RECLAMATION

Managing Water in the West

Delta-Mendota Canal Recirculation Feasibility Study

Alternatives Evaluation and Ranking Workshop
April 28, 2009

U.S. Department of the Interior
Bureau of Reclamation

State of California
Department of Water Resources

Agenda

- Introductions
- Purpose & Desired Outcome
- Feasibility Study Activities
- Plan Formulation Report
- Wrap-Up

Purpose and Desired Outcome

- **Purpose**
  - Provide overview of Alternatives Analysis and Ranking

- **Desired Outcome**
  - Obtain Stakeholder Input on Alternative Ranking and Formulation For EIS/EIR

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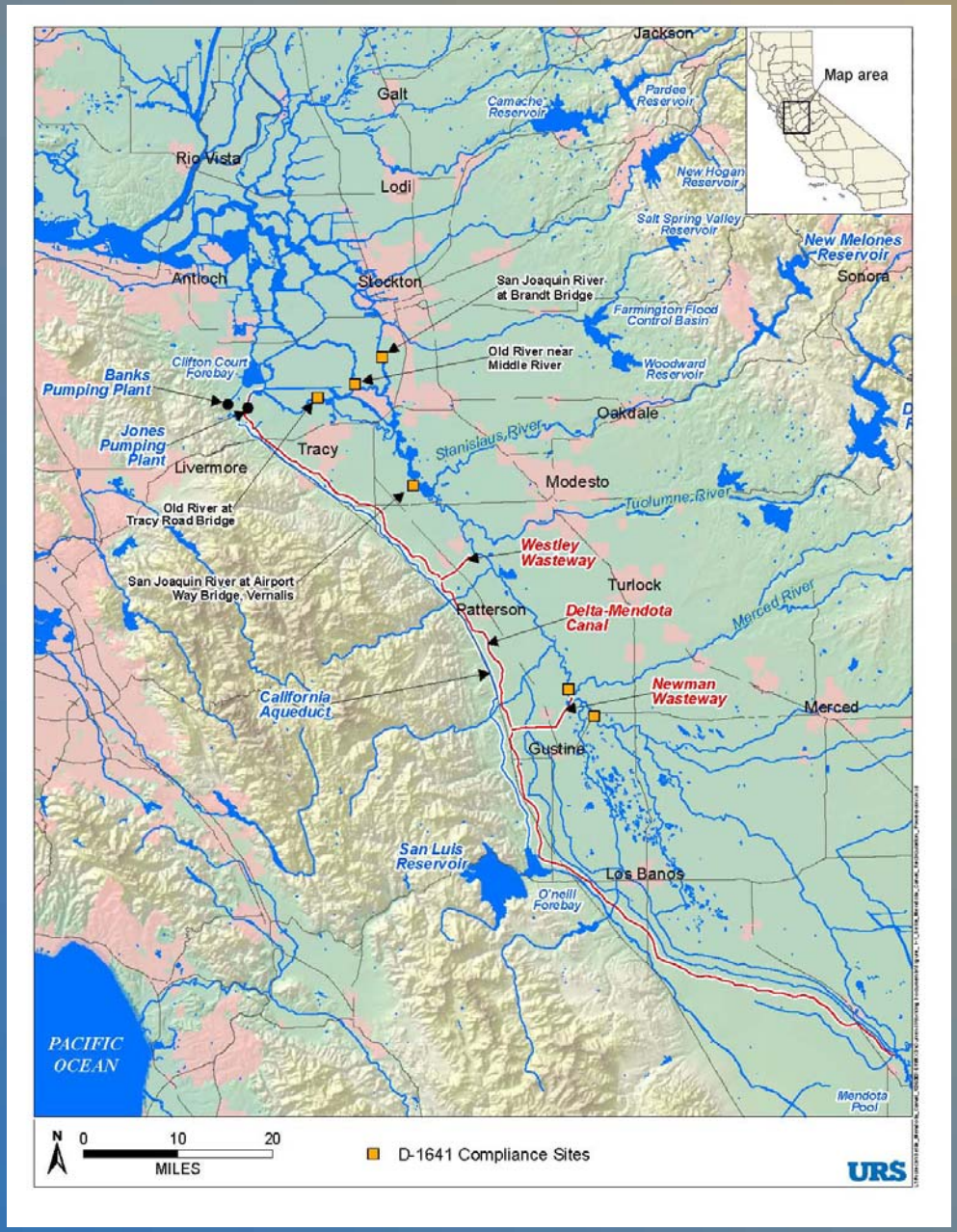

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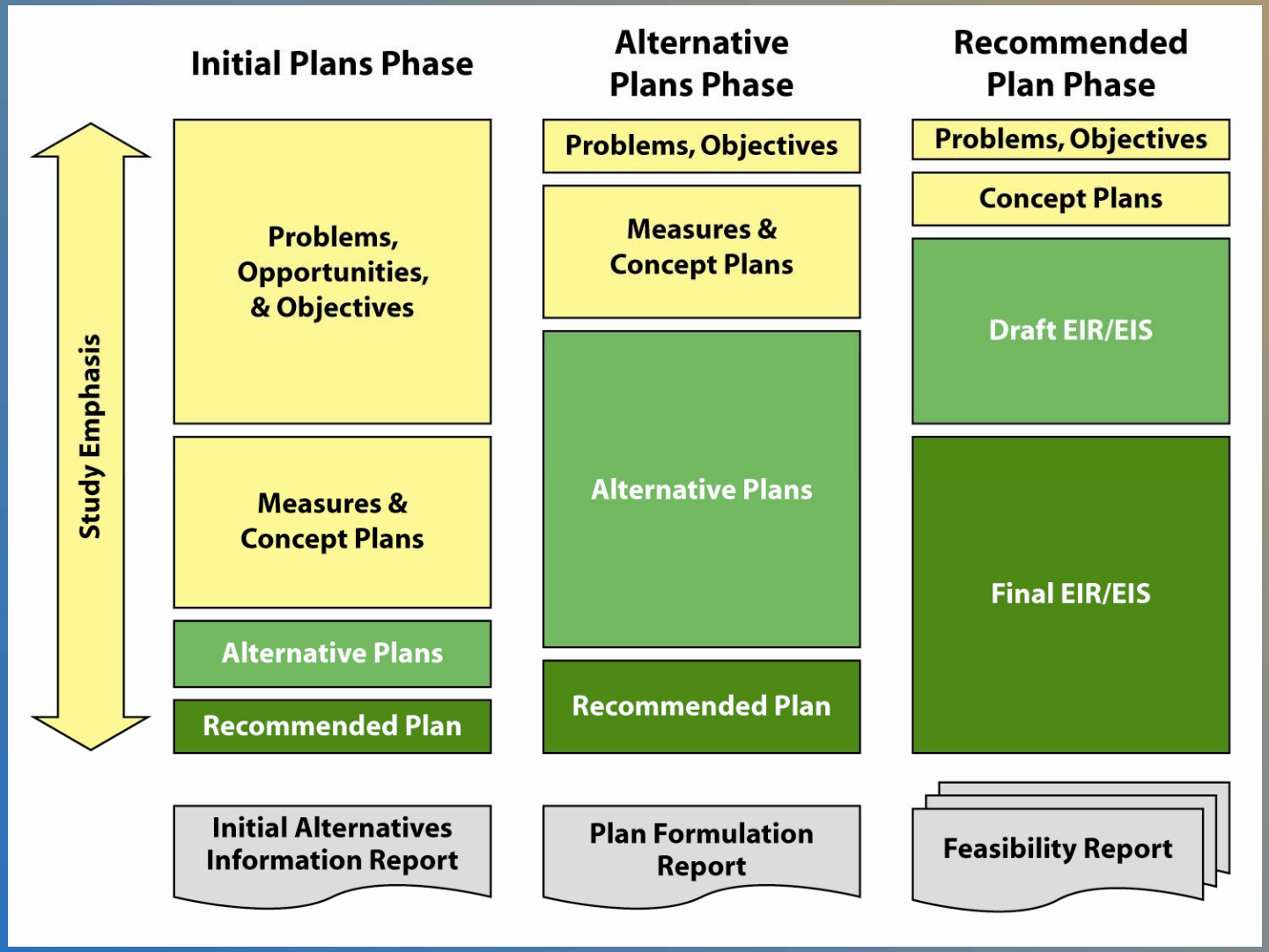
Study Process



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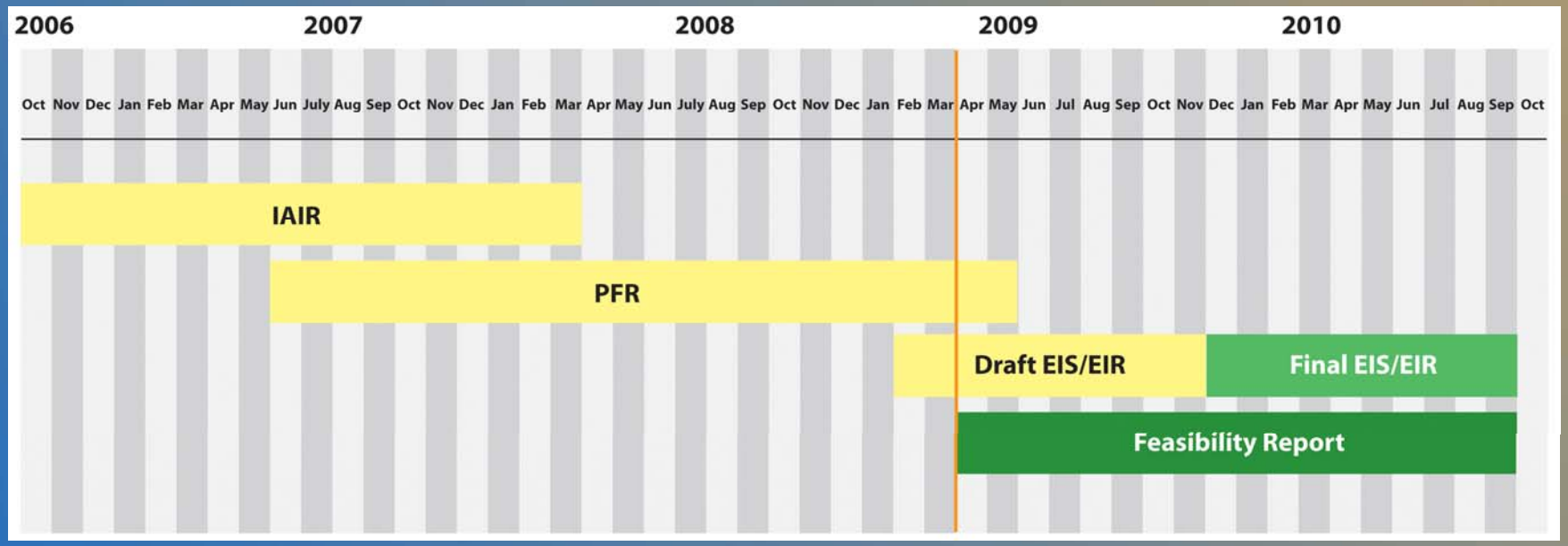
Schedule



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Study Authorization

- **P.L. 108-361 Water Supply, Reliability, and Environmental Improvement Act (CALFED)**

  "The Secretary shall incorporate into the program a recirculation program to provide flow, reduce salinity concentrations in the San Joaquin River, and reduce the reliance on the New Melones Reservoir for meeting water quality and fishery flow objectives through the use of excess capacity in export pumping and conveyance facilities"

SWRCB D 1641 Recirculation Study Direction

- Study Impacts of:
  - Changing water composition on Delta native fish and fall run Chinook salmon and steelhead in SJR Basin
  - Increased exports on Delta hydrodynamics and entrainment
  - Salt and contaminant loading in the SJR Basin
  - Water deliveries from DMC, California Aqueduct and San Luis Reservoir
- Identify improvements needed to physical facilities
- Identify conserved water
- Identify water quality improvements in SJR

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Feasibility Study Activities

- Released IAIR
- Conducted 2008 Pilot Study
- Developed Additional Alternatives from Stakeholder Comments
- Drafted Plan Formulation Report
- Conducted Wasteway Improvements Appraisal Study

Plan Formulation Report

- Alternatives Review
- Resource Analysis Overview
- Alternatives Ranking Process
- Alternatives Ranking Summary

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Screening and Evaluation Criteria

Developed From "Principals and Guidelines for Water and Related Land Resources Implementation Studies"

- **Completeness – Does Not Require Action By Others**
- **Effectiveness – Maximizes Achieving Project Objectives**
- **Efficiency – Cost Effectiveness**
- **Acceptability – Meets laws, regulations and policies and acceptable to stakeholders**

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Planning Objectives

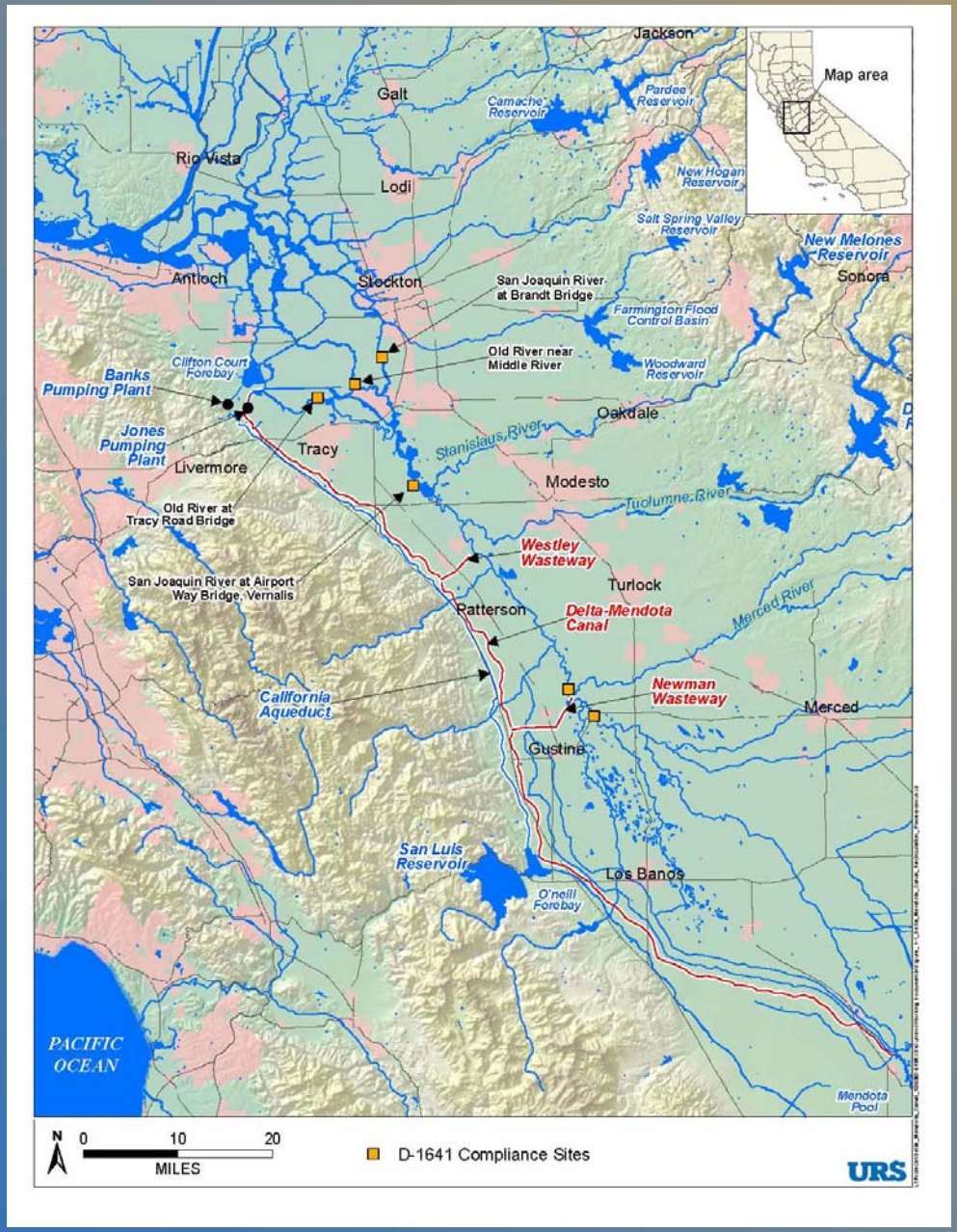
A. Provide supplemental flow in the lower SJR for meeting fishery flow objectives.

B. Provide lower salinity water to the SJR for meeting WQOs at Vernalis.

C. Provide greater flexibility in meeting the existing water quality standards and objectives so as to reduce the demand on water from New Melones Reservoir.

D. Use recirculation to improve DO in the SJR.

E. Provide lower salinity water to the SJR for meeting WQOs at interior south Delta stations.



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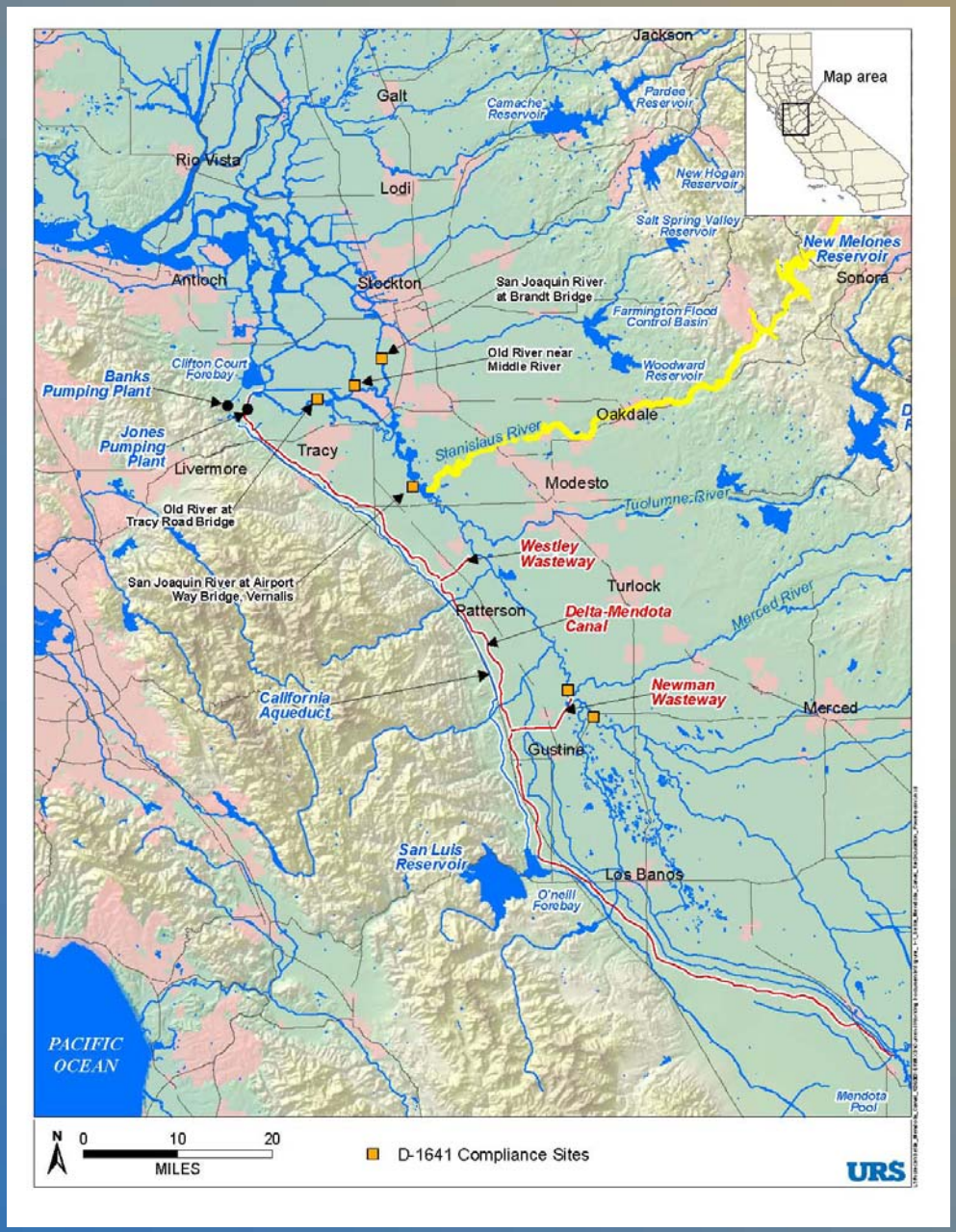

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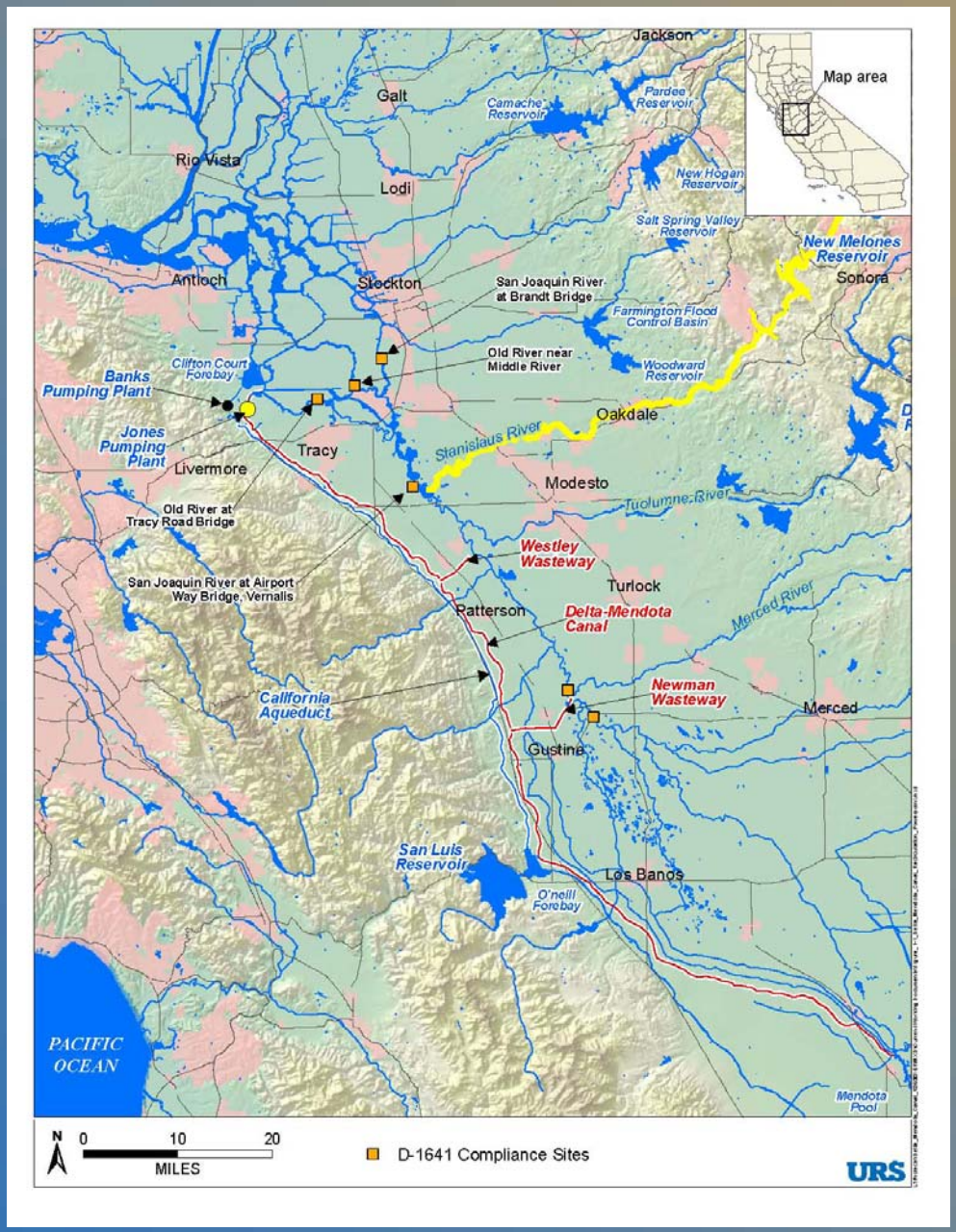

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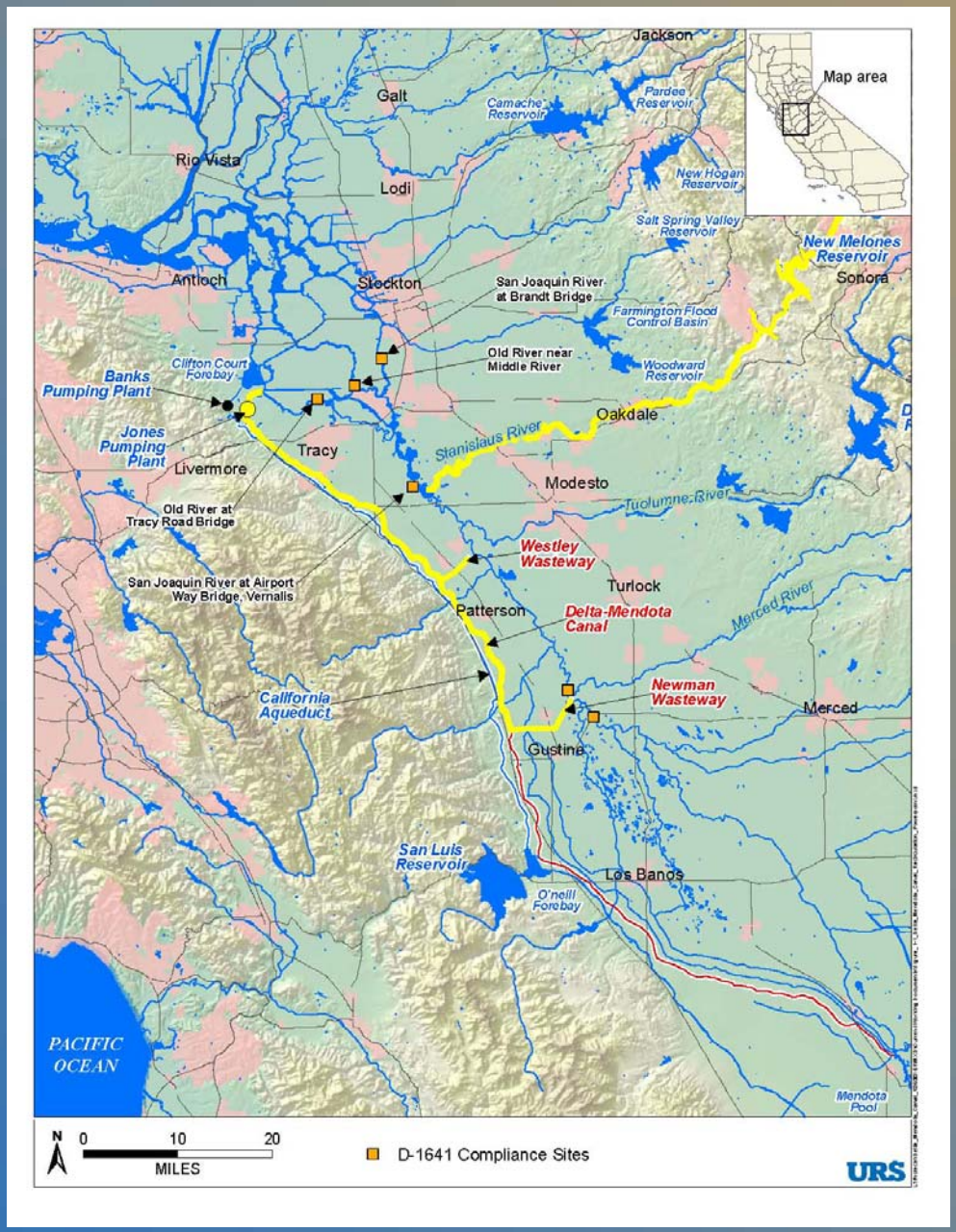

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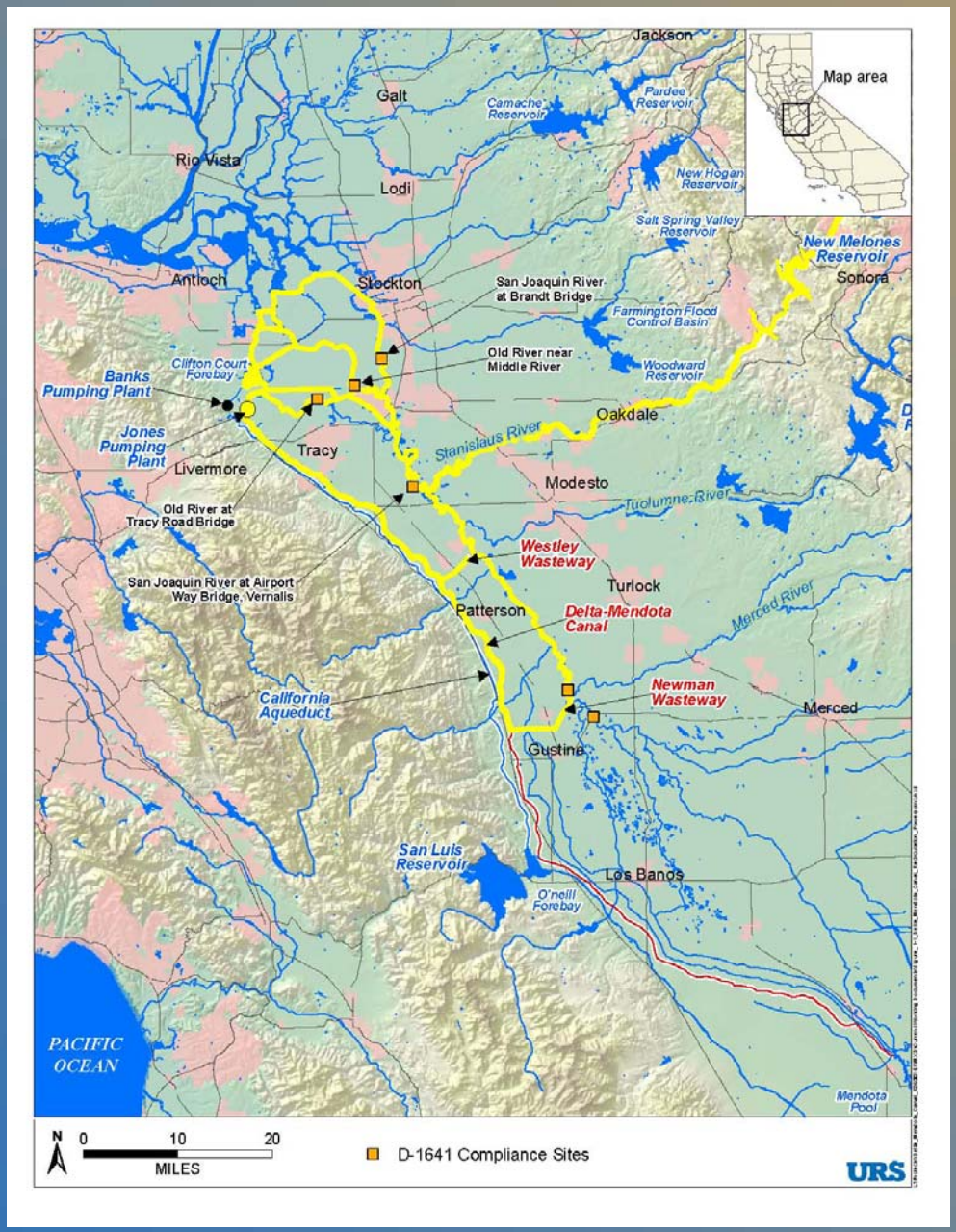

