RECLAMATION

Managing Water in the West

CVP Operations Overview

January 2018

U.S. Department of the Interior
Bureau of Reclamation

California Water Projects

- Central Valley Project
- State Water Project
- Local Water Projects

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Central Valley Project
Major Storage Facilities

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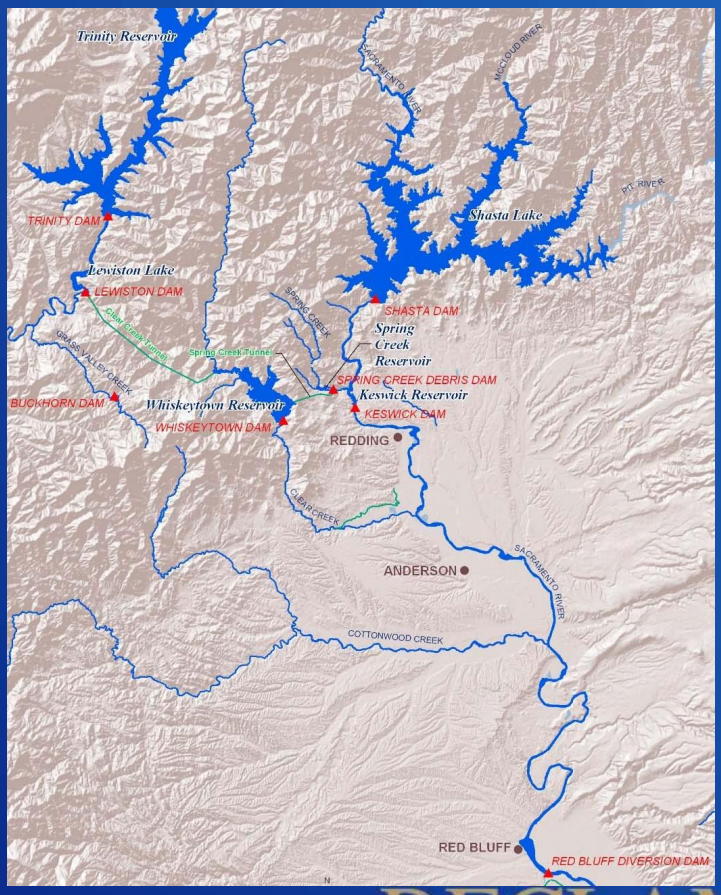
Northern System



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Trinity River Division

- Trinity Reservoir 2.4 MAF
- Avg Annual Inflow 1.3 MAF
- Trinity Powerplant 140 MW
- Carr Powerplant 184 MW

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Trinity Authorized Purposes

Power Generation

Fish and Wildlife

River Regulation

Recreation

Water Supply

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Trinity Reservoir Functions

- Integrated with CVP Operation
- Normal operations provide flood control benefits
- Fish and Wildlife Requirements – Trinity River Main-stem Fishery Restoration Record of Decision (2000)
- Temperature Objectives – SWRCB WR 90-5
- Trans-basin Diversion – hydropower generation and water temperature management

