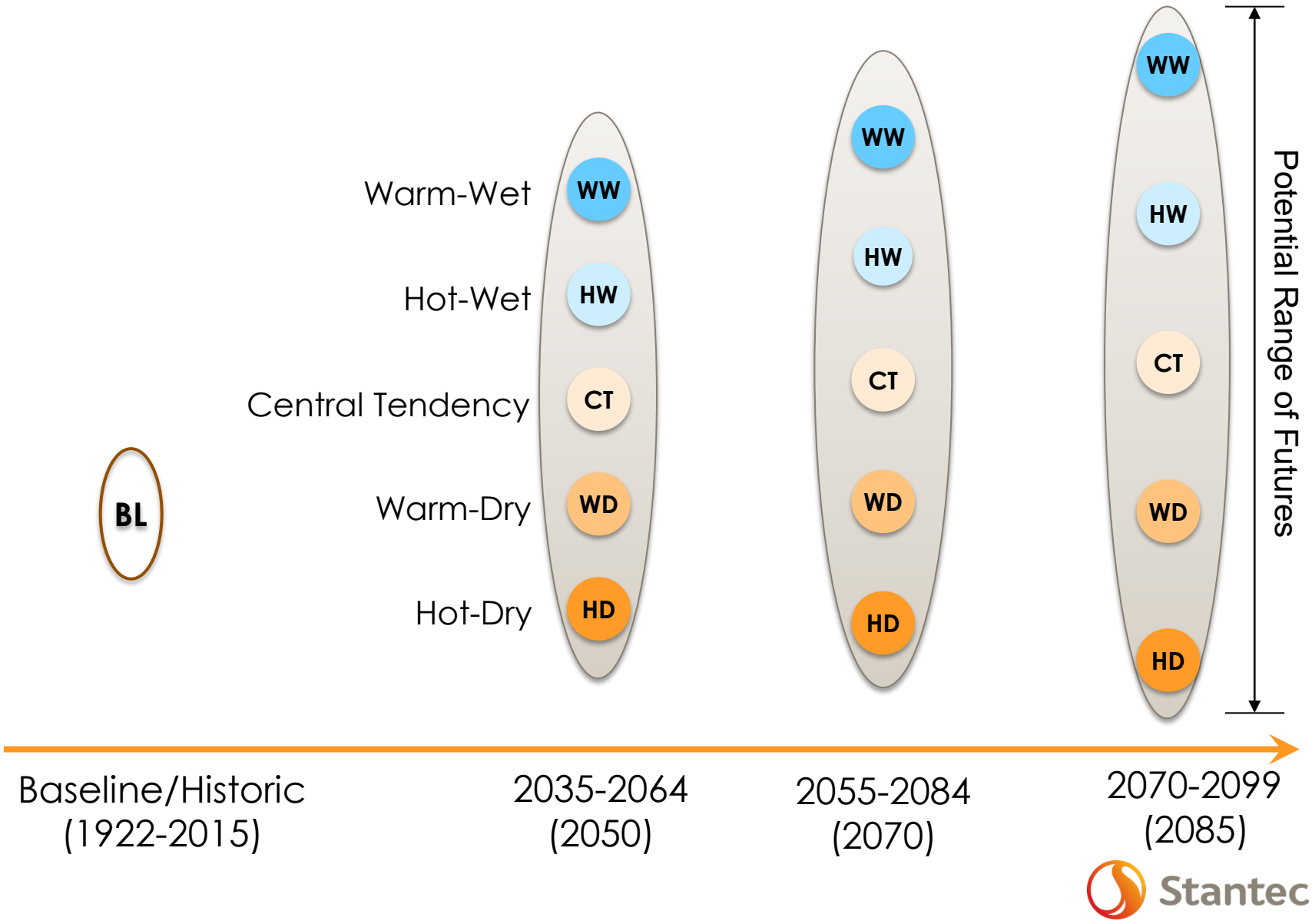
Future Climate Scenarios



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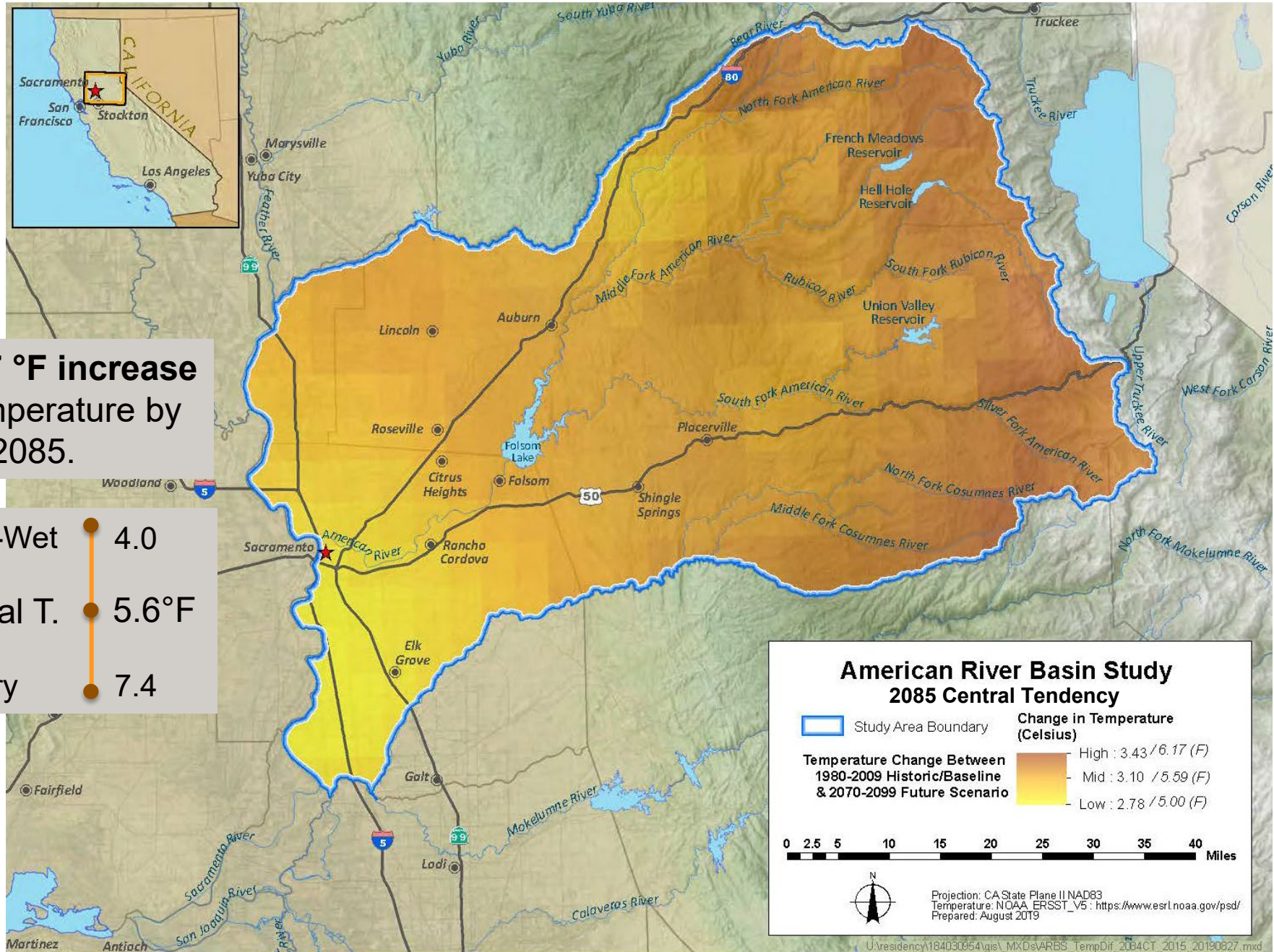
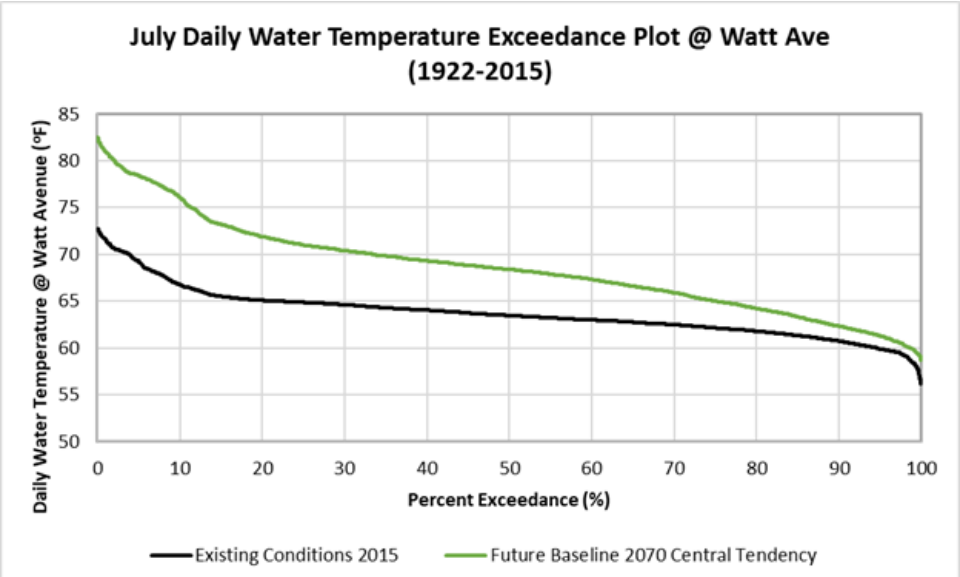
Future Changes in Temperature