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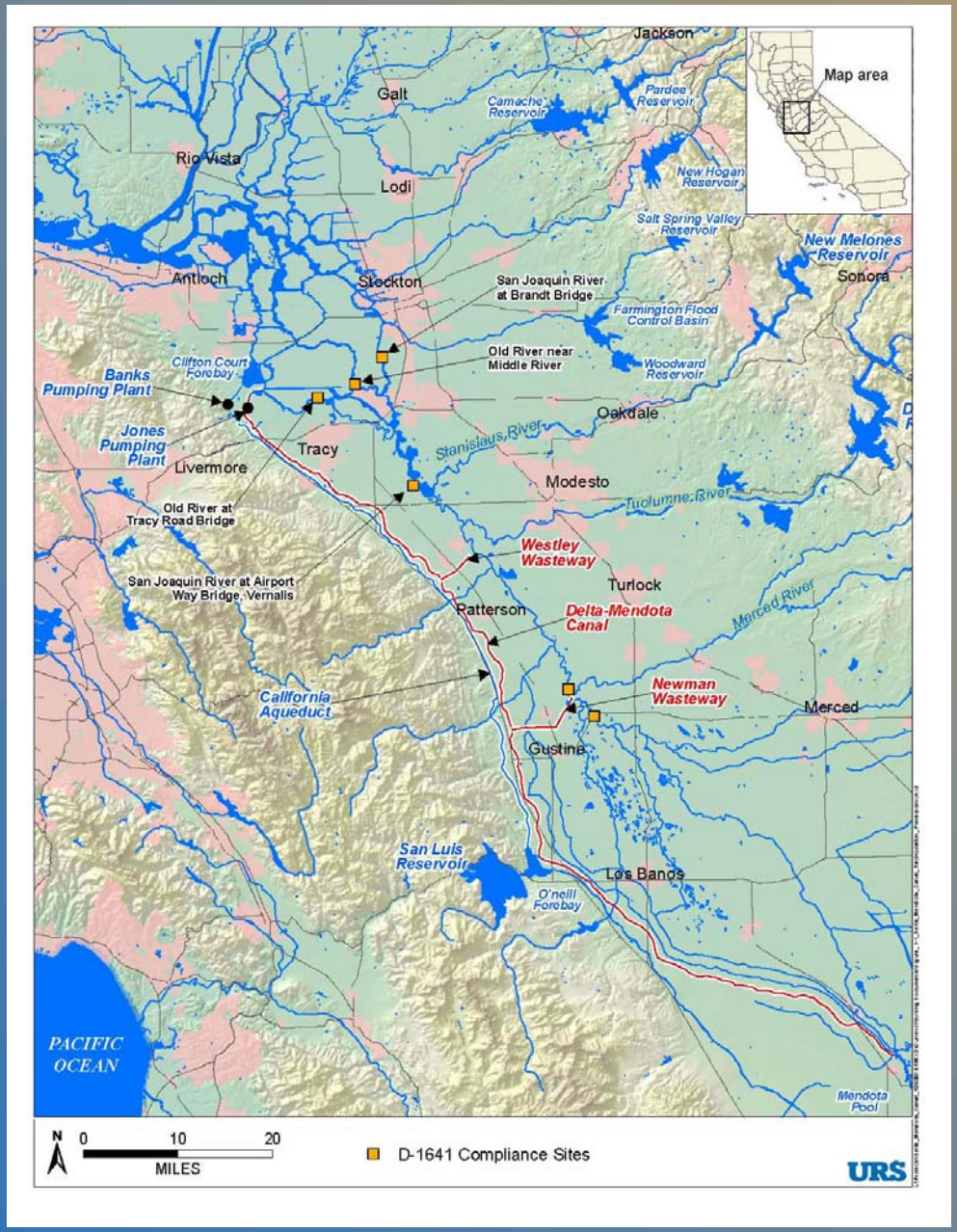

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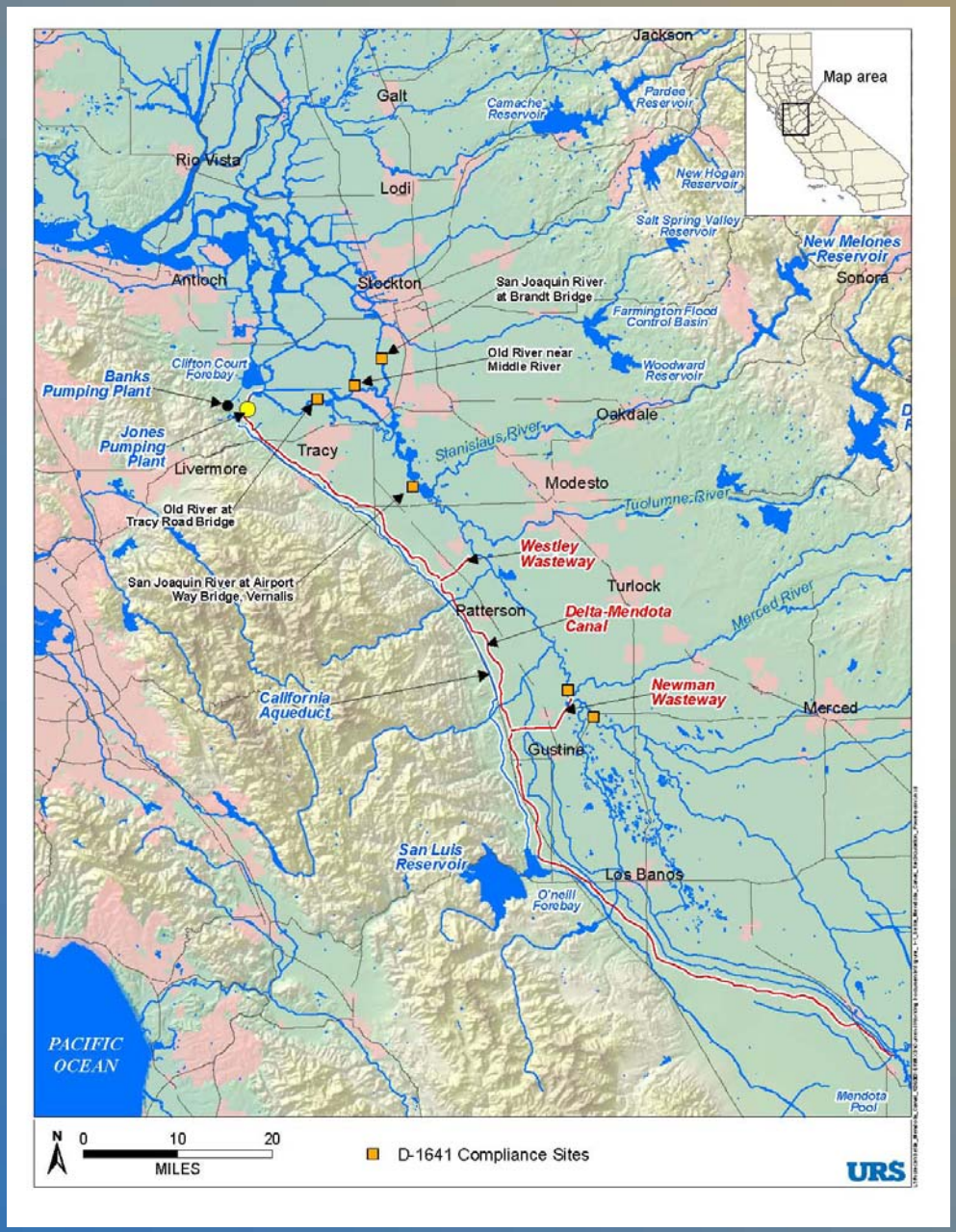

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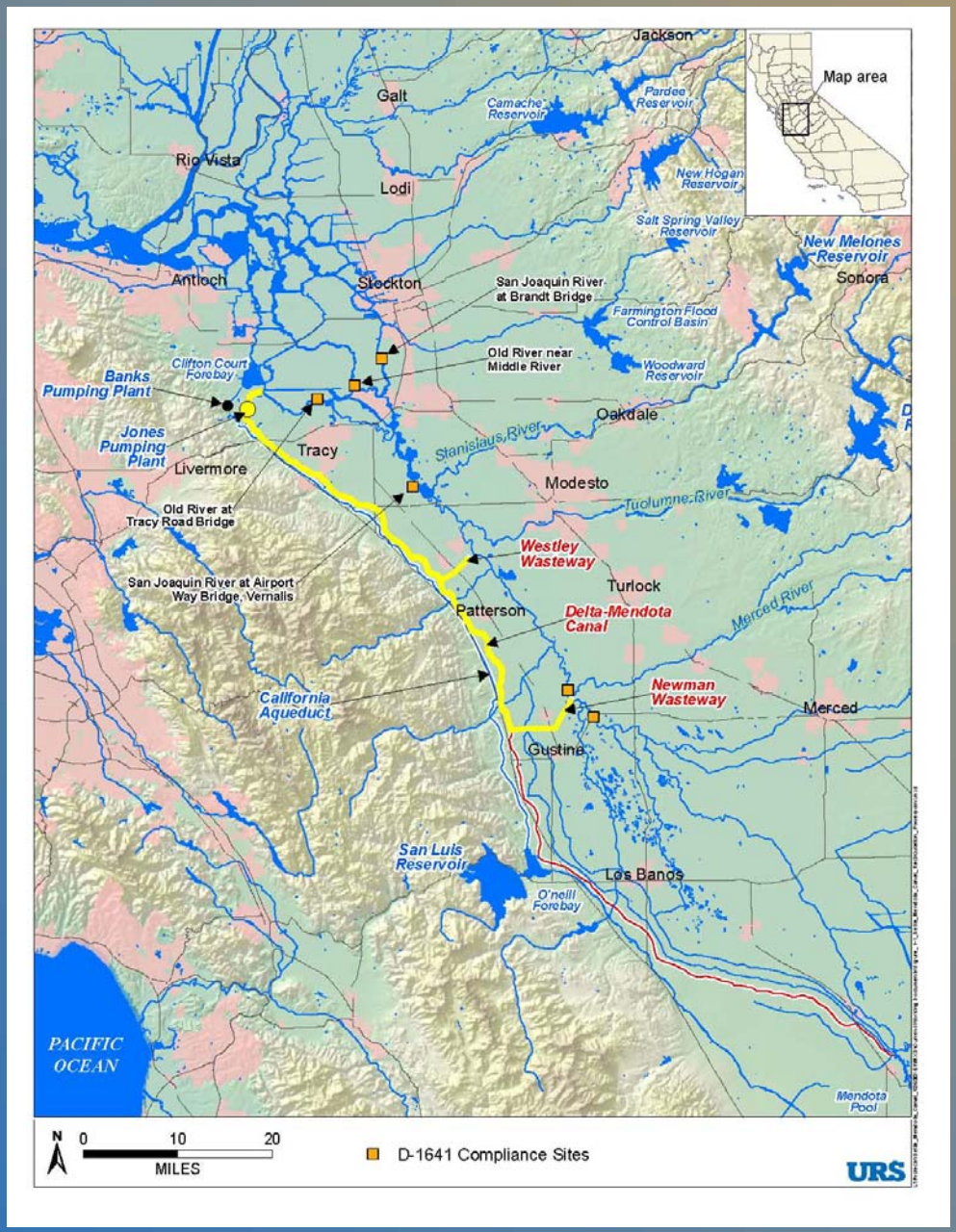

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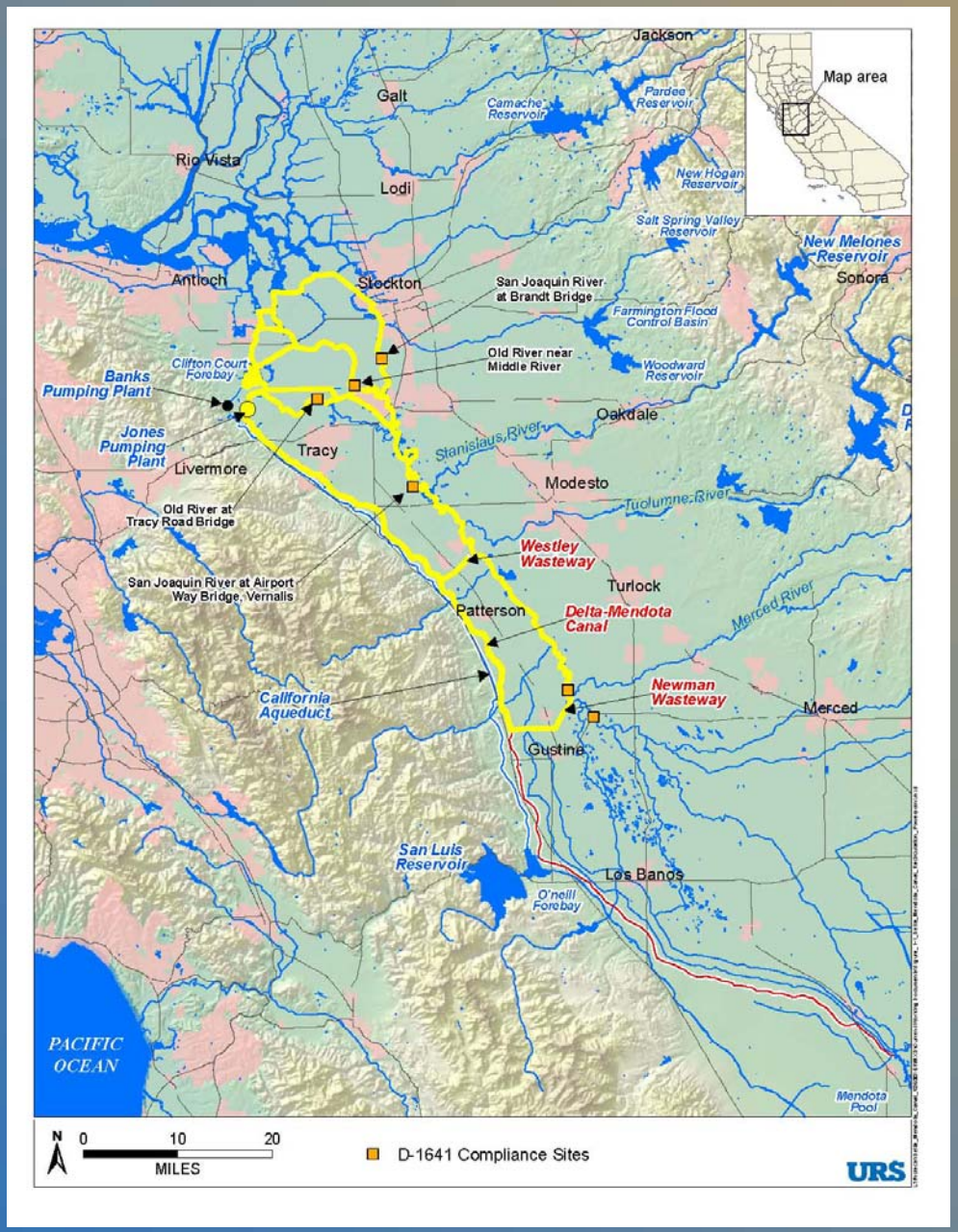

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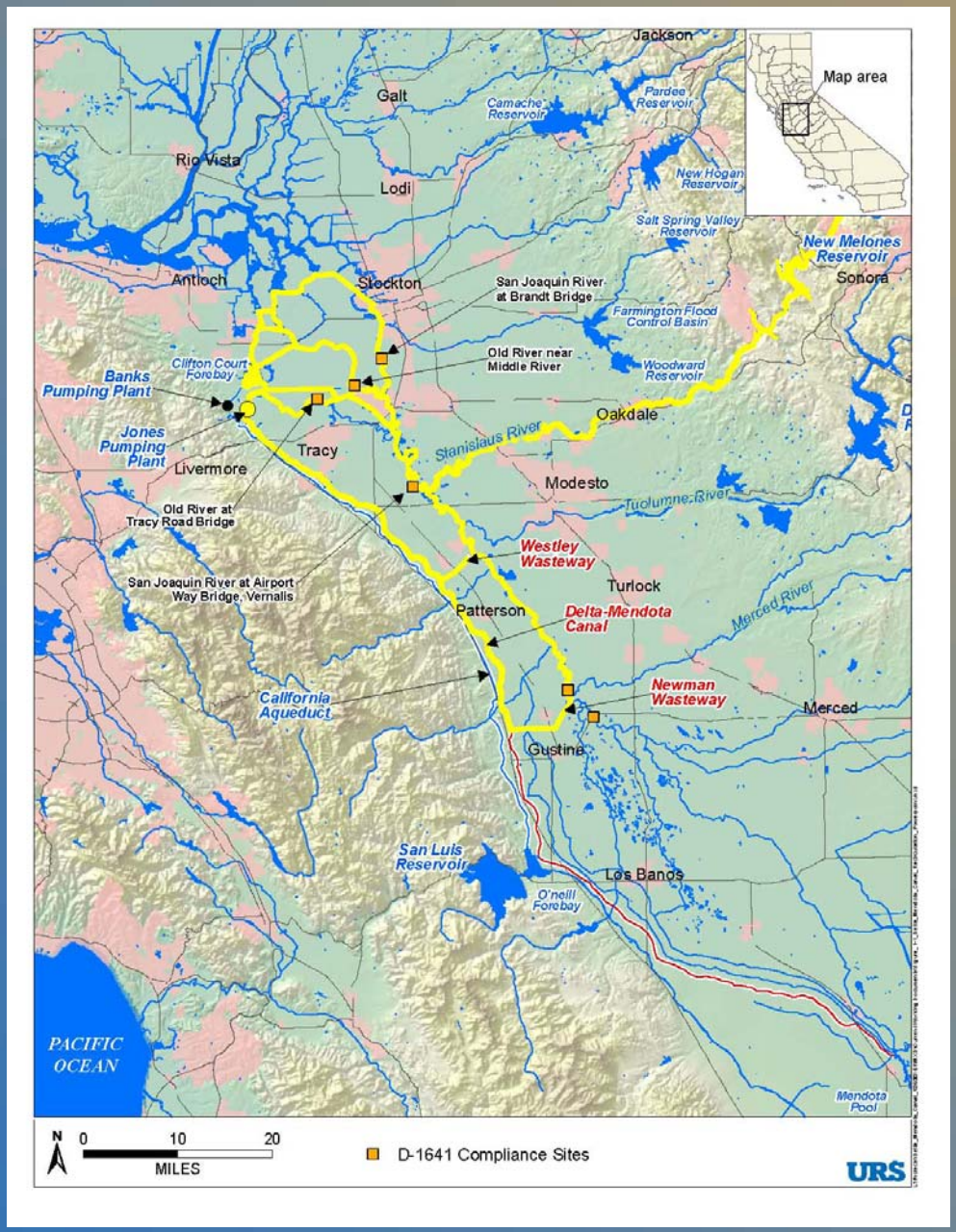

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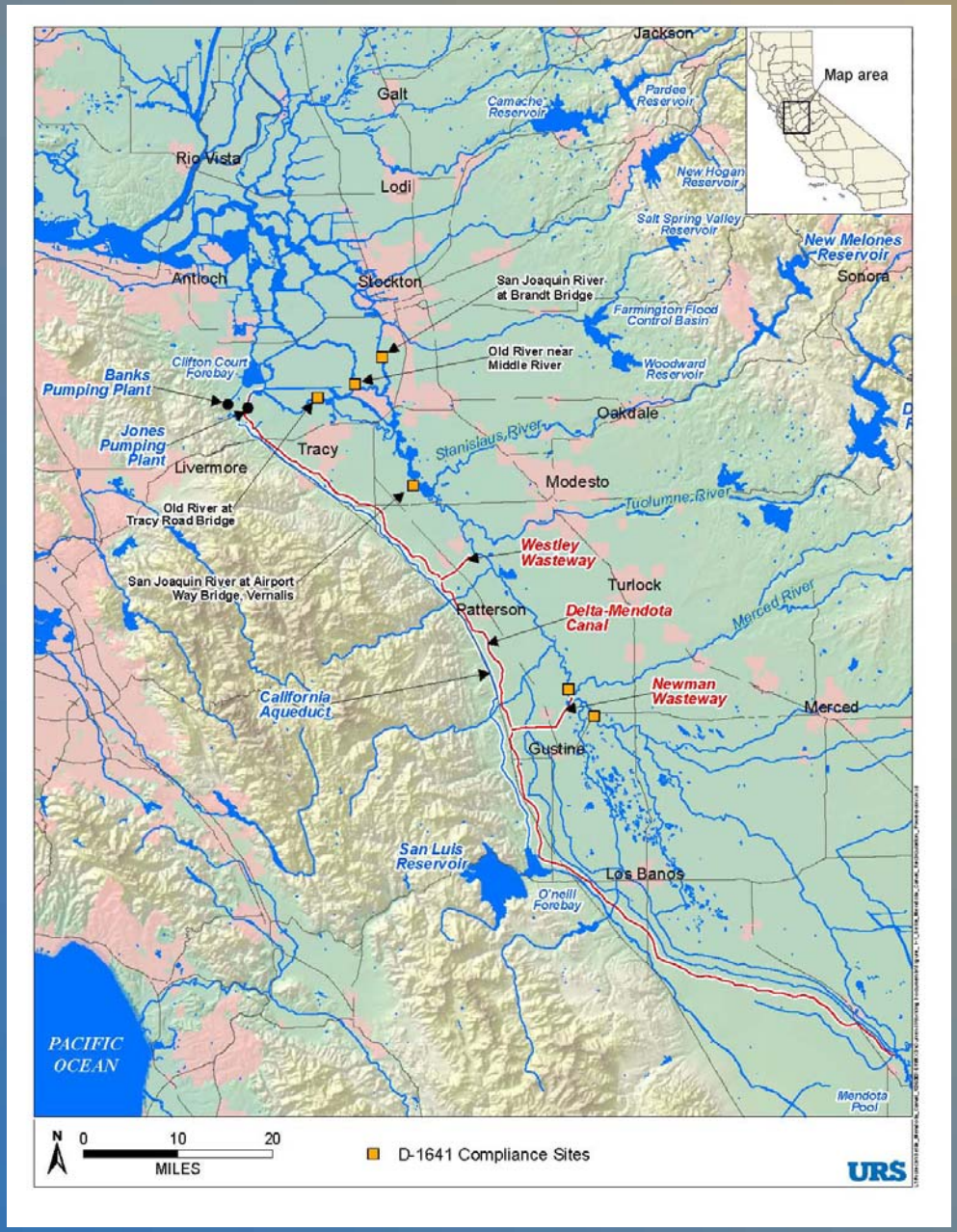

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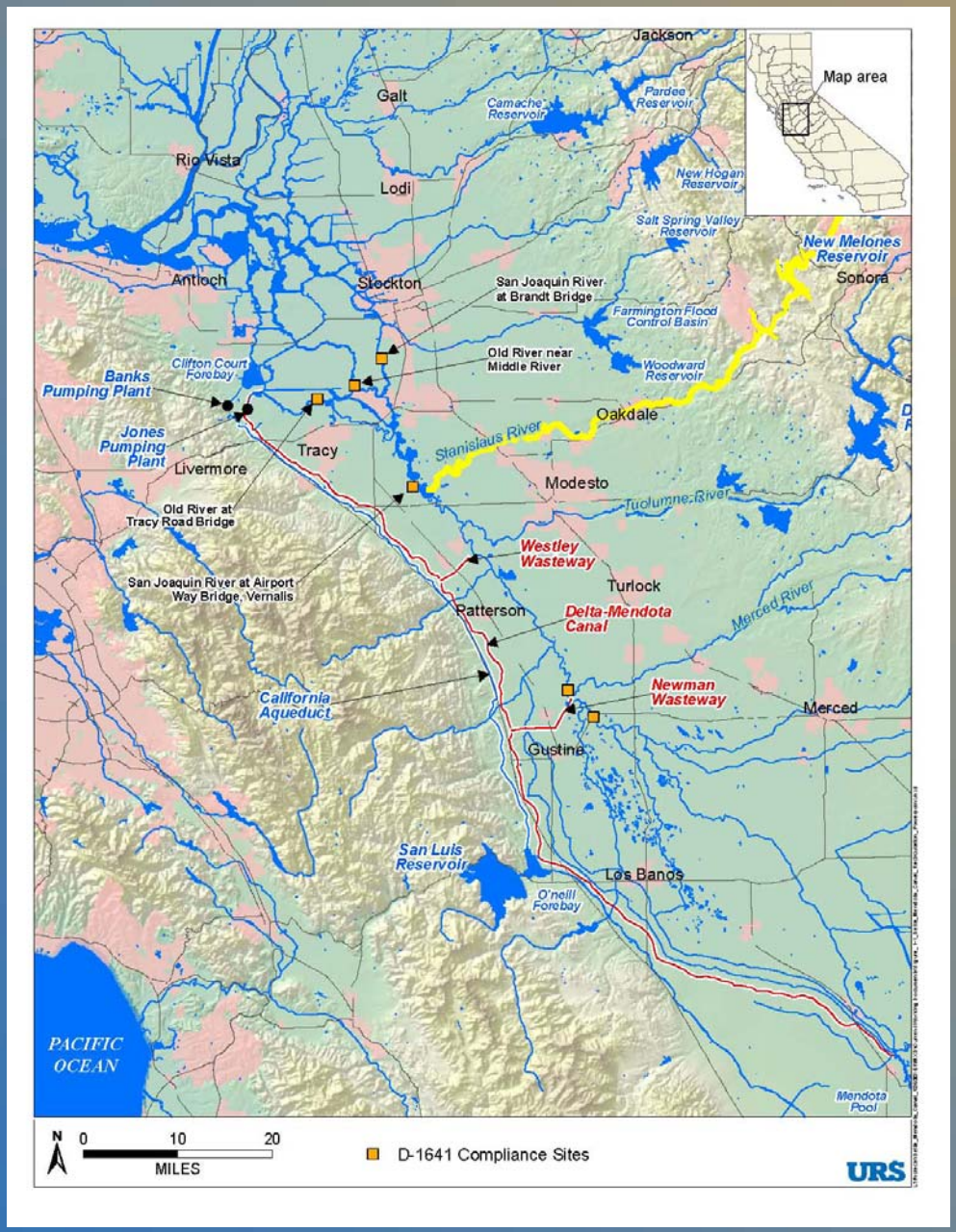

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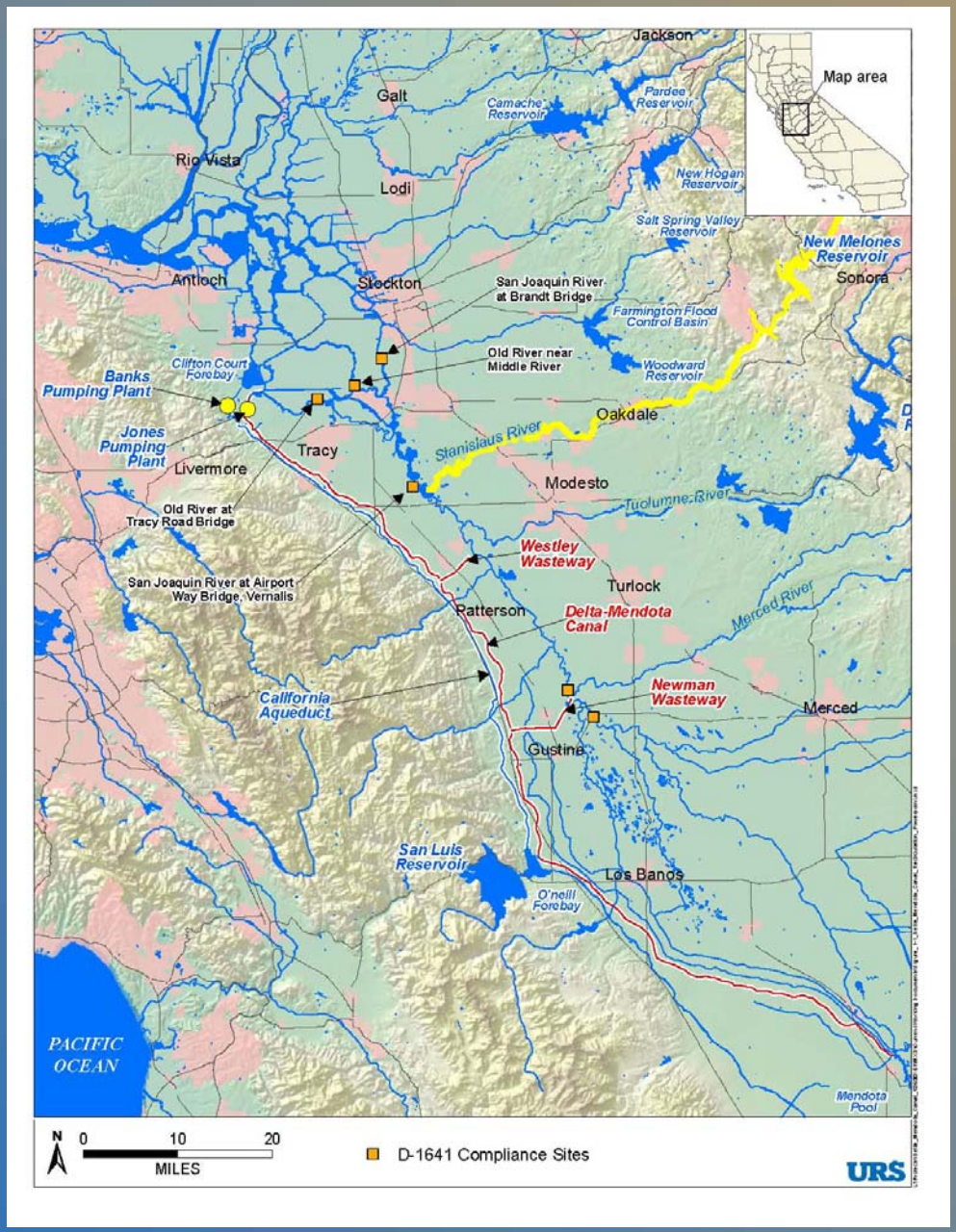

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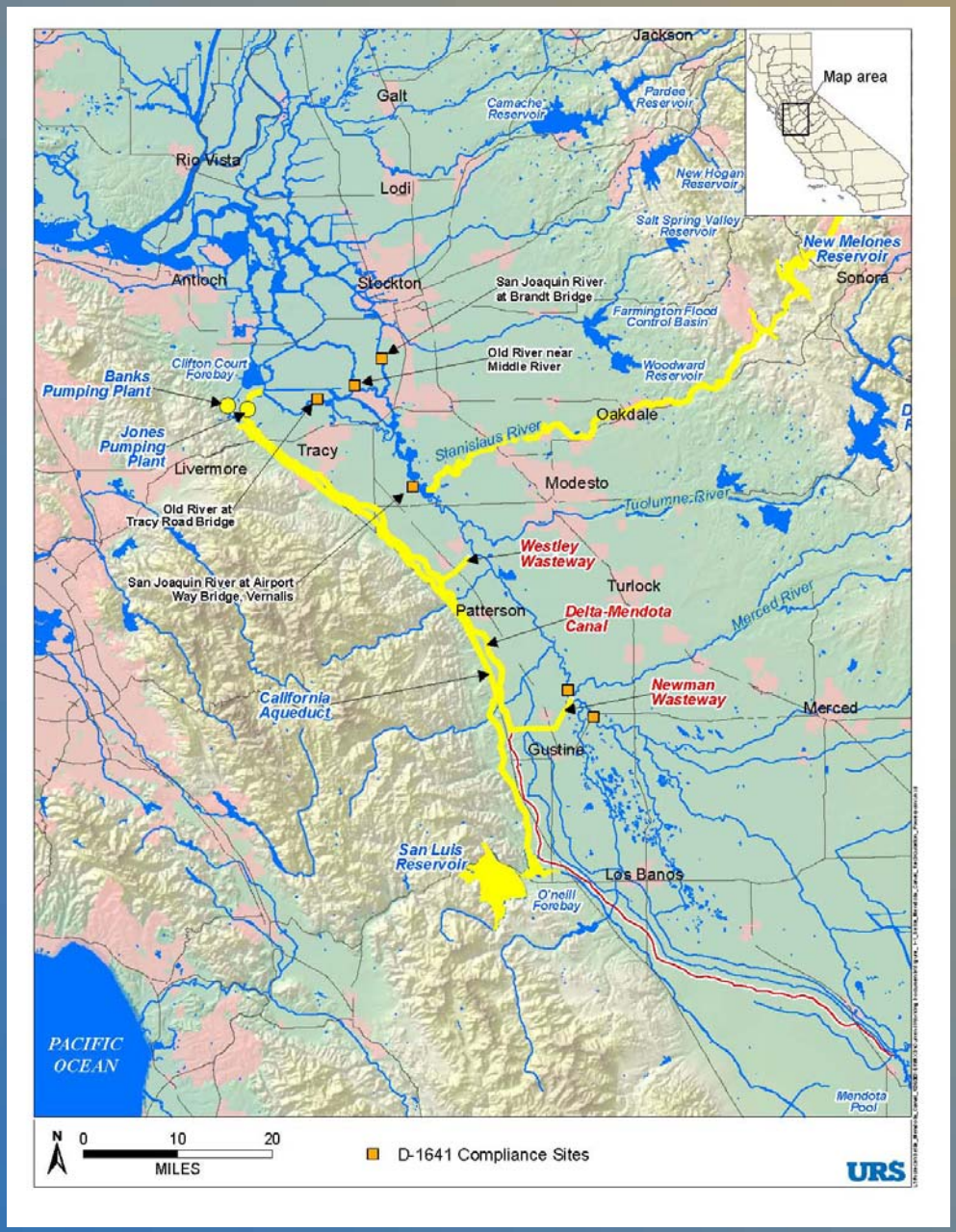