Whiskeytown

- Whiskeytown Lake 240 TAF
- Spring Creek PP 200 MW

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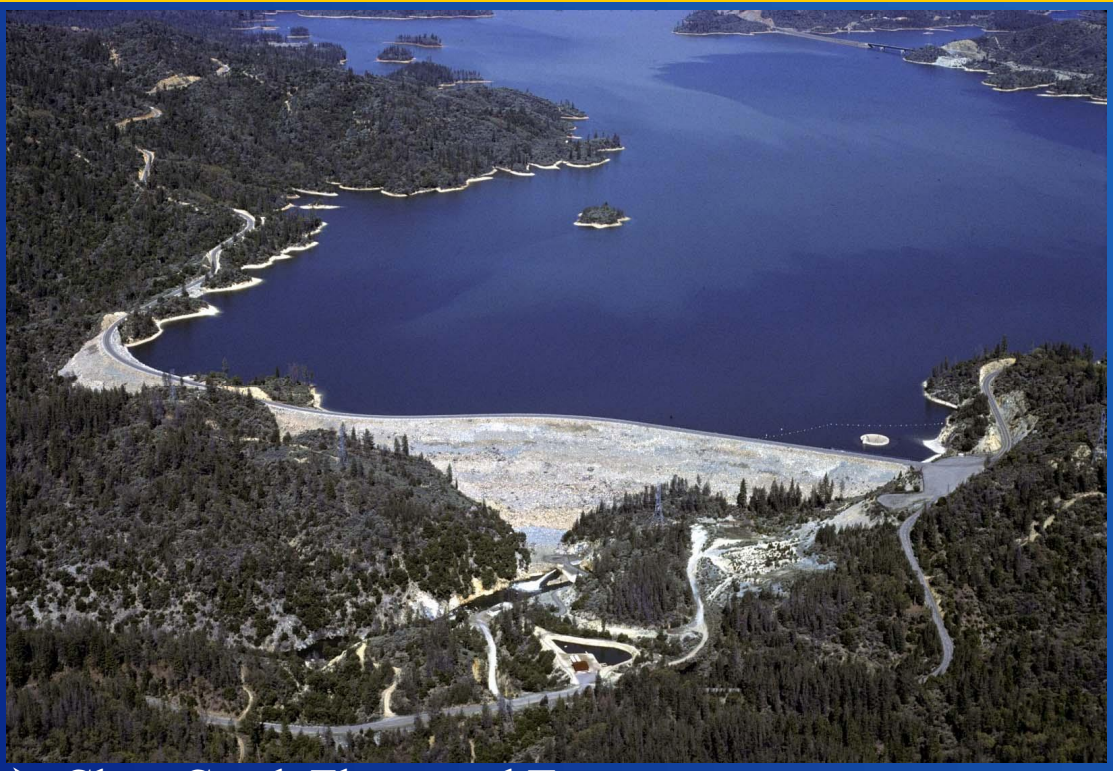
Whiskeytown ~ Operation Constraints



- Clear Creek Flows and Temperatures
- Sacramento River Operations

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Shasta Division

- Shasta Reservoir 4.5 MAF
- Avg Annual Inflow 5.4 MAF
- Shasta Powerplant 715 MW

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Sacramento River ~ Operation Constraints

- Sacramento River Water Temperatures
- Coordinated Flood Operations

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American River Division

- Folsom Reservoir 1.0 MAF
- Avg Annual Inflow 2.6 MAF
- Folsom Powerplant 215 MW

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American River ~ Operation Constraints

- Water Temperatures and Flows
- Flood Control

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East Side Division

- New Melones Reservoir 2.4 MAF
- Avg Annual Inflow 1 MAF
- New Melones PP 380 MW

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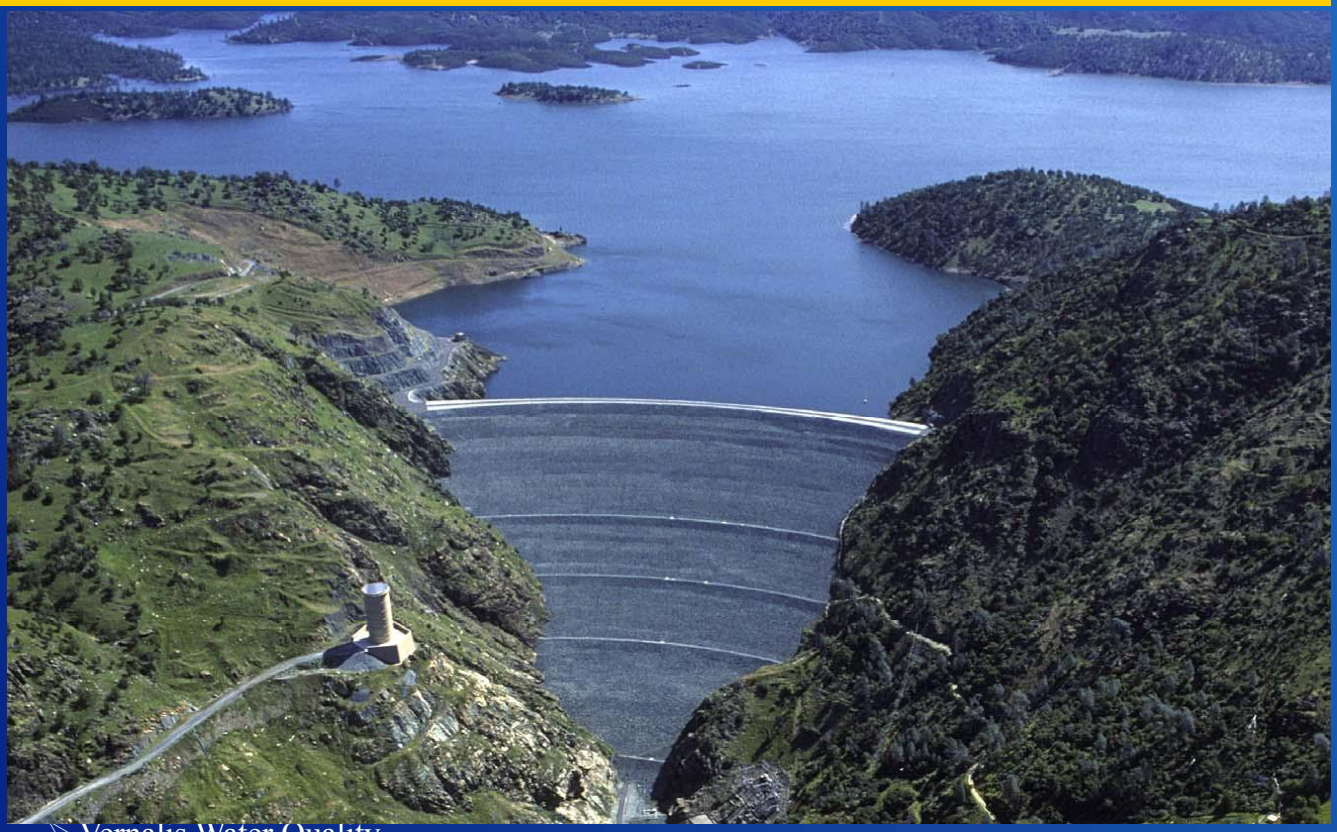
East Side ~ Operation Constraints