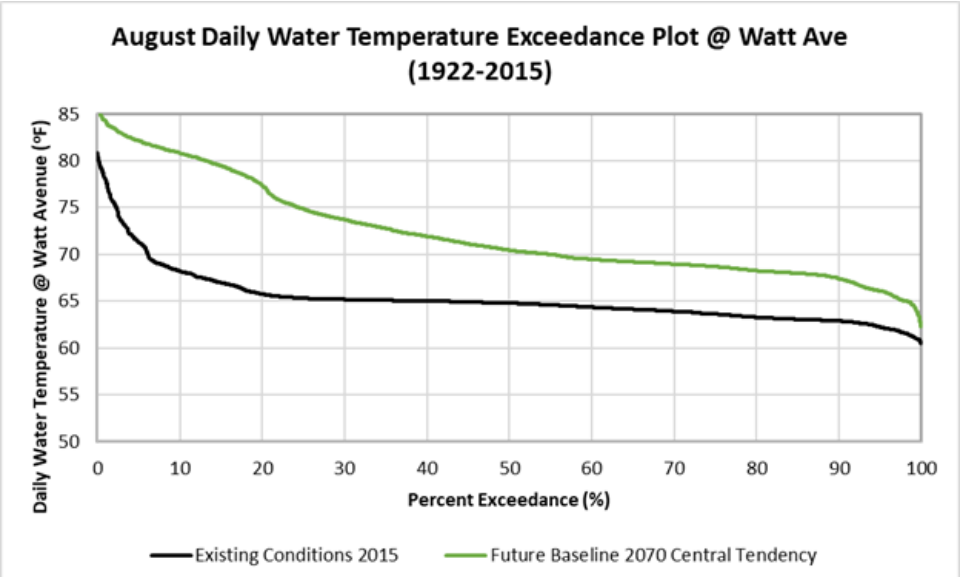


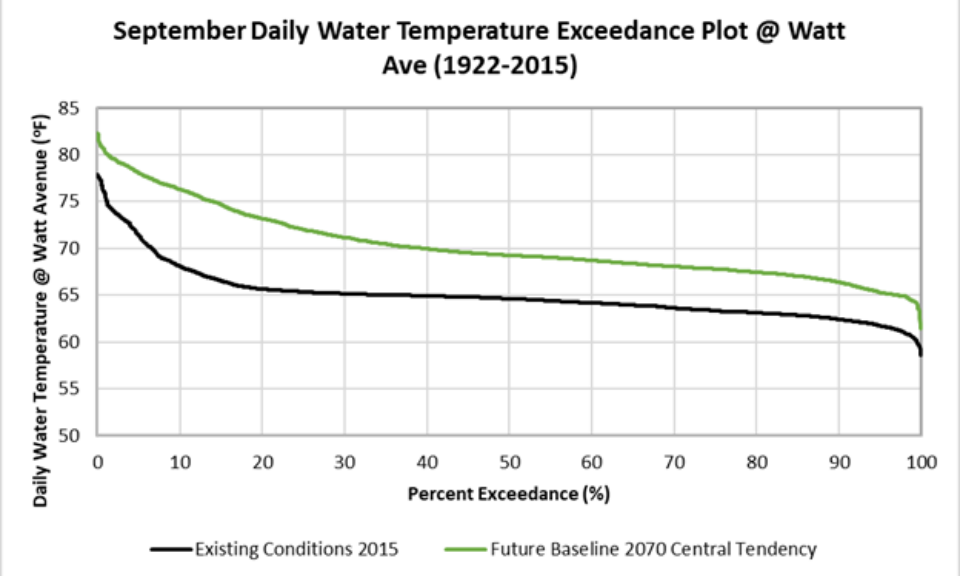
4 to 7 °F increase in temperature by year 2085.

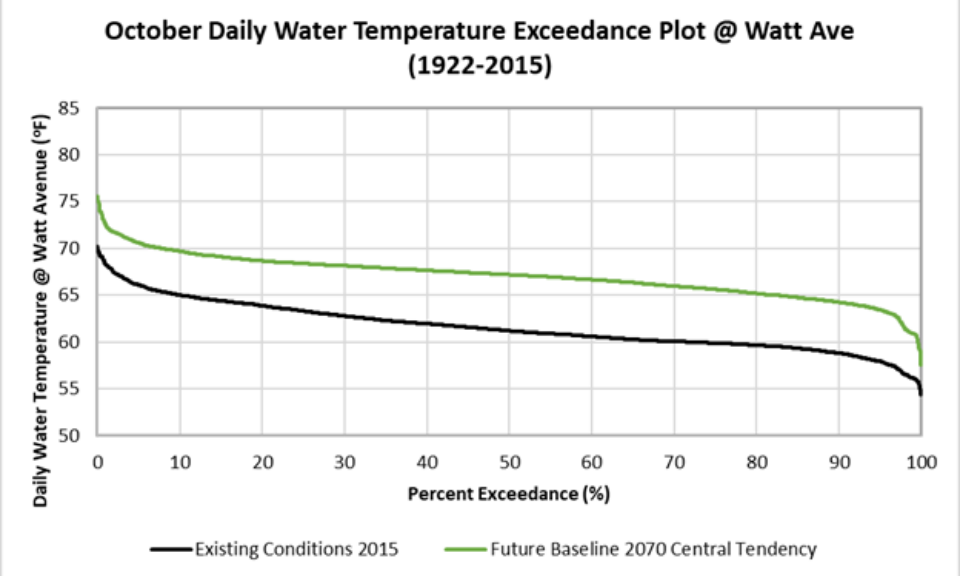
Warm-Wet	4.0
Central T.	5.6°F
Hot-Dry	7.4