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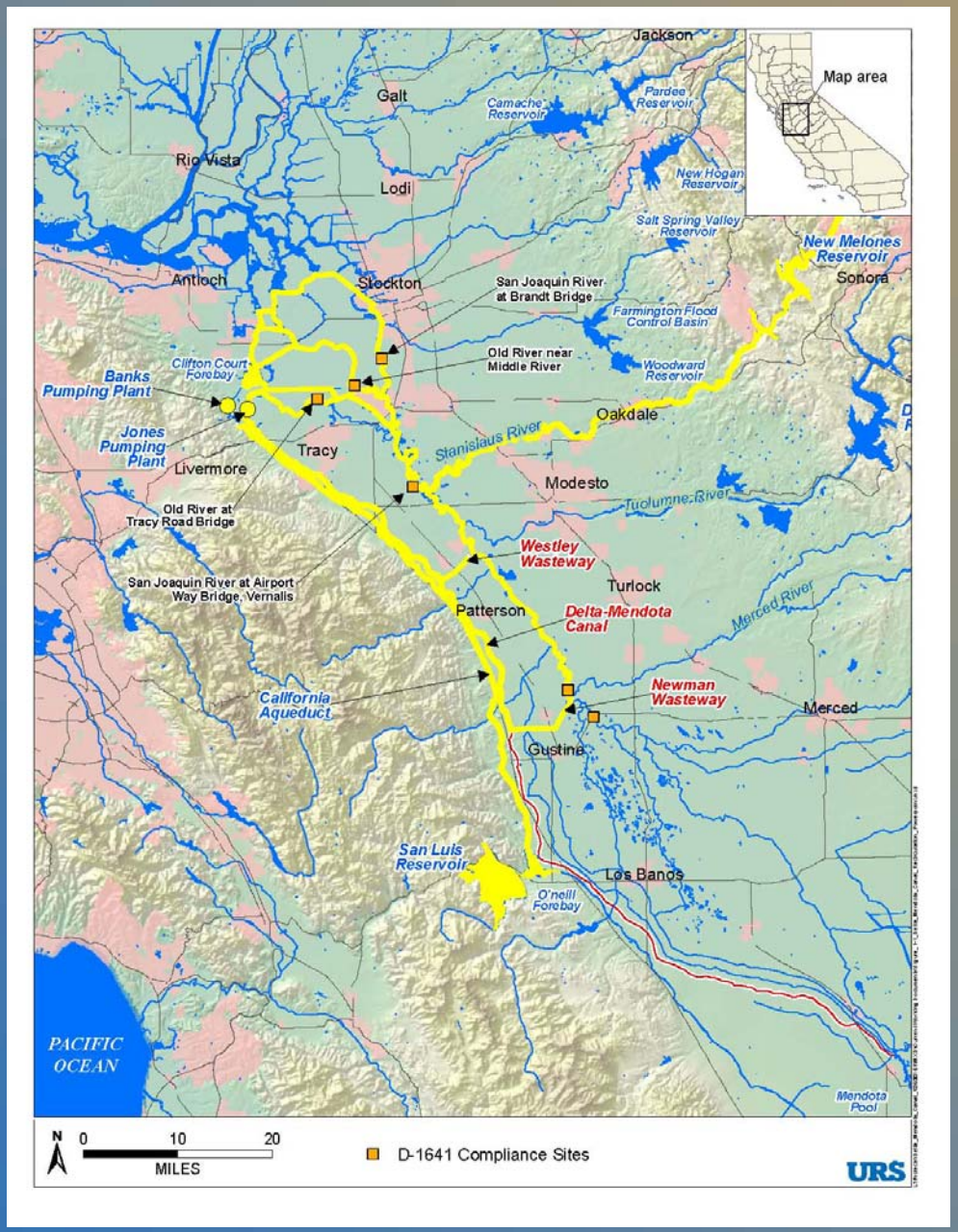

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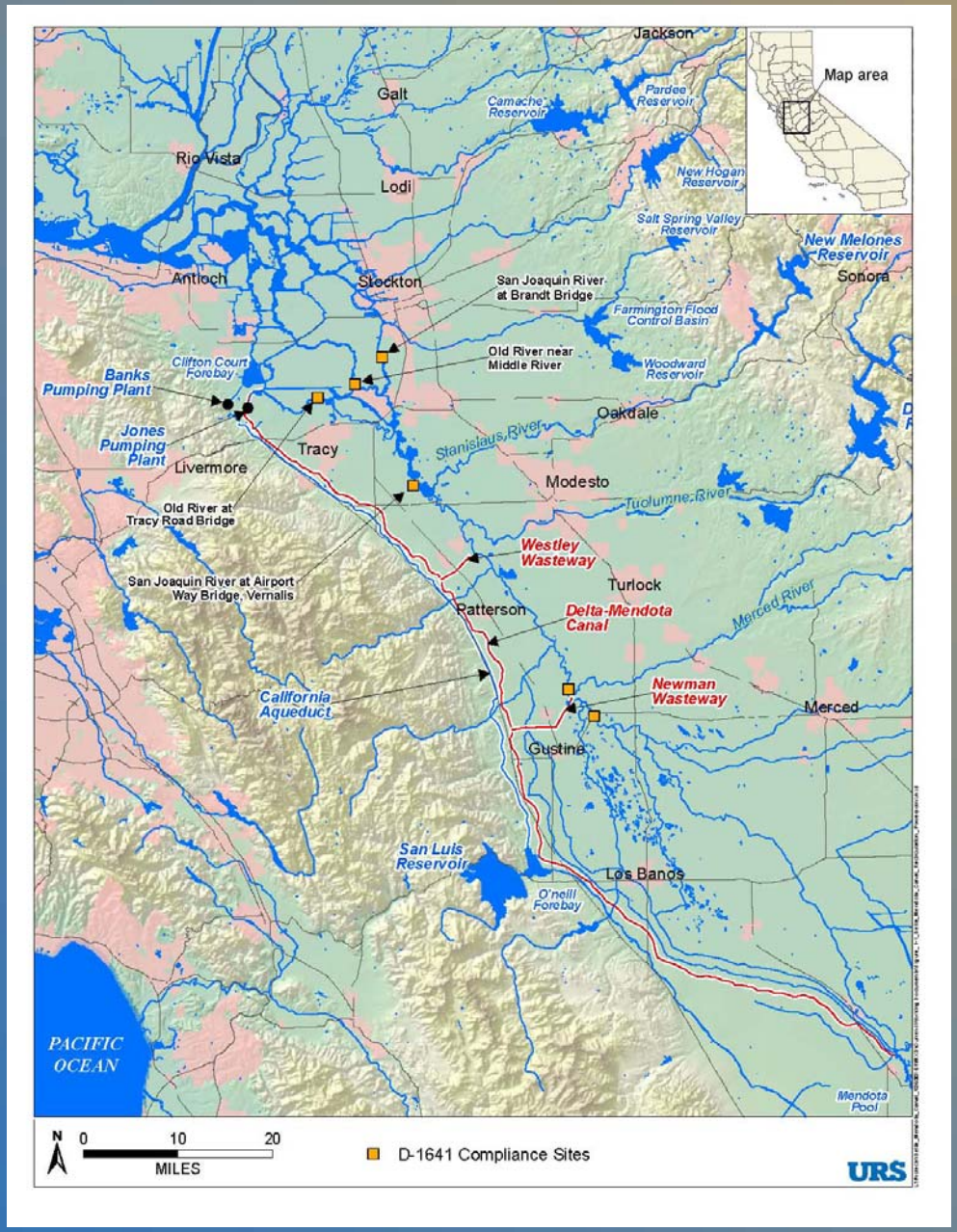

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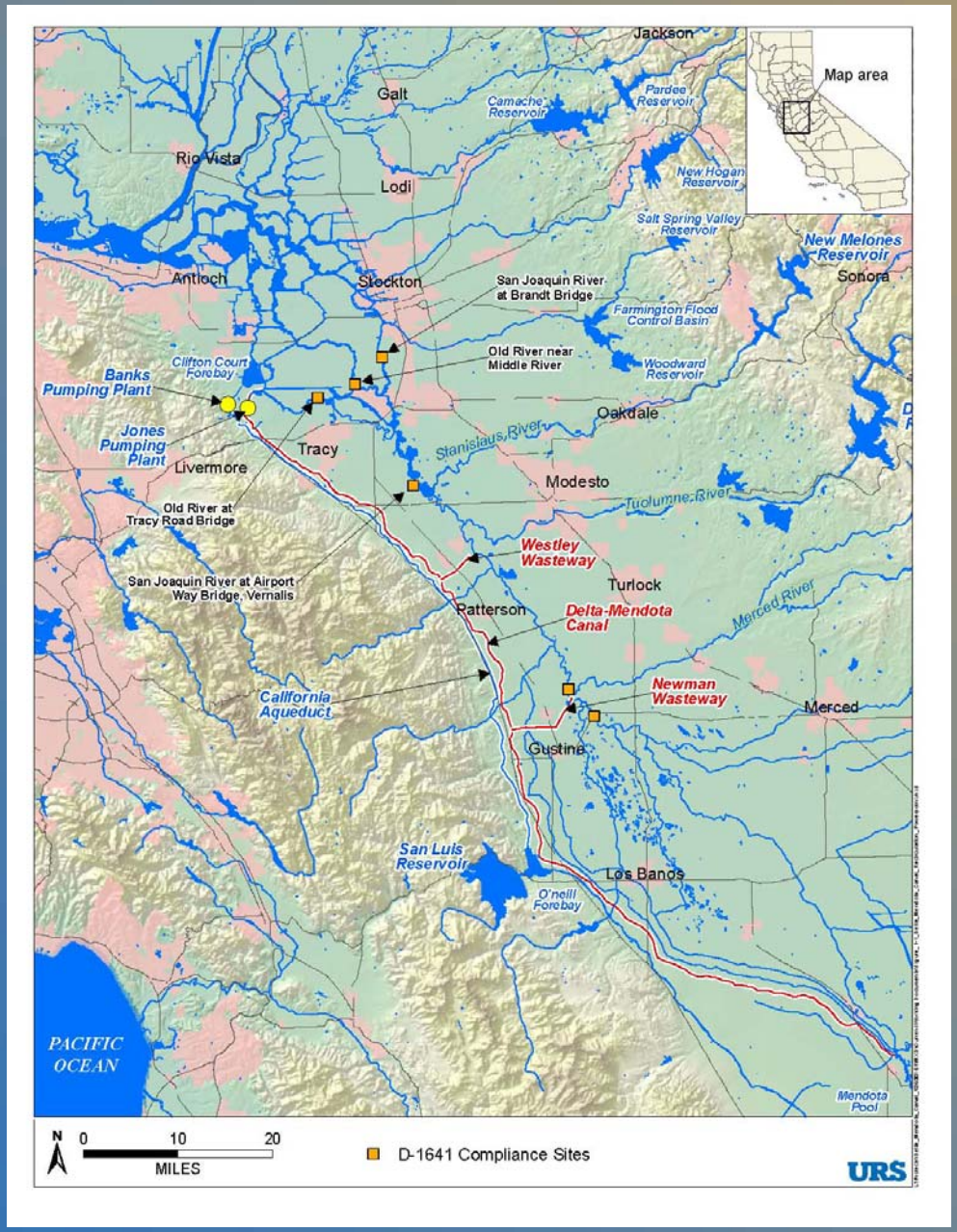

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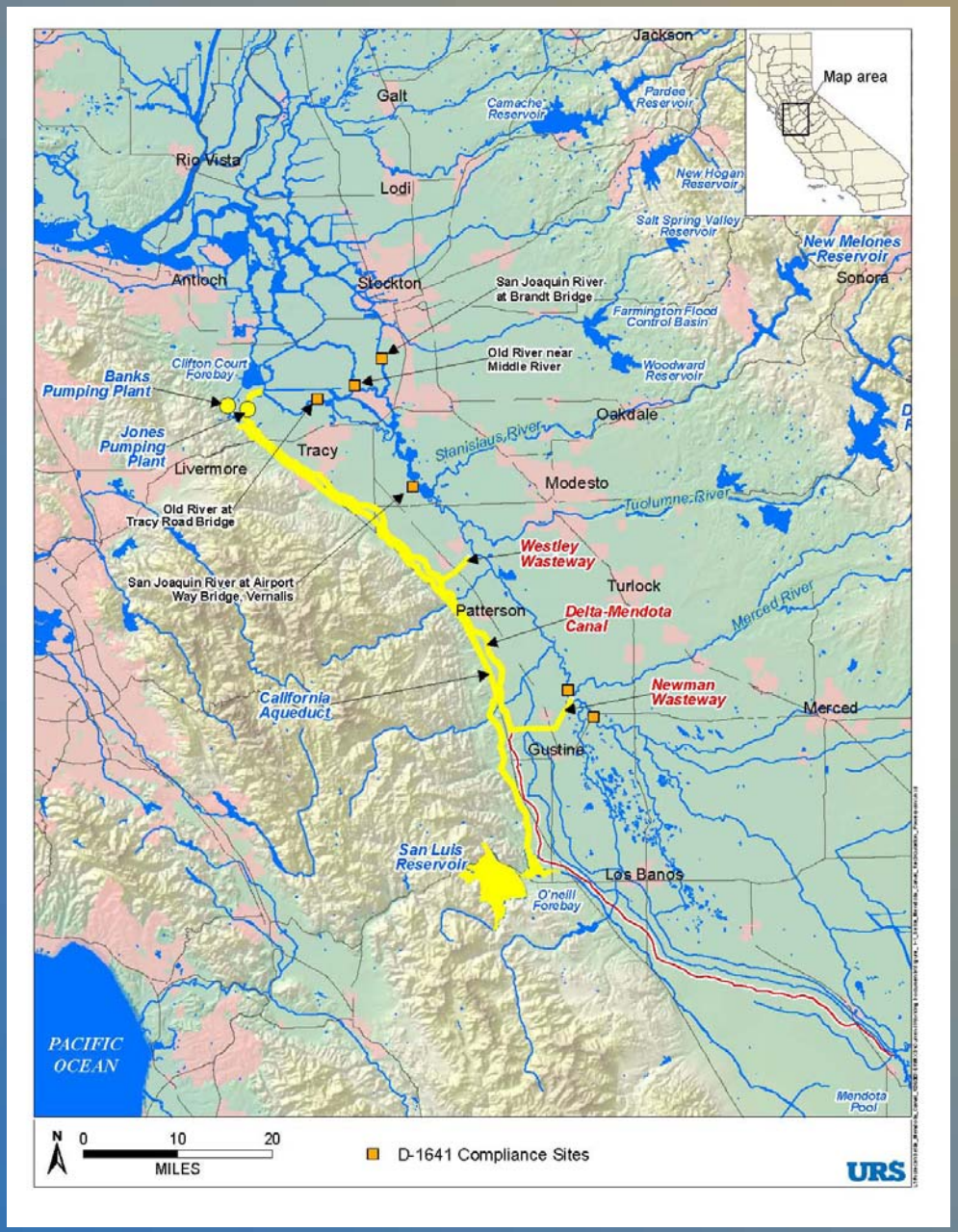

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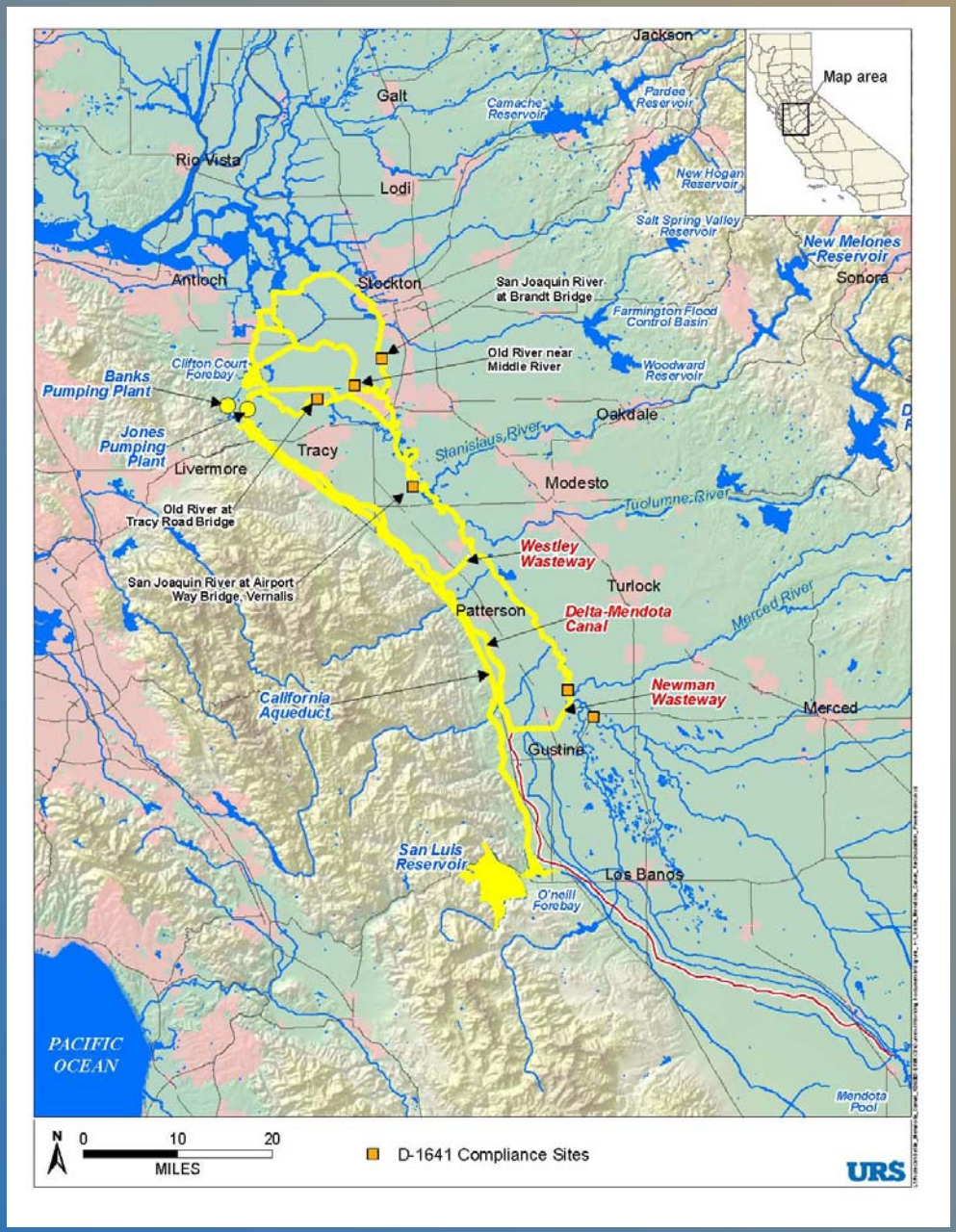

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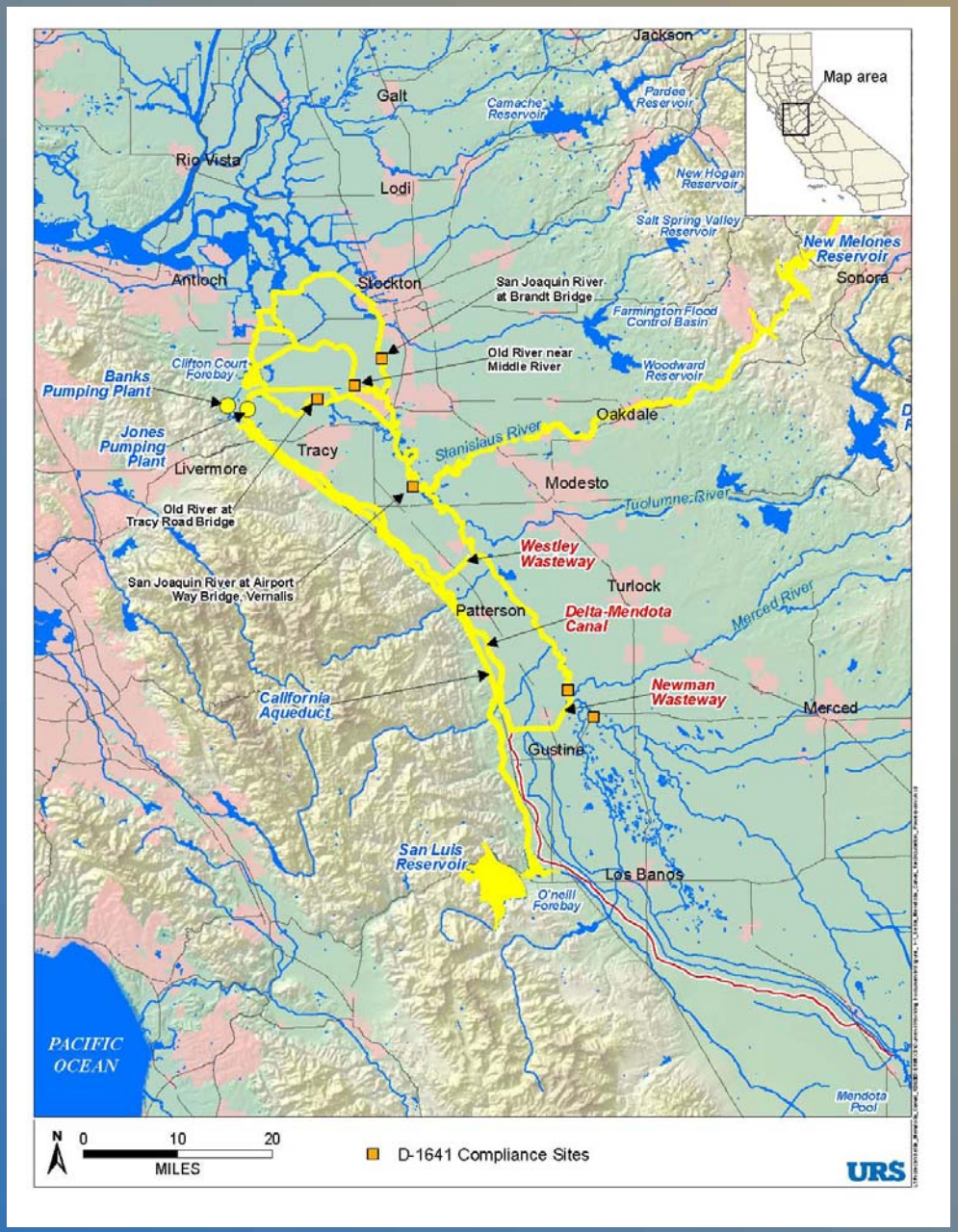

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DMC Recirculation Alternatives

A

Federal Facilities Only

- Excess Jones PP
- No CVP/SWP impact

A1
Supplement Vernalis Compliance

- Supplemental to New Melones release

A2
Supplement Vernalis Compliance and Enhance New Melones Water Supply

- Prior to New Melones release

B

Federal and State Facilities

- Excess Jones PP
- Excess Banks PP
- No CVP/SWP impact

B1
Supplement Vernalis Compliance

- Supplemental to New Melones release

B2
Supplement Vernalis Compliance and Enhance New Melones Water Supply

- Prior to New Melones release

C

Federal and State Facilities Limited Reduction of CVP Deliveries

- Excess Jones PP for Vernalis flow and water quality
- Excess Banks PP for Vernalis flow and quality
- CVP facilities then used for recirculation for Vernalis flow in priority to CVP SOD deliveries
- Prior to New Melones release

D

Federal and State Facilities Recirculation Priority to CVP Deliveries

- Excess Jones PP and Banks PP used first for Vernalis flow and quality
- CVP facilities then used for recirculation for Vernalis flow and quality in priority to CVP SOD deliveries
- Prior to New Melones release

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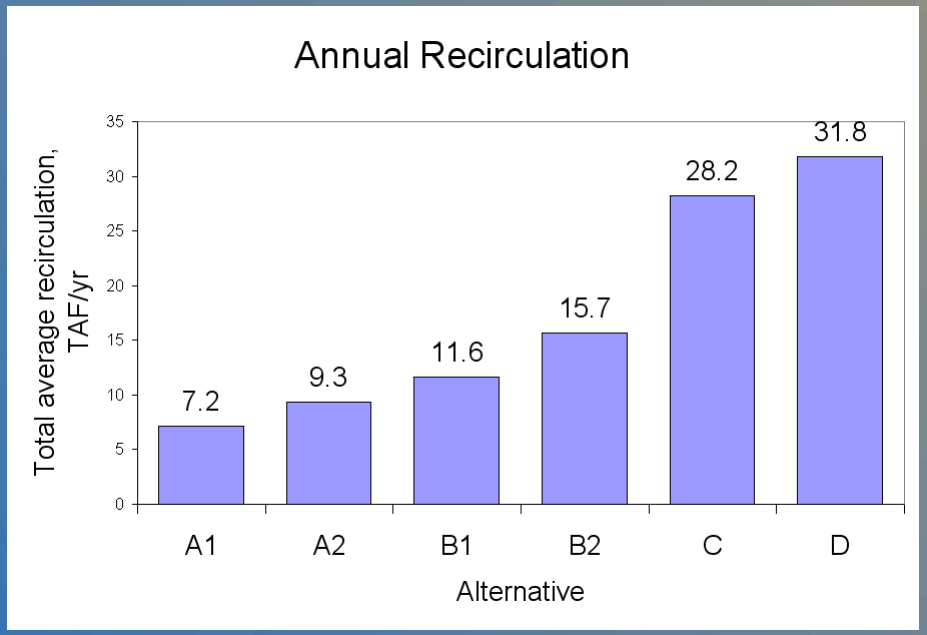

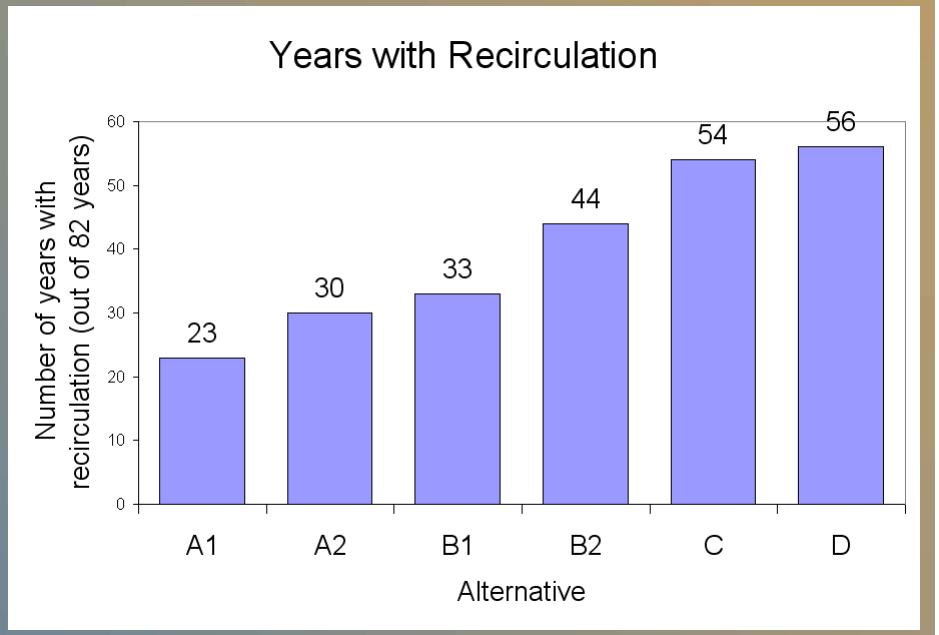

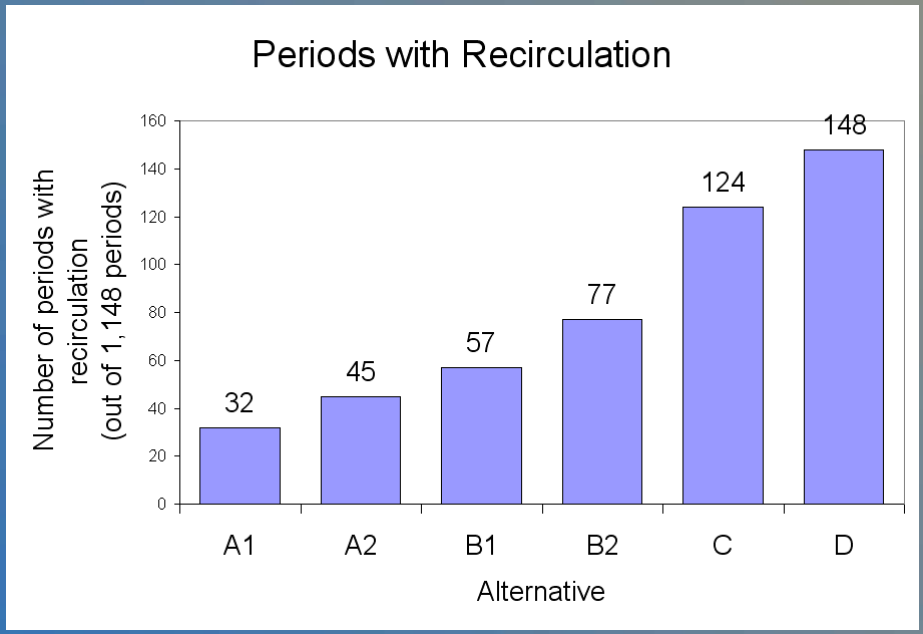

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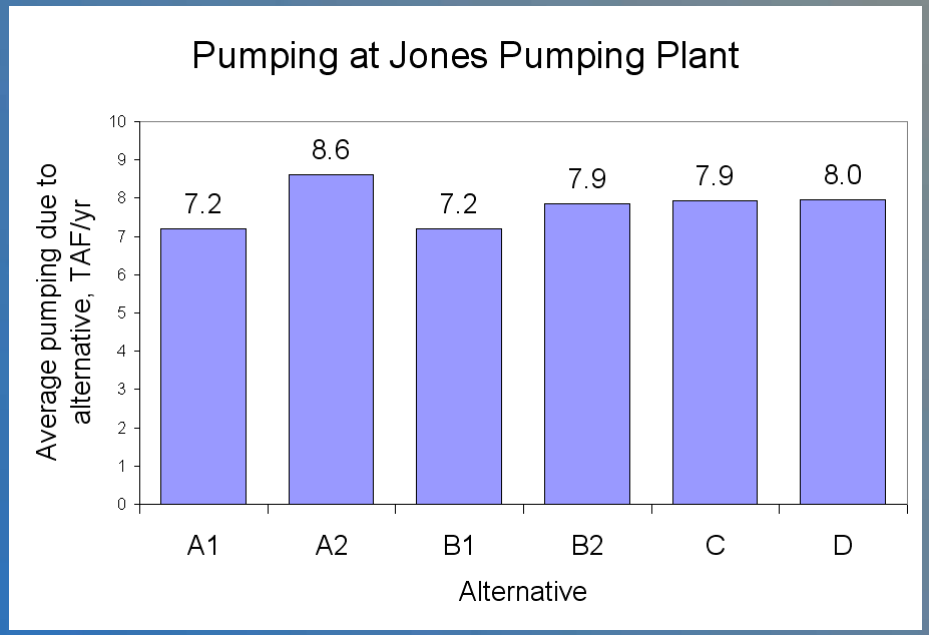