- Vernalis Water Quality
- In-stream Fishery Flows
- Flood Control

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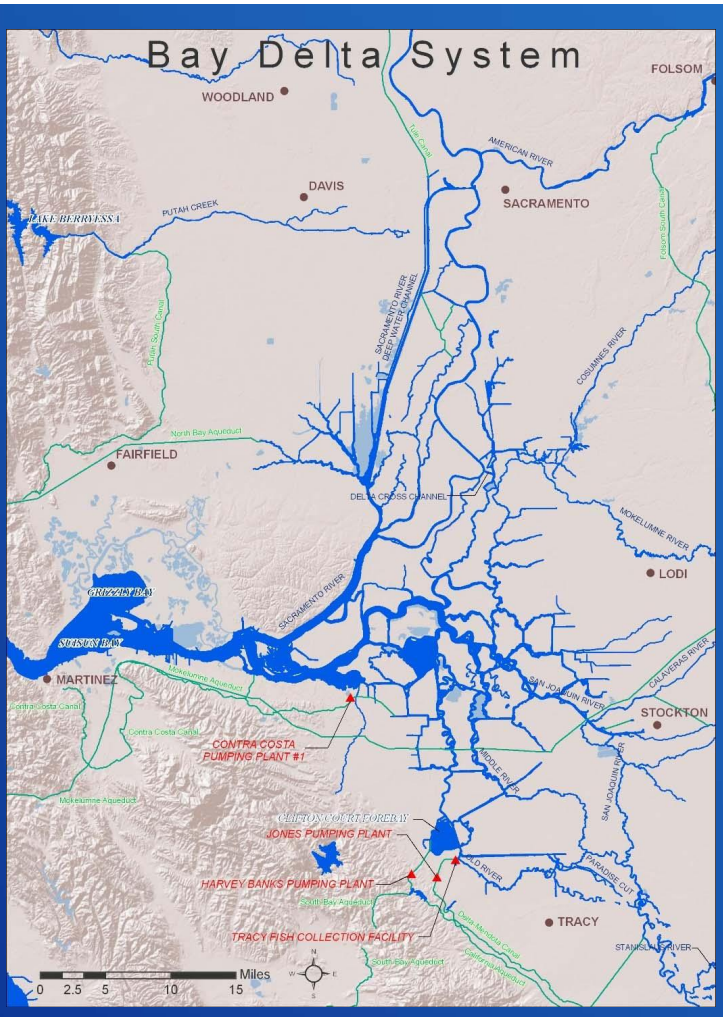
The Sacramento-San Joaquin Delta



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Delta Division

- Jones Pumping Plant 4,600 cfs
- Delta Mendota Canal 4,600 cfs
- Intertie (DCI) 450 cfs
- Delta Cross Channel Gates

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Delta ~ Operation Constraints

- Water Rights Decision 1641
- Biological Opinions
- Coordination with State Water Project