Temperature impacts to the Lower American River During future fall Salmon runs





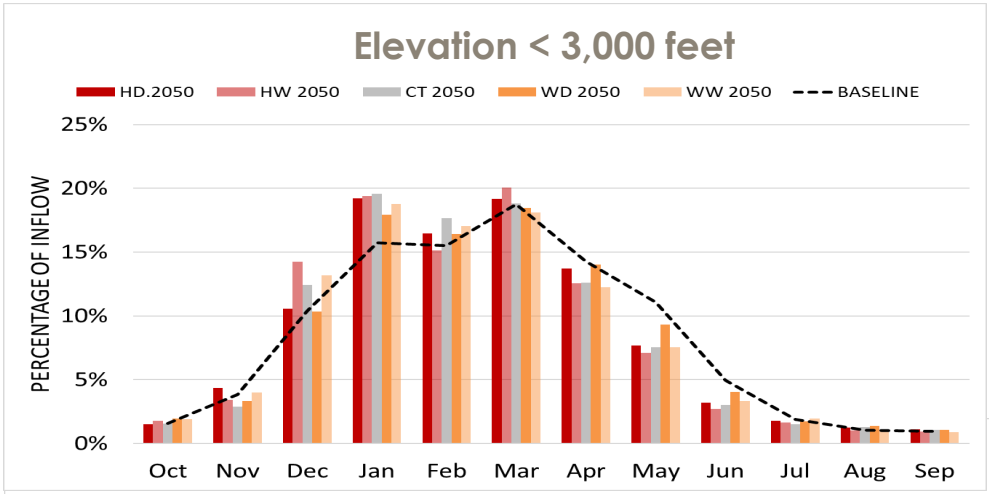


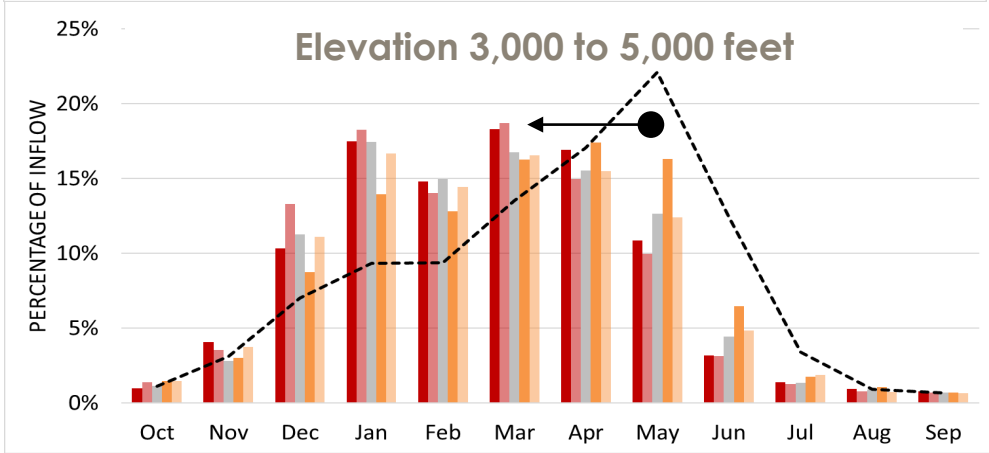


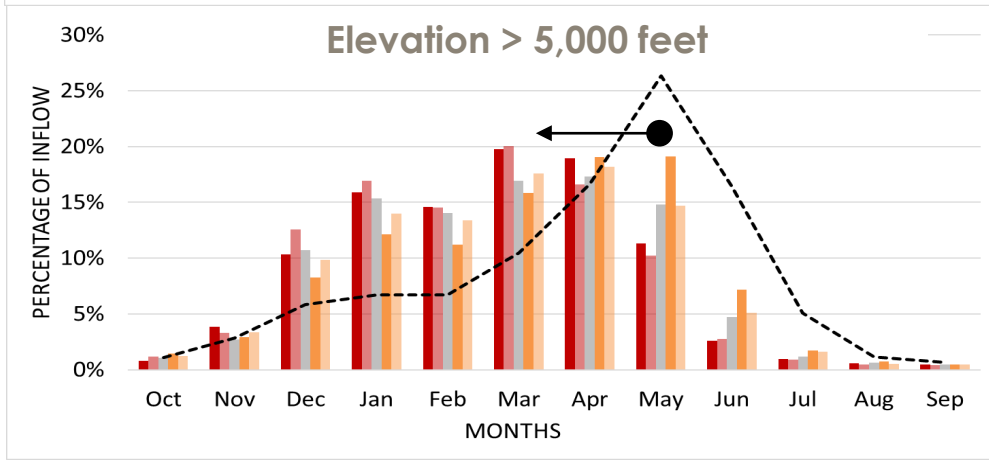
Changes in Timing of Snowmelt

Historically, runoff occurs in **late spring** at elevations above 3,000 feet, peaking around May.

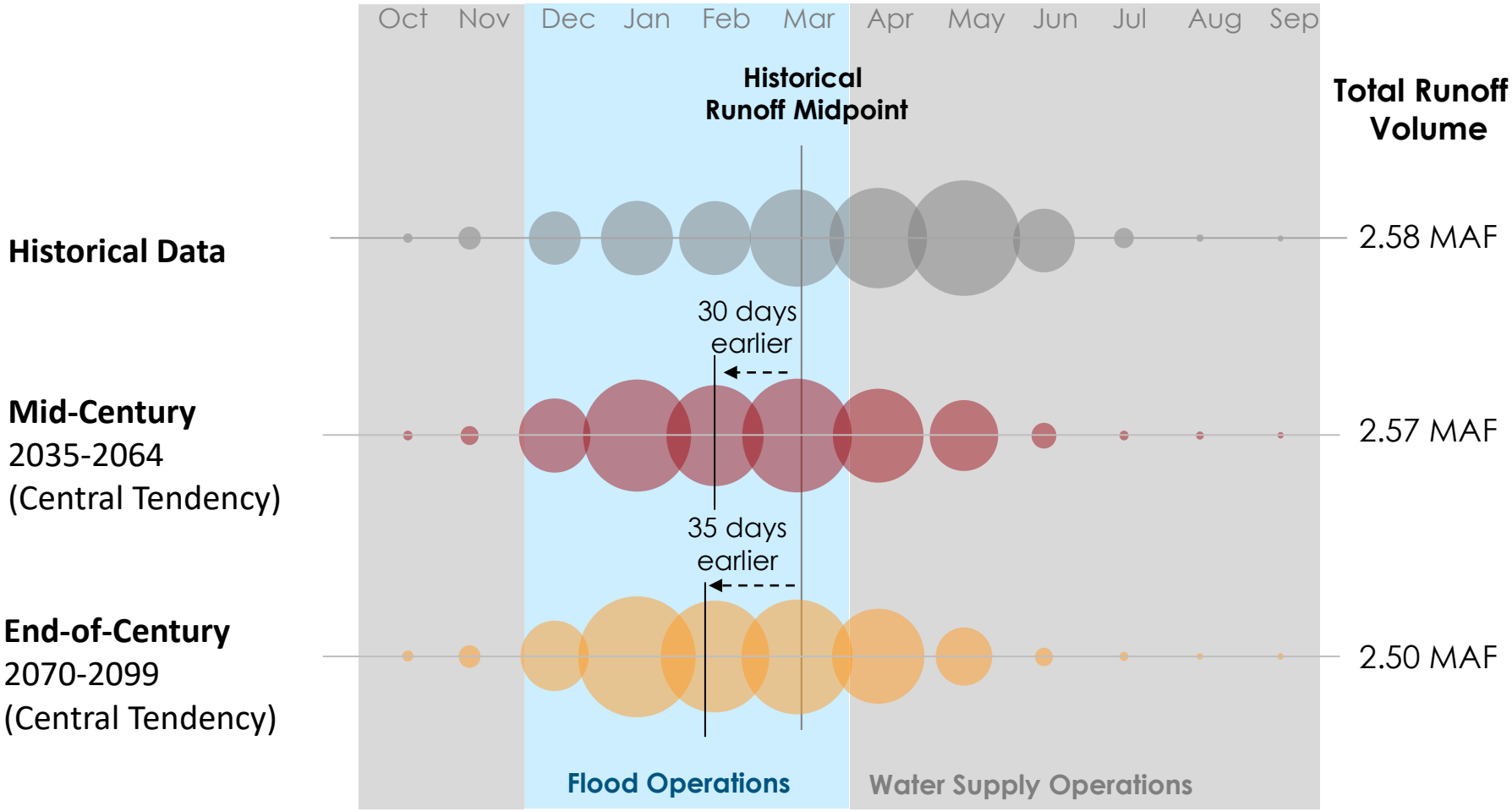
Under future conditions, runoff is expected earlier, with **peak snowmelt 30-60 days earlier**.