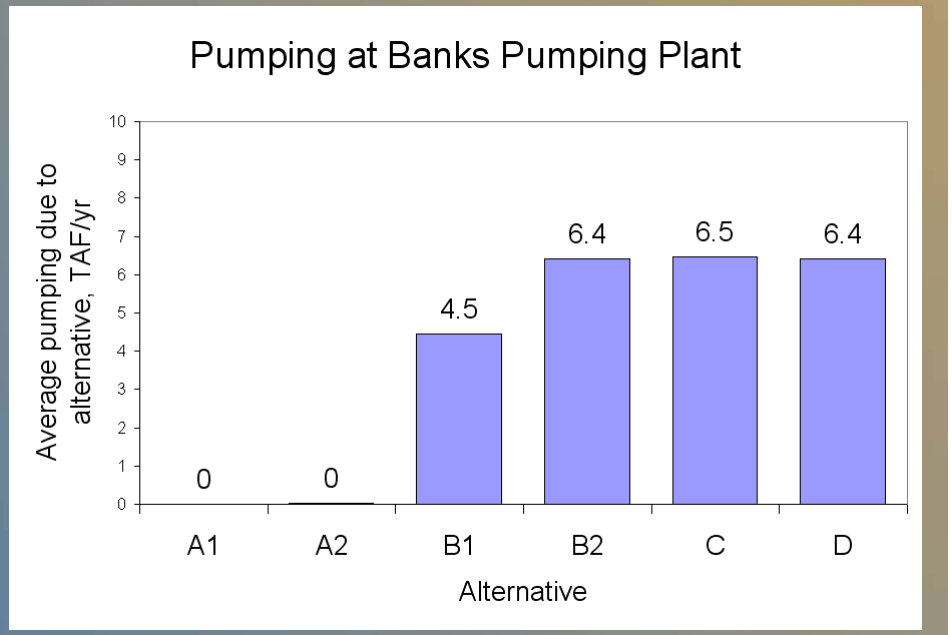

FNA = 2,427 TAF/yr

FNA = 3,531 TAF/yr

FNA = Future No Action

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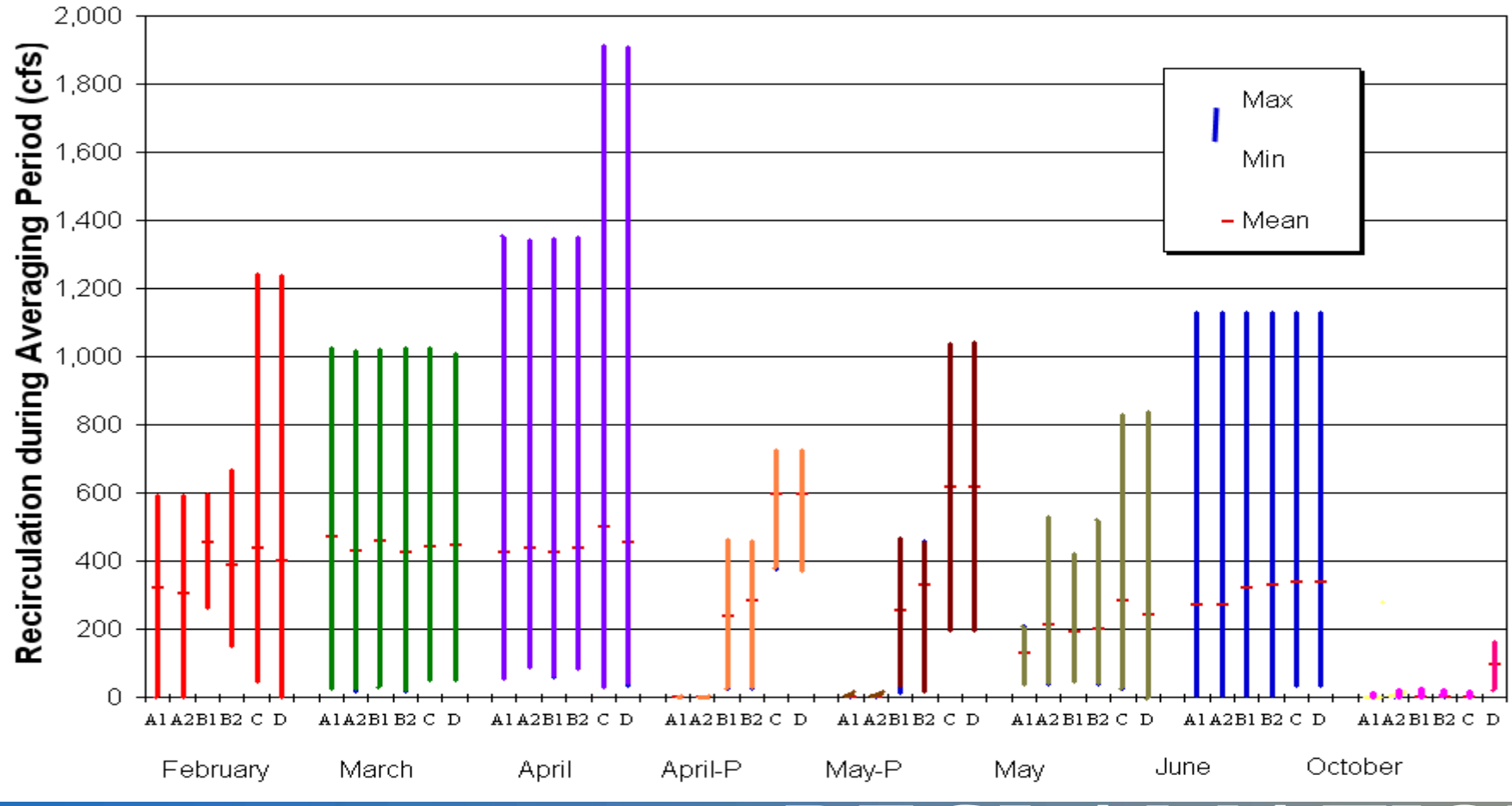
Recirculation By Alternative and Averaging Period (cfs)



Data only for recirculation periods (1922-2003)are shown

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Additional Modeling

- Sensitivity Analysis
  - Water Quality Requirements For DMC Use
  - Stanislaus River DO Requirements at Ripon
- Additional Objectives
  - Interior South Delta Water Quality
  - Augment Irrigation Season Flow in SJR
- Developed for Alternatives B2 and D

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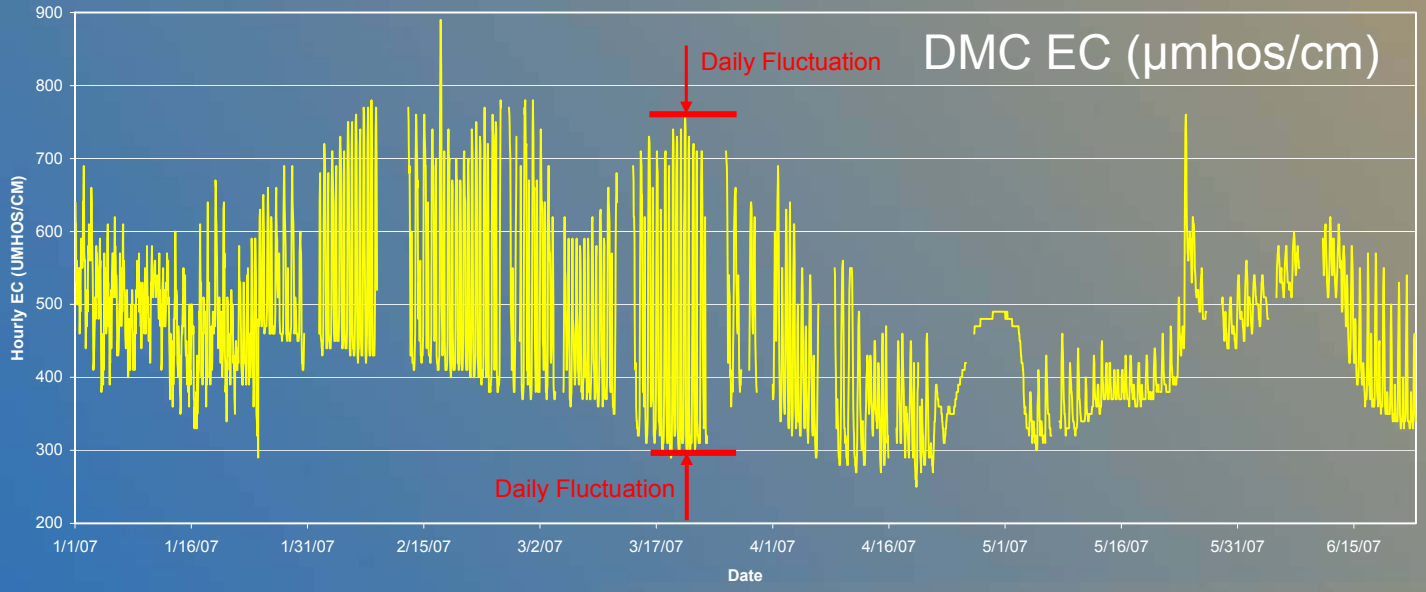
Sensitivity Analysis - Scenario 1

Delta Mendota Canal Water Quality Buffer

- 0 µmhos/cm buffer rather than 200 µmhos/cm
- Recirculation for flow objectives at Vernalis even if DMC EC is higher than SJR EC at Vernalis
- Vernalis water quality objectives will not be violated
- Limit Recirculation to 1300 cfs
- Applied to Alternatives B2 and D



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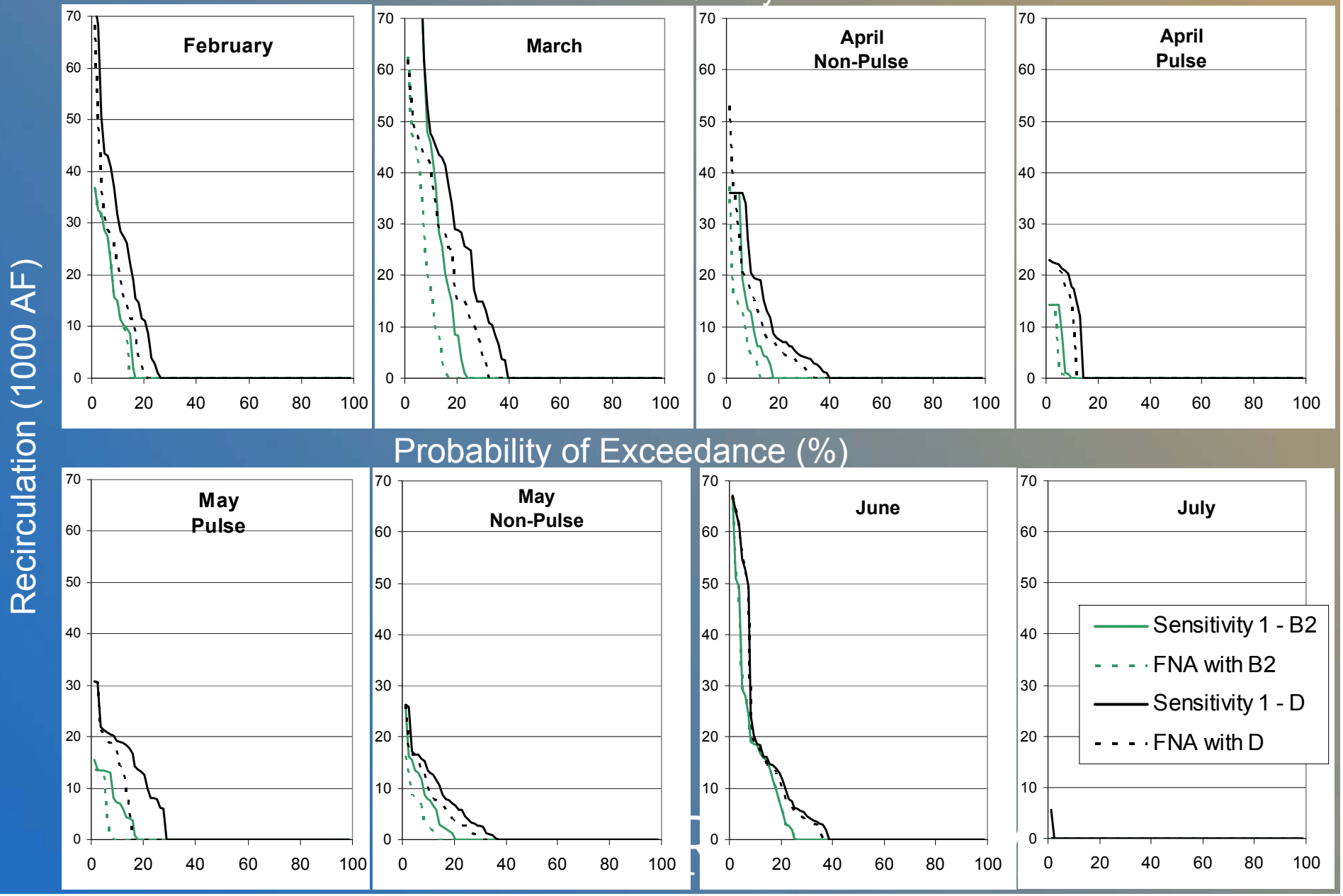
Sensitivity Analysis - Scenario 1

Recirculation for Quality and Flow



Sensitivity Analysis - Scenario 2

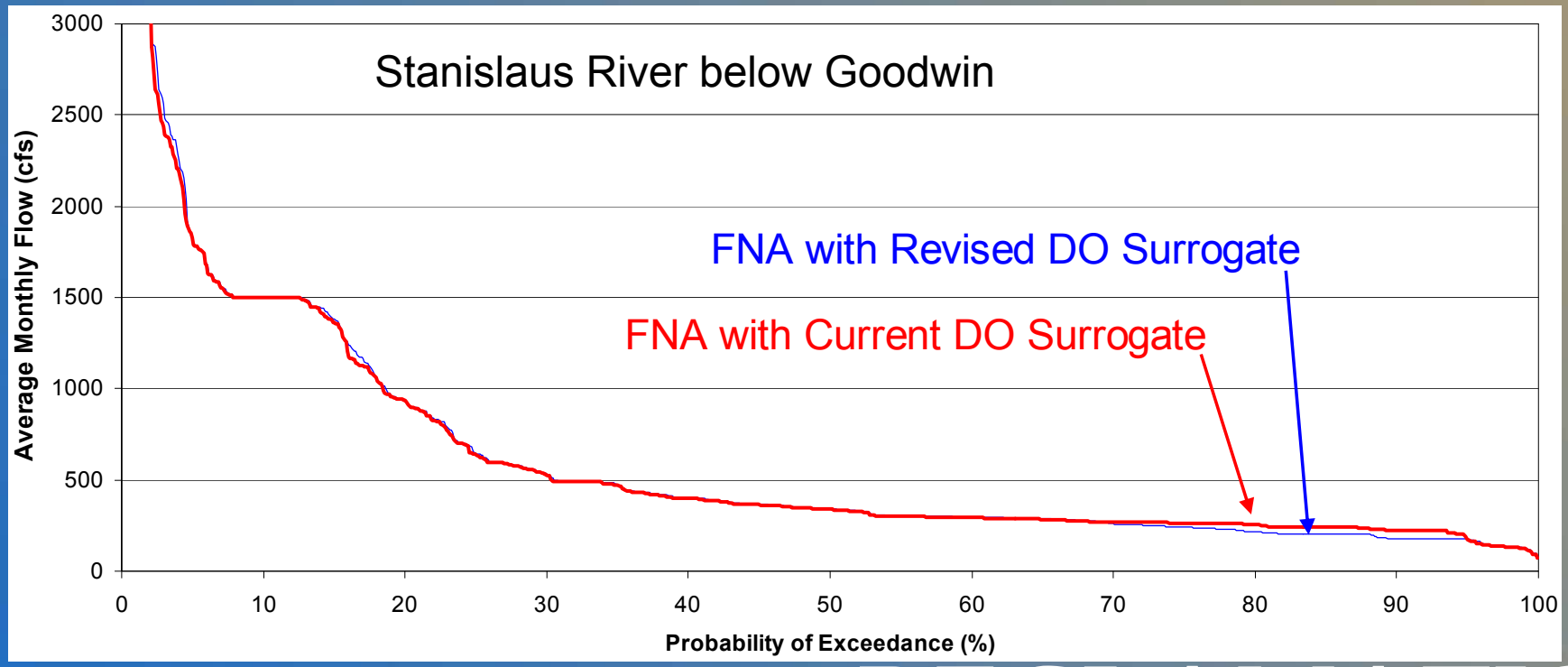
Stanislaus River Dissolved Oxygen Standard at Ripon

- **Flow surrogate for the DO objective in the Stanislaus River is replaced with a lower flow surrogate**

Stanislaus River DO Flow Surrogate (cfs)

	June	July	August	September
Sensitivity FNA	175	200	200	175
Current FNA	222	263	267	240

FNA Changes



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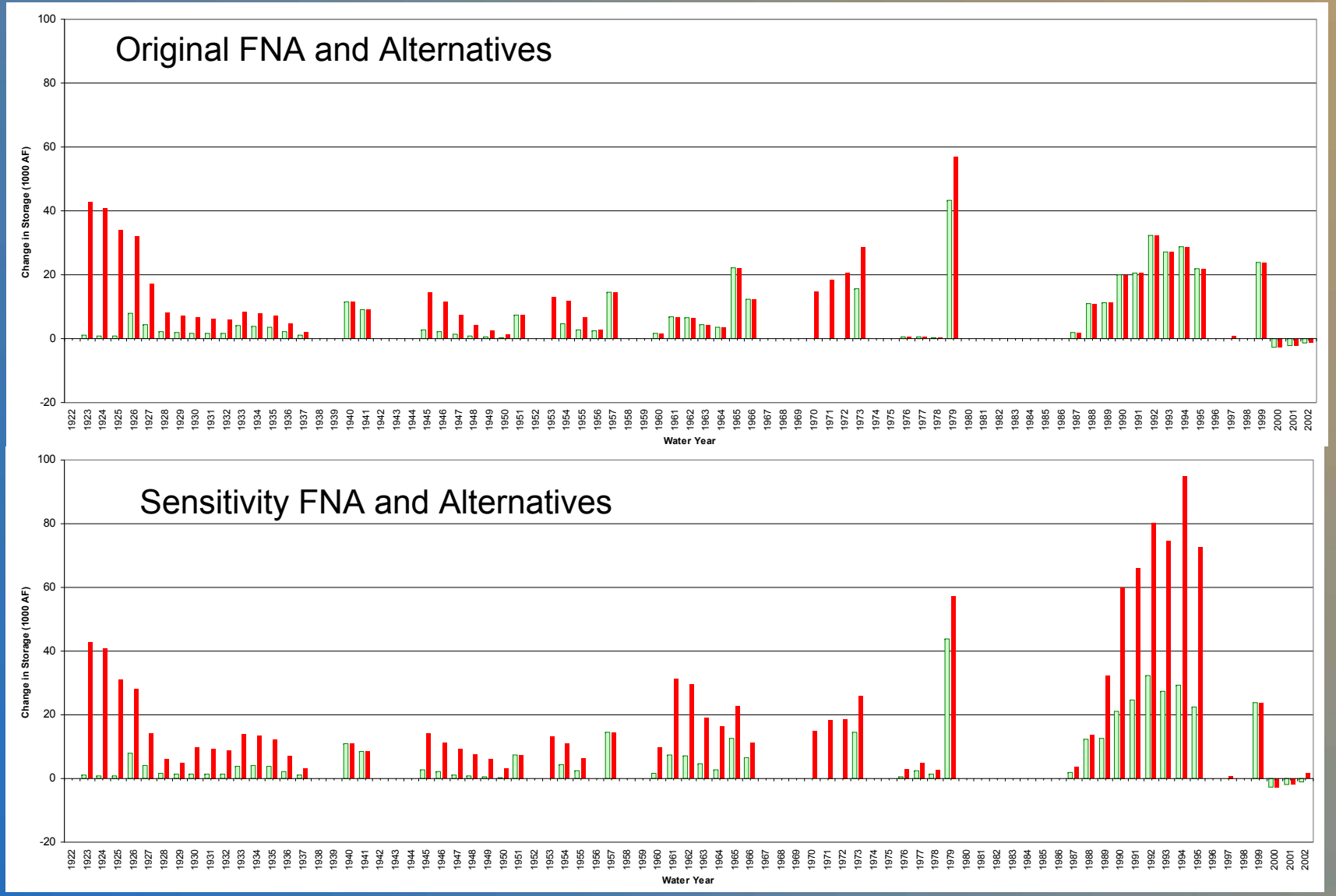
Sensitivity Analysis - Scenario 2

Change in New Melones Carryover Storage



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Sensitivity Analysis - Scenario 3

South Delta Water Quality Target

- **Recirculation used to meet WQ objectives on SJR at Brandt Bridge and Old River at Middle River**
  - **Vernalis objective adjusted to reflect interior Delta objective**

Water Quality Objective at Vernalis (EC - mmhos/cm)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Apr-Pulse	May	May-Pulse	Jun	Jul	Aug	Sep
Sensitivity	850	850	850	850	850	850	550	550	550	550	550	550	550	850
Current	1000	1000	1000	1000	1000	1000	700	700	700	700	700	700	700	1000

- **Analyzed under two conditions**
  1. **Using excess capacity at Jones and Banks PP (as in Alternative B2)**
  2. **Using excess capacity at Jones and Banks PP and possible reduction in CVP deliveries (as in Alternative D)**

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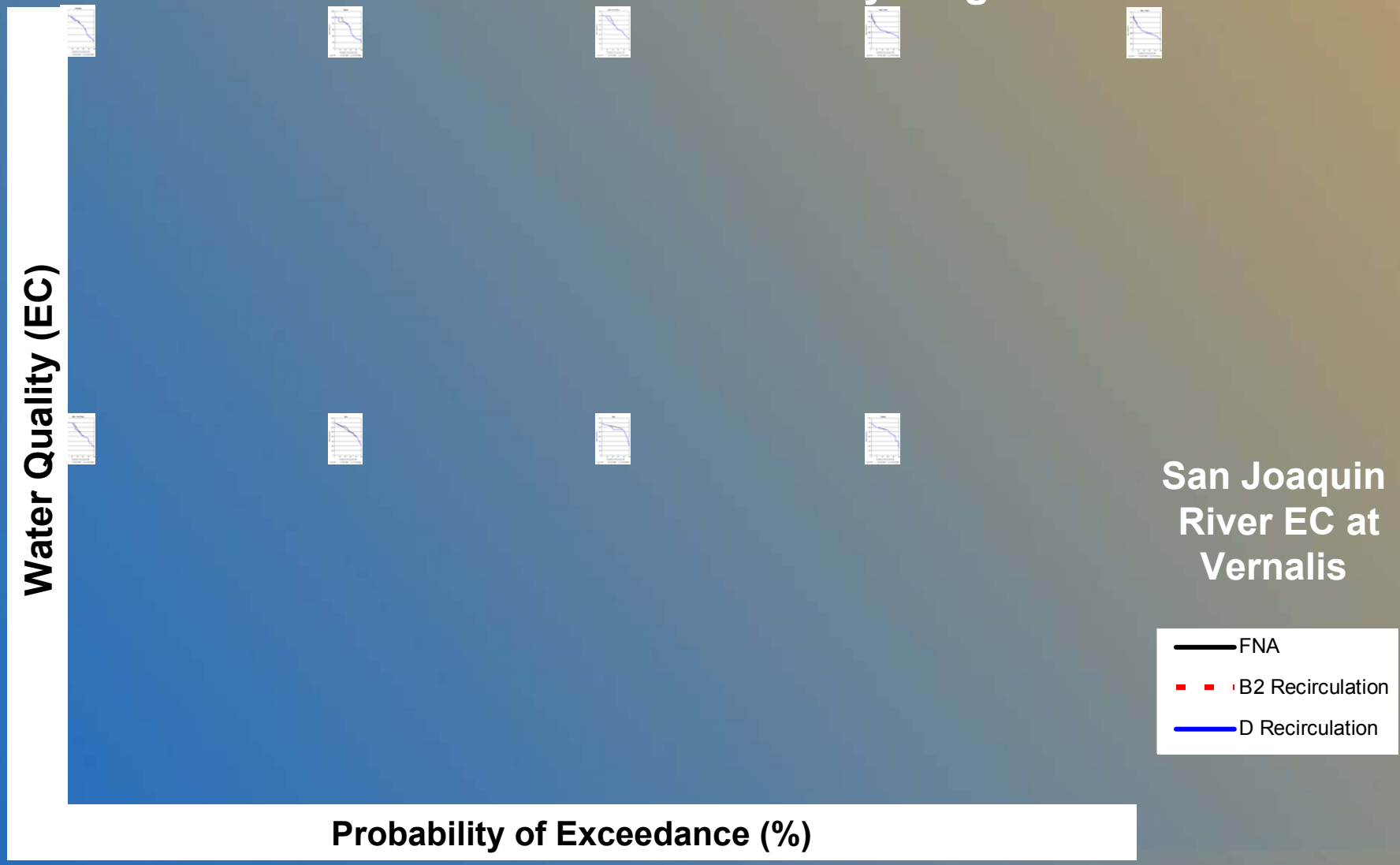
Sensitivity Analysis - Scenario 3

South Delta Water Quality Target



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Sensitivity Analysis - Scenario 4

Augment
Flow during the Irrigation Season

- Maintain Vernalis flow at 1500 cfs from April through August
- Limit Recirculation to 300 cfs
- Analyzed under two conditions
  1. Using excess capacity at Jones and Banks PP (as in Alternative B2)
  2. Using excess capacity at Jones and Banks PP and possible reduction in CVP deliveries (as in Alternative D)

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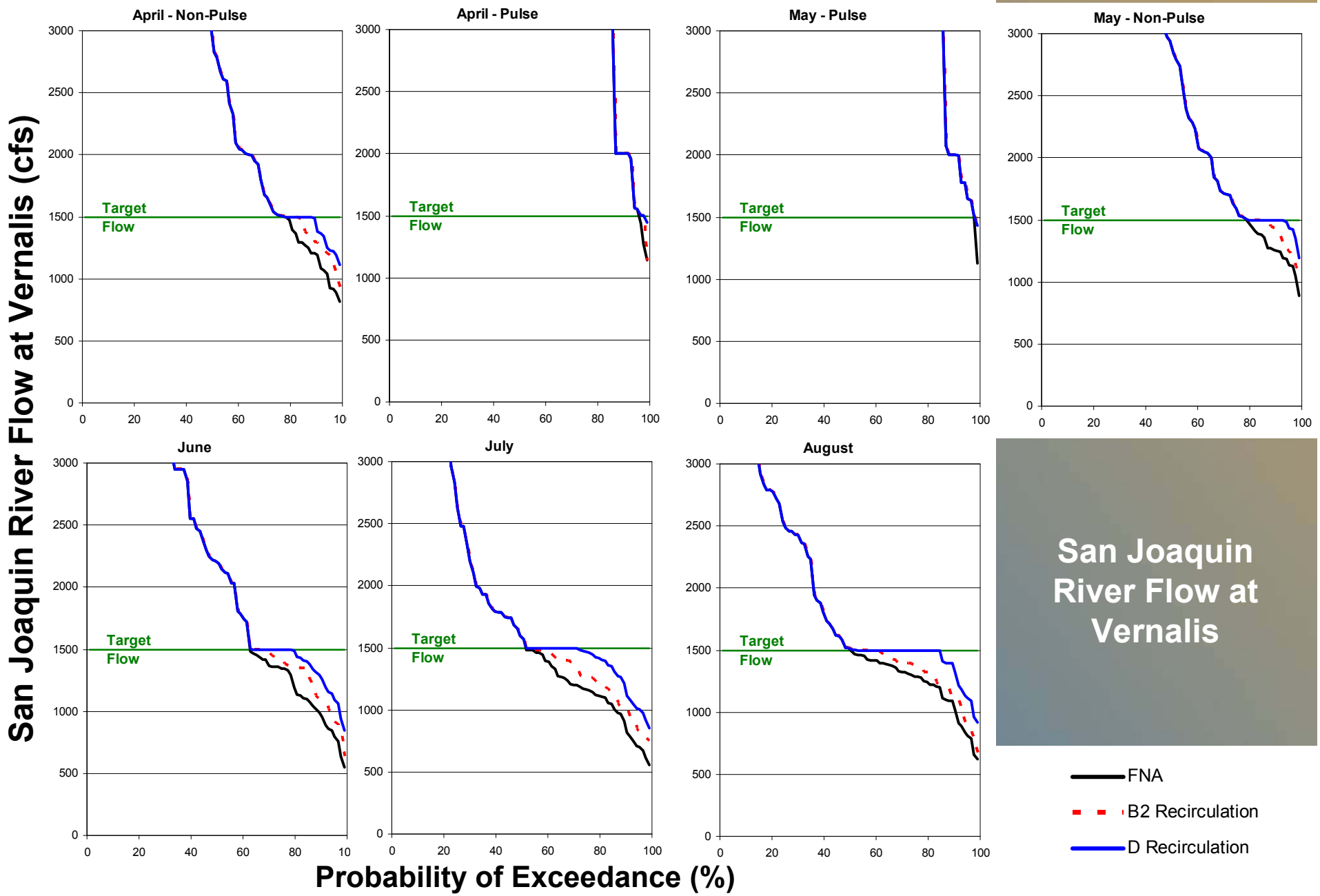
Sensitivity Analysis - Scenario 4



Planning Objectives

A. Provide supplemental flow in the lower SJR for meeting fishery flow objectives.

B. Provide lower salinity water to the SJR for meeting WQOs at Vernalis.

C. Provide greater flexibility in meeting the existing water quality standards and objectives so as to reduce the demand on water from New Melones Reservoir.

