San Joaquin River Restoration Program

Restoration Program Overview

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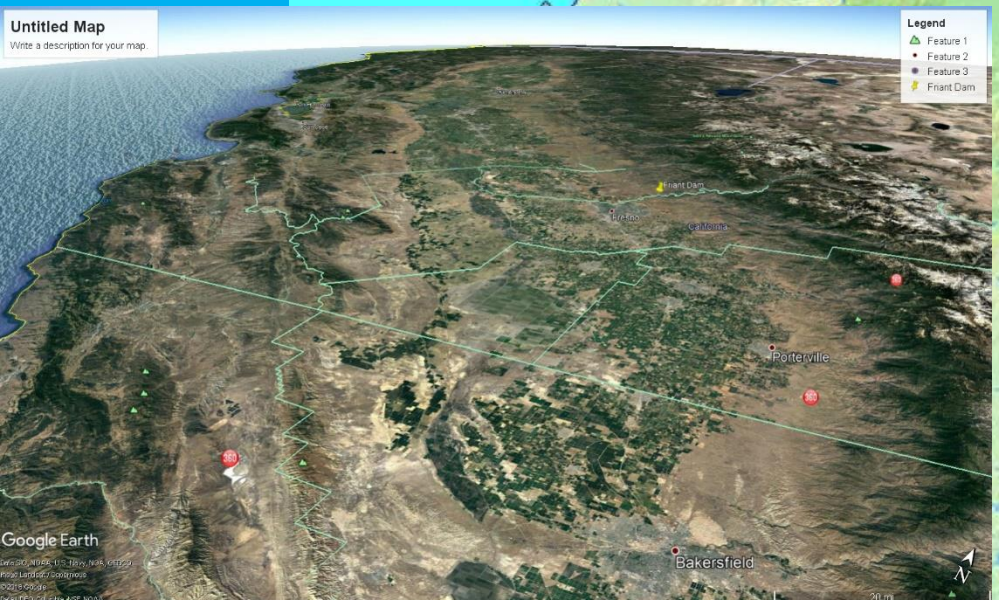
Program Manager

Water Education Foundation
San Joaquin River Tour
November 7 & 8, 2018

SAN JOAQUIN RIVER
RESTORATION PROGRAM

LET'S GET OUR BEARINGS…

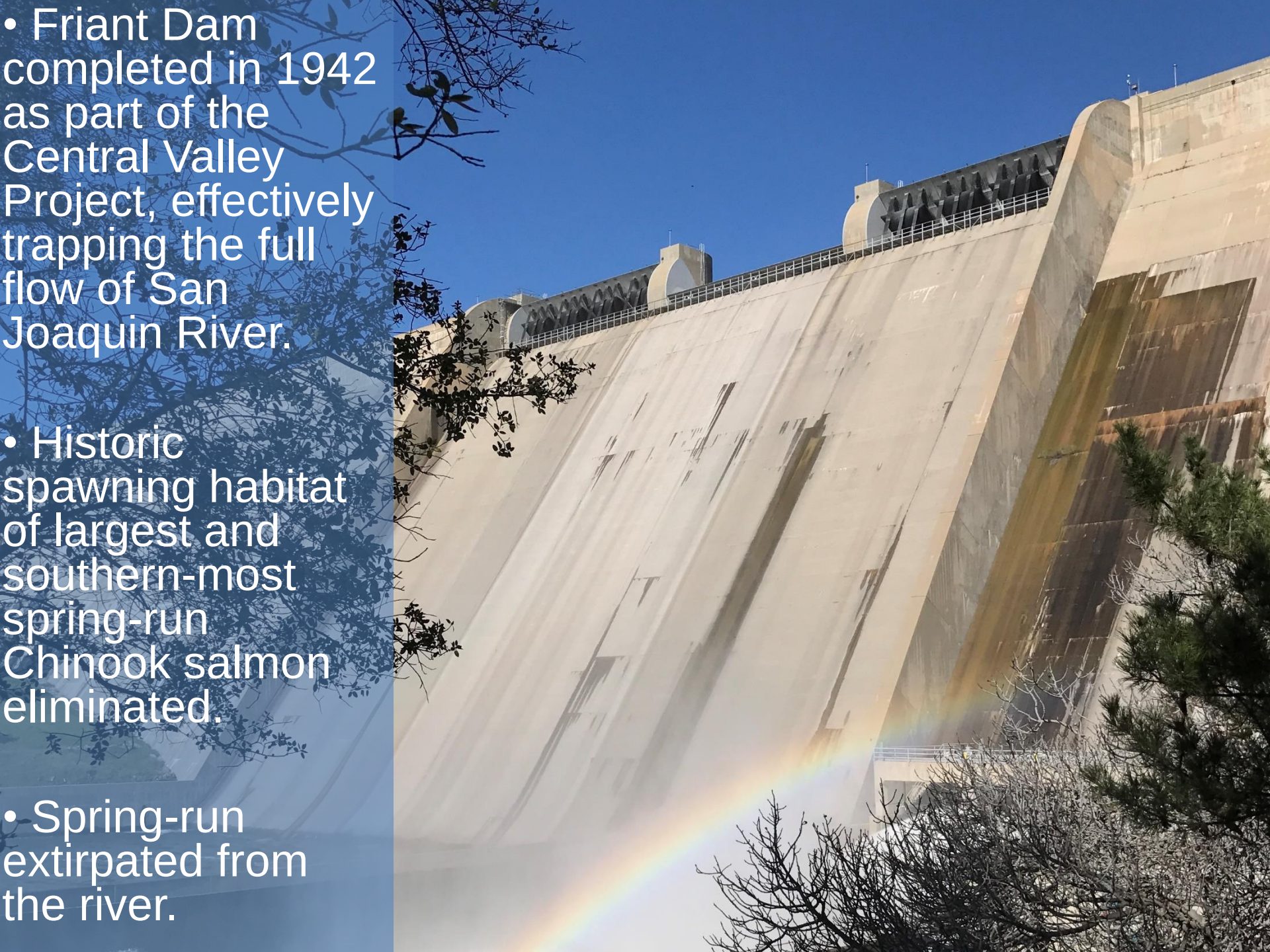

Untitled Map
Write a description for your map.
Legend
Feature 1
Feature 2
Feature 3
Friant Dam
Porterville
Bakersfield
Google Earth


Turlock
Newman
Tuolumne River
California Aqueduct
5
Merced and San Joaquin river confluence
Reach 4B channel vegetation
4B2
140
99
Los Banos
Reaches of the San Joaquin River under evaluation include the following:
Reach 1 – Friant Dam to Gravelly Ford
Reach 2 – Gravelly Ford to Mendota Dam
Reach 3 – Mendota Dam to Sack Dam
Reach 4 – Sack Dam to the confluence of Bear Creek and the Eastside Bypass
Reach 5 – Eastside Bypass/Bear Creek confluence to the Merced River confluence
Mariposa Bypass
Bear Creek
4B1
165
152
Delta-Mendota Canal
Sand Slough Control Structure
Arroyo Canal
4A
Eastside Bypass
Sack Dam
Sack Dam
Reach 4B1 downstream of Sand Slough
Ash Slough
3
Firebaugh
San Joaquin River
Mendota Dam
Chowchilla Bypass
Fresno River
Mendota Dam
Mendota
Reach 2B downstream of the Chowchilla Bifurcation
33
2B
Chowchilla Bifurcation Structure
2A
Mendota Pool
Gravelly Ford
180
1B
Fresno Slough
James Bypass
San Joaquin River
Reach 1 immediately downstream of Friant Dam
Milburn Unit
Fresno
1A
Friant Dam
Millerton Lake

SAN JOAQUIN RIVER
RESTORATION PROGRAM

THE HISTORY

- Construction begins on Friant Dam in 1939.
- Built for water supply for southern San Joaquin Valley through Friant-Kern Canal and Madera Canal.
- Authorized for both water supply and flood control
- 520,000 acre-feet, 15 miles north of Fresno, CA



- Friant Dam completed in 1942 as part of the Central Valley Project, effectively trapping the full flow of San Joaquin River.

- Historic spawning habitat of largest and southern-most spring-run Chinook salmon eliminated.