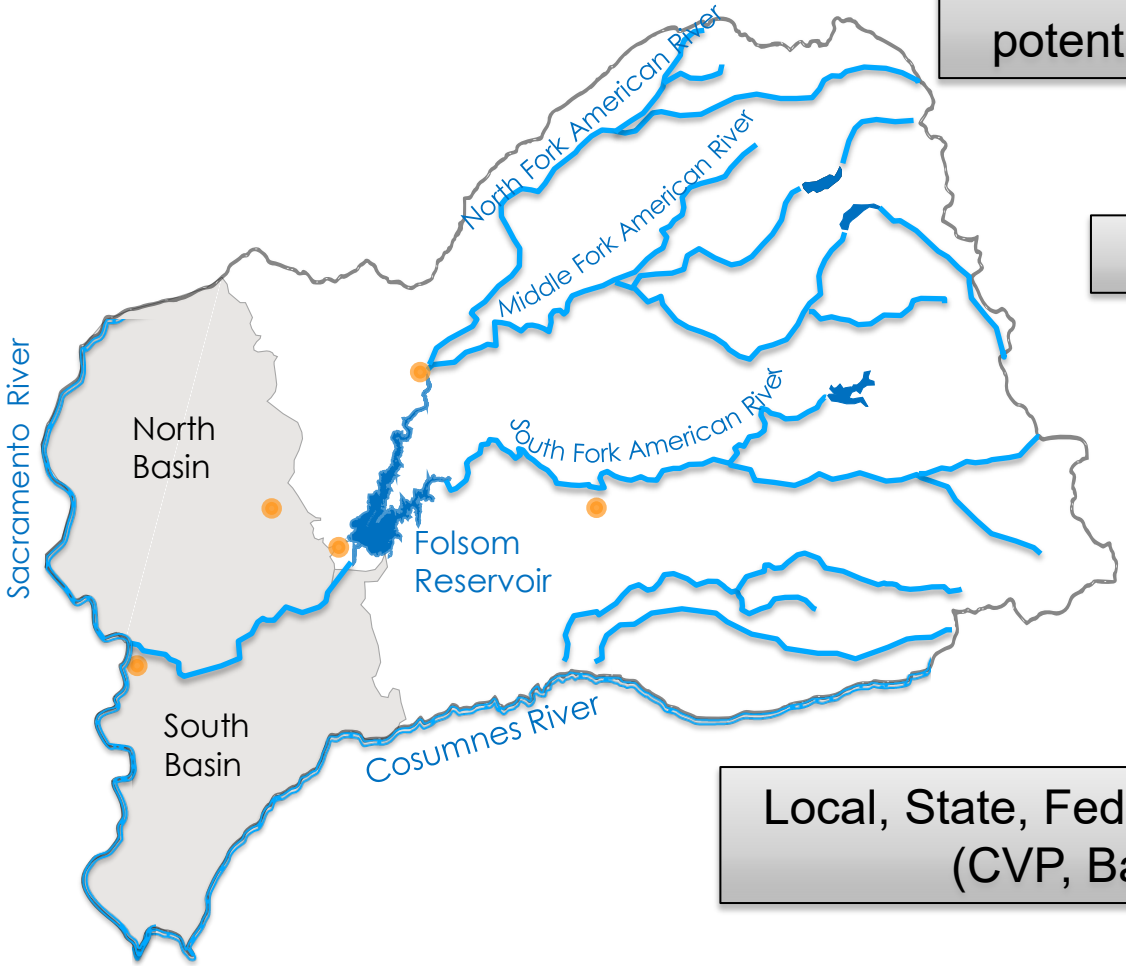
Potential Effects on Water Supply Availability



Earlier runoff would:

- **<u>increase the chance of spills</u>** from Folsom reservoir during flood season.
- **<u>reduce water supply</u>** available during summer and fall for M&I, ecosystem, hydropower, irrigation, recreation, etc.

Key Regional Water Vulnerabilities



Folsom Reservoir is small given the potential runoff from the watershed.

Reliance on snowpack

Wildfire risk and water quality impacts

Local, State, Federal reliance on surface water (CVP, Bay Delta Plan, Biops)

Groundwater management

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Adaptation Formulation Approach

Identify Adaptation Measures (SSJBS)

Improve Demand Management

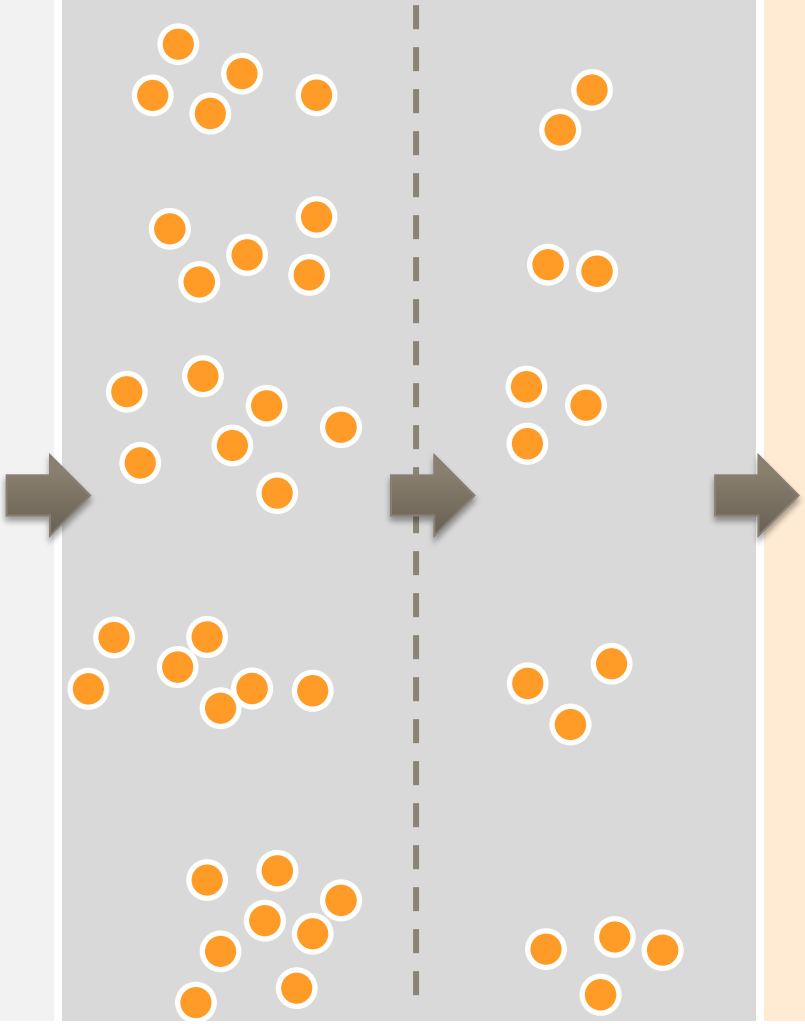
Diversify Water Supplies

Improve Operational Flexibility

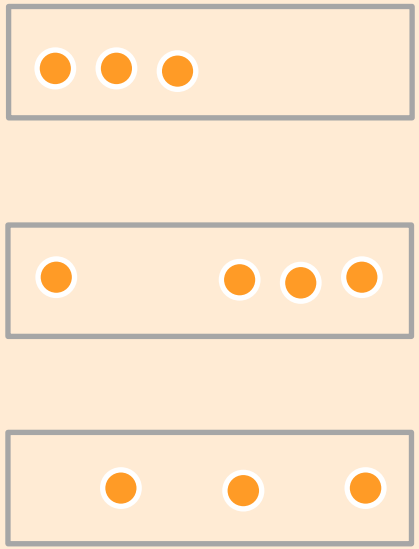
Improve Resource Stewardship

Secure Institutional Agreements to Enable Flexibility

Screen Initial Adaptations



Develop Adaptation Portfolios



Portfolios must address:

1. Benefits to Reclamation
2. Area of Federal Interest
3. Regional Vulnerabilities

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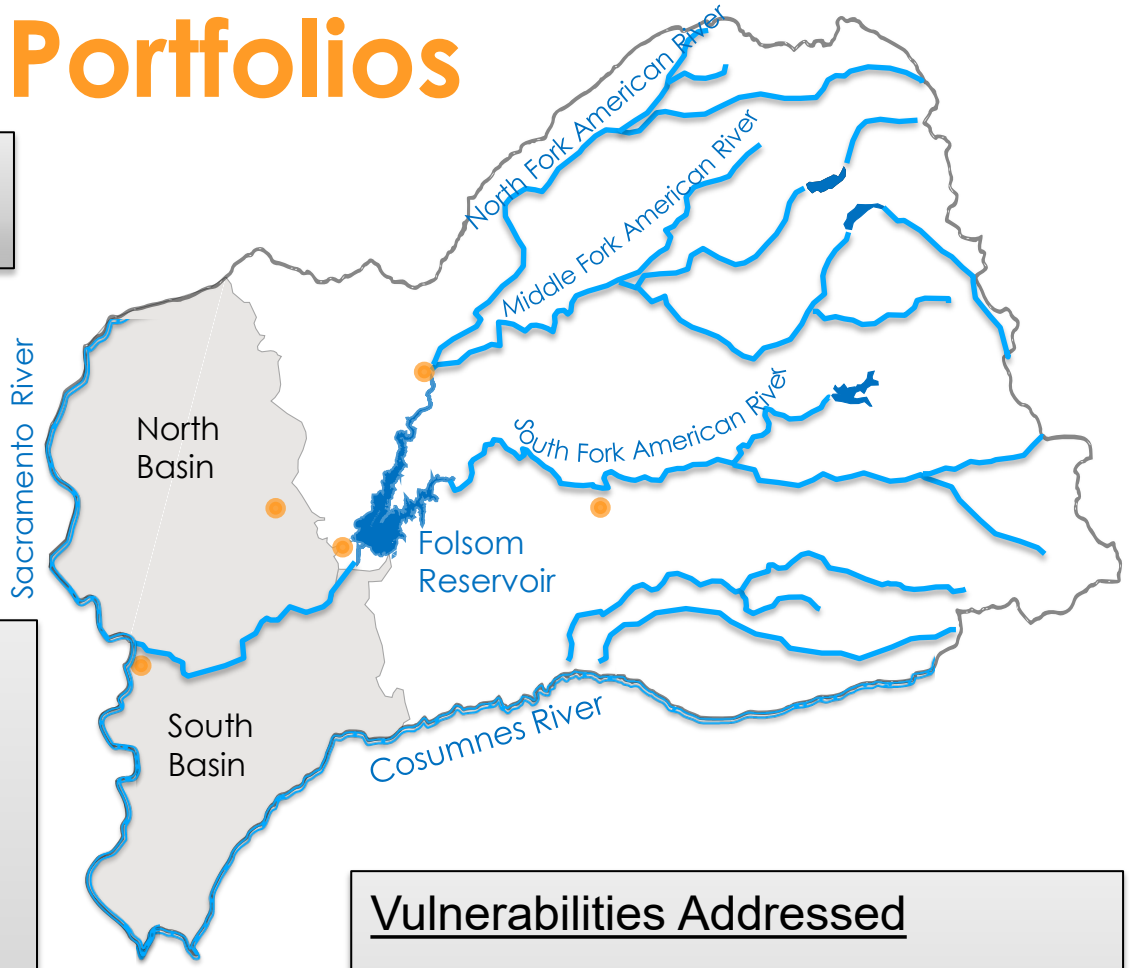
Adaptation Portfolios