D. Use recirculation to improve DO in the SJR.

E. Provide lower salinity water to the SJR for meeting WQOs at interior south Delta stations.

Achieving Planning Objectives: Approach

- Flow
  - Count of periods flow objective at Vernalis is met
  - Includes sensitivity analysis
- Electrical Conductivity (EC)
  - @ Vernalis
    - Count of periods WQO is met
    - Includes sensitivity analysis
  - @ Interior south Delta
    - Representative location: Brandt Bridge
    - Count of days WQO is met

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Achieving Planning Objectives: Approach (continued)

- **Reliance on New Melones**
  - Releases to meet both water quality and flow objectives, annual average volume
  - Includes sensitivity analysis
- **Dissolved Oxygen (DO)**
  - Port of Stockton DWSC
  - Evaluated representative periods (i.e., during recirculation)
  - Correlated DO to flow measured at Stockton
  - Count of periods WQO is met (Feb-June only)
- **Water Level**
  - Evaluated stage at south Delta sites
  - Average stage in feet (July-Sept only)

Achieving Planning Objectives: Results

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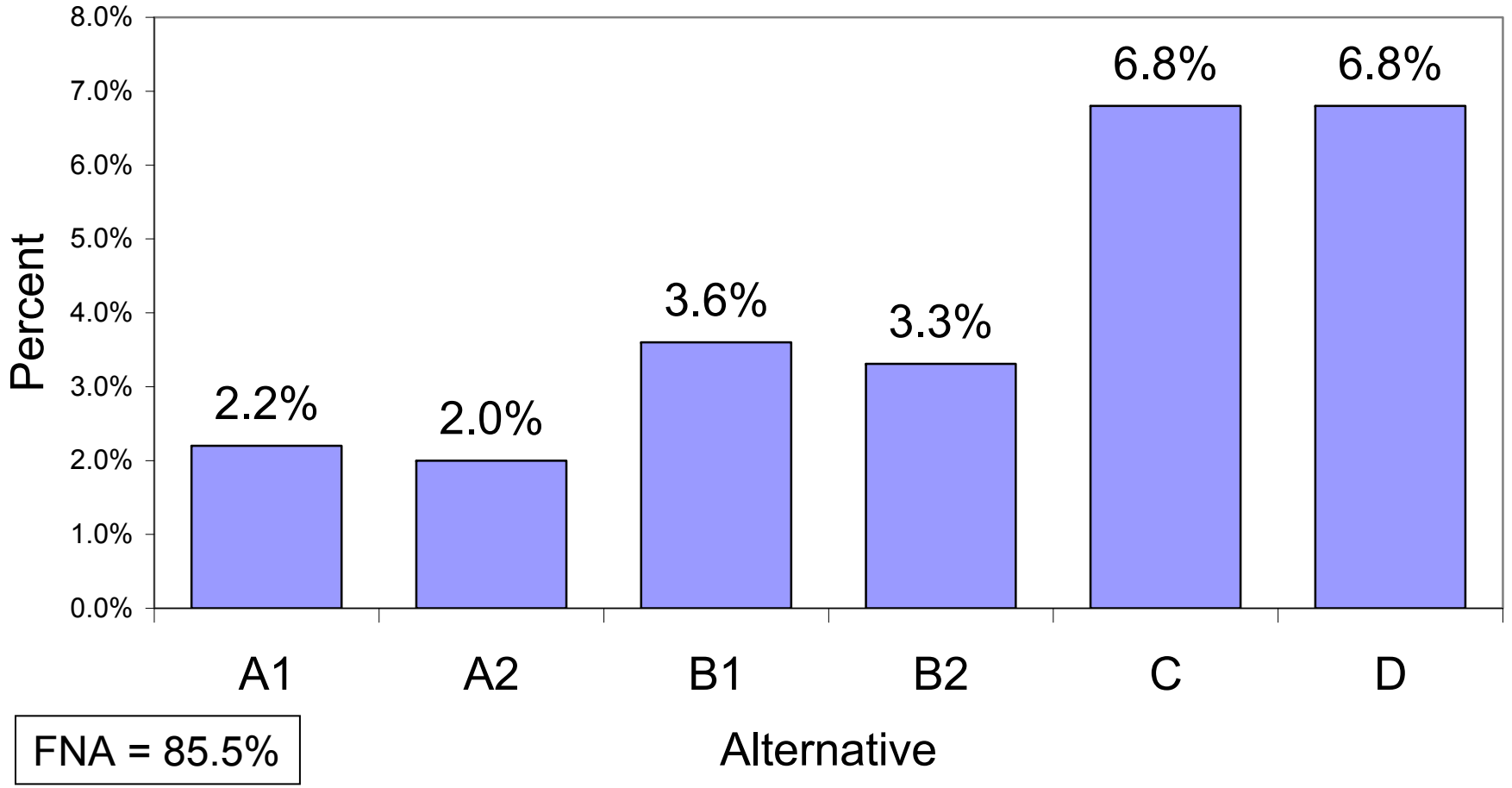
Flow at Vernalis

Percent of periods flow objective is predicted to be met due to alternative



FNA = 85.5%

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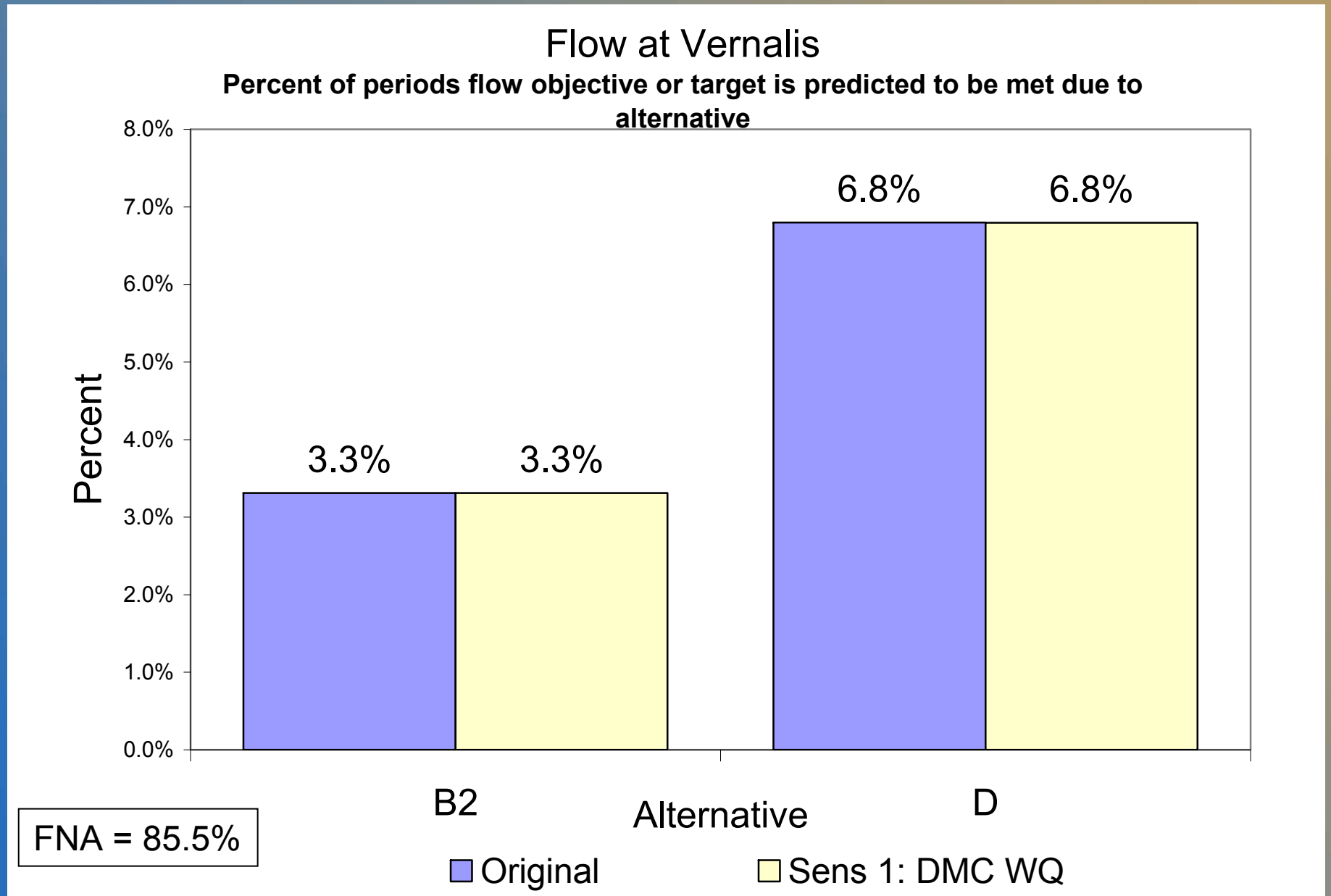

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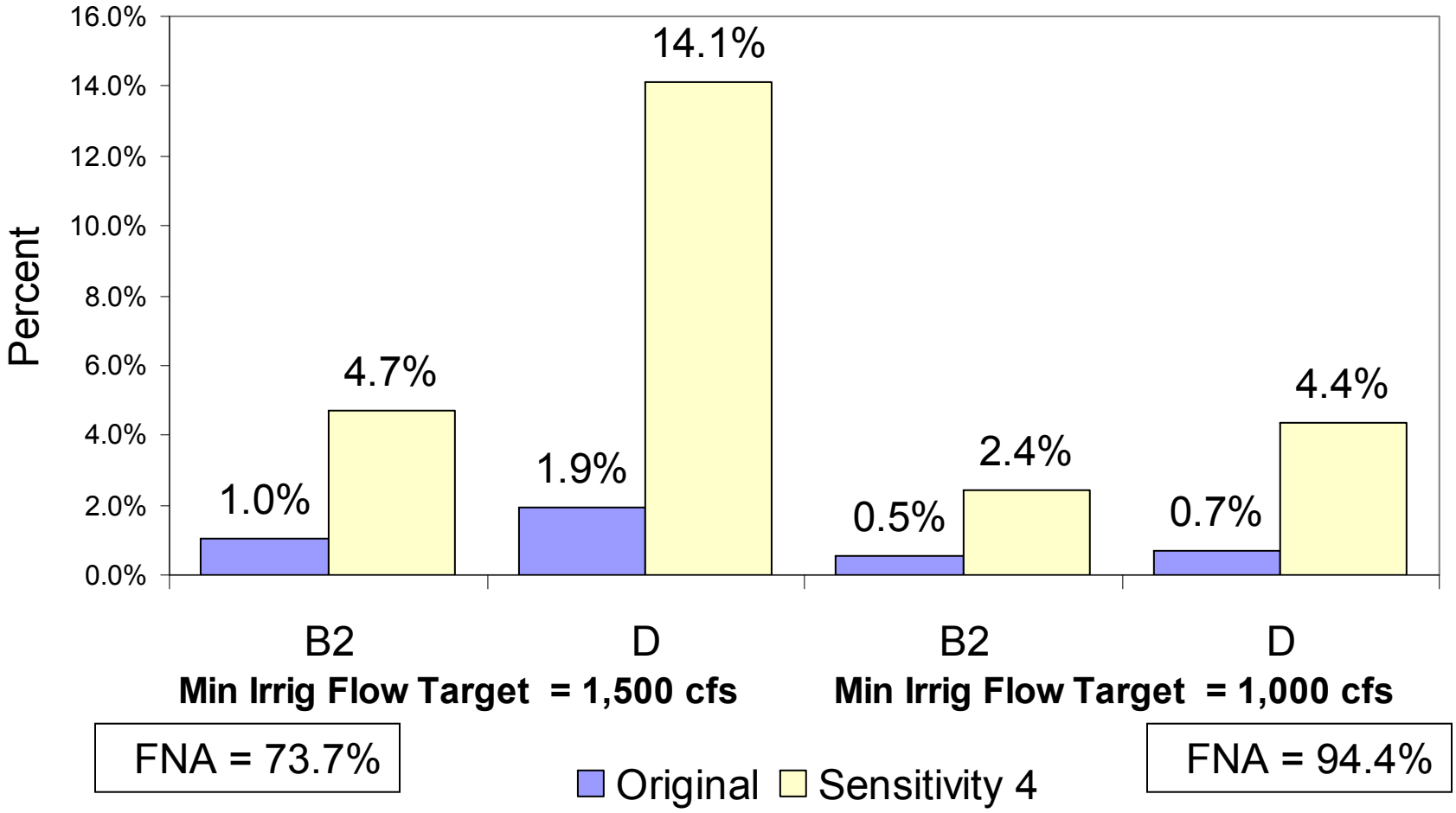
Flow at Vernalis

Percent of April through August periods flow target is predicted to be met due to alternative



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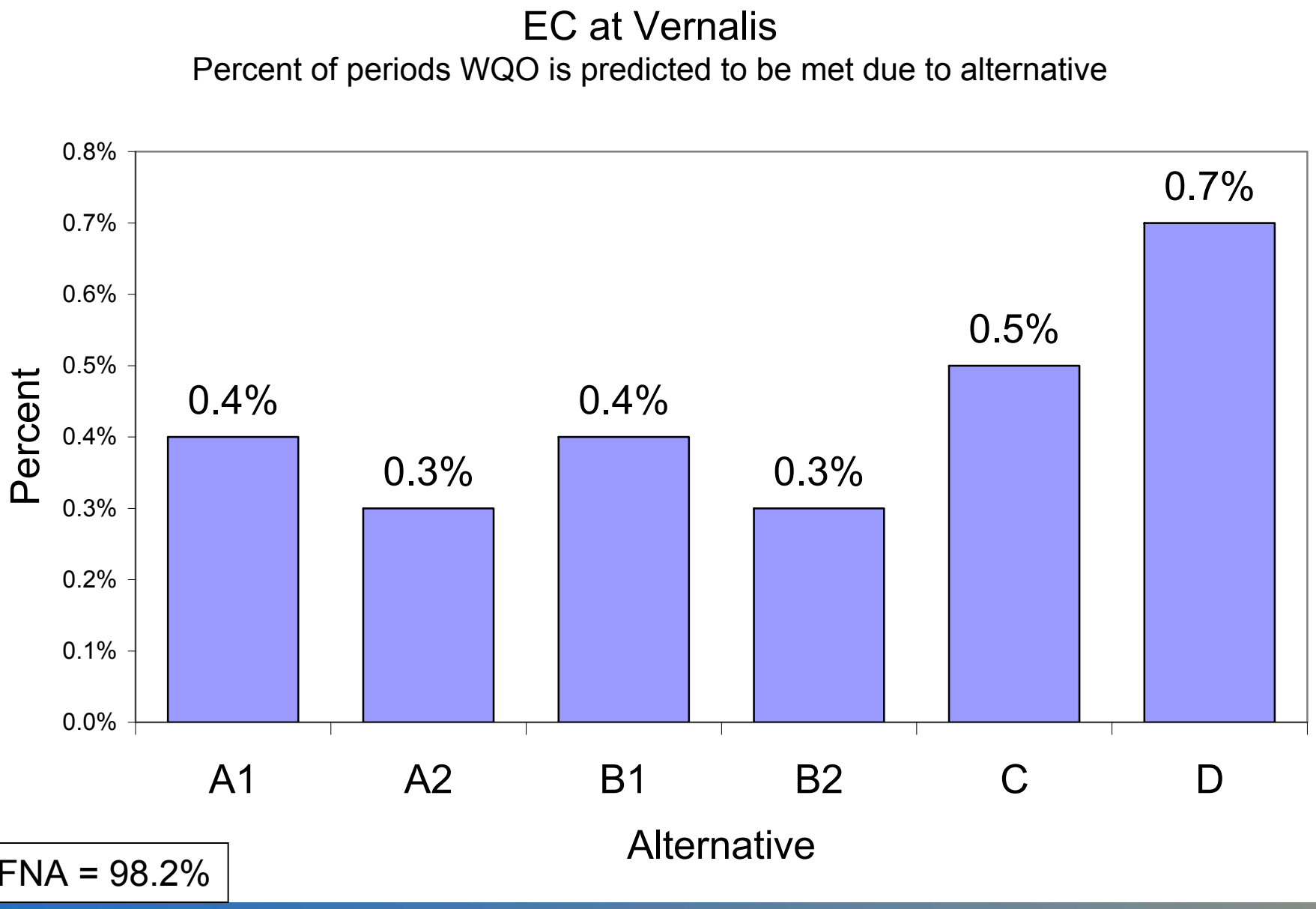

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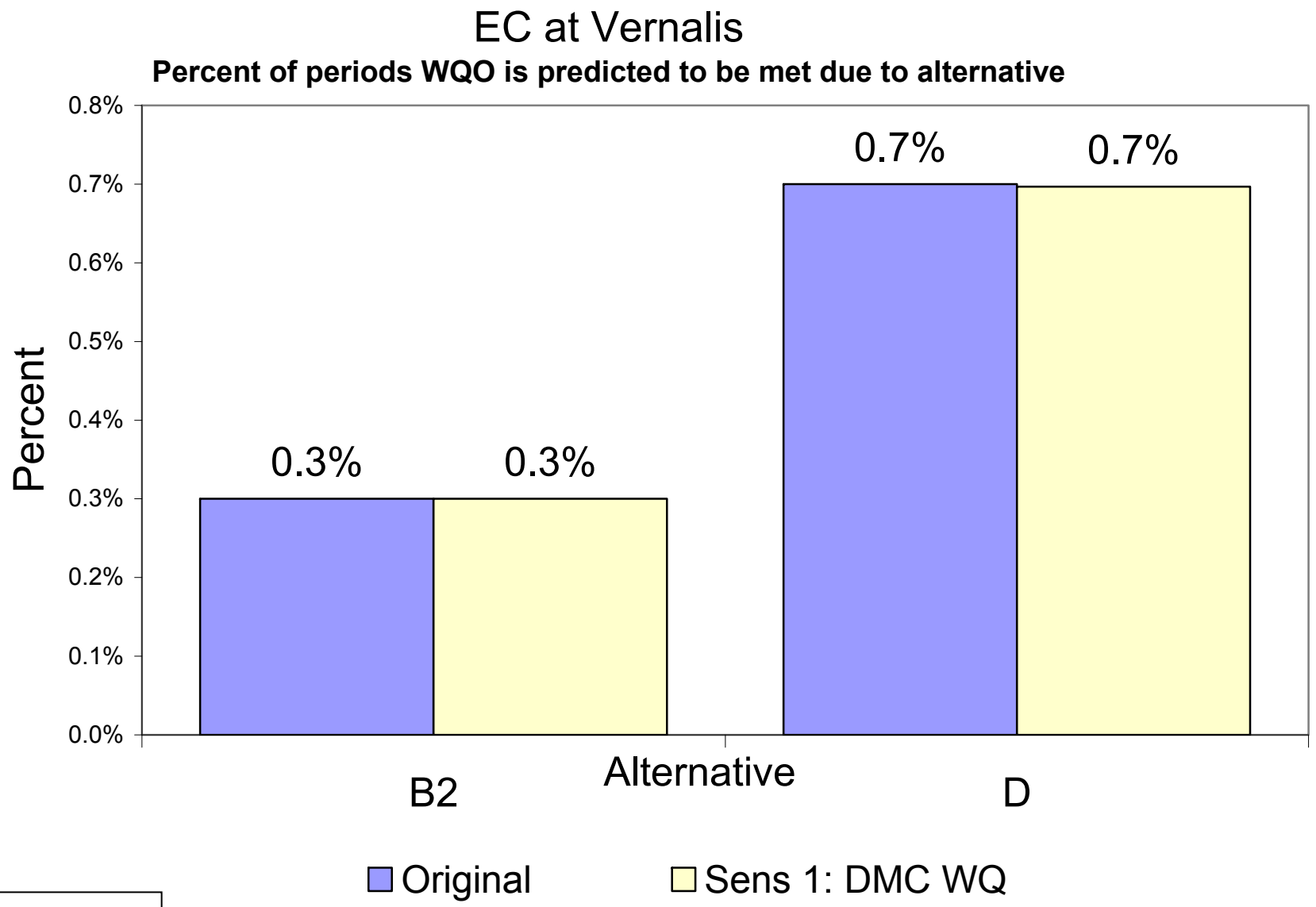

FNA = 98.2%

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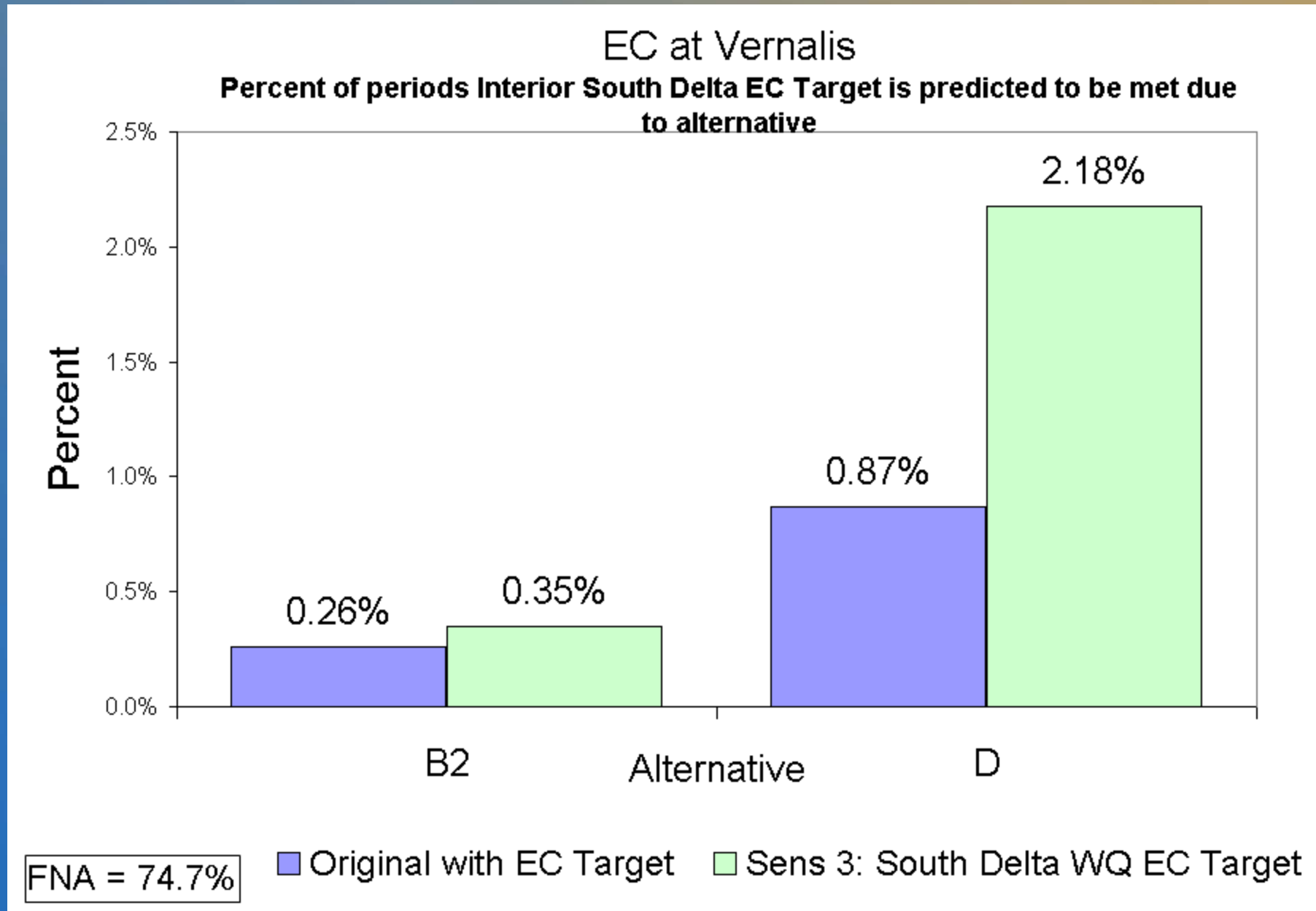

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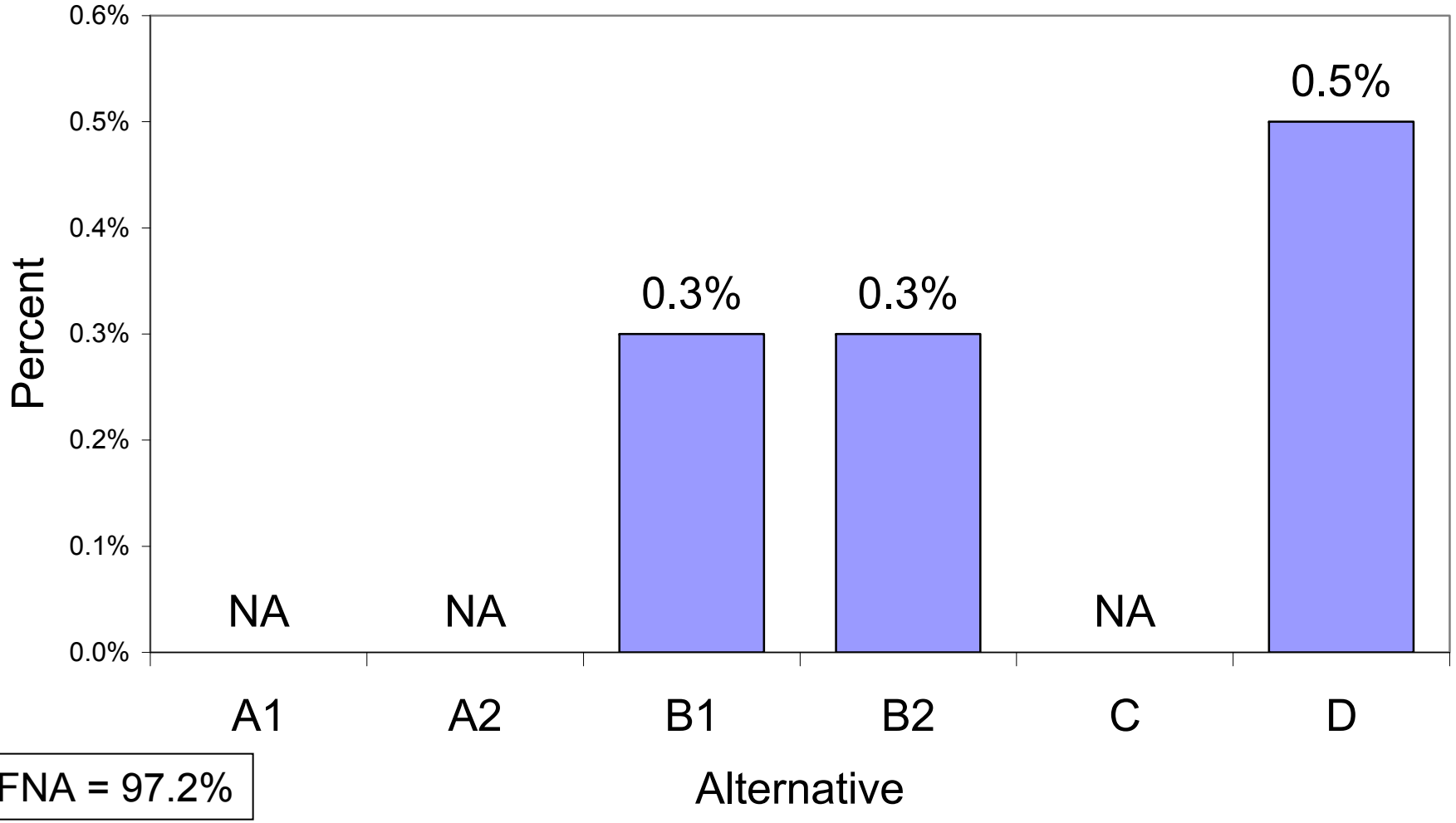
EC at Brandt Bridge

Percent of periods WQO is predicted to be met due to alternative



FNA = 97.2%

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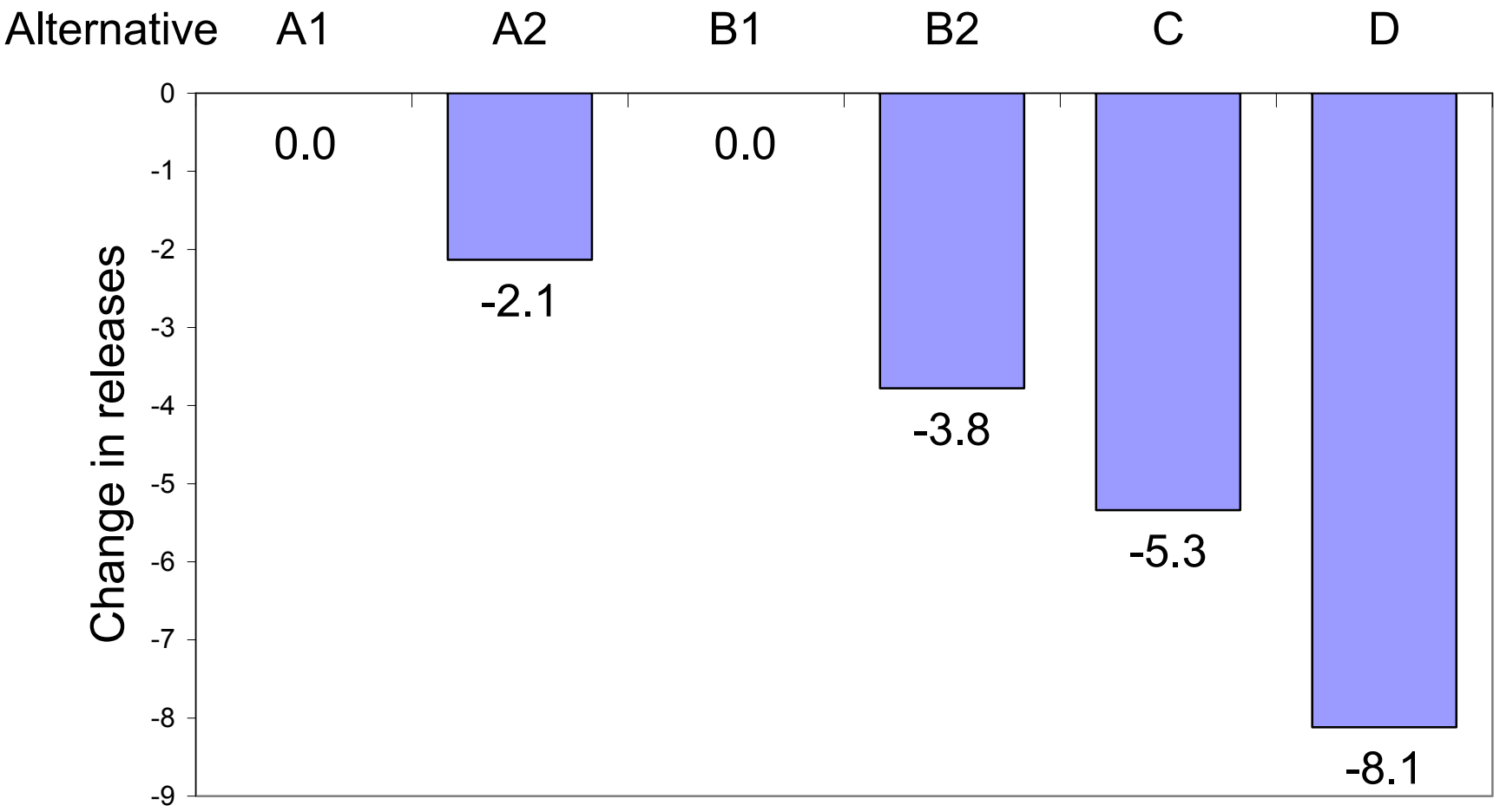
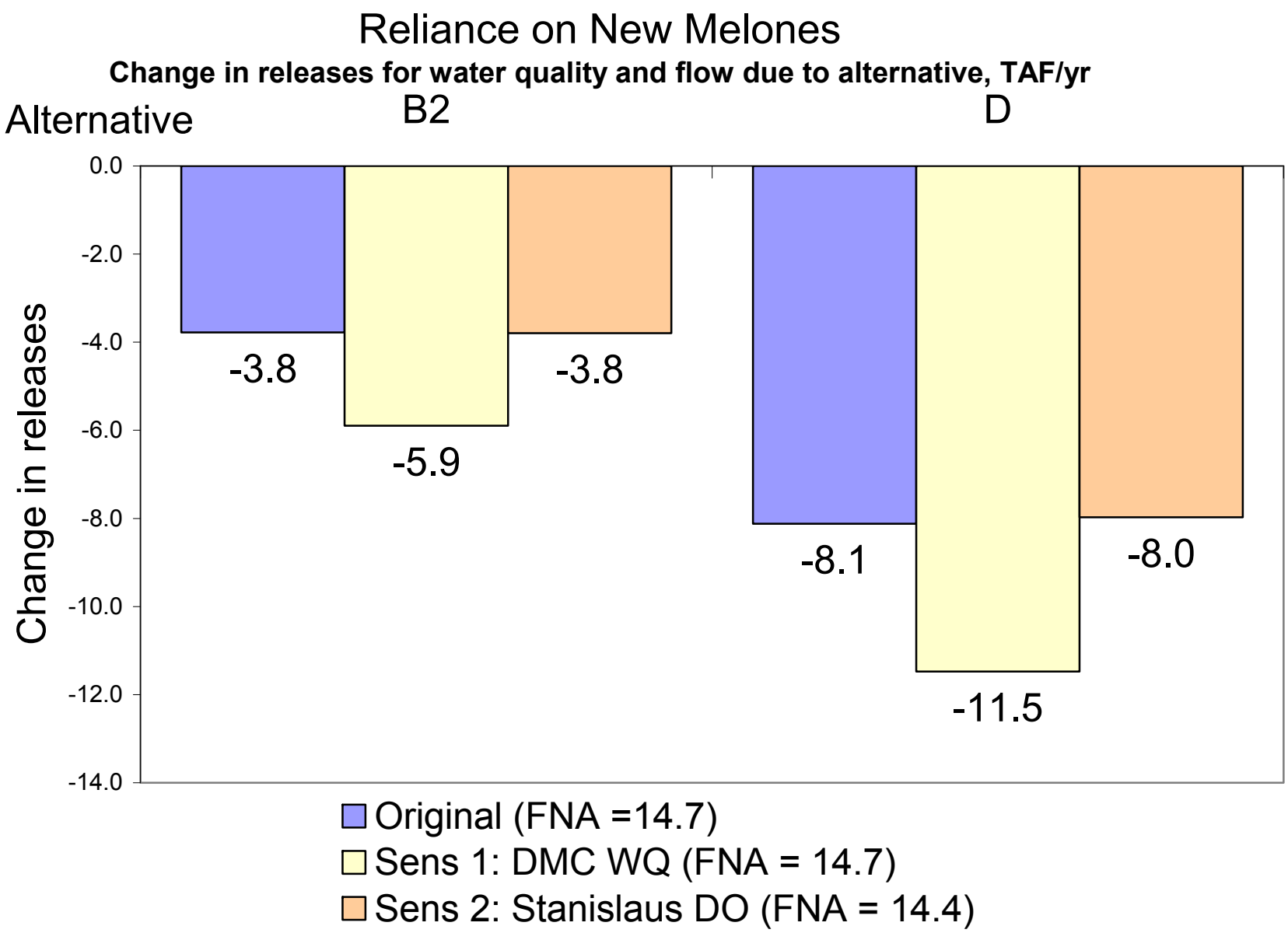
Reliance on New Melones