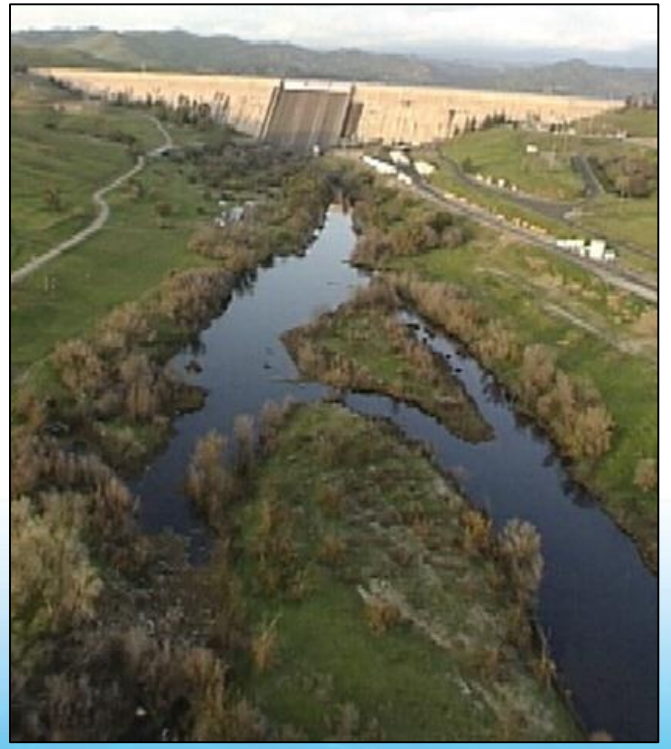
- Spring-run extirpated from the river.

Settlement History

Fast forward 46 years…

1988

Lawsuit filed challenging Reclamation's renewal of the long-term contracts with Friant Division contractors



2004

Federal Judge rules Reclamation violated Section 5937 of the California Fish and Game Code:

"The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam…"

Settlement History

2005

Settlement negotiations reinitiated

2006

Settlement reached; implementation begins

2009

Federal legislation enacted (Public Law 111-11) to fund the Program

The "Players"

Settling Parties

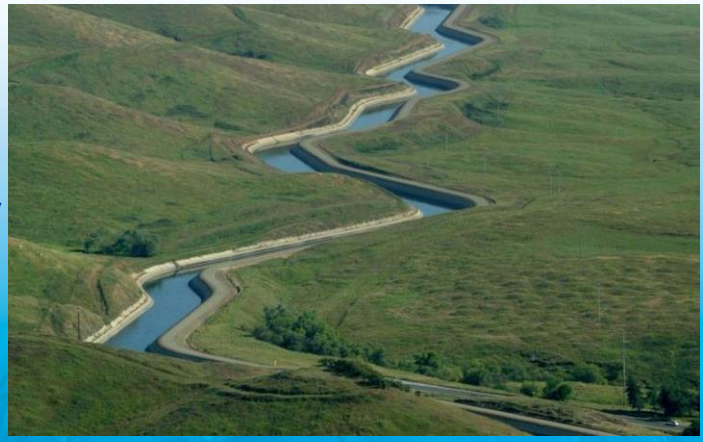
- NRDC Coalition
  - 14 organizations
- Friant Water Authority
  - 17 water agencies intervened
- Federal Government
  - Department of the Interior
    - Bureau of Reclamation
    - Fish and Wildlife Service
  - Department of Commerce
    - National Marine Fisheries Service
- State of California
  - Department of Water Resources
  - Department of Fish and Wildlife
- Restoration Administrator
- Third Parties

Implementing Agencies

Settlement Goals

- **Restoration Goal**
  - To restore and maintain fish populations in “good condition” in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.

- **Water Management Goal**
  - To reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.



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Key Restoration Goal Activities

- Increase flows from Friant Dam
- Improve channel and structures to convey flows and improve fish passage
- Reintroduce spring-run and fall-run Chinook salmon

Key Water Management Goal Activities

- Water Accounting and Recovery
  - Restoration Flow Guidelines (Completed 12/2013)
  - Recovered Water Account
  - Recapture and re-circulate Restoration Flows

- Physical Projects
  - Friant-Kern Canal Capacity Correction
  - Madera Canal Capacity Correction
  - Friant-Kern Canal Reverse Flow
  - Part III Groundwater Projects

Key Guiding Program Documents

How Restoration and Water Management goals are implemented:

- Settlement & Act (legally binding)
- 2015 Revised Framework for Implementation
  - Provides timeline for Program implementation in 5-year increments
- 2018 Fisheries Framework
  - Outlines fish reintroduction strategy and stressors
- 2018 Funding Constrained Framework
  - Program priorities into next decade given budgetary constraints (through 2024)

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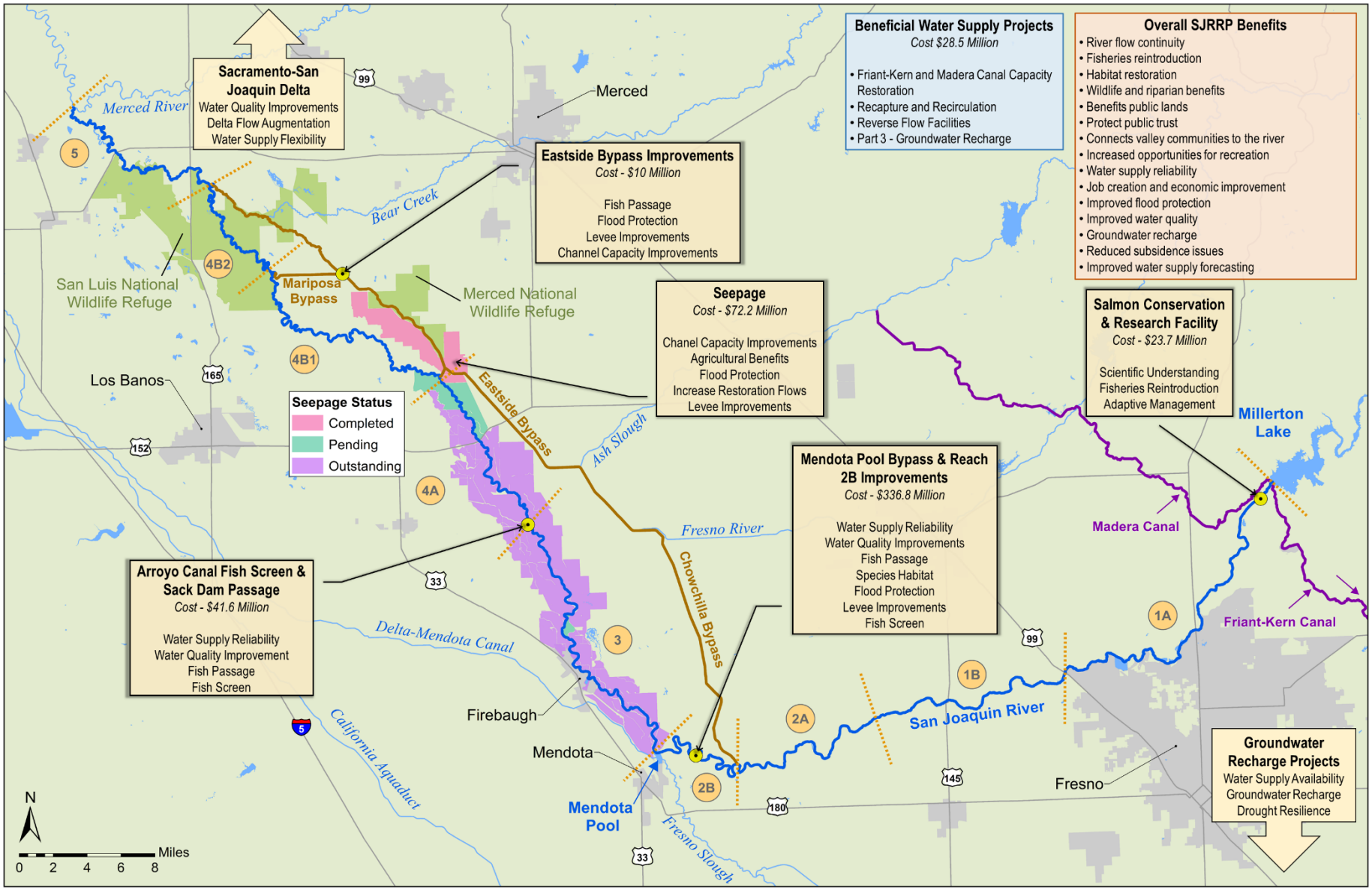
San Joaquin River Restoration Program Cost & Benefits Map