1. Foundational Institutions (Future Baseline conditions)



Major Features

- Demand management
- Execution of pending CVP contracts
- Accelerated CVP water transfer programs permitted under CVPIA
- Alignment of CVP service area with Place of Use
- Forest management

Vulnerabilities Addressed

❹ Water Rights and contract entitlements reliability

❼ Forest management

❾ Inefficient water use for urban and agricultural

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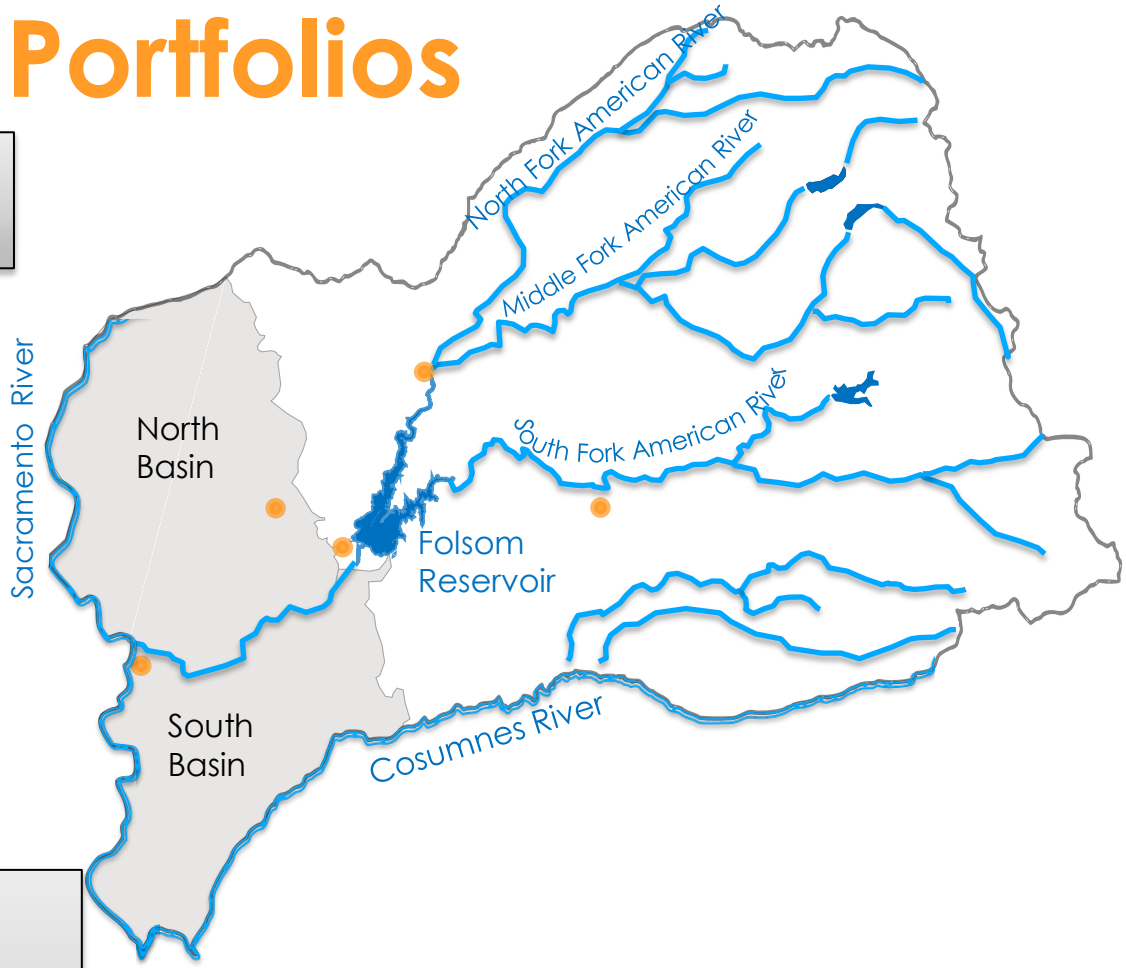
Adaptation Portfolios

2. No assurances for Long-term CVP Water Contracts



Major Features

- Includes Future Baseline elements
- Evaluates the loss of CVP water for agencies with no long-term CVP contracts

Vulnerabilities Addressed

❾ Inefficient water use for urban and agricultural

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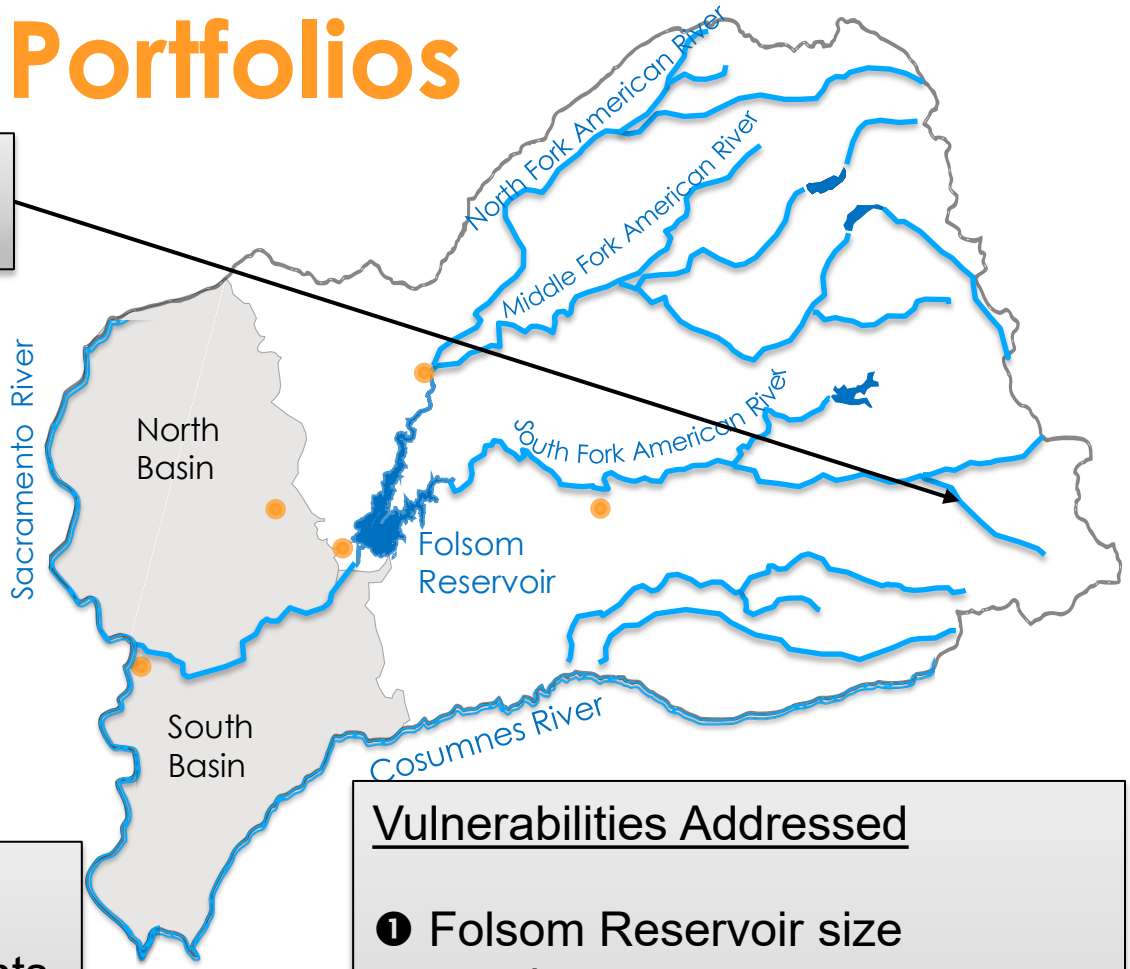
Adaptation Portfolios