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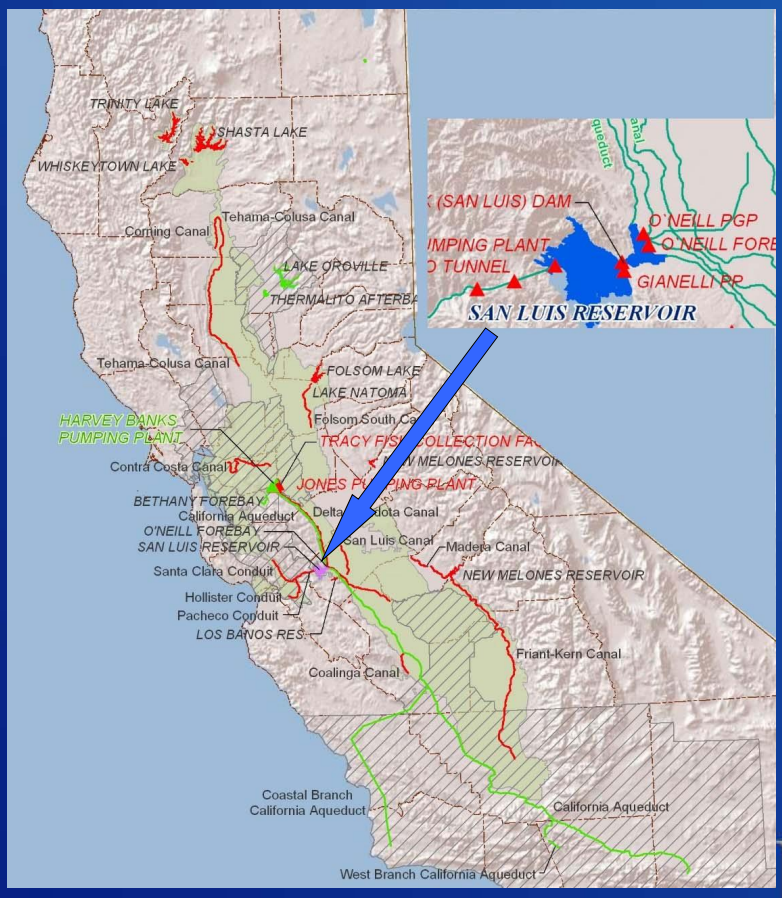
San Luis Unit



- San Luis Reservoir 966 TAF (Federal Share)
- Giannelli Powerplant 424 MW
- Dos Amigos Pumping Plant 13,000 cfs
- O'Neill Pumping Plant 4,200 cfs
- Pacheco Pumping Plant 500

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San Luis ~ Operation Constraints