Funding Constrained Framework - Stage 1: FY 2015 to FY 2024

- **Goal: Begin the reestablishment of spring-run and fall-run Chinook salmon**
- **Construction / completion of the following:**
  - Mendota Pool Bypass, Fish Screen, and Reach 2B Project
  - Seepage and levee stability projects to achieve up to 2,500 cfs capacity in all reaches
  - Arroyo Canal Fish Screen and Sack Dam Fish Passage Project
  - Conservation Facility construction
  - Fish passage and levee improvement actions in the Eastside Bypass
  - All remaining funding provided for the Friant-Kern Canal and Madera Canal Capacity Restoration projects

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Flows

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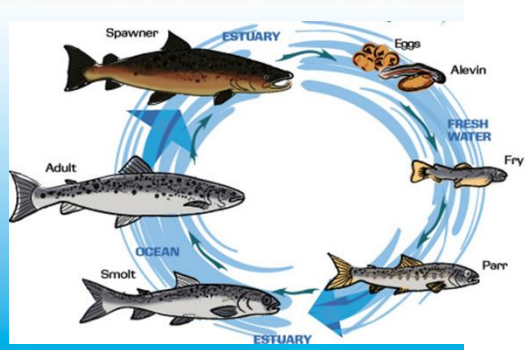
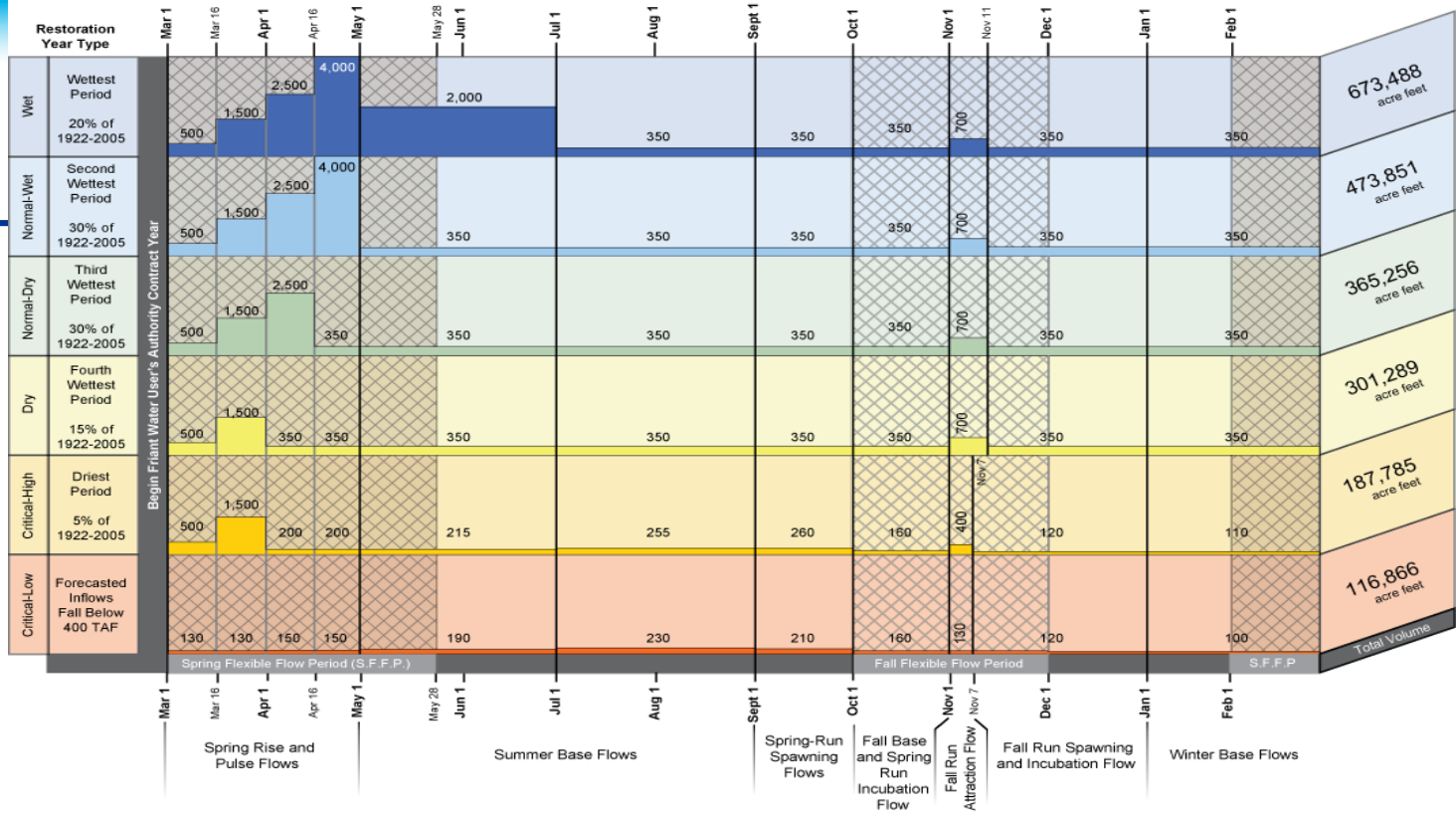
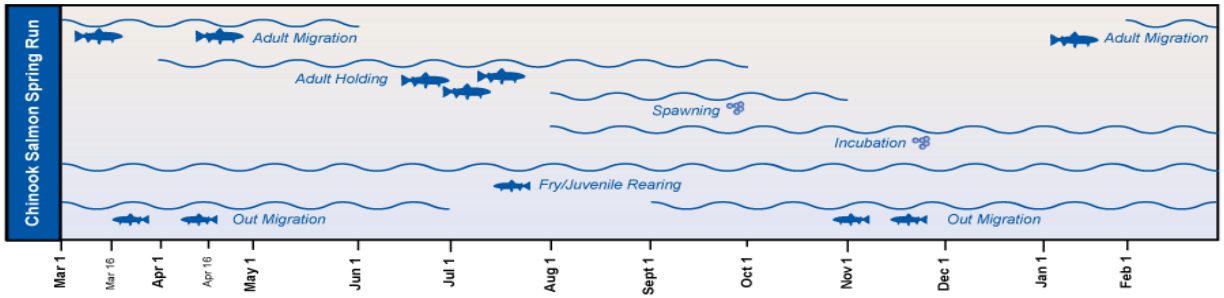
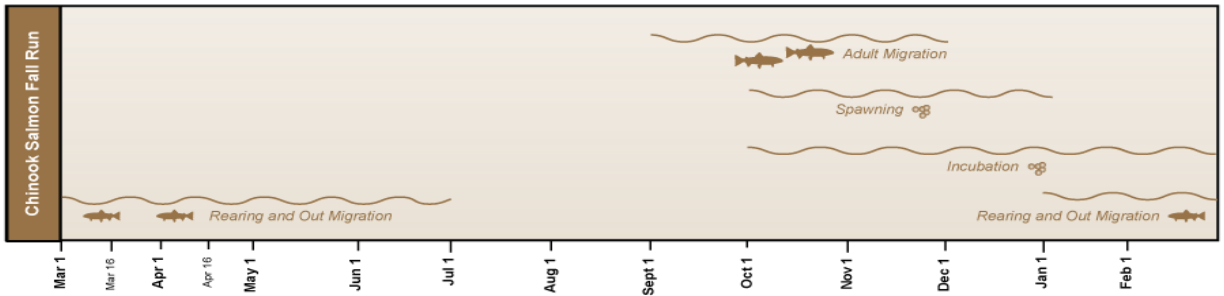
Friant Release Schedule with Fisheries Migration Timing