3. Alder Creek Storage and Conservation Project



Major Features

- Includes Future Baseline elements
- Adds upper watershed storage to replace some of lost snowpack, and increase Folsom Reservoir flexibility

Vulnerabilities Addressed

❶ Folsom Reservoir size constraints

❺ Folsom Reservoir CVP operations is not aligned with local needs

❻ Foothill region reliability (no groundwater)

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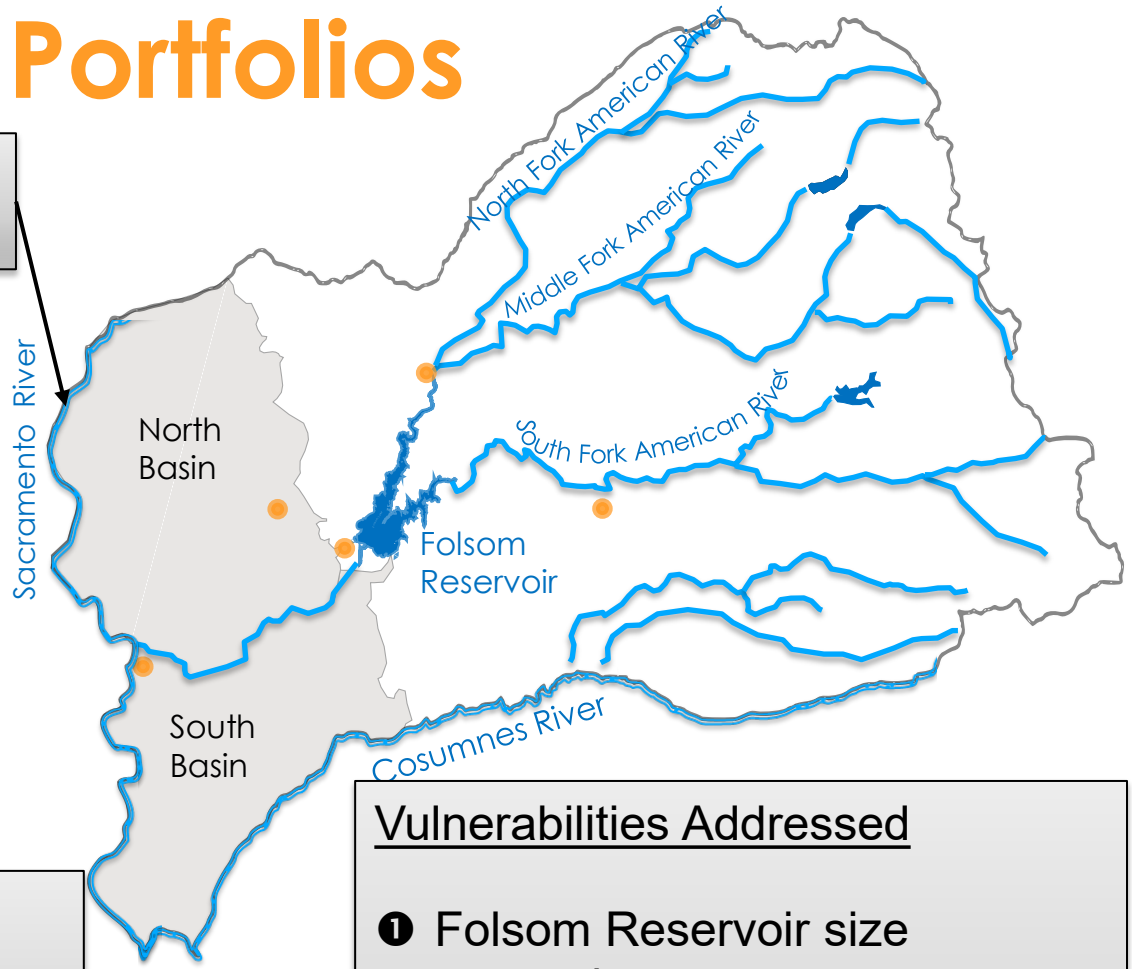
Adaptation Portfolios

4. Sacramento River Diversion Project



Major Features

- Includes Future Baseline elements
- Shifts some of the American River and Folsom Reservoir diversions to the Sacramento River

Vulnerabilities Addressed

❶ Folsom Reservoir size constraints

❷ Water supply heavily depends on one river

❺ Folsom Reservoir CVP operations is not aligned with local needs

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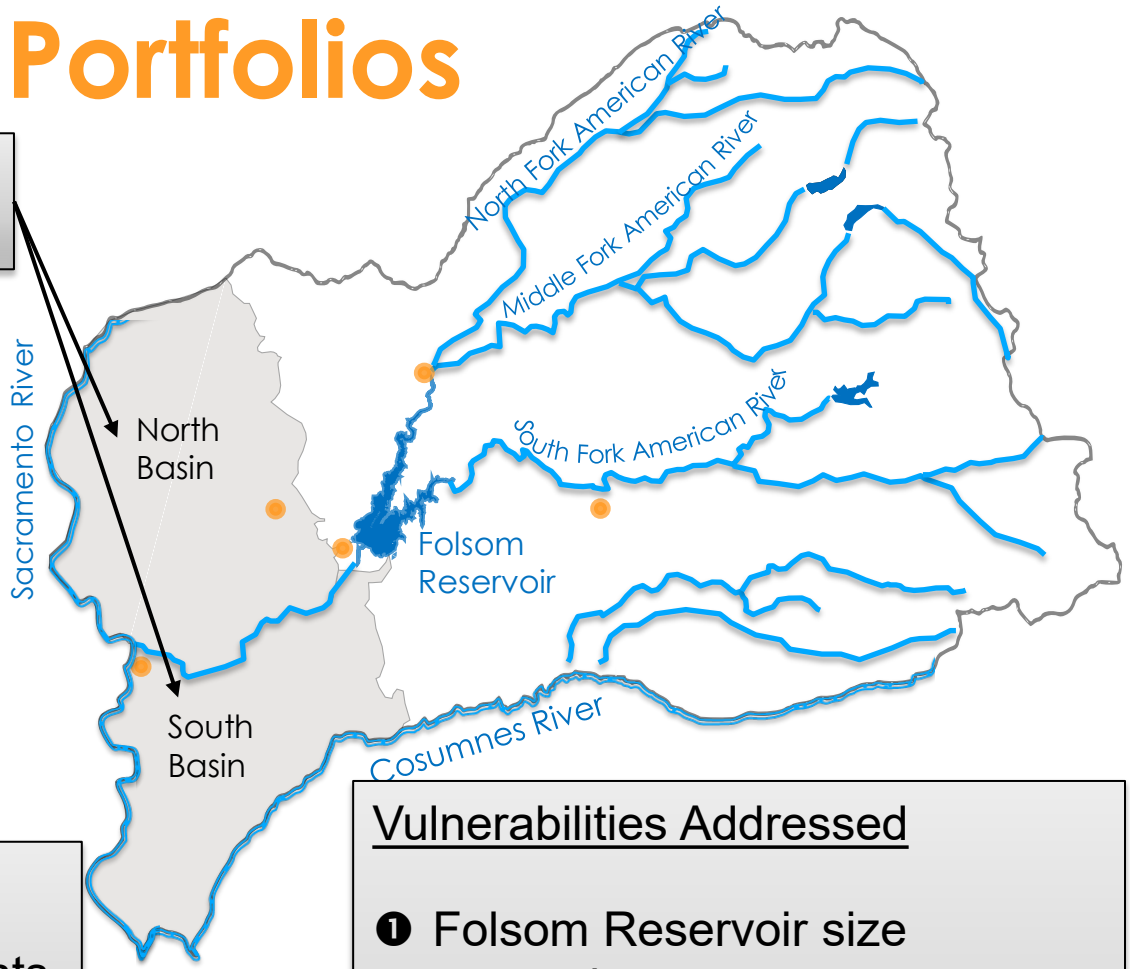
Adaptation Portfolios