Change in releases for water quality and flow due to alternative, TAF/yr



FNA = 14.7

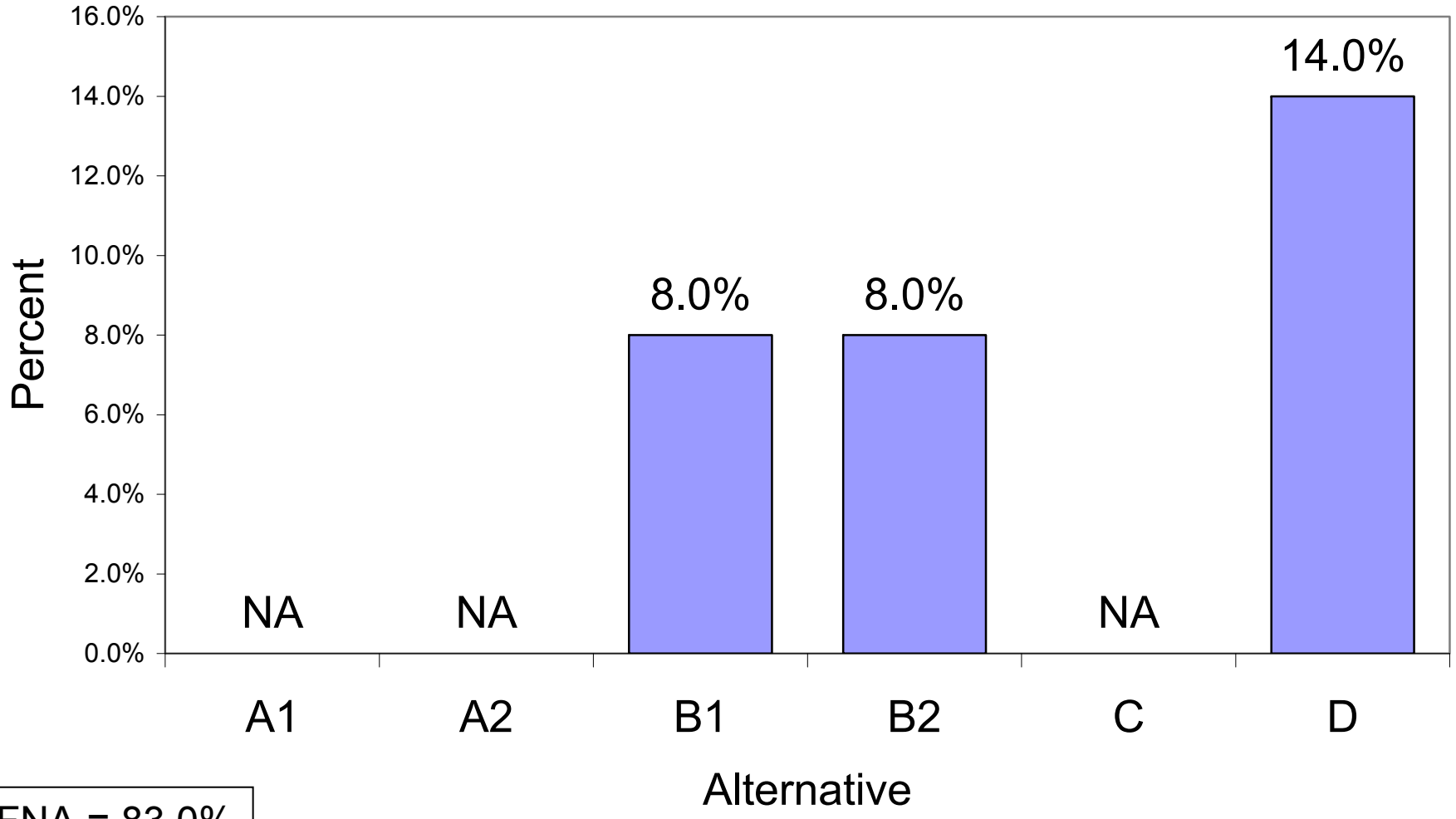
RECLAMATION



RECLAMATION

DO at DWSC

Percent of periods (Feb-June) WQO is predicted to be met due to alternative



FNA = 83.0%

RECLAMATION

Water Levels in South Delta

- Period of Concern - Late Summer Irrigation Season
- No recirculation during July, August, September, and rarely during October
- No effect on water levels during period of concern
- Sensitivity Analysis 4 Not Evaluated

RECLAMATION

Resource Analysis

- Water Supply
- Water Quality
- Fisheries
- Energy
- Economics

RECLAMATION

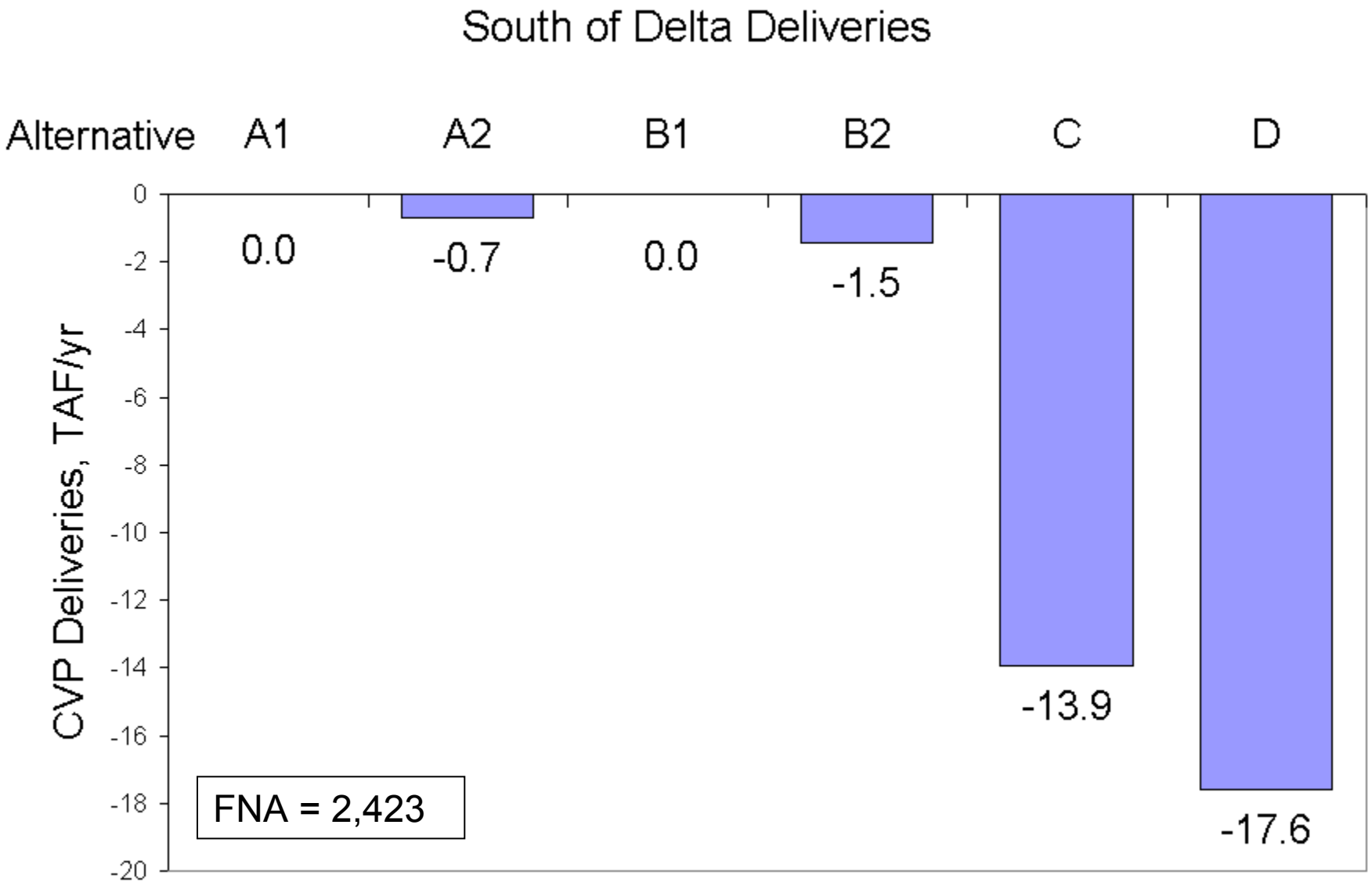
Water Supply: Approach

- Change in Deliveries for SOD Contractors
- Change in New Melones Vernalis Flow and Quality Releases (shown under Planning Objective)

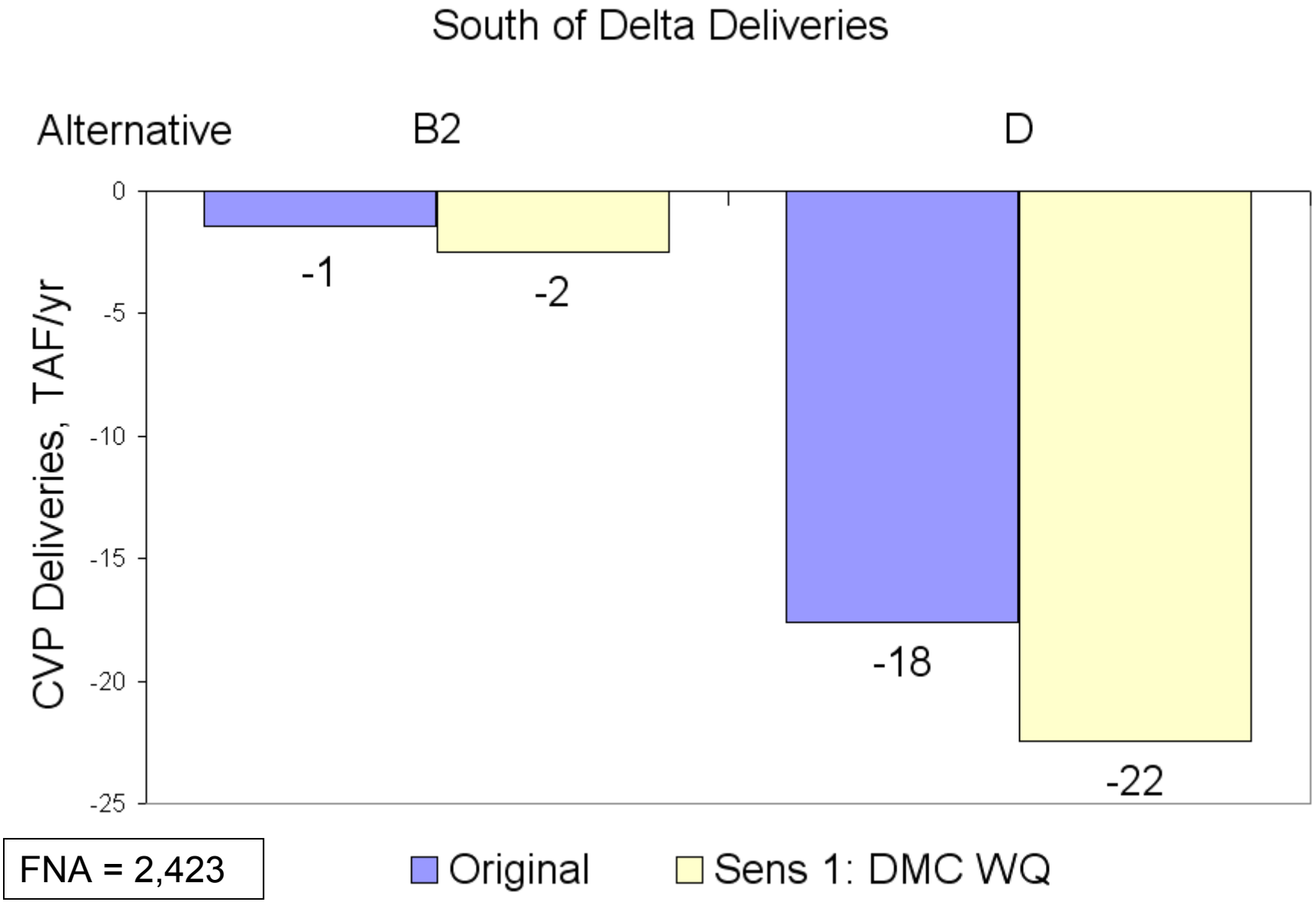
RECLAMATION

Water Supply: Results

RECLAMATION



RECLAMATION



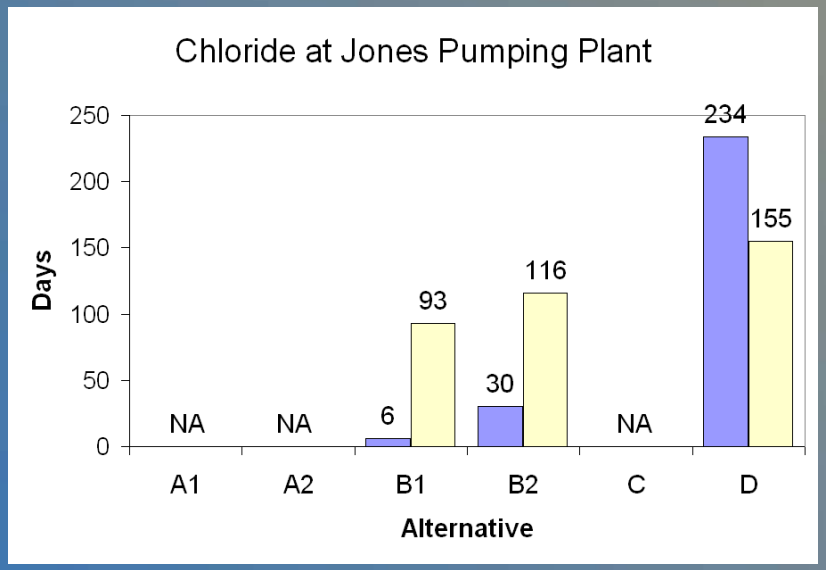
RECLAMATION

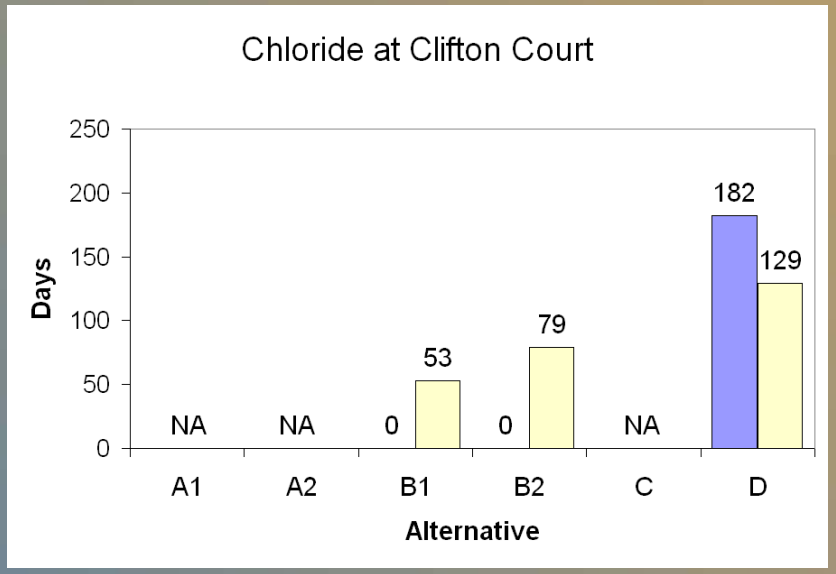
Water Quality: Approach

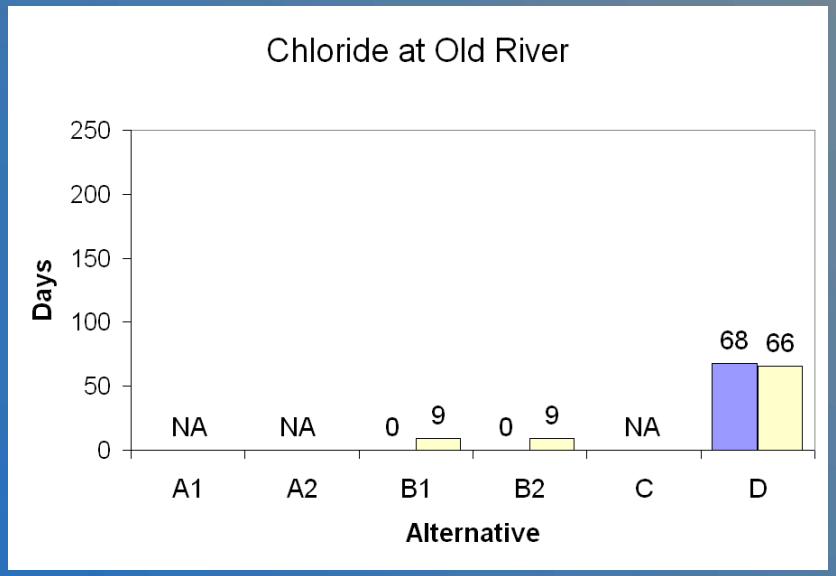
- Drinking Water: Bromide and Chloride
  - Most affected and of greatest concern in Delta
  - Br closely correlated to Cl
  - Count of days Cl increases/decreases by at least 5 mg/L
- Turbidity
  - Turbidity contributions from Newman Wasteway modeled along SJR
  - Representative location: SJR above Merced River
  - Count of periods when Basin Plan WQO violated
- Water Temperature
  - Modeled along Stanislaus River
  - Representative location: Orange Blossom Bridge
  - Count of periods when Basin Plan WQO violated

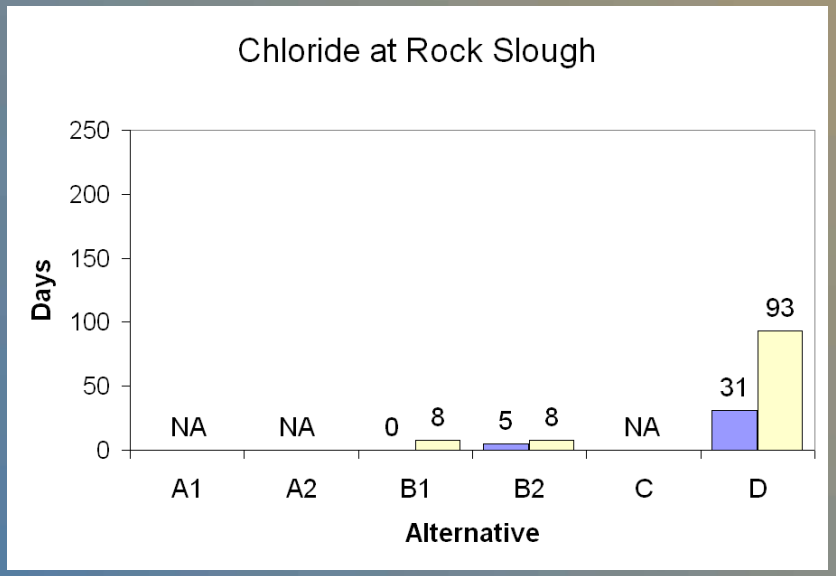
Water Quality: Results

RECLAMATION





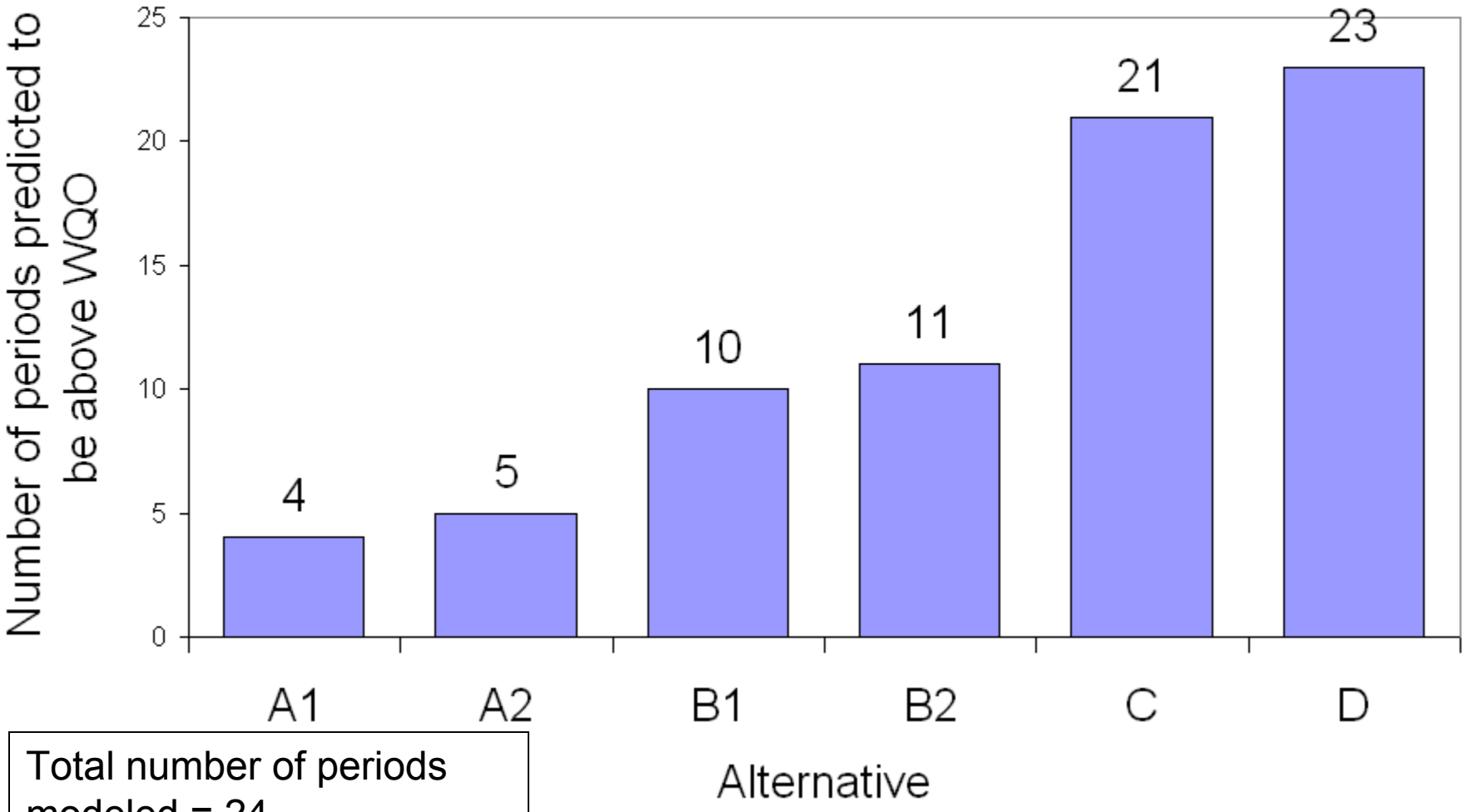




Number of days chloride is increased by at least 5 mg/L

Number of days chloride is decreased by at least 5 mg/L

RECLAMATION



Total number of periods modeled = 24

RECLAMATION

Fisheries Approach

- **Developed evaluation process in collaboration with the 2007 Fisheries Technical Working Group**
  - CDFG – Jim White
  - NMFS – Bruce Oppenheim
  - USFWS - Jeff McLain, Andrea Bartoo
  - AFRP – JD Wikert
  - Reclamation – Maury Kruth
  - DWR – Jacob McQuirk
  - ENTRIX – Tom Taylor, Larry Wise, Chris Hogle
  - URS – Steve Ottemoeller, Terry Cooke
- **Identified principal management species**
- **Developed approach to evaluation**

RECLAMATION

Principal Management Species

Regulatory Status	Species	Reason for Management Consideration
ESA Listed	Winter run Chinook Salmon	FE, SE
	Spring run Chinook Salmon	FT, ST
	Steelhead	FT, Recreation
	Delta smelt	SE, FT (Proposed for FE)
	Green sturgeon	FT, Recreation
Species of Concern	Fall/late-fall Chinook Salmon	FSC, SSC, Commercial, Recreation
	Splittail	SSC
	Longfin smelt	SE
None	White sturgeon	Ecological, Recreation
	Striped bass	Recreation/POD
	American shad	Recreation

RECLAMATION

Ecoregions

- Delta
- San Joaquin River
- Stanislaus River

- Project has different kinds and levels of effects in these regions

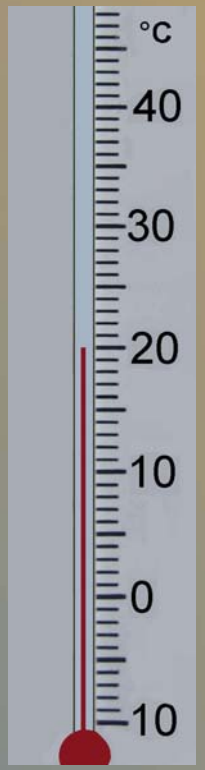
Potential Effects in the Delta

- Hydrodynamics
  - Reverse flows
  - Delta outflow
  - X2 location
- Water Quality
  - DWSC Dissolved Oxygen
- Biology
  - Entrainment
  - Salmonid straying

RECLAMATION

Potential Effects in San Joaquin River

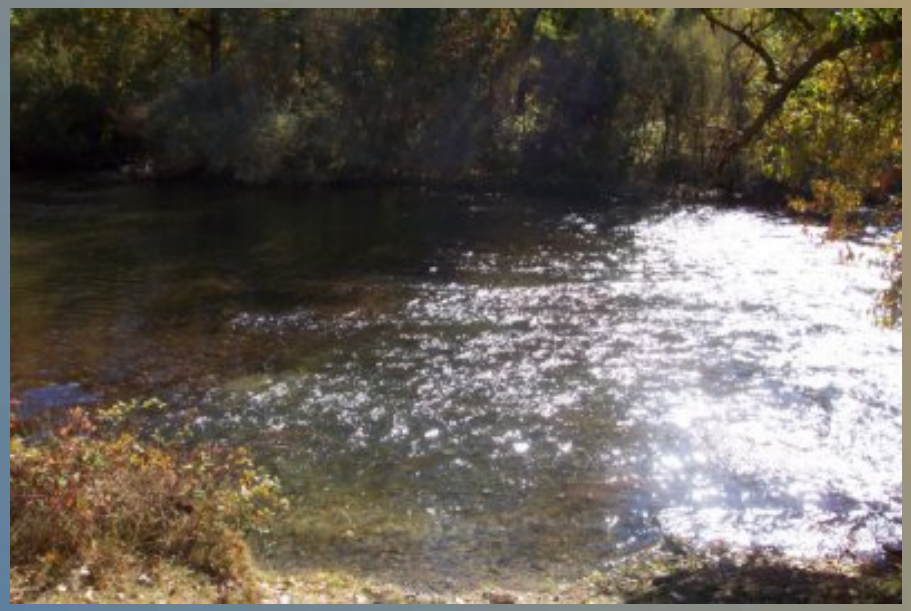
- Flow
- Temperature
- Suspended Sediment Concentrations
- Straying