- Interim Flows began in 2009
- Restoration Flows began in 2014





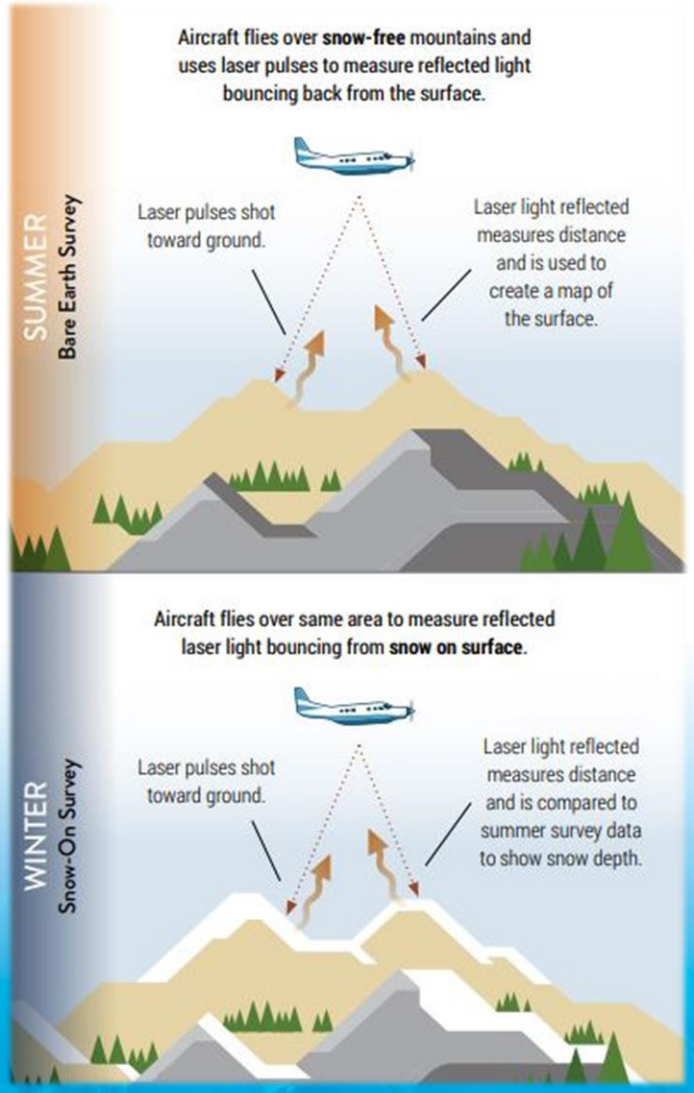




Runoff Forecasting

- Determining how much water is available for flows is critical
  - Determines water year type
  - Restoration Flows
  - Water User availability

- Use a number of tools including:
  - Blended forecasts from DWR and NWS
  - NASA's Airborne Snow Observatory. Accurate and early warning of runoff addresses multiple challenges across all four realms



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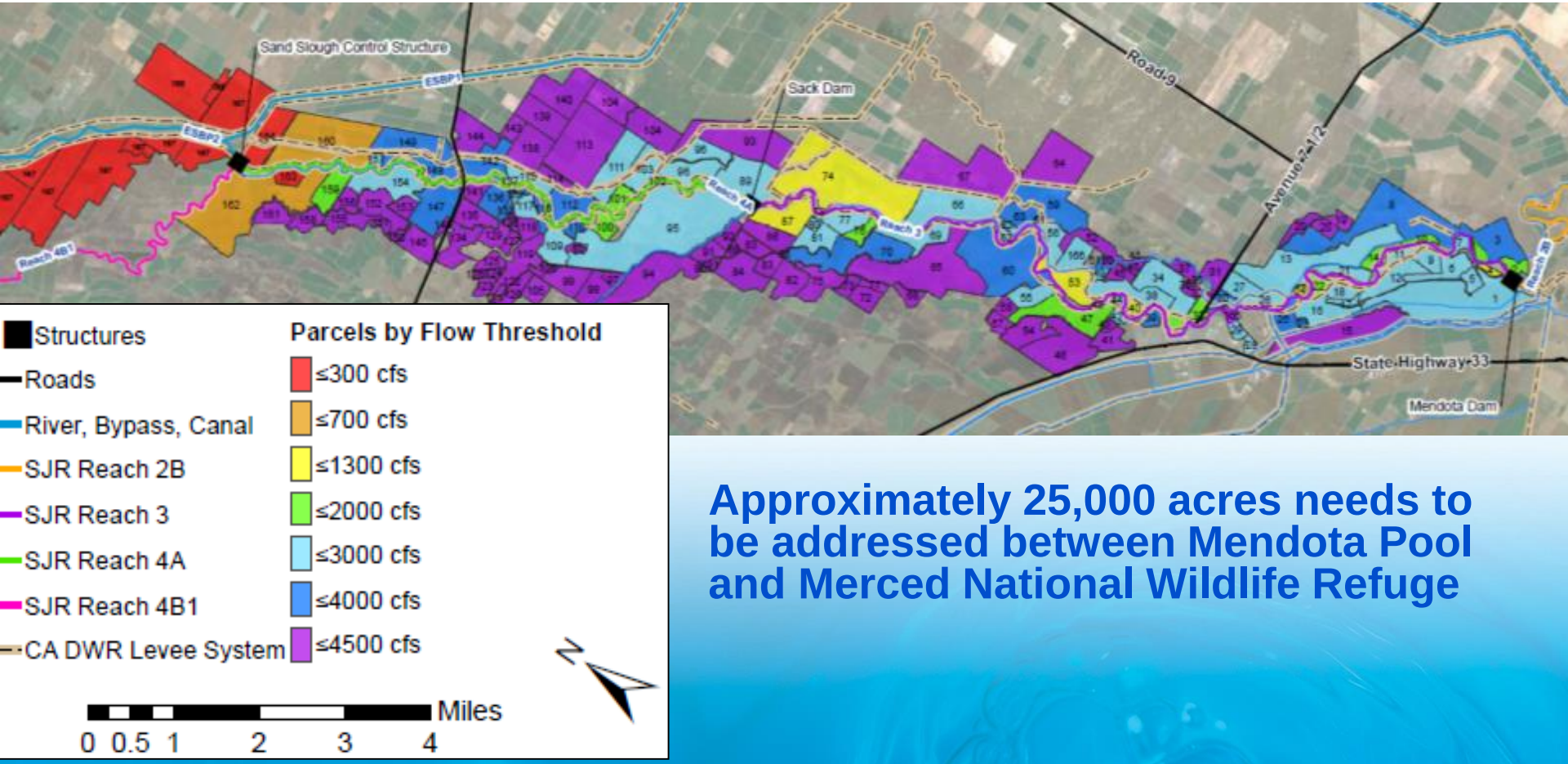
Seepage Management

- Rewetting the San Joaquin River increases shallow groundwater elevations
- Can effect crop productivity (i.e. increased salinity and water logging of crops)

Seepage Management



Approximately 25,000 acres needs to be addressed between Mendota Pool and Merced National Wildlife Refuge