5. Federally Recognized Groundwater Bank



Major Features

- Includes Future Baseline elements
- Expands conjunctive use in the North and South American GW Basin using in-lieu recharge and ASR

Vulnerabilities Addressed

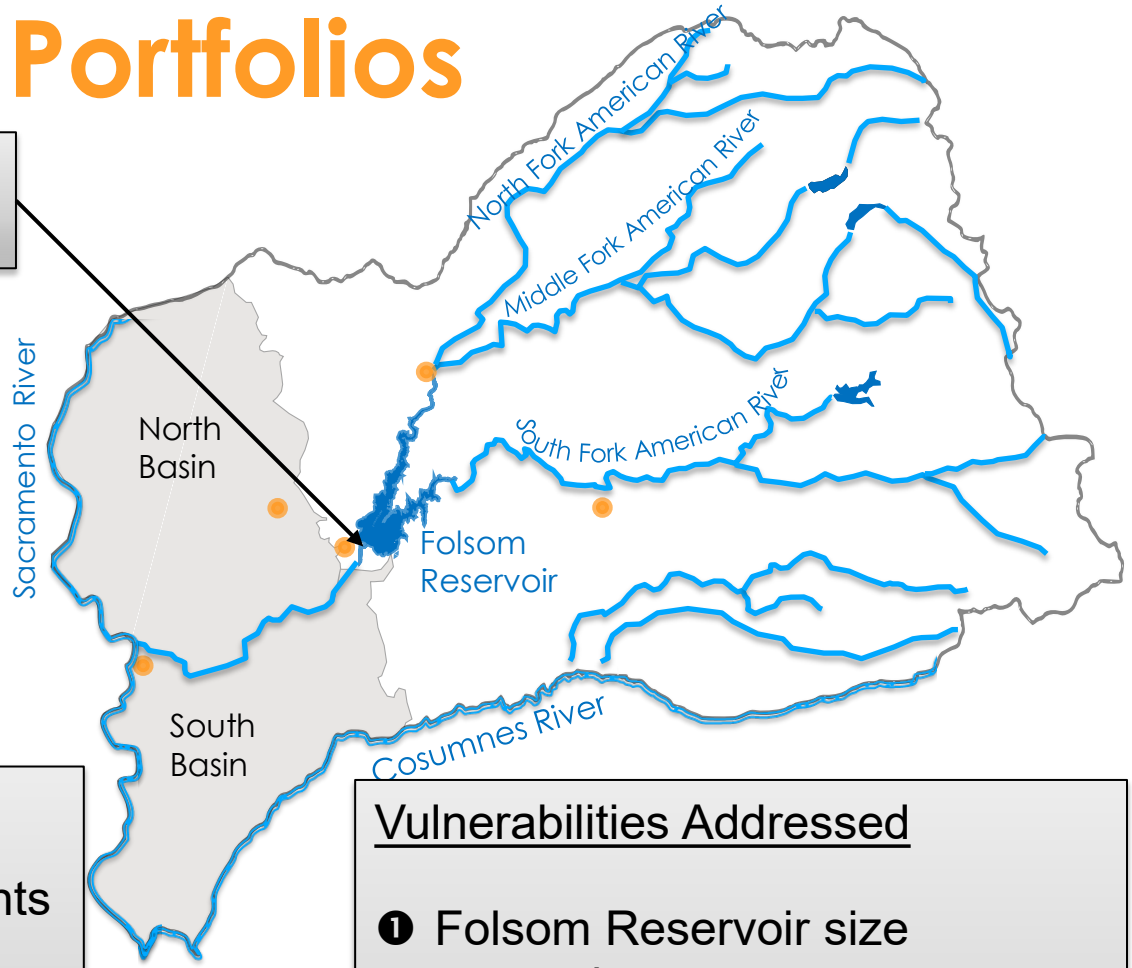
❶ Folsom Reservoir size constraints

❺ Folsom Reservoir CVP operations is not aligned with local needs

❽ Regional conjunctive use potential is not fully developed

Adaptation Portfolios

6. Folsom Dam Raise and Groundwater Banking



Major Features

- Includes Future Baseline elements
- Raises Folsom Dam for Flood Control with Forecast Informed-Operations of upper watershed reservoirs.
- Uses flood flows for groundwater banking along the Cosumnes River

Vulnerabilities Addressed

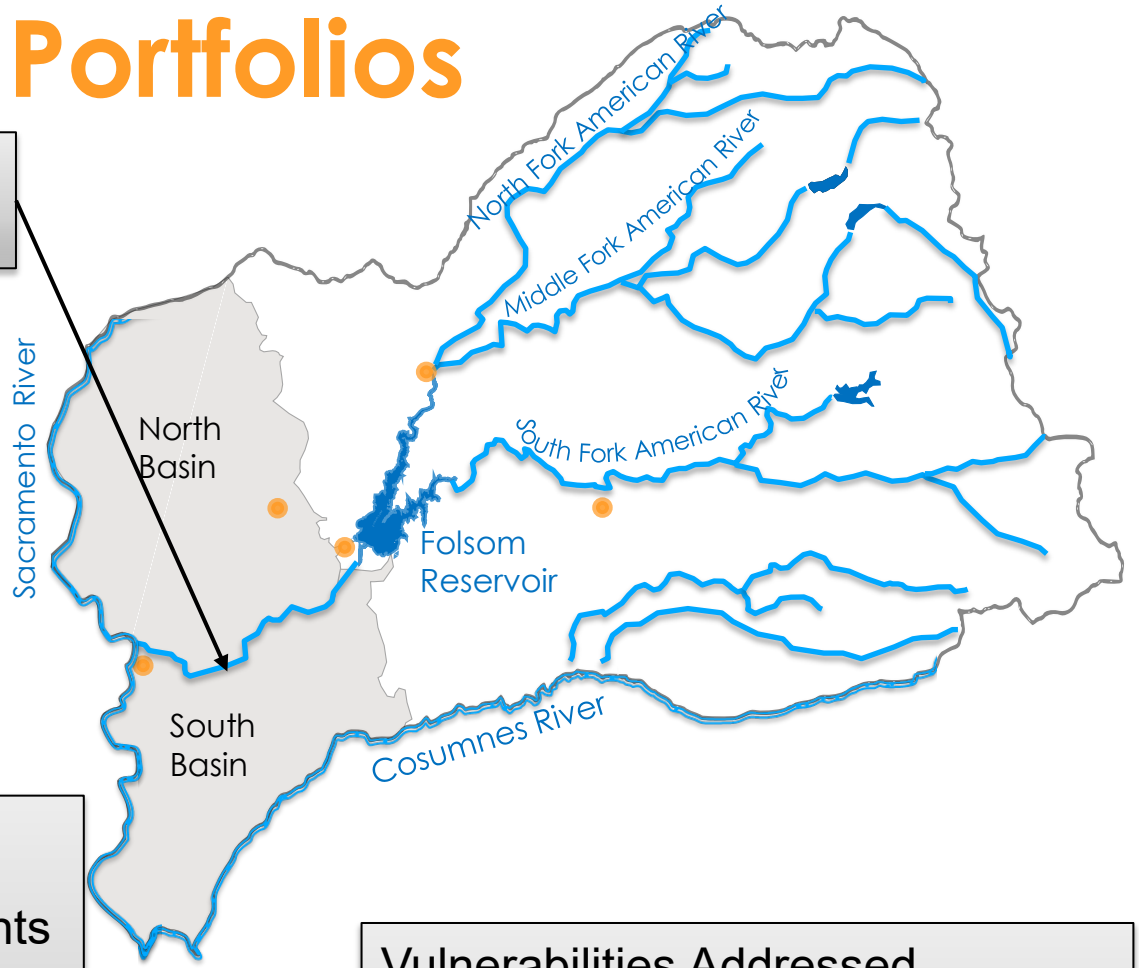
❶ Folsom Reservoir size constraints

❸ Lack of opportunity for setting back levees for the increasing volume of floods in the future

❽ Regional conjunctive use potential is not fully developed

Adaptation Portfolios

6. Modified Flow Management Standards



Major Features

- Includes Future Baseline elements
- Implements MFMS with May and December target storage in Folsom, and Spring pulse flow
- Includes Folsom Dam temperature control device.