RECLAMATION

Potential Effects in the Stanislaus River

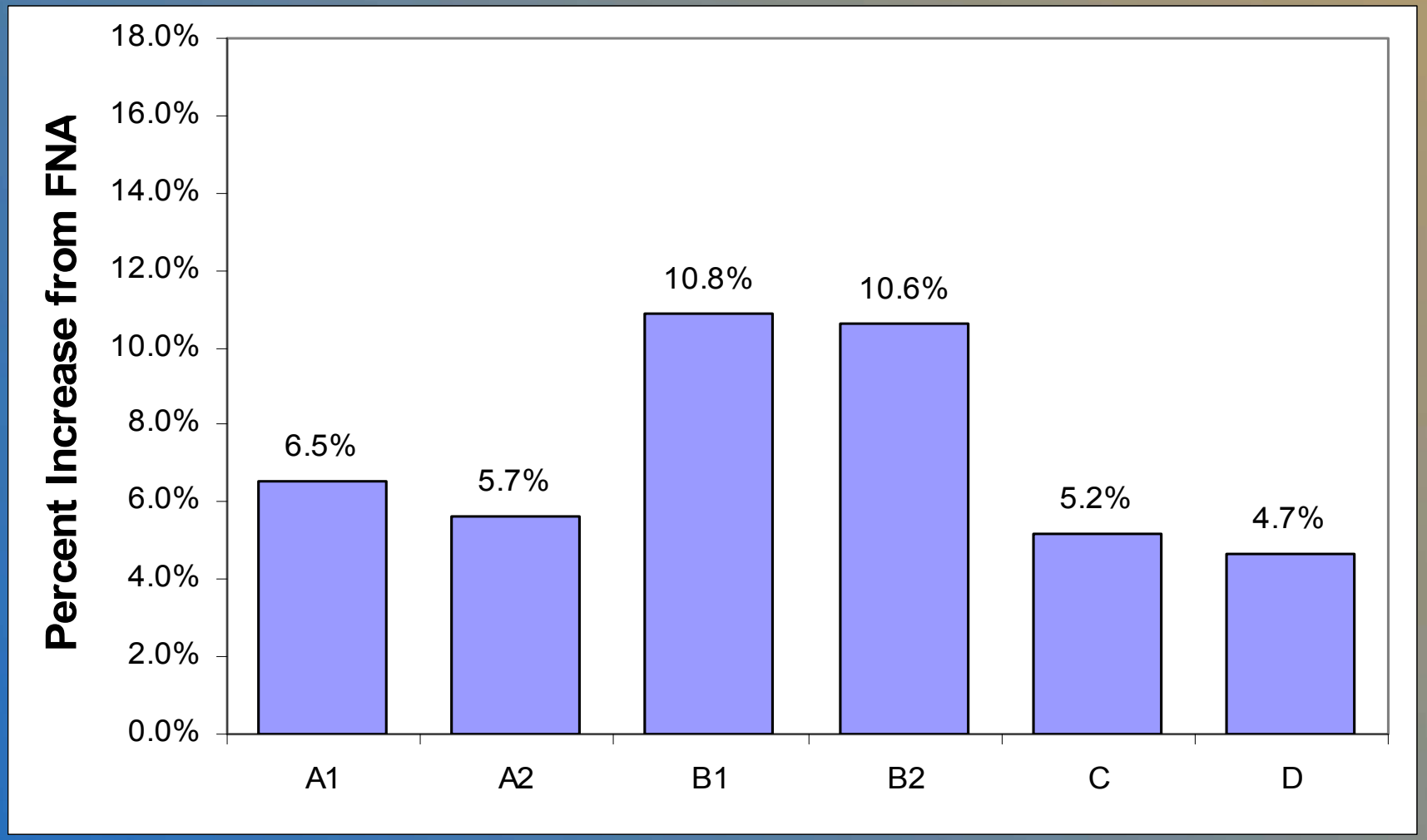
- Flow
- Temperature



RECLAMATION

Percent Increase in Delta Exports

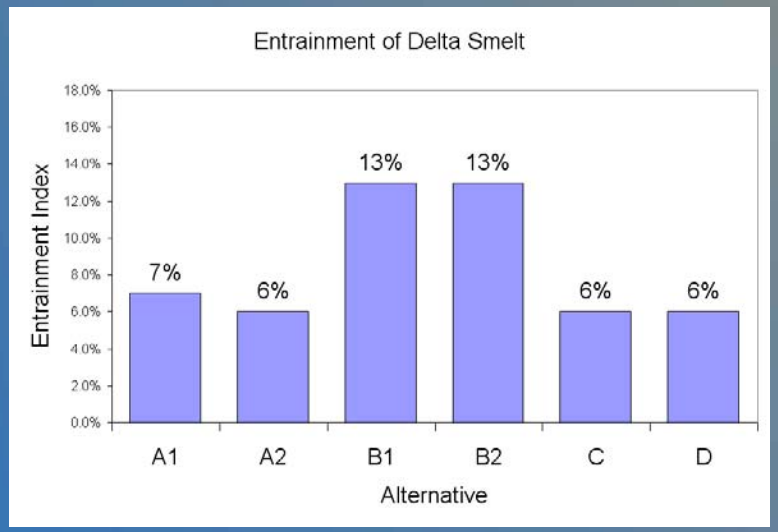
when Recirculation is Occurring

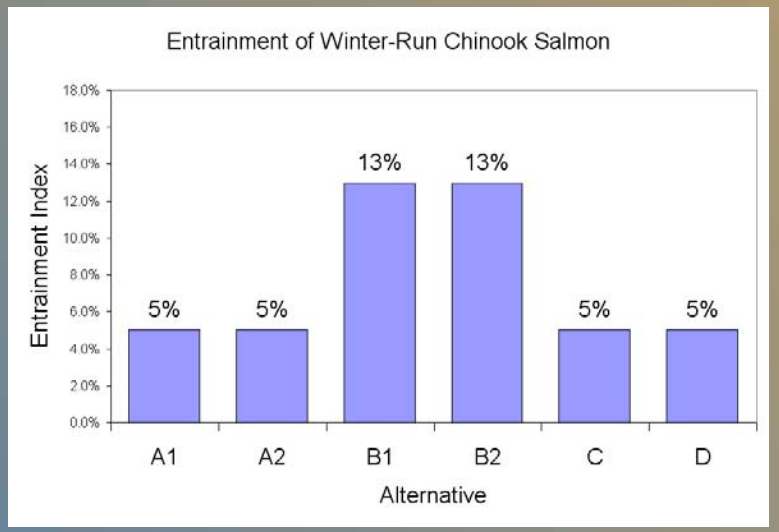


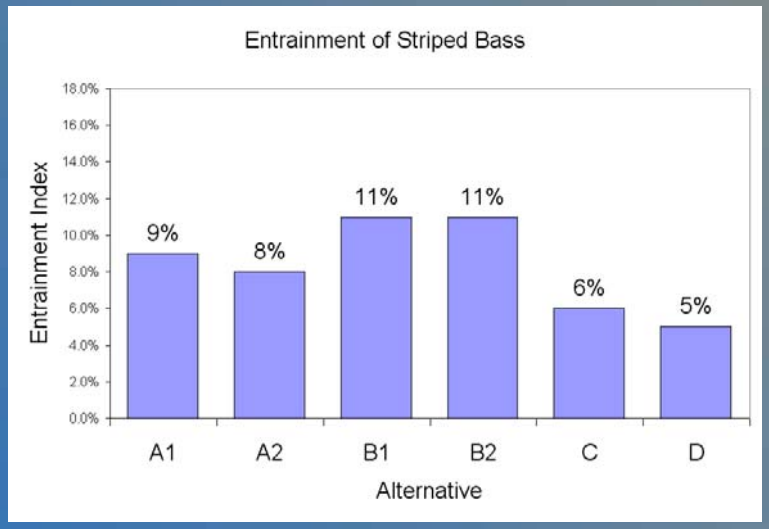
RECLAMATION

Percent Increase in Entrainment Index

when Recirculation is Occurring







RECLAMATION

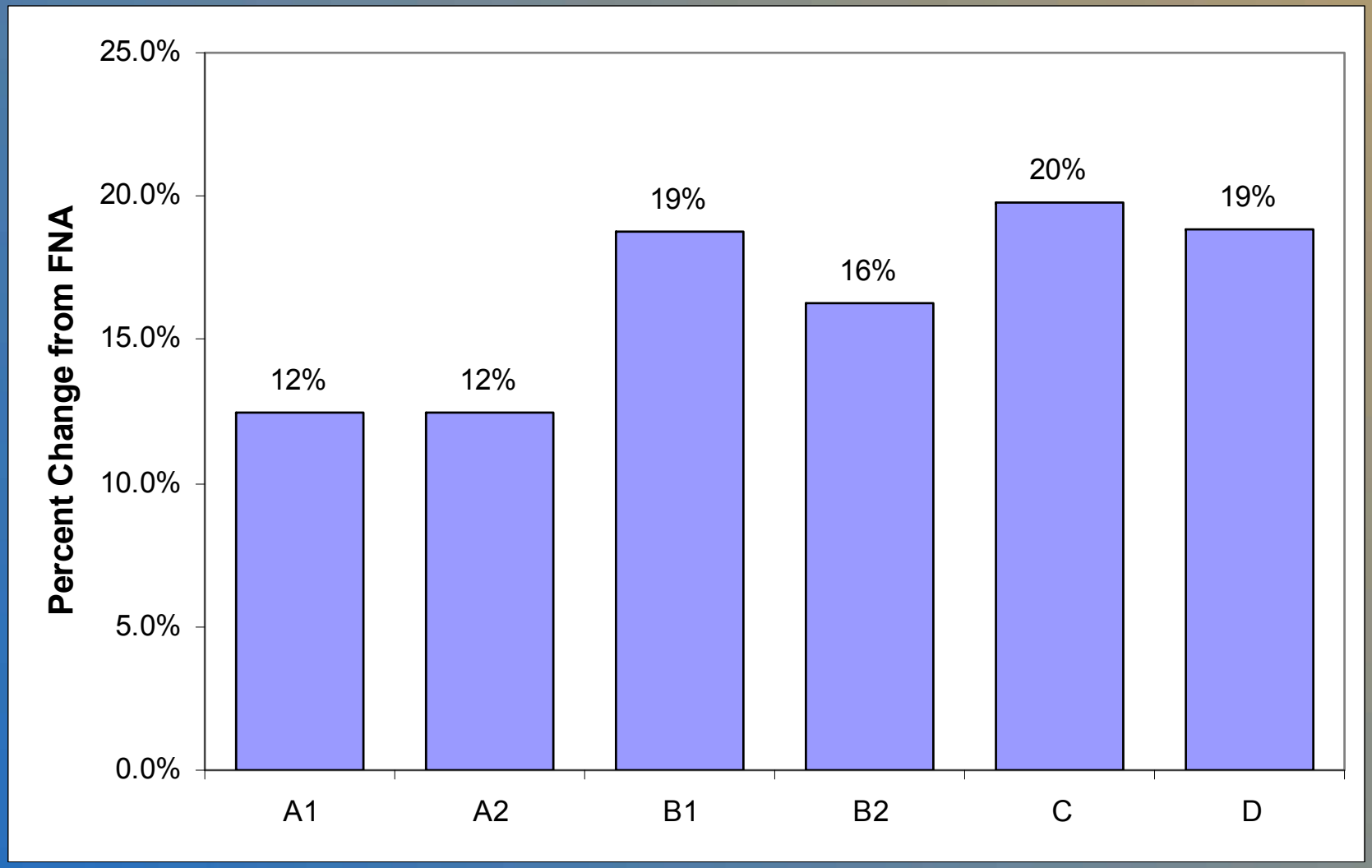
Fisheries Results
Delta

- **Minor changes from FNA for:**
  - **Delta Outflow**
  - **Reverse Flows in Old and Middle River**
  - **Straying potential**

RECLAMATION

Change in San Joaquin River Flow

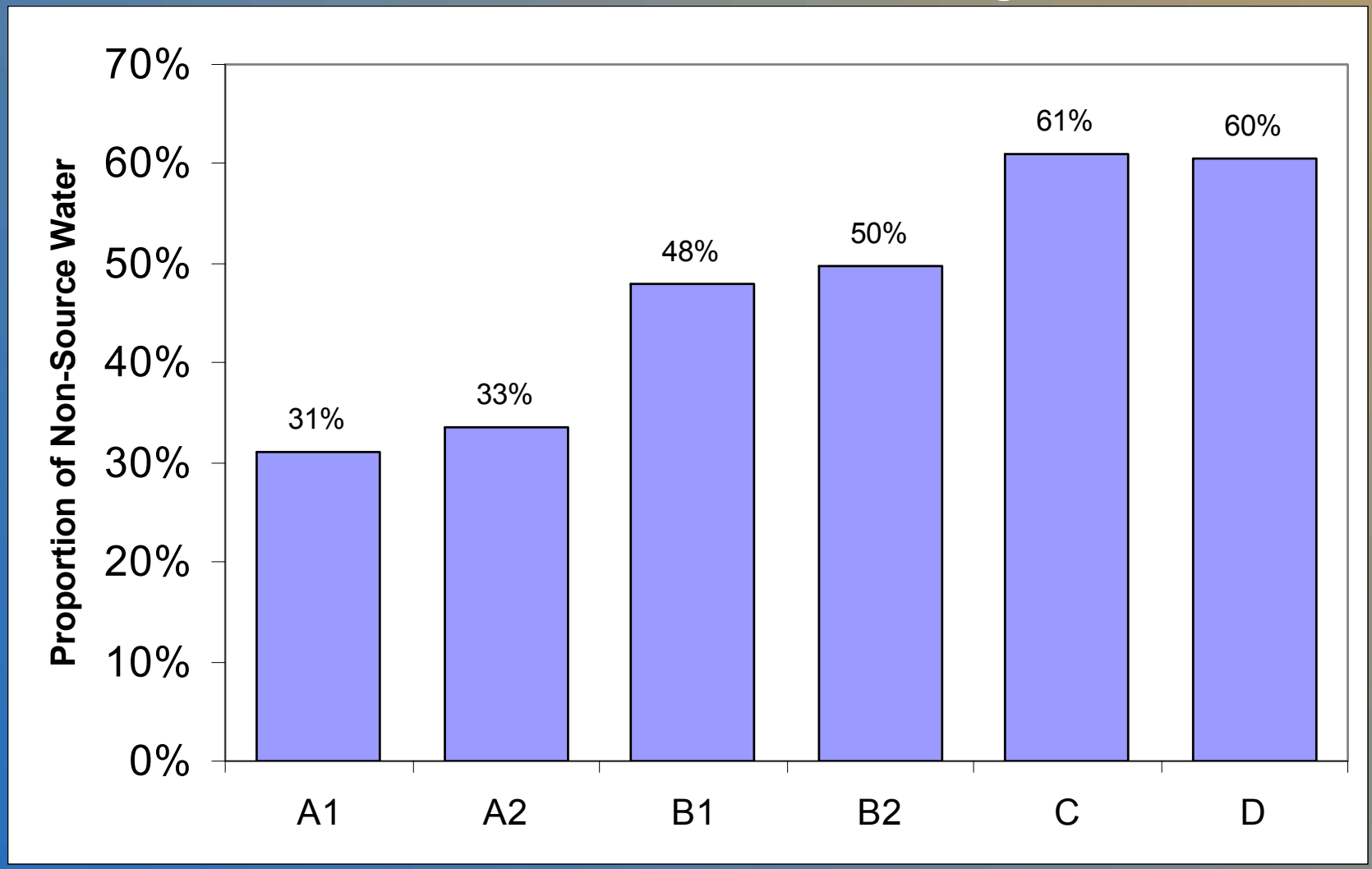
when Recirculation is Occurring



RECLAMATION

Change in Proportion of Non-Source Water in the SJR

when Recirculation is Occurring



RECLAMATION

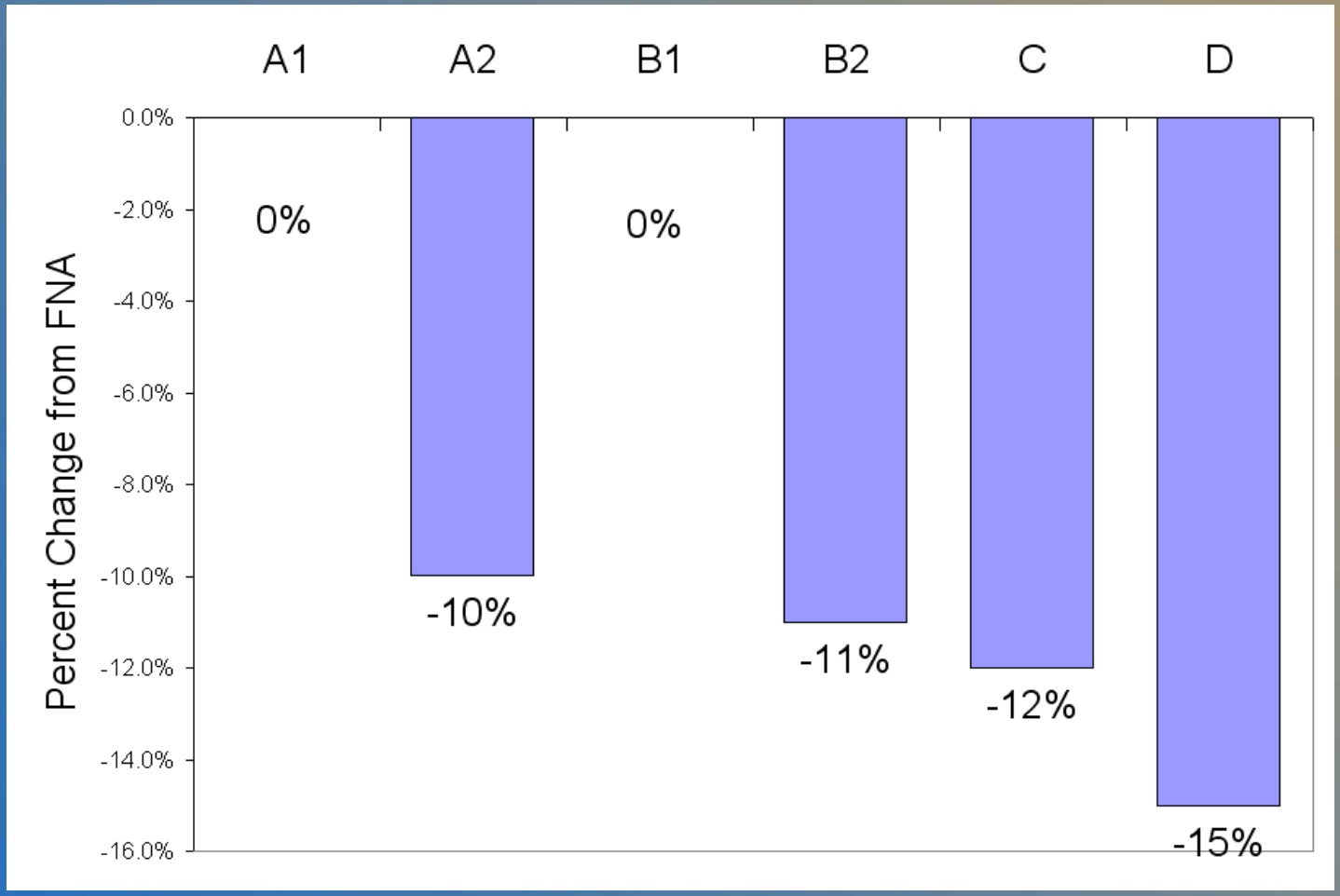
Fisheries Results
San Joaquin River

- **Minor Changes in:**
  - **Temperature**
  - **Suspended Sediment**

RECLAMATION

Change in Flow in the Stanislaus River

when Recirculation is Occurring



RECLAMATION

Overall Change in Flow in the Stanislaus River

RECLAMATION

Fisheries Results
Stanislaus River

- **Temperature – Increases occurred, but infrequently. Alt D generally resulted in warmer temperatures than the other alternatives**

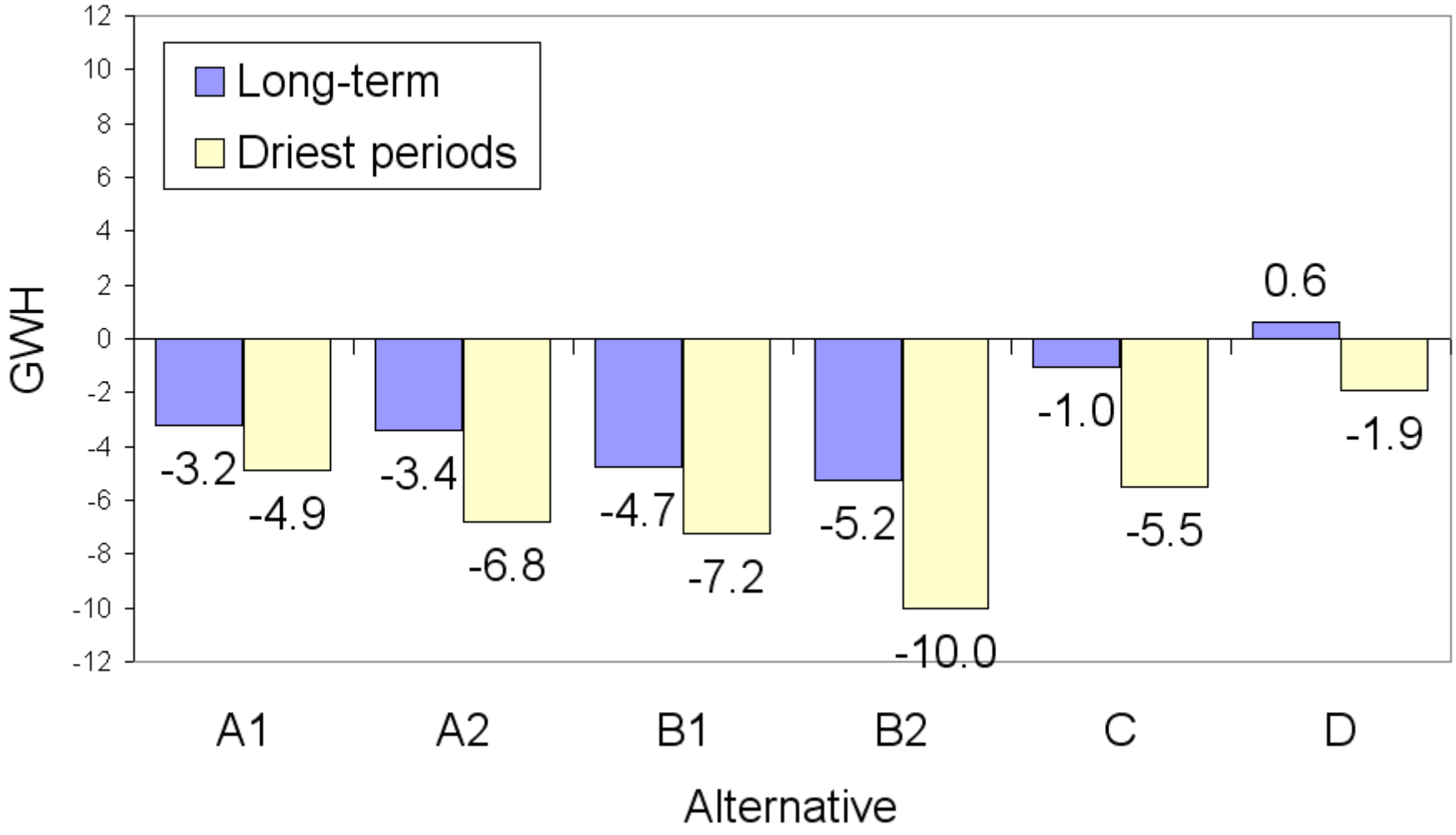
RECLAMATION

Energy: Approach

- **Net Energy Generation**
  - Net amount of energy (gigawatt-hours) from CVP and SWP facilities
  - Also evaluated
    - Total capacity of all facilities
    - Total energy generation of all facilities
    - Total energy use of all facilities
    - Power costs
    - Etc.
  - Long-term and drought conditions

Energy: Results

RECLAMATION



FNA (Long-term) = 3,396
FNA (Driest periods) = 2,242

RECLAMATION

Economics: Approach

- **National Economic Development (NED) account**
  - **Change in the economic value of the national output of goods and services**
- **Regional Economic Development (RED) account**
  - **Change in the distribution of regional economic activity**

National Economic Development (NED): Approach

- Agricultural Water Supplies and Production
  - Central Valley Production Model (CVPM)
  - Metric: producer surplus (farm profit) + consumer surplus
- Hydropower
  - Based on net energy generation
  - Values based on purchase cost of replacement energy
  - Metric: Value of net energy generation
- Other Benefits & Costs (Not quantified)
  - Fishery improvements
  - Water quality
  - South Delta water levels
  - Groundwater overdraft
  - Recreation

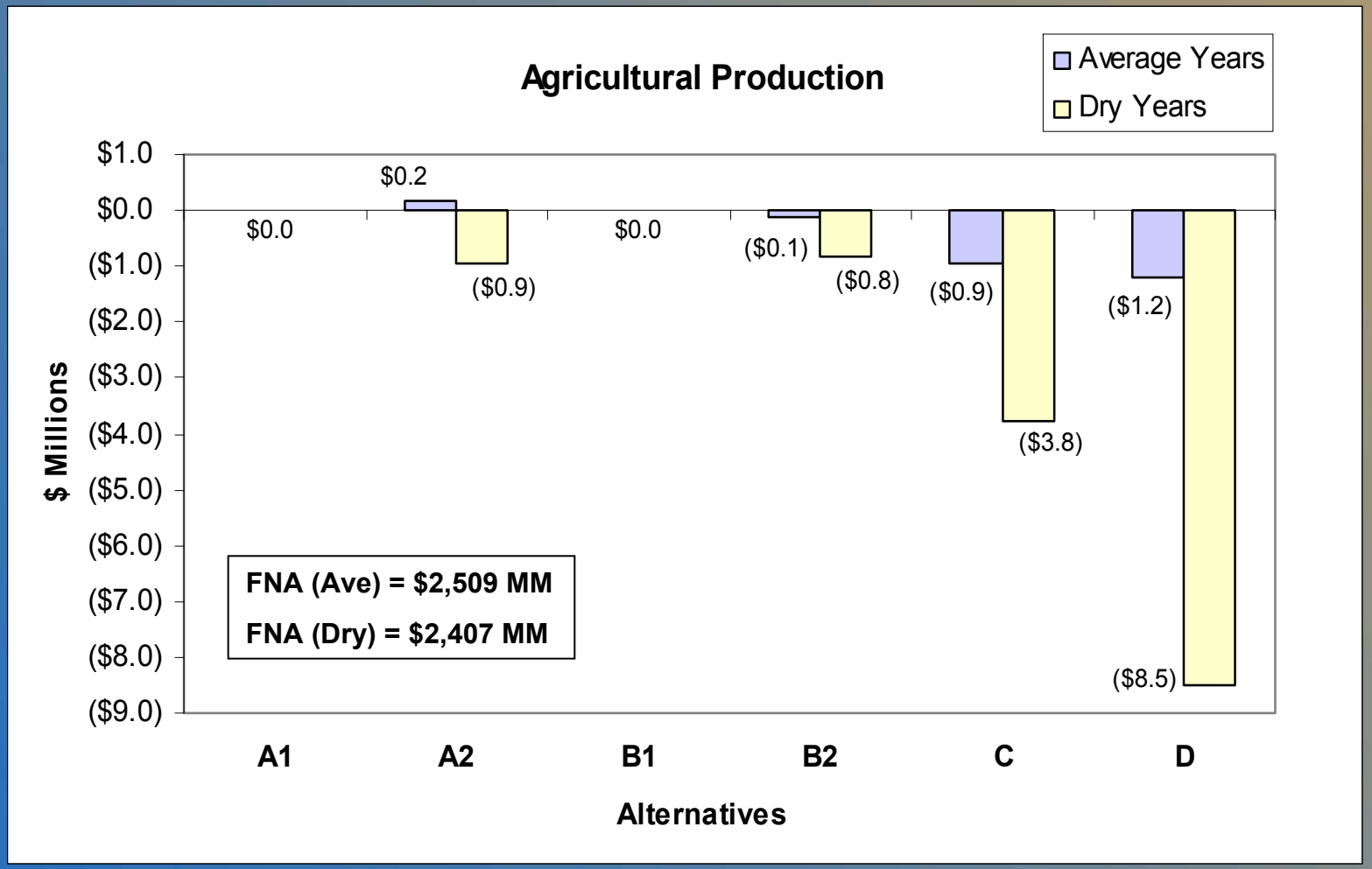
Regional Economic Development (RED): Approach

- Based on change in the value of Ag production
- Regional economic model (IMPLAN)
  - Measures changes in total output, income, and employment
  - Total impacts = direct + indirect + induced effects
- Statewide and regional-level models
- Metric: change in total output (production)