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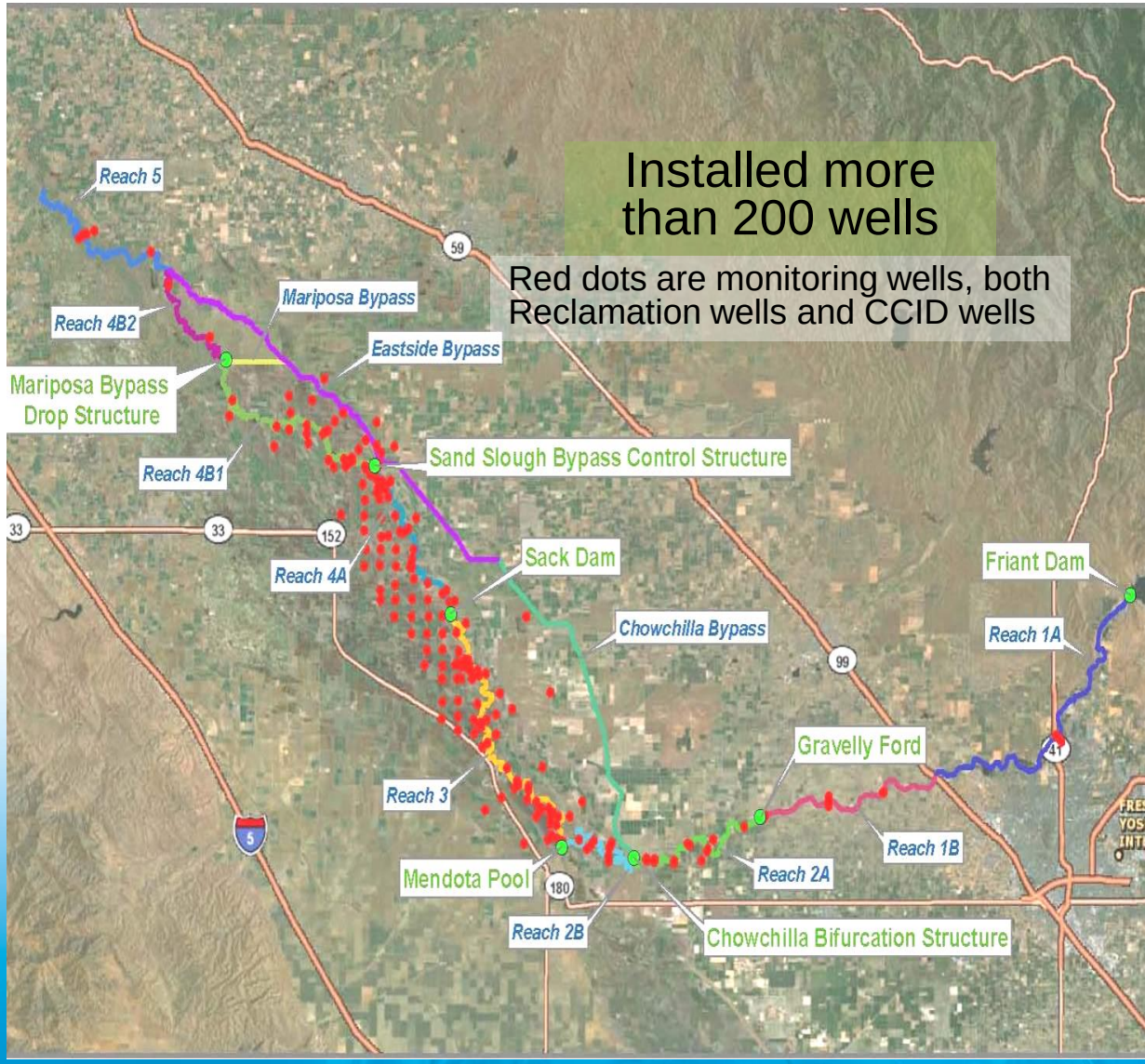
SJRRP Monitoring Well Network

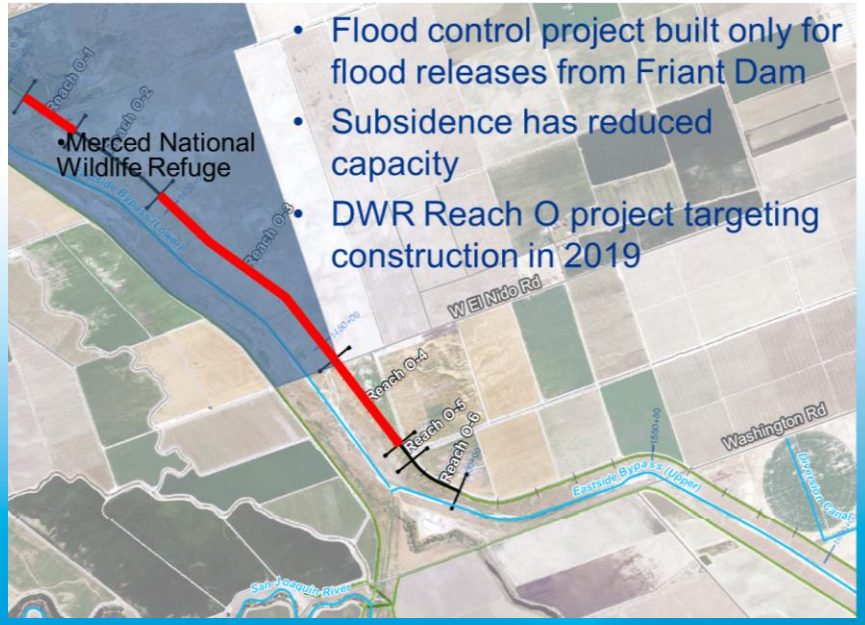
Data Reporting

- Real-time wells online
- Weekly measurements for key wells
- Monthly or quarterly for all other wells depending on site conditions
- Pressure transducers gathering hourly data
- Well Atlas provides well locations, groundwater elevations, topography and similar items and is updated about quarterly



Levee Stability & Channel Capacity

- Flood control project designed and built assuming only flood releases from Friant Dam
- Levee improvements needed to address long-term flows
- Channel capacity limits flow levels that meet USACE Safety Factors for Levee Slope Stability and Underseepage



Reach	Flood Design Flows (cfs)	2017 Then-Existing Channel Capacity (cfs)	How Capacity is Determined
2A	8,000	6,000*	Geotechnical
2B	2,500	1,120	In-channel
3	4,500	2,860*	In-channel
4A	4,500	2,840*	Geotechnical/ In-channel
4B2	10,000	930	In-channel
5	26,000	2,350	In-channel
Middle Eastside Bypass	16,500	580 (0)	Geotechnical
Lower Eastside Bypass	18,500	2,890	In-channel
Mariposa Bypass	8,500	350	In-channel

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Passage and Habitat

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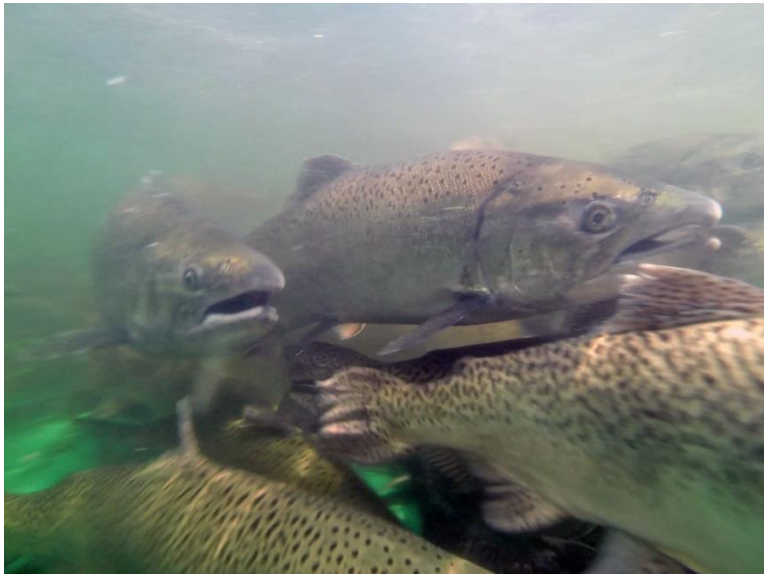
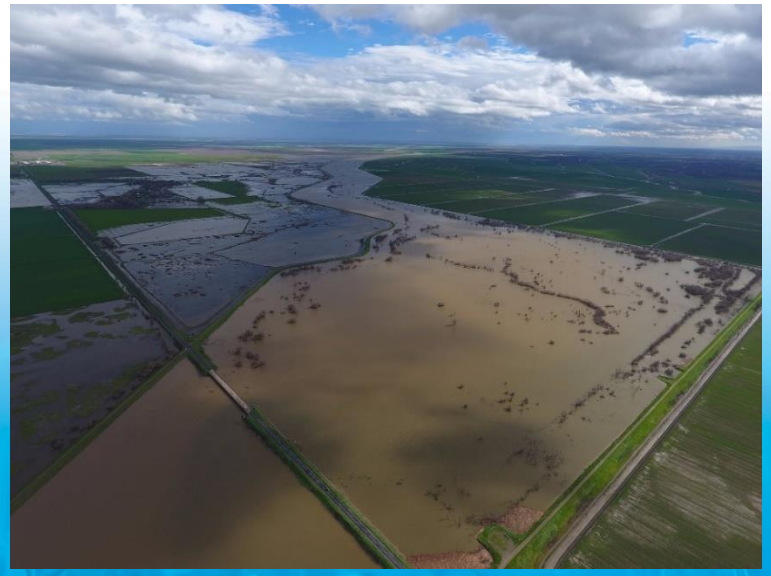
Key actions for fish survival

- Volitional upstream migration of adult and downstream emigration of juvenile fall-run and spring-run Chinook salmon
- Eliminate stranding and entrainment potential
- Create habitat needed for holding, spawning, rearing, and migration.