Vulnerabilities Addressed

❶ Folsom Reservoir size constraints

❺ Folsom Reservoir CVP operations is not aligned with local needs

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Data Resources

- Now:
  - **CalSim III** (2070 CC) & **VIC hydrology** (2016 CWC)
  - Climate change downscaled temperature and precipitation (DWR and USBR)
  - Draft ARBS Report
- May 2020: Technical Sufficiency Review
- May/June 2020: ARBS public workshop on portfolio formulation and evaluations
- July/August 2020: Reclamation Review
- November 2020: Public ARBS Report
- December 2020: release of Final ARBS Report and ARBS CalSim 3.0 and dataset

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Website
https://www.pcwa.net/planning/arbs

Backup slides

Key Regional Water Vulnerabilities

❶ Folsom Reservoir size is not optimized for the potential runoff from the watershed

❷ Basin-wide water supply heavily depends on one river, especially in the north basin

❸ Lack of opportunity for setting back levees along the Lower American River in Sacramento urban areas for the increasing volume of floods in the future

❹ Water rights and contract entitlements of individual water agencies are less reliable or less protected than believed to be.

❺ Reclamation's operation of Folsom Reservoir for CVP purposes is not fully coordinated with regional needs for water supply and flood protection

❻ The Upper Basin (Foothills area) lack groundwater the foothills as a reliable supplemental water supply source

❼ Improper forest management can affect snowpack retention, major wildfires threats, and subsequently water quality

❽ Regional conjunctive use potential is not fully developed due to high investment costs and lack of accepted governance framework

❾ Inefficient water use for urban and agricultural

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Adaptation Portfolios

Adaptation Portfolio	Major Features[1]	Vulnerability Pathways Addressed[2]	Benefits to Reclamation[3]	Areas of Federal Interest Addressed[4]
Foundational Institutions (Future Baseline Conditions)	• Demand management • Work with U.S. Forest Service for proper forest management and implementation of cohesive strategy • Execution of pending CVP long-term water supply contracts (City of Roseville, SMUD, SCWA, and PCWA) • Execution of the Fazio water supply contract (EDCWA) • Alignment of individual contract CVP service area with corresponding water right Place of Use as much as possible • Accelerated CVP water transfer program permitted under the Central Valley Project Improvement Act • EDCWA-PCWA exchange agreement for serving Georgetown Divide Public Utility District (embedded American River Pump Station capacity authority)	1 2 3 **4** 5 6 **7** 8 **9**	**1** 2 3	**1** 2 3 4 5 6 7 8
No Assurances for Long-term CVP Water Contracts	• Demand management • Work with U.S. Forest Service for proper forest management and implementation of cohesive strategy	1 2 3 4 5 6 7 8 **9**	1 2 3	1 2 3 4 5 6 7 8

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Adaptation Portfolios

Adaptation Portfolio	Major Features[1]	Vulnerability Pathways Addressed[2]	Benefits to Reclamation[3]	Areas of Federal Interest Addressed[4]
Alder Creek Storage and Conservation Project	• **Foundational Institutions (Future Baseline)** • Upstream, offstream reservoir with additional water rights to replace loss of snowpack and power generation capacity • Provision of water supply reliability and drought protection for the Upper Basin (Foothills) • Capacity exchange and other operational agreements to address Folsom Reservoir operational constraints and storage needs • Limited exchange and operational agreements to augment water supply reliability and future for certain water agencies • Flexibility for water market participation (primary focus on support of Reclamation's Long-Term Water Transfer Program)	1 2 3 4 5 6 7 8 9	1 2 3	1 2 3 4 5 6 7 8
Sacramento River Diversion Project	• **Foundational Institutions (Future Baseline)** • Alternative point of delivery for existing water rights and contract entitlements through exchange to leverage the different hydrologic conditions in a different river basin • Implementation of Water Forum Agreement voluntary diversion reductions in certain hydrologic conditions	1 2 3 4 5 6 7 8 9	1 2 3	1 2 3 4 5 6 7 8
Federally Recognized Groundwater Bank (North and South Basin)	• **Foundational Institutions (Future Baseline)** • Enhanced regional conjunctive use operations using existing infrastructure, levering in-lieu operation in the urban core of the North and South American River groundwater basins • Water market-oriented operations (focused on needs of CVP contractors and Reclamation)	1 2 3 4 5 6 7 8 9	1 2 3	1 2 3 4 5 6 7 8

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Adaptation Portfolios

Adaptation Portfolio	Major Features[1]	Vulnerability Pathways Addressed[2]	Benefits to Reclamation[3]	Areas of Federal Interest Addressed[4]
Folsom Dam Raise with Groundwater Banking (South Basin)	• **Foundational Institutions (Future Baseline)** • Forecast-based flood operations • Folsom Dam raise with limited allowable storage and no increased flood and infrastructure risks • Upstream reservoir outlet modifications for additional flood storage made available by pre-releases per forecast • Pre-releases and limited storage releases through Folsom South Canal for groundwater banking in the South American groundwater basin • Groundwater banking using rural area spreading grounds for water market opportunity and/or for Cosumnes River ecosystem benefits	1 2 3 4 5 6 7 8 9	1 2 3	1 2 3 4 5 6 7 8
Modified Flow Management Standard	• **Foundational Institutions (Future Baseline)** • Modified Flow Management Standard (Sacramento Water Forum, 2015; Reclamation, 2019)	1 2 3 4 5 6 7 8 9	1 2 3	1 2 3 4 5 6 7 8

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Notes:

1. Adaptation measures are described in the *Draft Adaptation Portfolio Formulation and Refinement TM.*

2. Vulnerability Pathways Addressed

Definitions:

- ❶ = Folsom Reservoir lacks the storage capacity to capture all potential runoff from the upper watershed
- ❷ = Basin-wide water supply heavily depends on one river (i.e., the American River), especially in the North American River groundwater basin
- ❸ = Lack of opportunity in setting back levees along the Lower American River in Sacramento urban areas for increasing volume of floods in the future
- ❹ = Water rights and contract entitlements of individual water agencies are less reliable or less protected than believed to be.
- ❺ = Reclamation's operation of Folsom Reservoir for CVP purposes is not fully coordinated with regional needs for water supply and flood protection
- ❻ = The Upper Basin (Foothills area) lack groundwater the foothills as a reliable supplemental water supply source
- ❼ = Improper forest management can affect snowpack retention, major wildfires threats, and subsequently water quality
- ❽ = Regional conjunctive use potential is not fully developed due to high investment costs and lack of accepted governance framework
- ❾ = Inefficient water use for urban and agricultural

Coloring Legend:

- ● pathway is addressed by this portfolio
- ● pathway addressed is unique to the portfolio
- ● pathway is not addressed by this portfolio
- ❶ ❺ pathways addressed by all portfolios
- ❹❼❾ pathways addressed by major features in the Foundational Institutions portfolio

3. Benefits to Reclamation

Definitions:

- ❶ = affirming equality among CVP contractors in terms of basis of long-term operation
- ❷ = reducing direct demands on Folsom Reservoir operation (needs are satisfied via alternative means) on a long-term basis or an as-needed basis
- ❸ = increasing Folsom Reservoir's regulating capacity for flow and storage (capacity increase surrogates)

(Note that ❶ is assumed in all CVP operations but not implemented. Both ❷ and ❸ make it possible for Reclamation to operate Folsom Reservoir easier to meet all authorized purposes including meeting Delta WQCP and BiOps – provided that it would not compromise other part of the CVP operation beyond applicable law and regulations allow)

Coloring Legend:

- ● portfolio provides this benefit
- ❶ benefits seen in multiple portfolios due to major features in the Foundational Institutions portfolio
- ● portfolio does not provide this benefit

4. Areas of Federal Interest Addressed

Definitions:

- ❶ = ability to deliver water, including the impacts of droughts
- ❷ = hydroelectric power generation
- ❸ = recreation
- ❹ = fish and wildlife habitat
- ❺ = listed species protection
- ❻ = water quality issues (including salinity level)
- ❼ = flow and water dependent ecological resiliency
- ❽ = flood control and/or management, including impacts of extreme events