Economics: Results

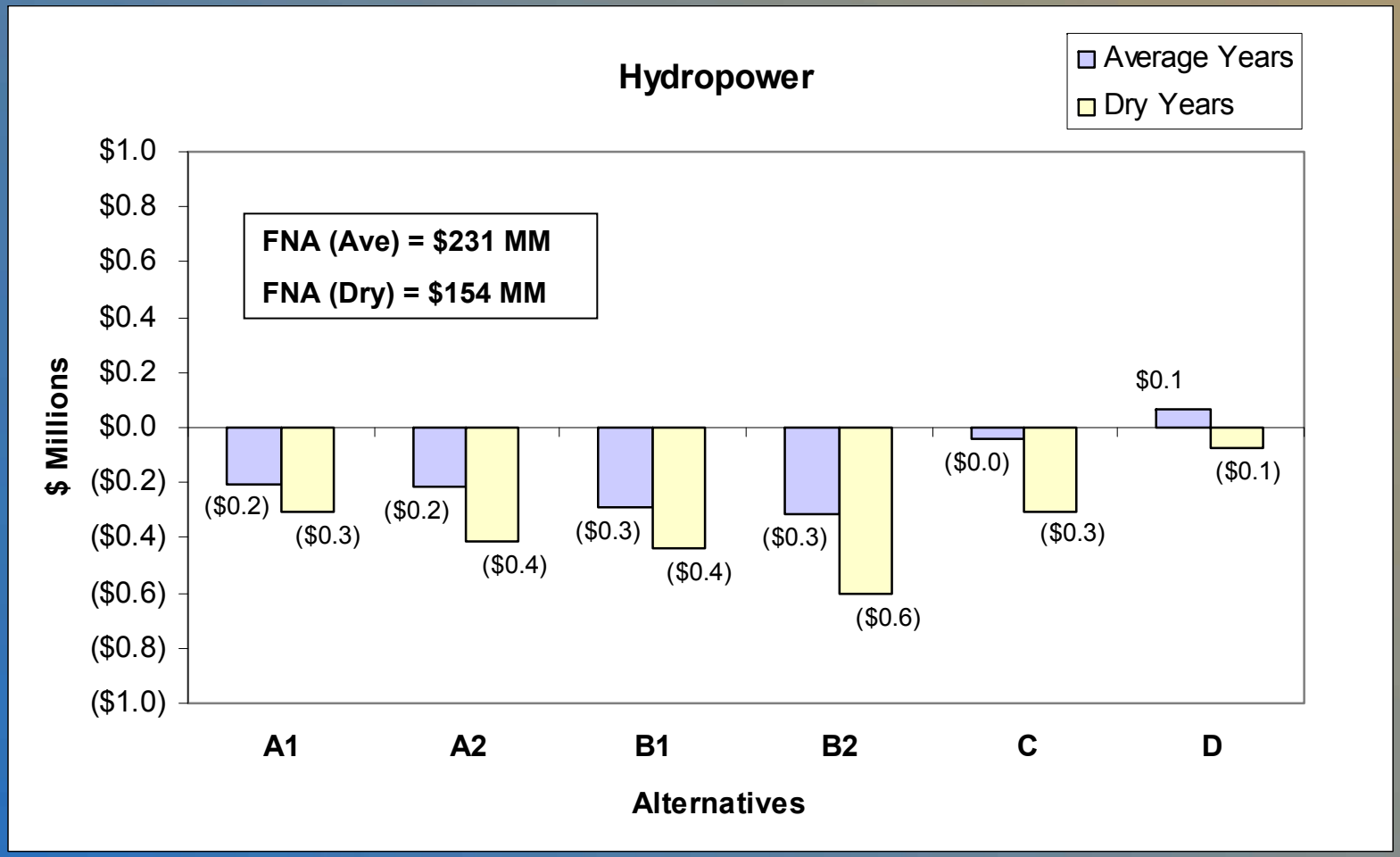
RECLAMATION

National Economic Development (NED): Agricultural Production



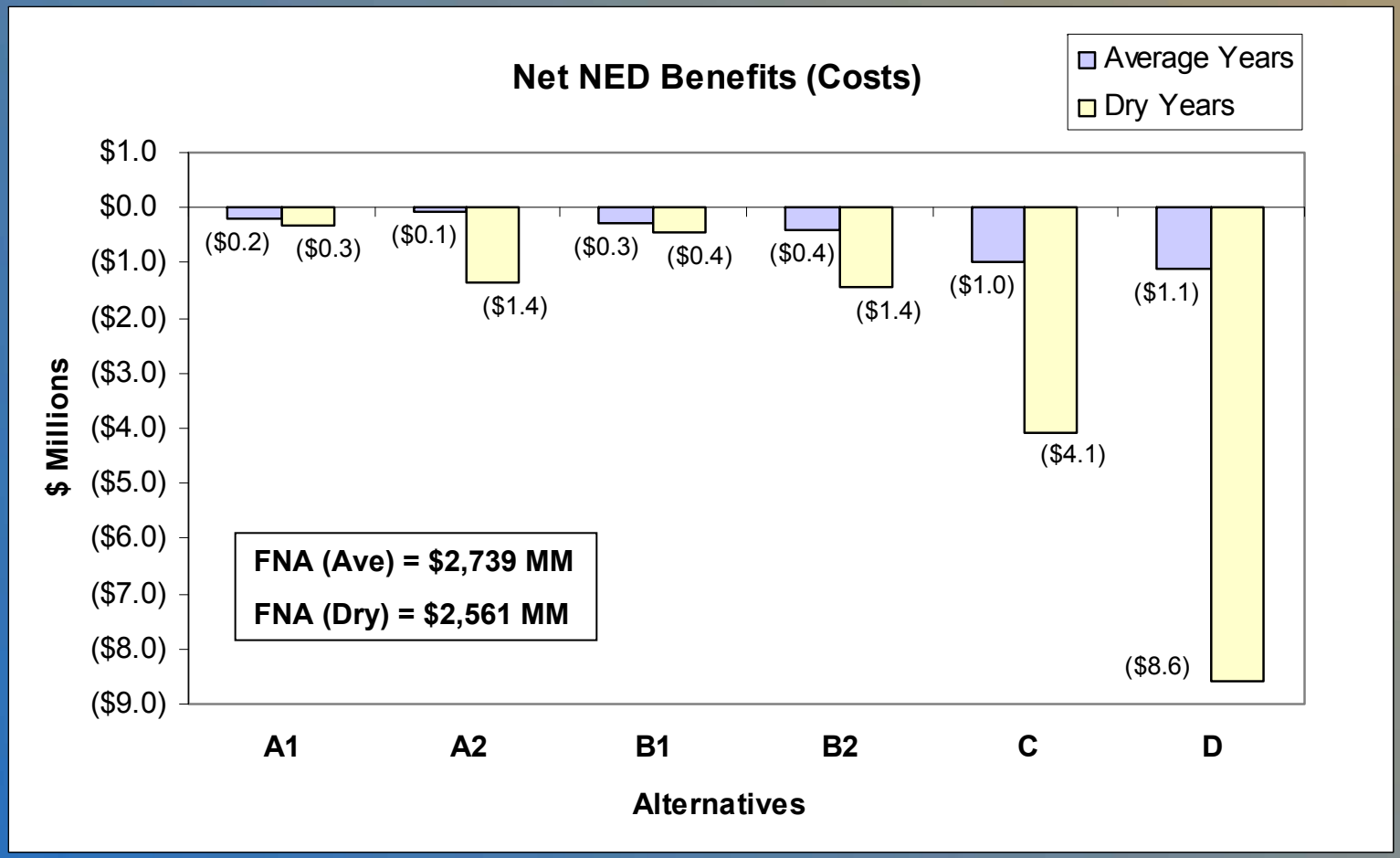
RECLAMATION

NED: Hydropower



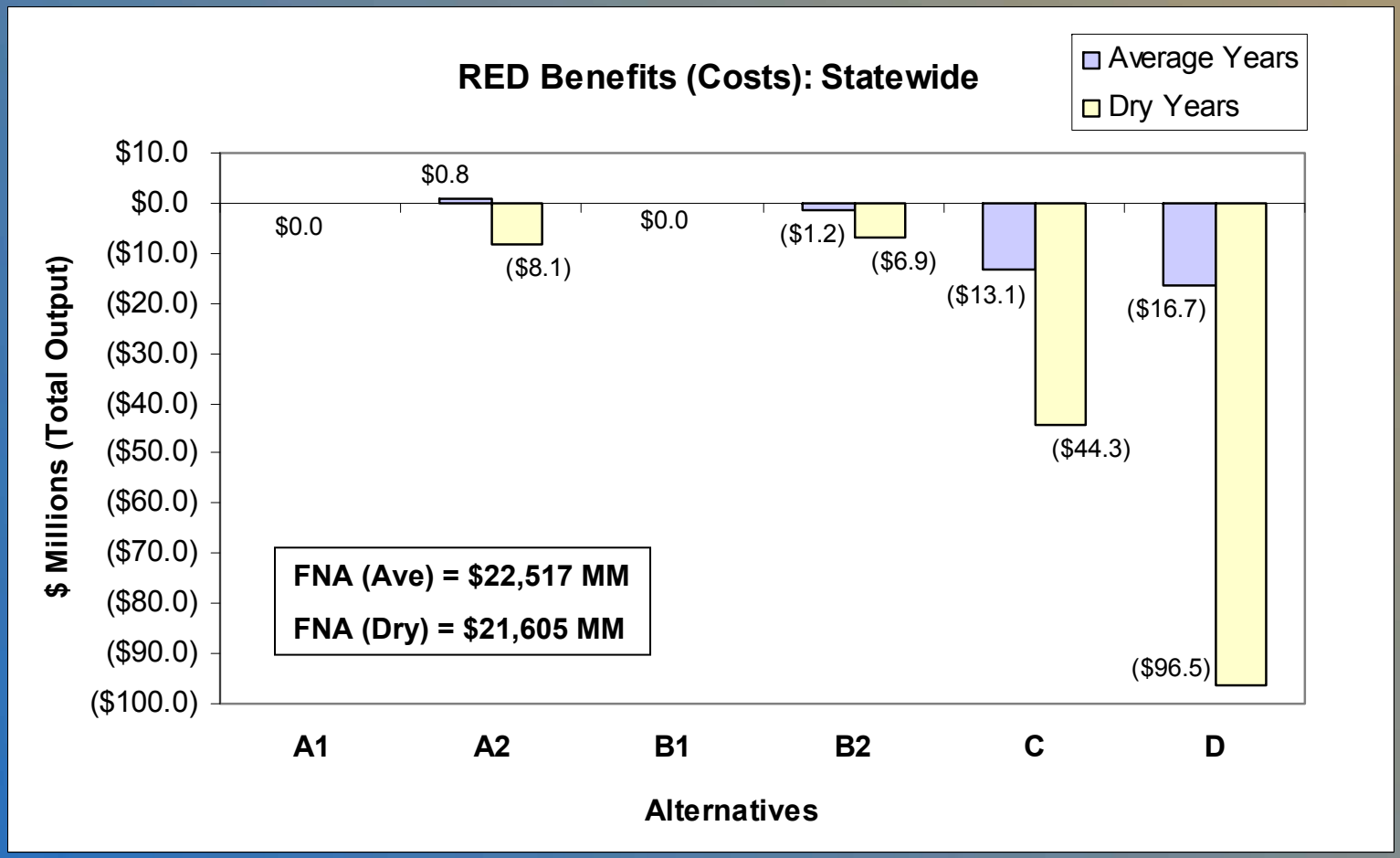
RECLAMATION

Summary of NED Benefits & Costs



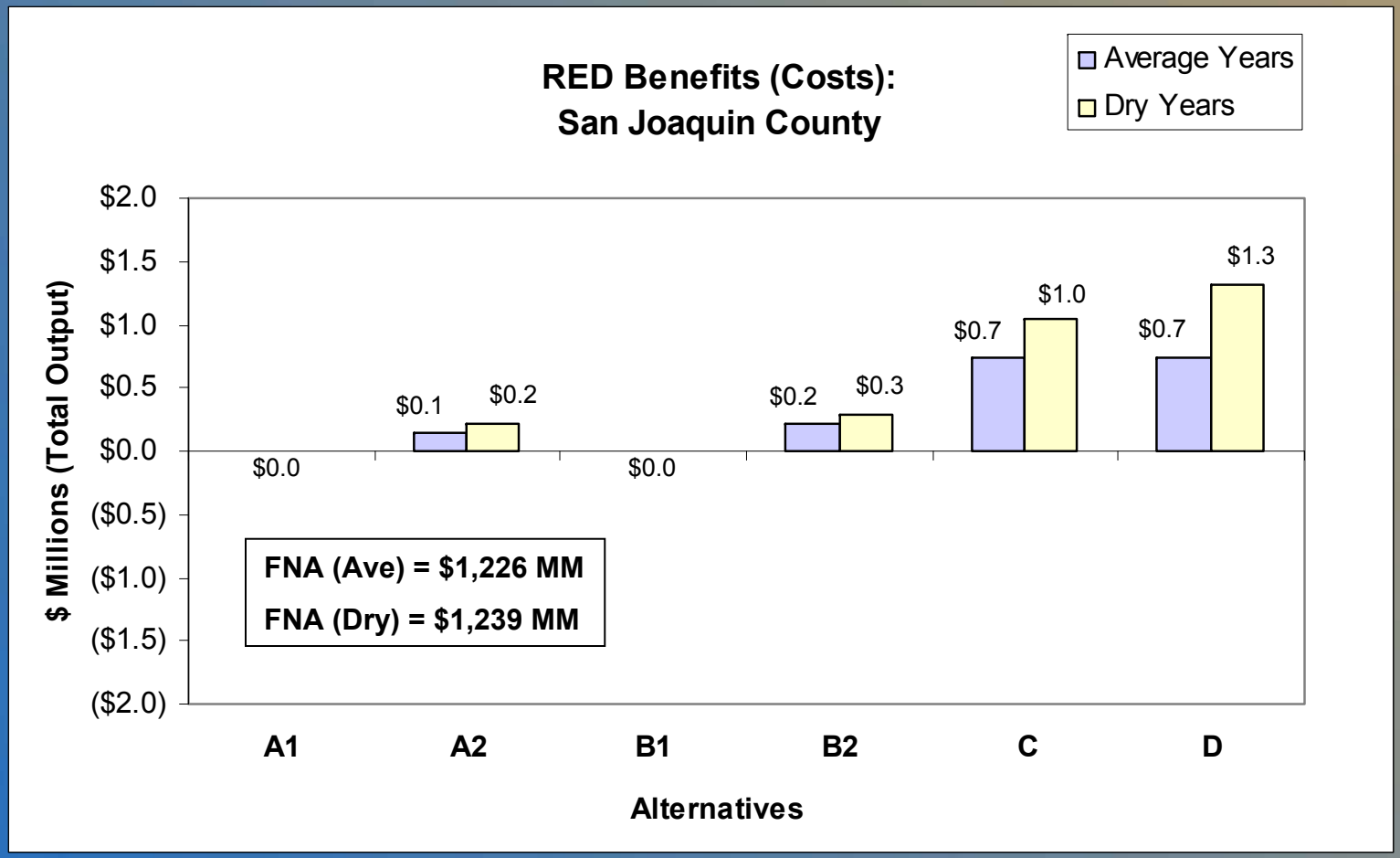
RECLAMATION

Regional Economic Development (RED): Statewide Impacts



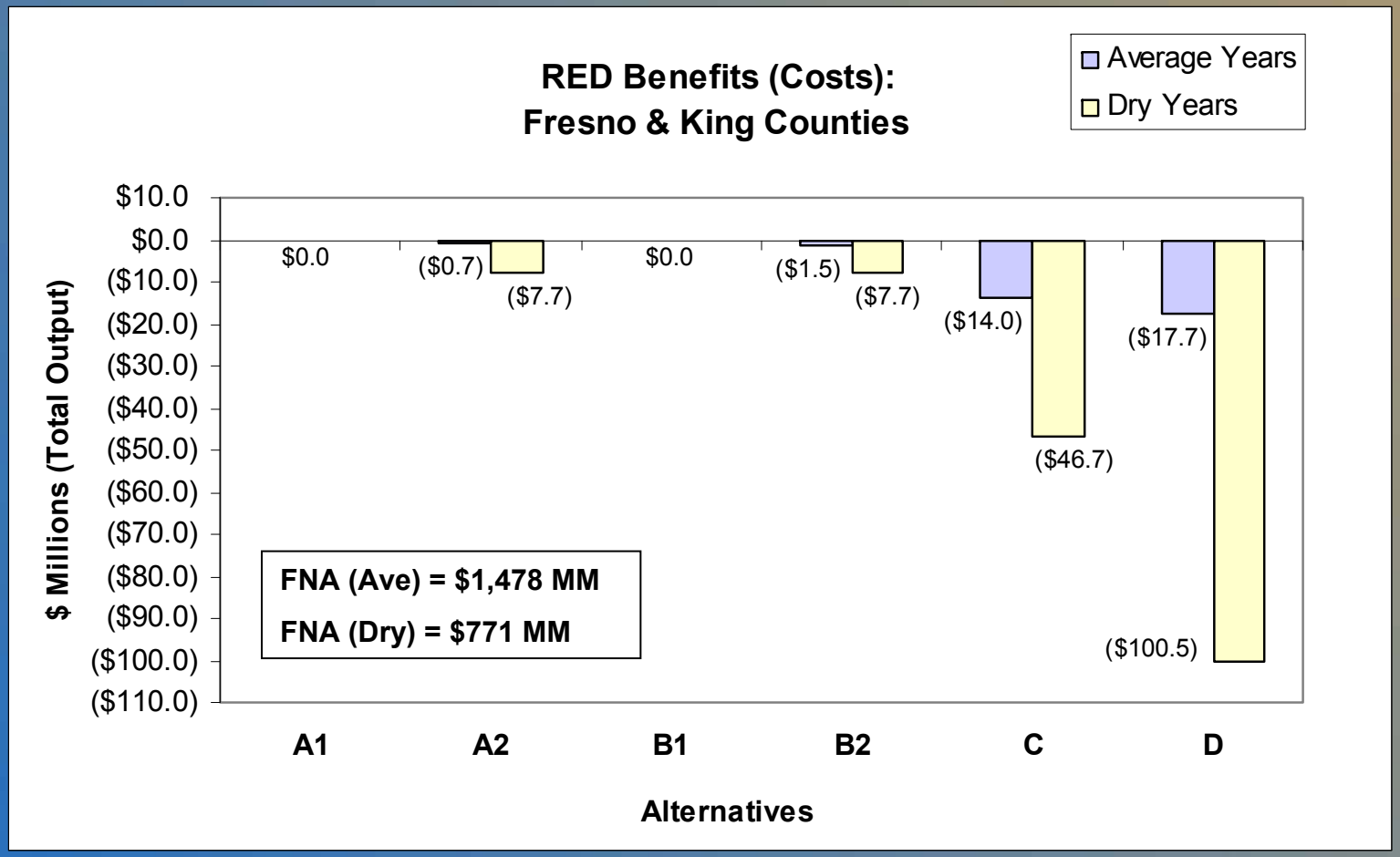
RECLAMATION

Regional Economic Development (RED): San Joaquin County Impacts



RECLAMATION

Regional Economic Development (RED): Fresno & King Counties Impacts



RECLAMATION

Ranking Process

- Identified Resource Areas
- Developed Sub-elements (“unit”) for each Resource Area
- Compiled Results relative to FNA
- Developed Ranking Thresholds
- Scored each Sub-element for each alternative
- Weighted each Sub-element within each Resource Area
- Calculated summary for Resource Area
- Equally weighted each Resource Area for overall score for each alternative

RECLAMATION

Ranking Criteria

Criteria	Ranking Score
Significant adverse change compared to other alternatives	-2
Significant adverse change compared to FNA	-1
No significant change compared to FNA	0
Significant beneficial change compared to FNA	1
Significant beneficial change compared to other alternatives	2

Example of Ranking Process

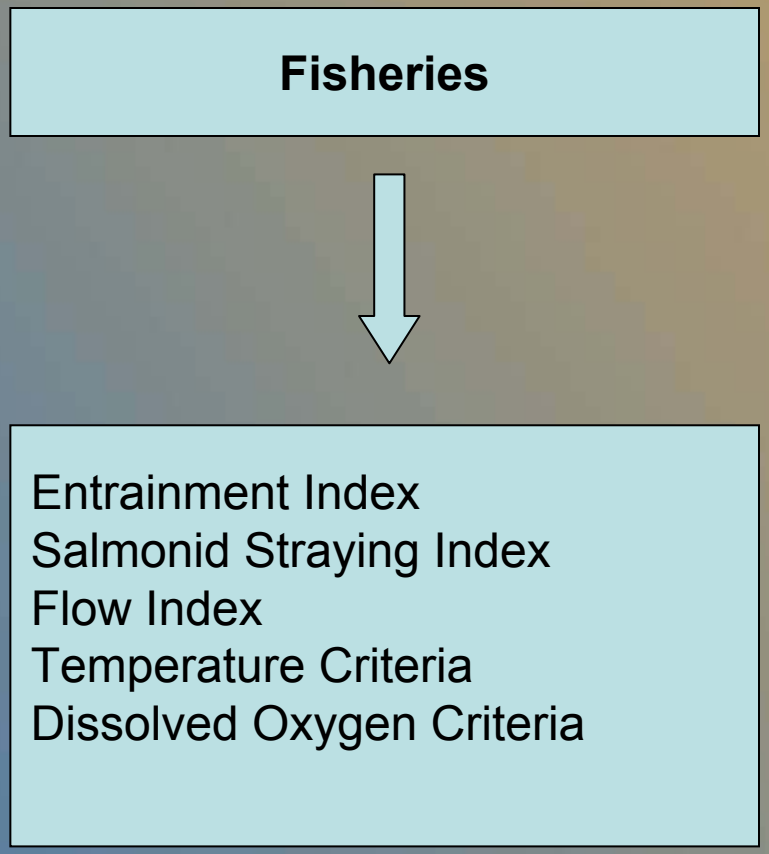
- **Identified Resource Areas**

Water Supply
Water Quality
Fisheries
Energy
Economics

RECLAMATION

Example of Ranking Process

- **Identified Resource Areas**
- **Developed Sub-elements ("unit") for each Resource Area**



Example of Ranking Process

- Identified Resource Areas
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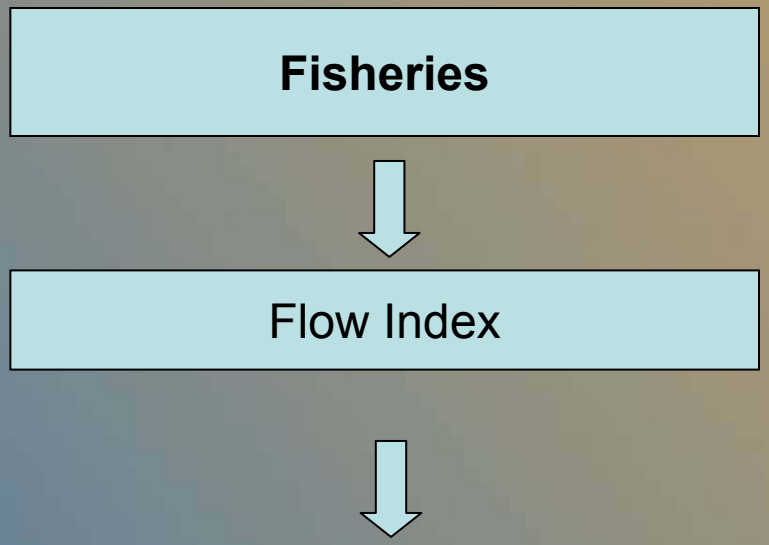
- Compiled Results relative to FNA

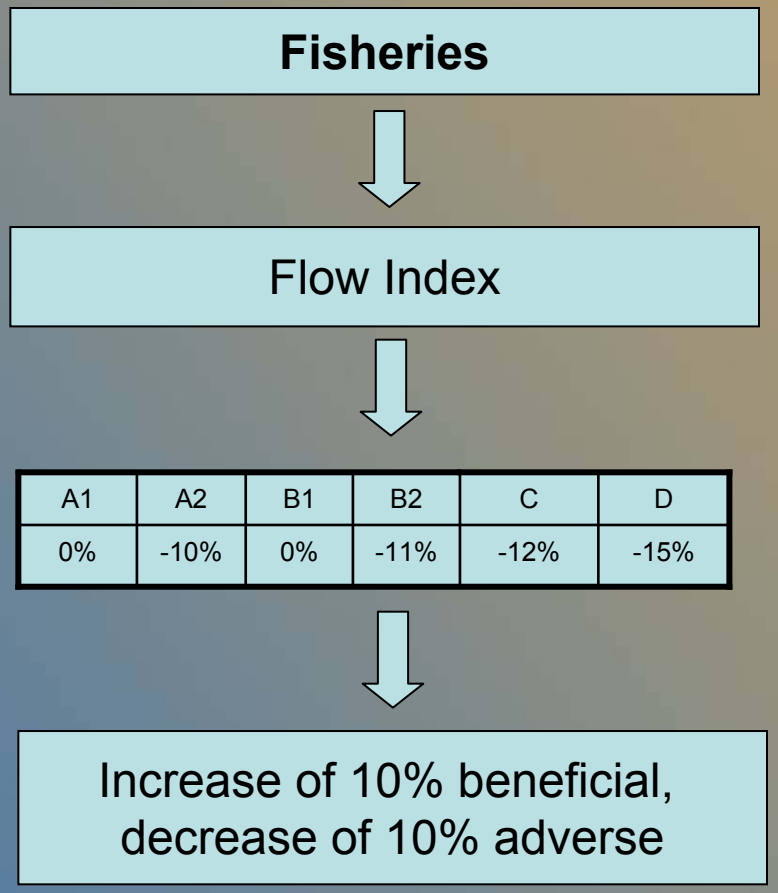


A1	A2	B1	B2	C	D
0%	-10%	0%	-11%	-12%	-15%

RECLAMATION

Example of Ranking Process

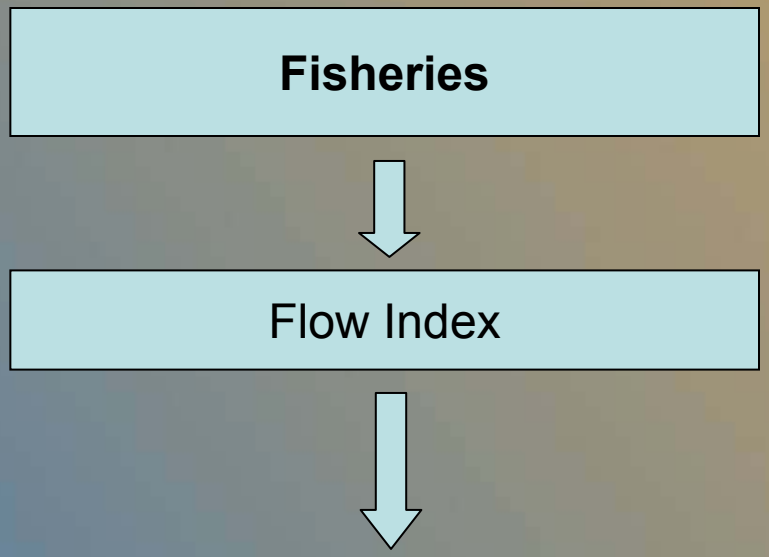
- Identified Resource Areas
- Developed Sub-elements ("unit") for each Resource Area
- Compiled Results relative to FNA
- Developed Ranking Thresholds



RECLAMATION

Example of Ranking Process

- Identified Resource Areas
- Developed Sub-elements ("unit") for each Resource Area
- Compiled Results relative to FNA Developed Ranking Thresholds
- Scored each Sub-element for each alternative



A1	A2	B1	B2	C	D
0%	-10%	0%	-11%	-12%	-15%
0	-1	0	-1	-1	-1

RECLAMATION

Example of Ranking Process

- Identified Resource Areas
- Developed Sub-elements ("unit") for each Resource Area
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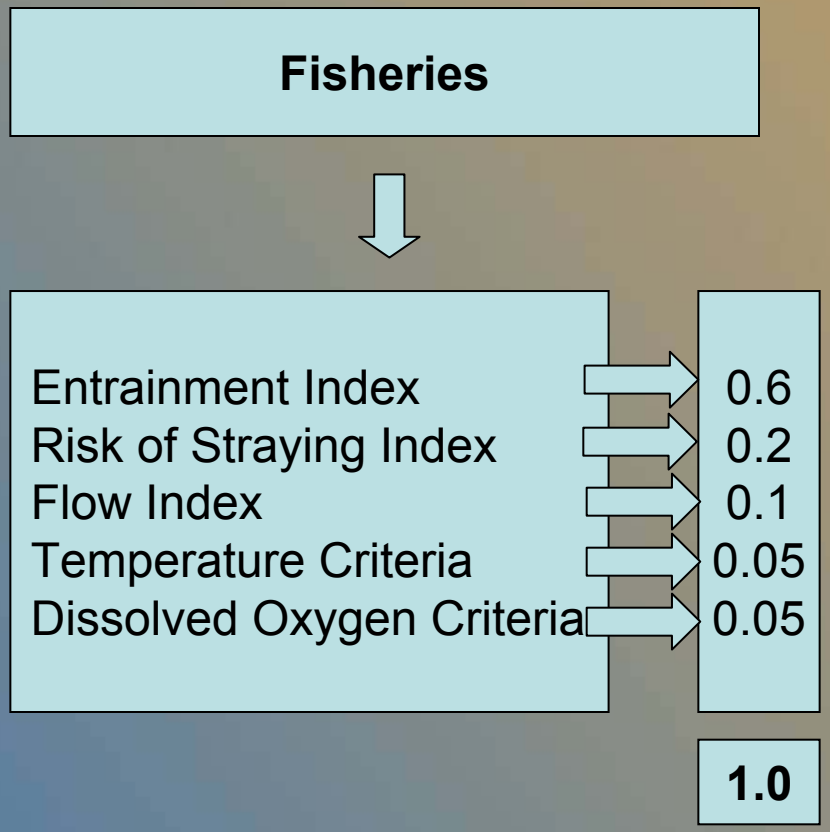

RECLAMATION

Example of Ranking Process

- Identified Resource Areas
- Developed Sub-elements ("unit") for each Resource Area
- Compiled Results relative to FNA (where available)
- Developed Ranking Thresholds
- Scored each Sub-element for each alternative
- Weighted each Sub-element within each Resource Area
- Calculated summary for Resource Area

Fisheries

Unit	Weight	A1	A2	B1	B2	C	D
Entr.	0.6	-1	-1	-2	-2	-1	-1
Stray.	0.2	-1	-1	-2	-2	-2	-2
Flow	0.1	0	-1	0	-1	-1	-1
Temp.	0.05	0	0	0	0	0	-1
DO.	0.05	1	1	1	1	2	2
Wtd. Avg.		**-0.2**	**-0.3**	**-0.5**	**-0.6**	**-0.5**	**-0.5**

RECLAMATION

Example of Ranking Process

- Identified Resource Areas
- Developed Sub-elements ("unit") for each Resource Area
- Compiled Results relative to FNA (where available)
- Developed Ranking Thresholds
- Scored each Sub-element for each alternative
- Weighted each Sub-element within each Resource Area
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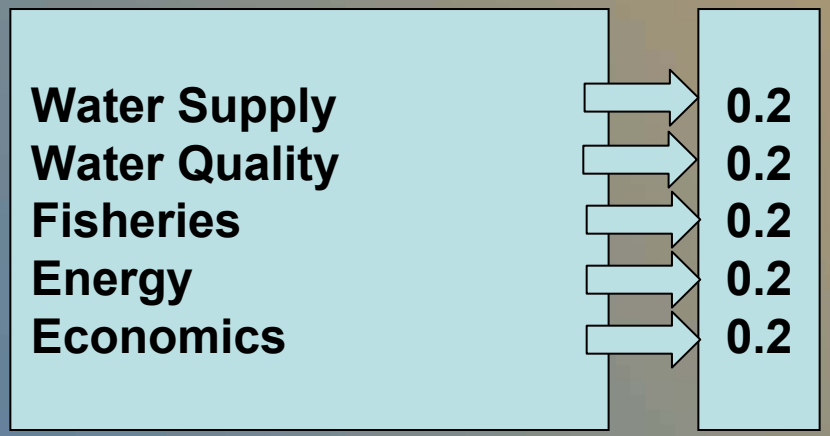


RECLAMATION

Ranking Results

	Overall Weighted Ranking Value						Weight
	A1	A2	B1	B2	C	D	
Achieving Planning Objectives	**0.5**	**0.7**	**0.5**	**0.7**	**1.5**	**1.6**	
Resource Areas							
Water Supply	0.0	0.0	0.0	0.0	-1.0	-1.0	0.20
Water Quality	-0.1	-0.1	-0.4	-0.5	-0.5	-0.5	0.20
Fisheries	-0.2	-0.3	-0.5	-0.6	-0.5	-0.5	0.20
Energy	0.0	-0.2	-0.2	-1.2	-0.2	0.0	0.20
Economics	0.0	-0.1	0.0	-0.1	-0.6	-1.0	0.20
Resource Ranking	**-0.07**	**-0.15**	**-0.22**	**-0.47**	**-0.56**	**-0.61**	

Screening and Evaluation Criteria

- Completeness – Does Not Require Action By Others
- Effectiveness – Maximizes Achieving Project Objectives
- Efficiency – Cost Effectiveness
- Acceptability – Meets laws, regulations and policies and acceptable to stakeholders

Screening Results

P&G Acceptance Criteria	Alternative						
	A1	A2	B1	B2	C	D	Notes/Assumptions
Completeness	High	High	High	High	High	High	All alternatives rely on investments or actions limited to Reclamation and DWR, not on the actions of others.
Effectiveness	Medium	Medium	Medium	Medium	High	High	All alternatives meet planning objectives. Alternatives C and D have higher effectiveness due to the beneficial effects of increased recirculation. Refer to Table 6-3 of the PFR.
Efficiency: FNA comparison method	Low	Low	Low	Low	Low	Low	All alternatives yield negative NED benefits relative to FNA.
Efficiency: Cost-effectiveness method	Medium	Medium	Medium	Medium	High	Medium	All alternatives are cost-effective, as determined by summing the ranking results of "Achieving Planning Objectives" and "Net NED benefits for an average water year".
Acceptability (could break out by stakeholder groups and weigh each equally)	Low	Low	Low	Low	Low	Low	Although all alternatives would meet the requirements of applicable laws, regulations, and policies, none of the alternatives would satisfy all stakeholder groups (i.e., State and local entities, the public).

Discussion

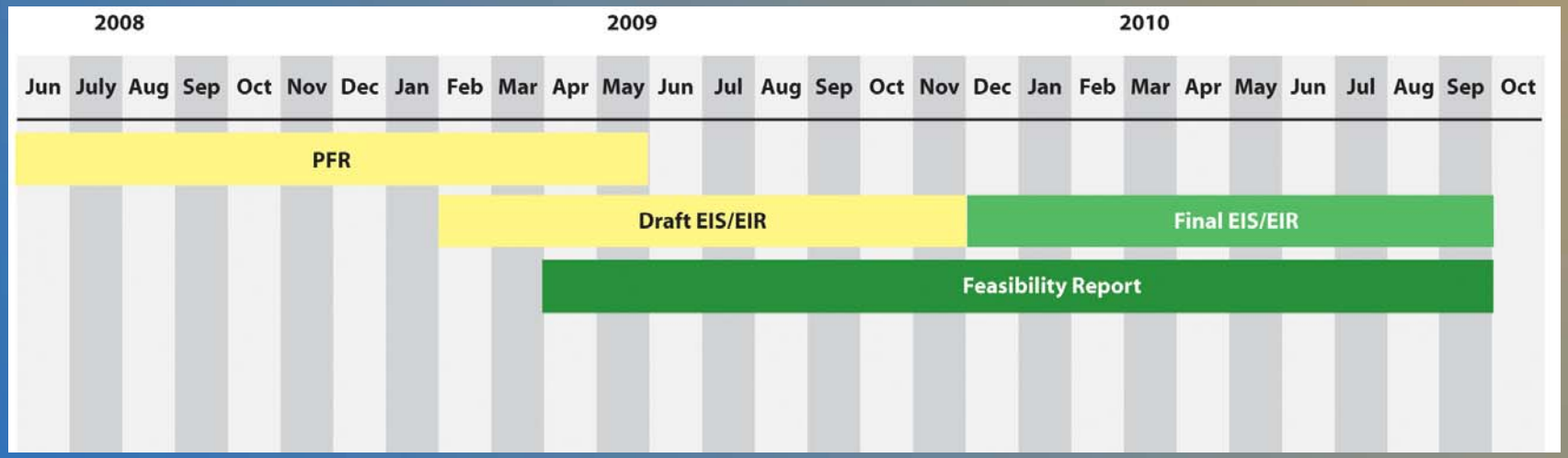
RECLAMATION

Next Steps

- Select and refine alternatives for EIS/EIR
  - Include Range of Alternatives
  - Minimize Fisheries Impacts
  - Include Consideration of OCAP BOs
  - Incorporate Lessons Learned from Sensitivity Analysis
- Release PFR
- Complete EIS/EIR/FR

RECLAMATION

Next Steps



RECLAMATION

Wrap-up

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www.usbr.gov/mp/dmcrecirc/

http://baydeltaoffice.water.ca.gov/sdb/recirc/index_recirc.cfm

RECLAMATION