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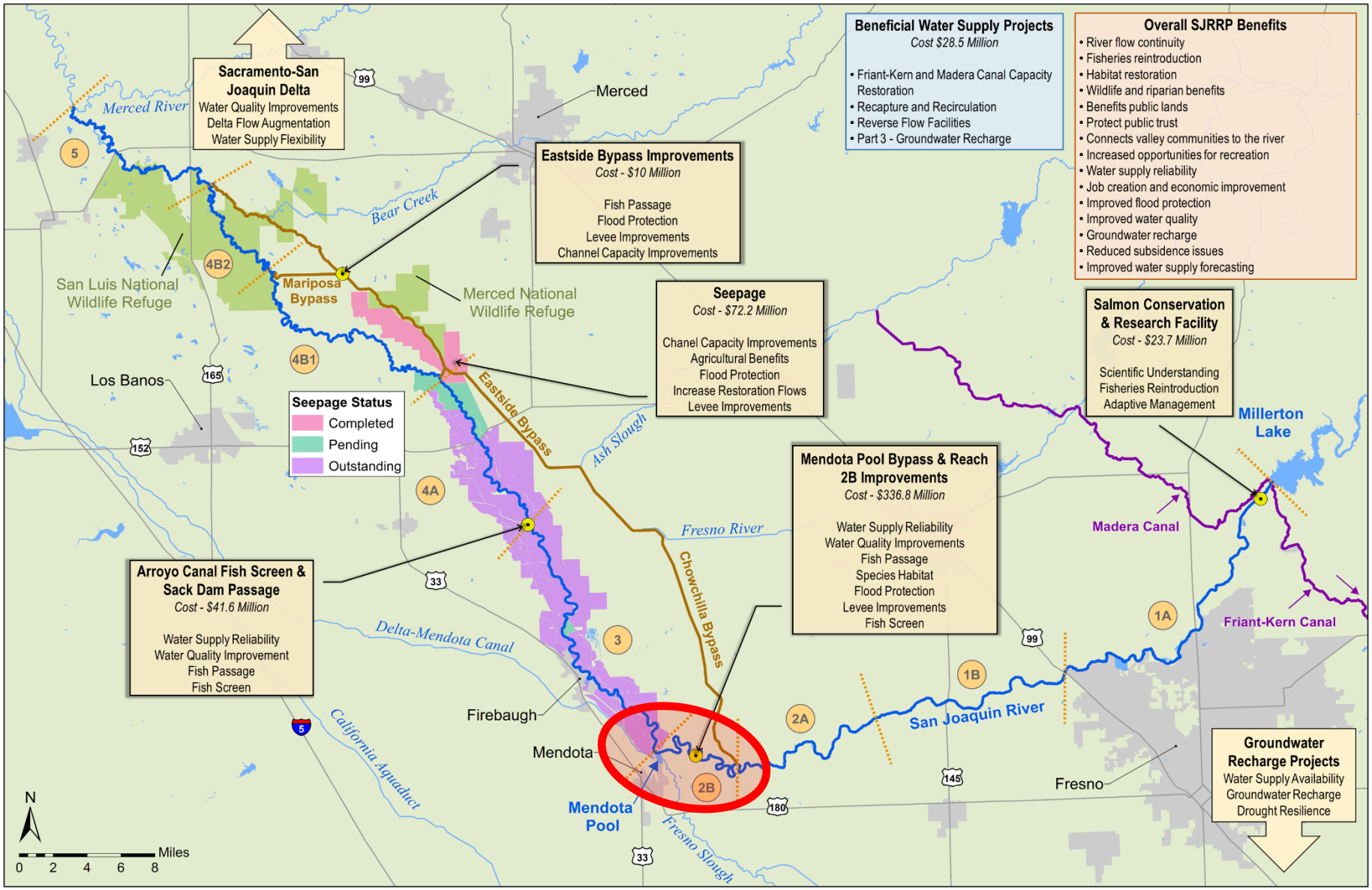
Reach 2B

San Joaquin River Restoration Program Cost & Benefits Map

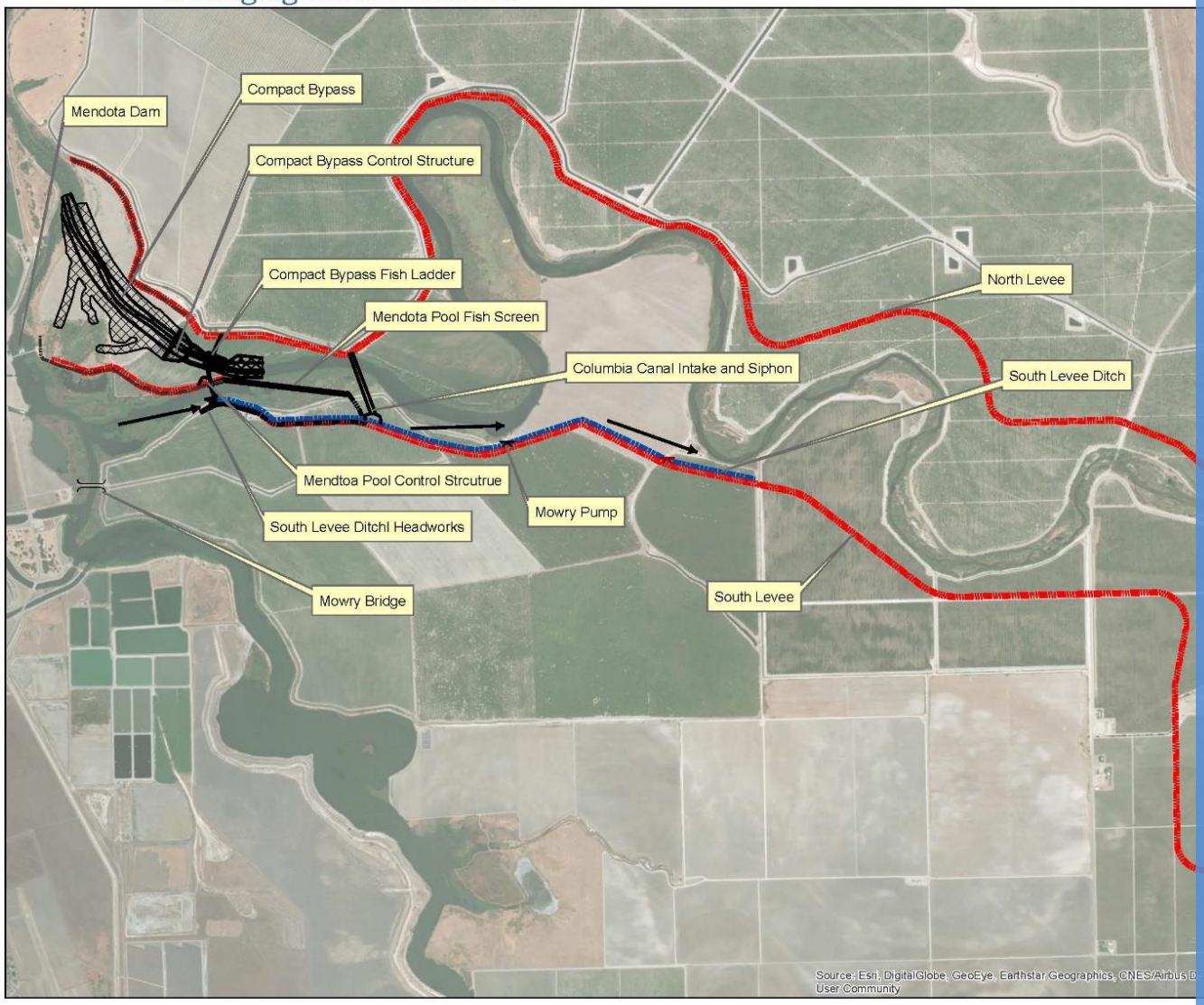


Reach 2B and Mendota Pool Bypass Project

- Area between Chowchilla Bypass and Mendota Pool
  - Most is not part of Flood Control Project
  - Original design capacity was 2,500 cfs
  - Current capacity is ~1,300 cfs
  - Levees built by landowners of native soil and will need to be rebuilt

Mendota Pool Bypass and Reach 2B Channel Improvements Project

RECLAMATION
Managing Water in the West



- Create bypass channel around the Mendota Pool (about 3/4 mile of new river channel)
- Expand Reach 2B capacity to convey at least 4,500 cfs (11 miles of new levee and flood plain habitat)
- *Current Schedule*: ROD – October 2016
- Land acquisition 2017/2018 Construction start date – 2019
- *Cost*: $336 million