- San Luis Low Point
- Two Foot Drawdown Per Day

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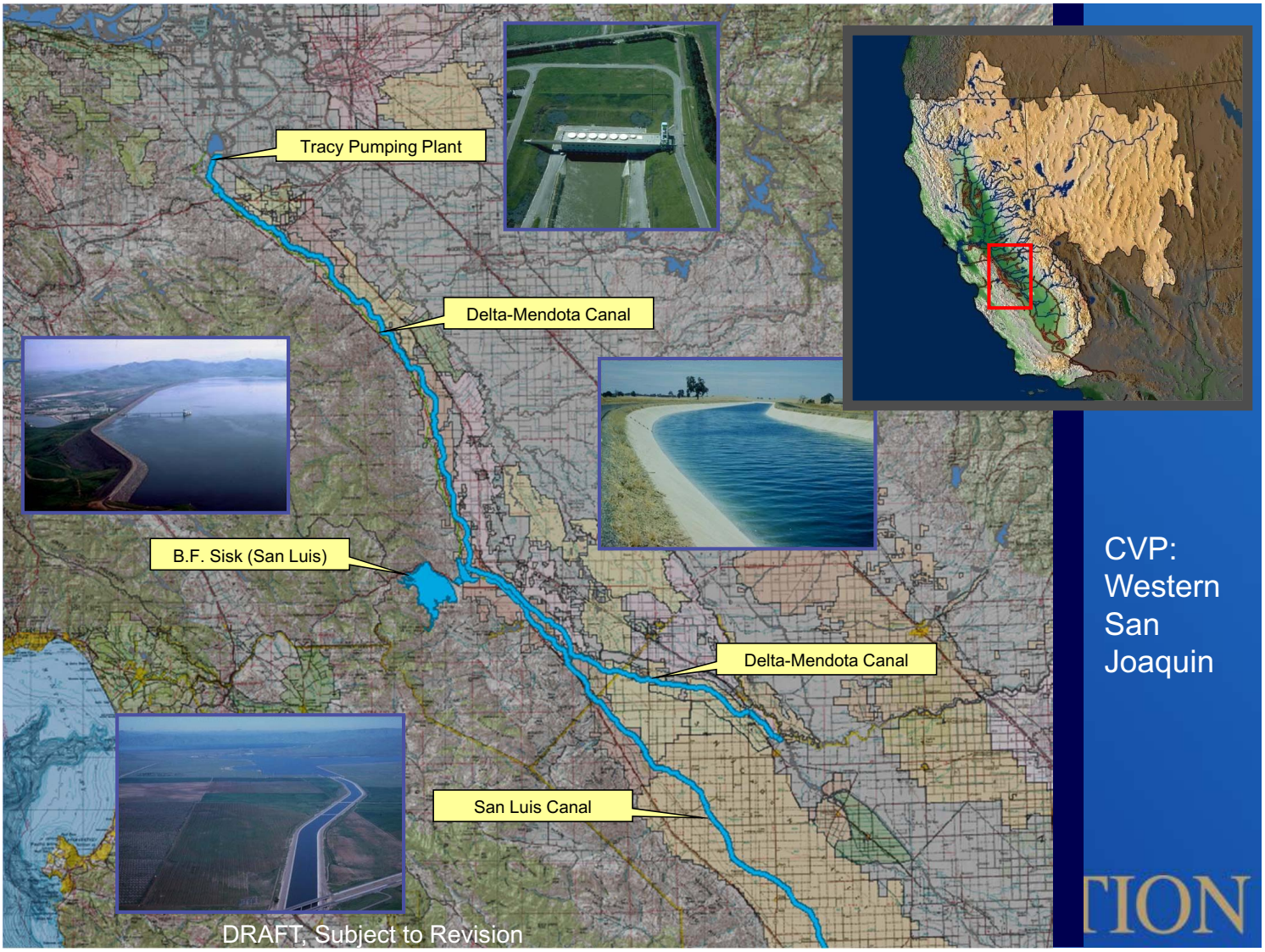
Tracy Pumping Plant
Delta-Mendota Canal
B.F. Sisk (San Luis)
Delta-Mendota Canal
San Luis Canal
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CVP:
Western
San
Joaquin
TION

Friant Division

- Friant Reservoir 520 TAF
- Avg Annual Inflow 1.7 MAF
- Friant – Kern Canal
- Madera Canal

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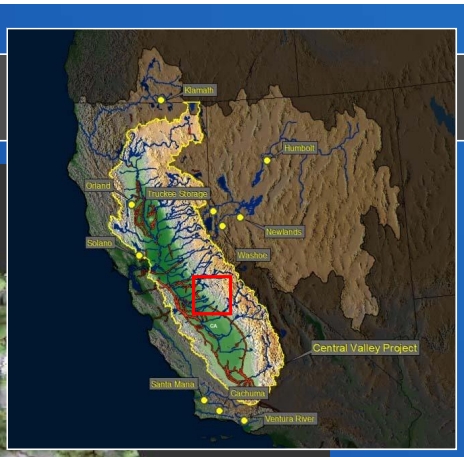
Friant Dam