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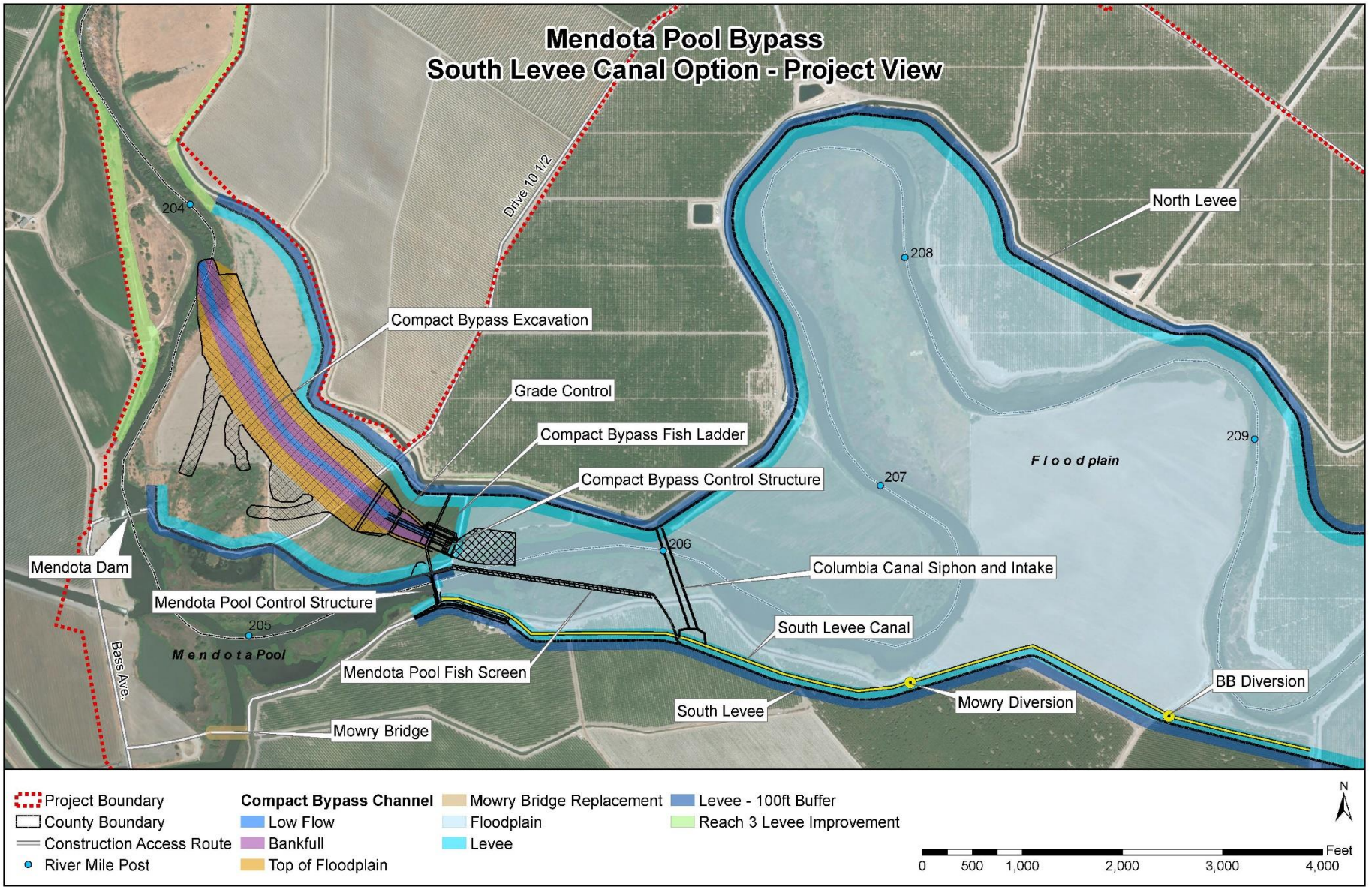
Mendota Pool Bypass



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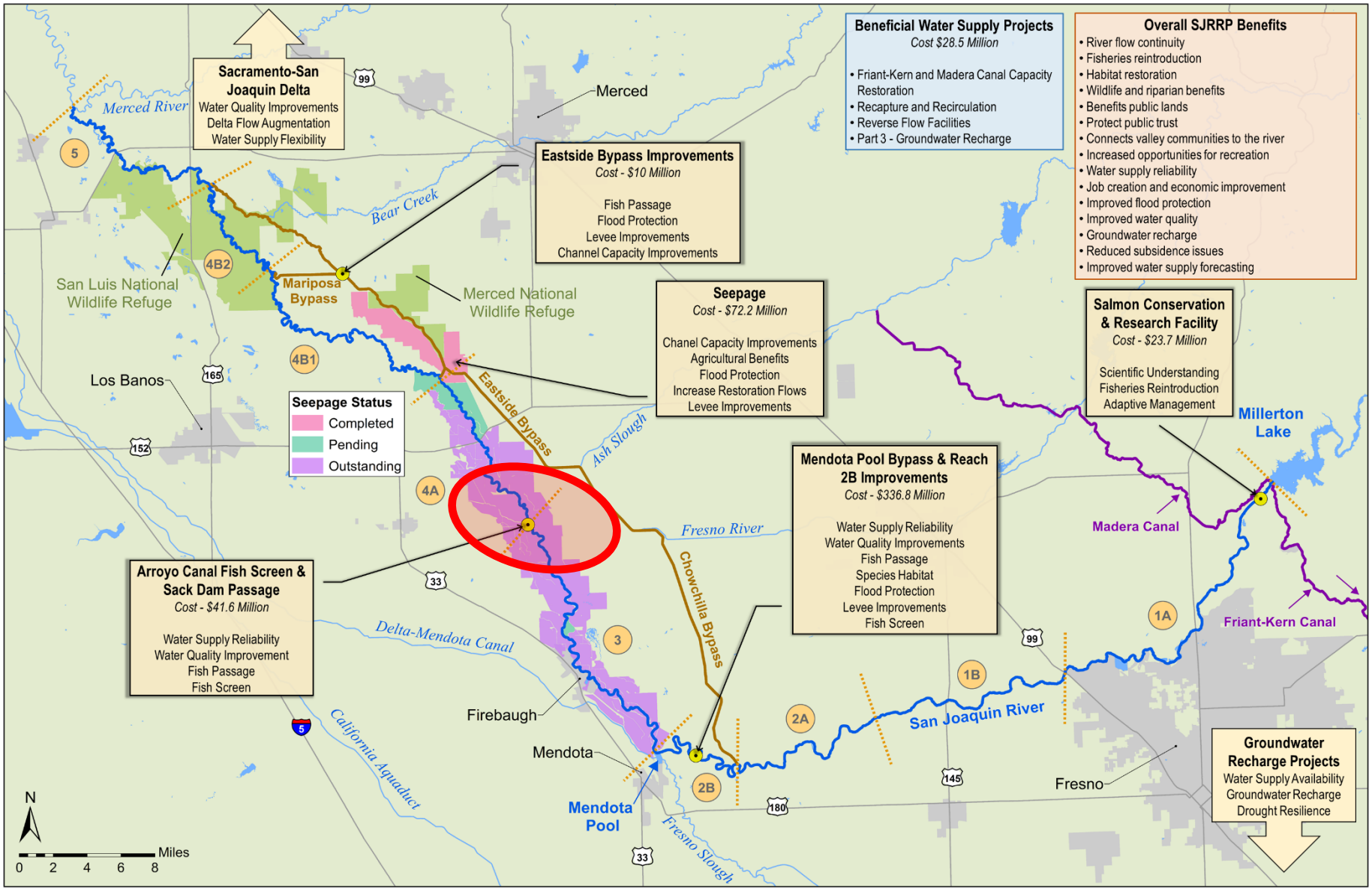
Arroyo Canal Fish Screen and Sack Dam Fish Passage Project