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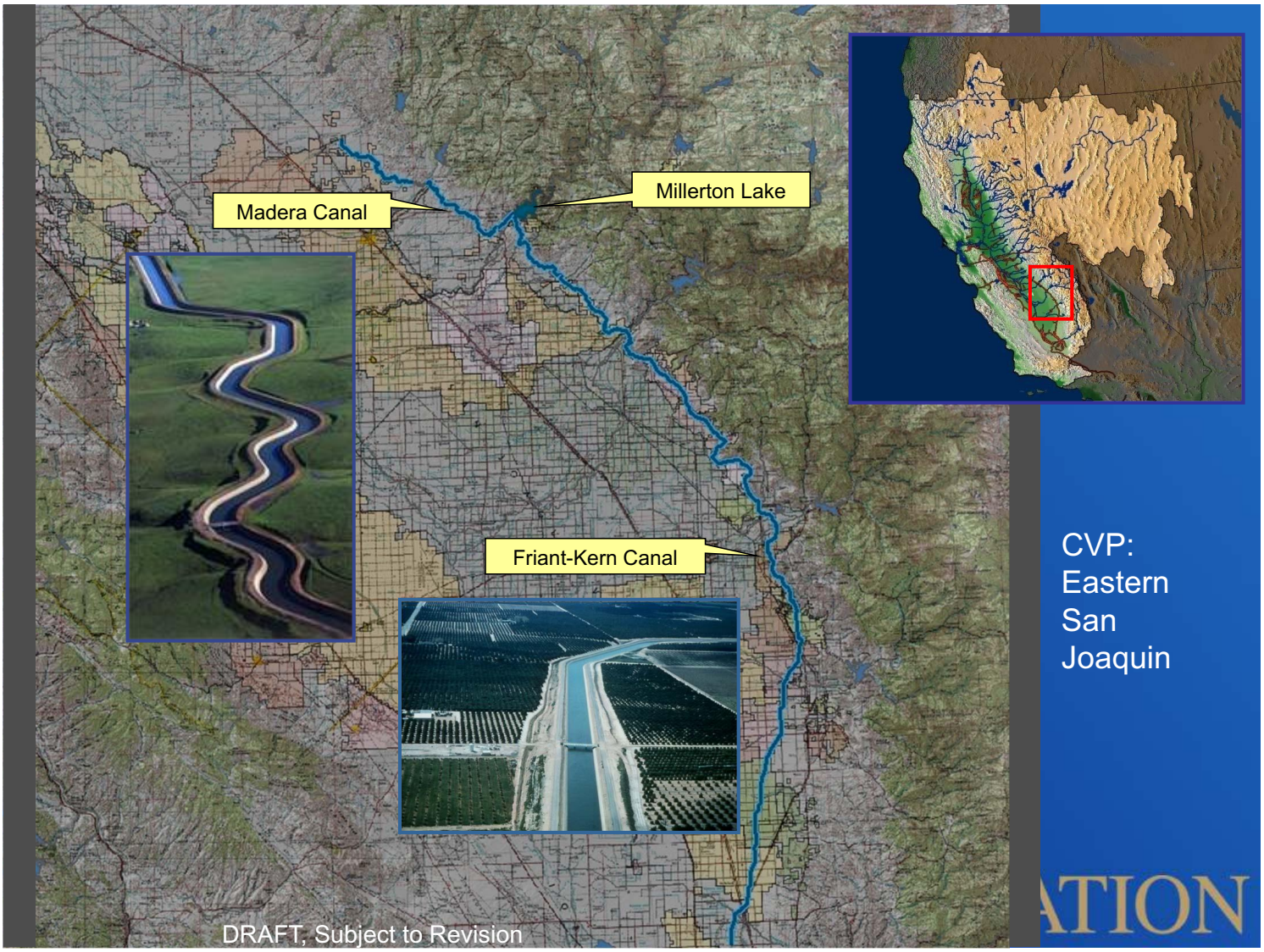
Madera Canal
Millerton Lake
Friant-Kern Canal
CVP:
Eastern
San
Joaquin
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State Water Project

- Oroville 3.5 MAF
- Hyatt Powerplant 644 MW
- Banks Pumping Plant 11,000 cfs
- San Luis Reservoir 1062 TAF (State share)
- CA Aqueduct

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Authorized Project Purposes

- Flood Control
- River Regulation
- Fish and Wildlife Needs
- Municipal & Agricultural Water Supplies
- Power Generation
- Recreation

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Coordinating the Operations

- U. S. Fish and Wildlife Service
- National Marine Fisheries Service
- Western Area Power Administration
- U. S. Army Corps of Engineers
- State Water Resources Control Board
- State Department of Water Resources
- State Department of Fish and Wildlife
- Local Stakeholders

System Constraints

- Maximize contractual water supply deliveries given the constraints of the system:
  - Geographic
  - Hydrologic
  - Physical Capacity
  - Flood Control requirements
  - Environmental (i.e. water quality, outflow)
  - Contractual and Water Rights Requirements
  - Economic
  - Demand Patterns

Hydrologic Constraints

- Water supply greatest in the winter & spring.
- Demand peaks in the summer.
- Unfavorable hydrologic distribution pattern.
  (i.e. early snow melt, small snow pack)
- Multi-year Drought

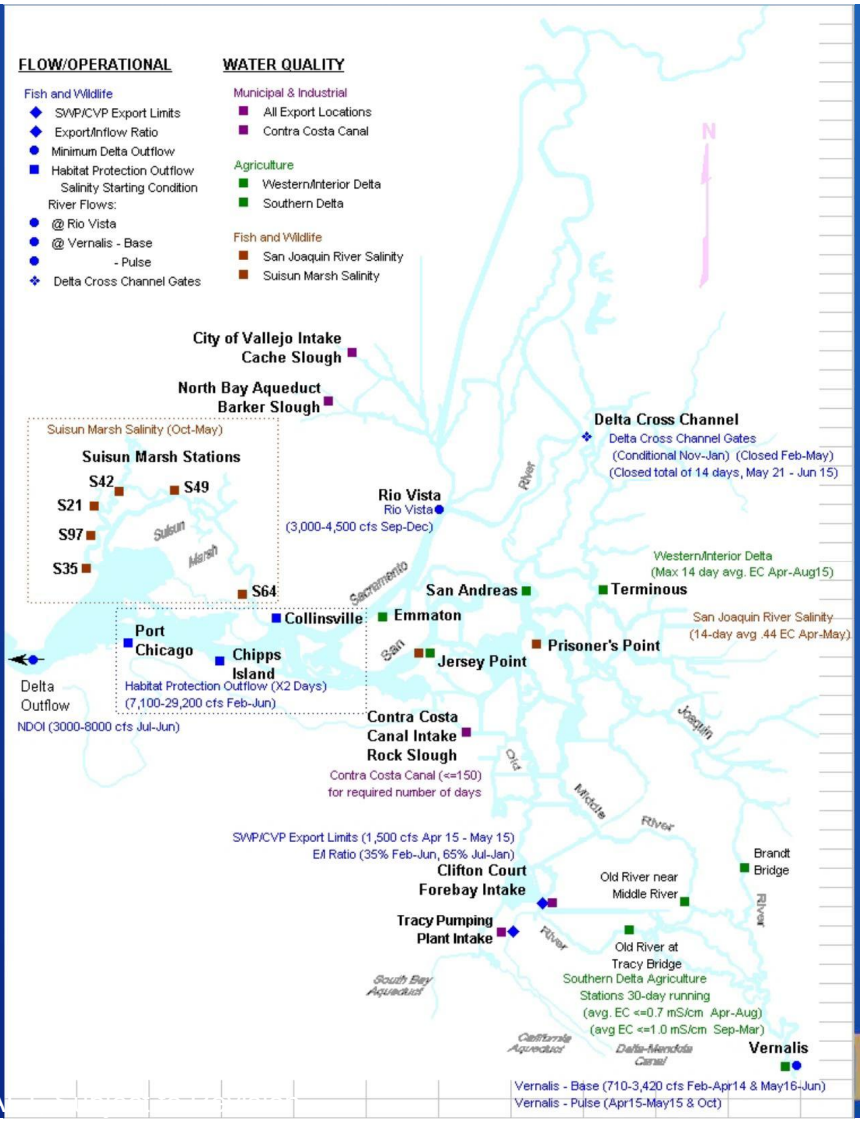
Environmental

- Water Quality Standards
- Minimum River Flow Requirements
- Delta Outflow Requirements
- Water Temperature Management

Permits and Contractual Agreements

Key Operating Agreements and Standards

- Coordinated Operations Agreement
- Water Rights Decision 1641
- Biological Opinions
  - Winter-run & Spring-run Chinook Salmon
  - Central Valley steelhead
  - Delta Smelt
- San Joaquin River Agreement
- Central Valley Improvement Act


FLOW/OPERATIONAL
Fish and Wildlife
SWP/CVP Export Limits
Export/Inflow Ratio
Minimum Delta Outflow
Habitat Protection Outflow
Salinity Starting Condition
River Flows:
@ Rio Vista
@ Vernalis - Base
- Pulse
Delta Cross Channel Gates
WATER QUALITY
Municipal & Industrial
All Export Locations
Contra Costa Canal
Agriculture
Western/Interior Delta
Southern Delta
Fish and Wildlife
San Joaquin River Salinity
Suisun Marsh Salinity
N
City of Vallejo Intake
Cache Slough
North Bay Aqueduct
Barker Slough
Suisun Marsh Salinity (Oct-May)
Suisun Marsh Stations
S42
S49
S21
S97
S35
S64
Suisun
Marsh
Rio Vista
Rio Vista
(3,000-4,500 cfs Sep-Dec)
Sacramento
River
Delta Cross Channel
Delta Cross Channel Gates
(Conditional Nov-Jan) (Closed Feb-May)
(Closed total of 14 days, May 21 - Jun 15)
Western/Interior Delta
(Max 14 day avg. EC Apr-Aug15)
San Andreas
Terminous
Collinsville
Emmaton
San Joaquin River Salinity
(14-day avg .44 EC Apr-May)
Port
Chicago
Chipps
Island
Jersey Point
Prisoner's Point
San
Delta
Outflow
Habitat Protection Outflow (X2 Days)
(7,100-29,200 cfs Feb-Jun)
NDOI (3000-8000 cfs Jul-Jun)
Contra Costa
Canal Intake
Rock Slough
Contra Costa Canal (<=150)
for required number of days
Joaquin
Old
Middle
River
SWP/CVP Export Limits (1,500 cfs Apr 15 - May 15)
E/I Ratio (35% Feb-Jun, 65% Jul-Jan)
Clifton Court
Forebay Intake
Brandt
Bridge
Old River near
Middle River
Tracy Pumping
Plant Intake
Old River at
Tracy Bridge
Southern Delta Agriculture
Stations 30-day running
(avg. EC <=0.7 mS/cm Apr-Aug)
(avg EC <=1.0 mS/cm Sep-Mar)
South Bay
Aqueduct
California
Aqueduct
Delta-Mendota
Canal
Vernalis
Vernalis - Base (710-3,420 cfs Feb-Apr14 & May16-Jun)
Vernalis - Pulse (Apr15-May15 & Oct)

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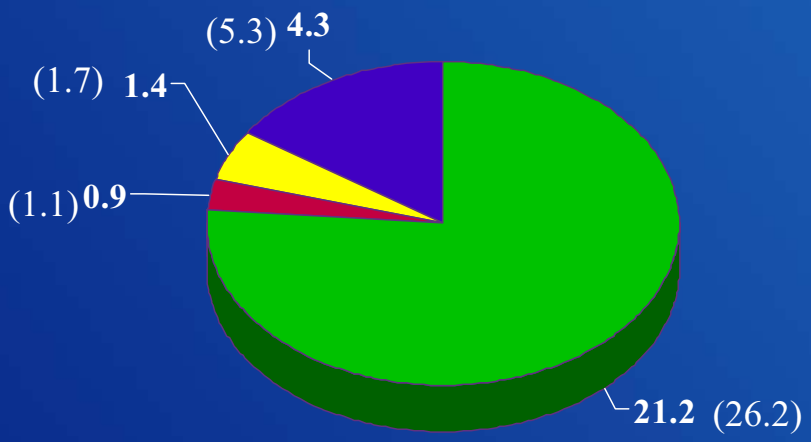
Geographic Constraints

Sacramento/San Joaquin Delta

Avg Annual Inflow in MAF (Billion Cu Meters)



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What Constitutes Delta Control?

- The Delta controls when any change in the Delta requires a response from upstream reservoirs.
  - Typically under balanced conditions
  - Rarely, E/I conditions

- Delta *does not* typically control when:
  - Flood control operations are underway
  - During fishery related export reductions
  - When constraints on upstream reservoirs prevent adjustment of releases to achieve balanced conditions.

What Constrains Delta Operations?

- About 28 operational compliance points, with standards which vary by year type and date
  - Usually 1 to 5 dominate decisions at any given time
  - Flow, salinity (EC), CL-, Export/Inflow Ratio
- Largely a feedback driven system (gages) with poor predictability for EC (models project trends only)
- Fishery concerns
- South Delta water levels
- Upstream releases in dry years

Factors Affecting the Delta

- Tidal Cycles (Overwhelmingly a tidal environment)
- Atmospheric Pressure
- Wind Strength and Direction
- Antecedent Salinity Conditions (very strong persistence)
- Delta Inflow (Sac Valley accretion/depletion rates)
- Export Rates
- Delta Cross Channel Gate Position (water circulation patterns)

Key CVP-SWP Delta Compliance Management Tools

- Increase Delta Inflow (Response to seasonal or daily shifts in system depletions, EC, CL-, exports
  - Shasta release 5 days away
  - Oroville release 3 days away
  - Folsom release 1 day away
  - After initial response, rebalance reservoirs
- Export Reductions (Response to Central /South Delta EC, CL-)
  - CVP export levels (single speed pumps, difficult to adjust)
  - SWP export levels (variable speed pumps, forebay)
- Delta Cross Channel Gates (water circulation effects)
- Combinations of all the above

Take Home Points

- Delta operations and compliance with current standards are based upon an integrated system of upstream reservoirs and export facilities and continuous compliance monitoring.
- Delay in implementing a required reservoir release change or export reductions to meet Delta compliance usually results in a much larger and longer duration management action(s) being ultimately required.
- System-wide operations flexibility is a key management asset in the Delta environment.

Questions?