San Joaquin River Restoration Program Cost & Benefits Map



Arroyo Canal Fish Screen and Sack Dam Fish Passage Project

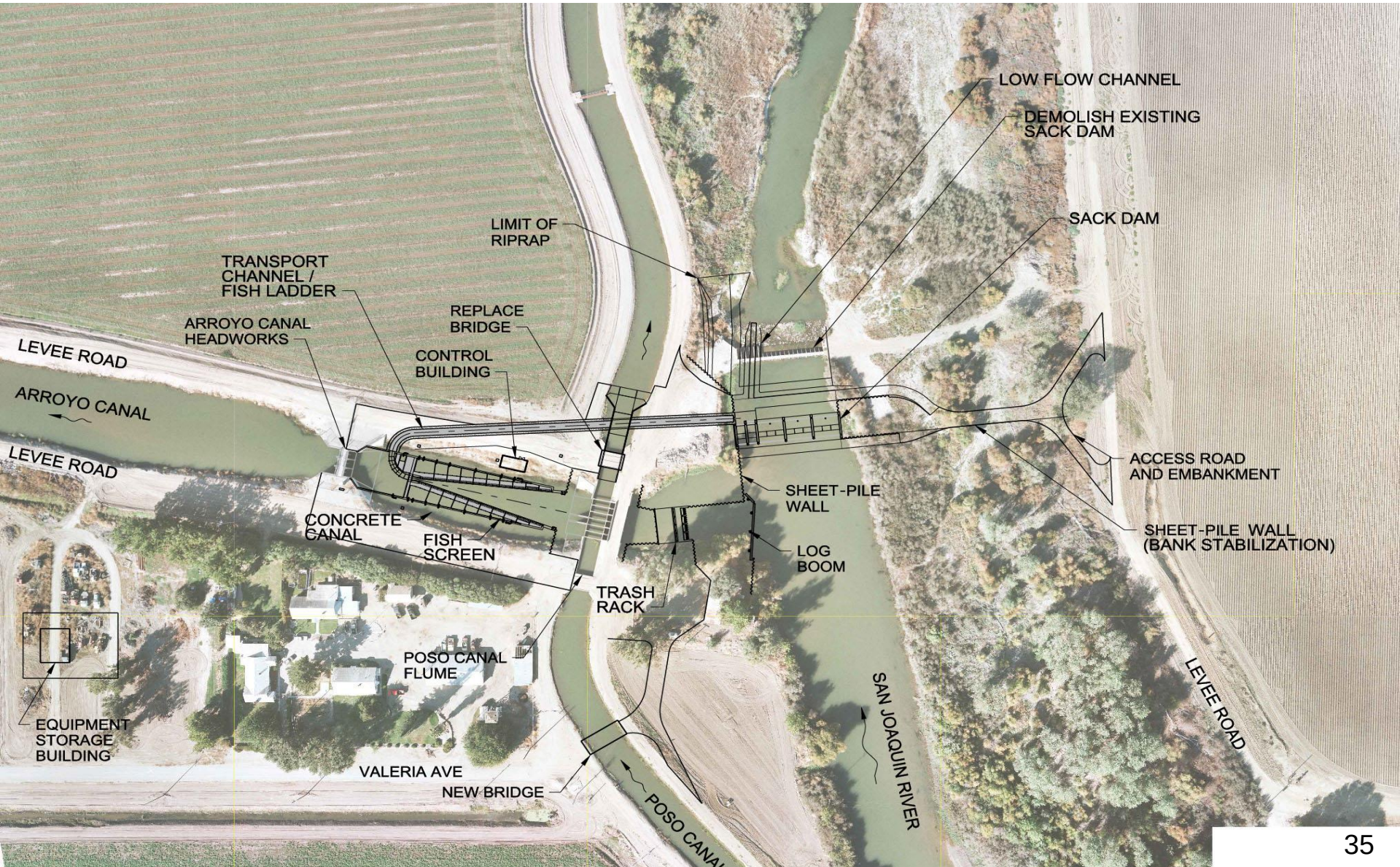
Sack Dam – Modify for fish passage

NEPA and CEQA completed

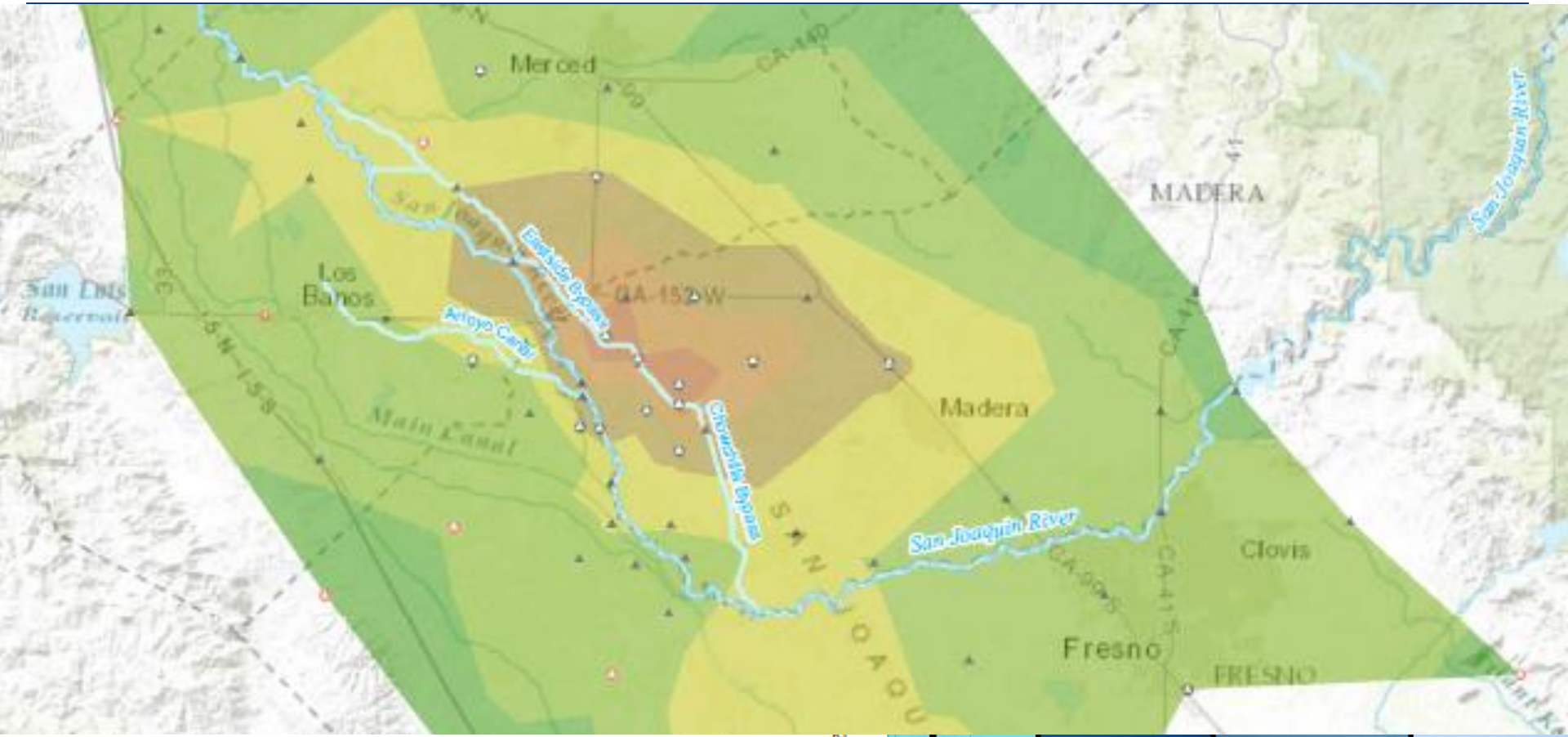
Construction – Redesign for project underway to address subsidence.

Arroyo Canal – Screen to prevent fish entrainment

Arroyo Canal Fish Screen and Sack Dam Fish Passage Project



Subsidence, Control Point Survey Results



Subsidence Rates (feet/year)
July 2012 to July 2016

- 0.15 to 0.3
- 0 to 0.15
- -0.15 to 0
- -0.3 to -0.15
- -0.45 to -0.3
- -0.6 to -0.45
- -0.75 to -0.6

GPS Coordinates

- GPS Point-December 2011
- GPS Point-added July 2012
- GPS Point-added December 2013

0 7 14 21 Miles

Path: S:\214-CVP-Friant Division\San Joaquin River\Subsidence Mapping_GIS\SJRRP-Subsidence Mapping-20160718.mxd

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Arroyo Canal Fish Screen and Sack Dam Fish Passage Project

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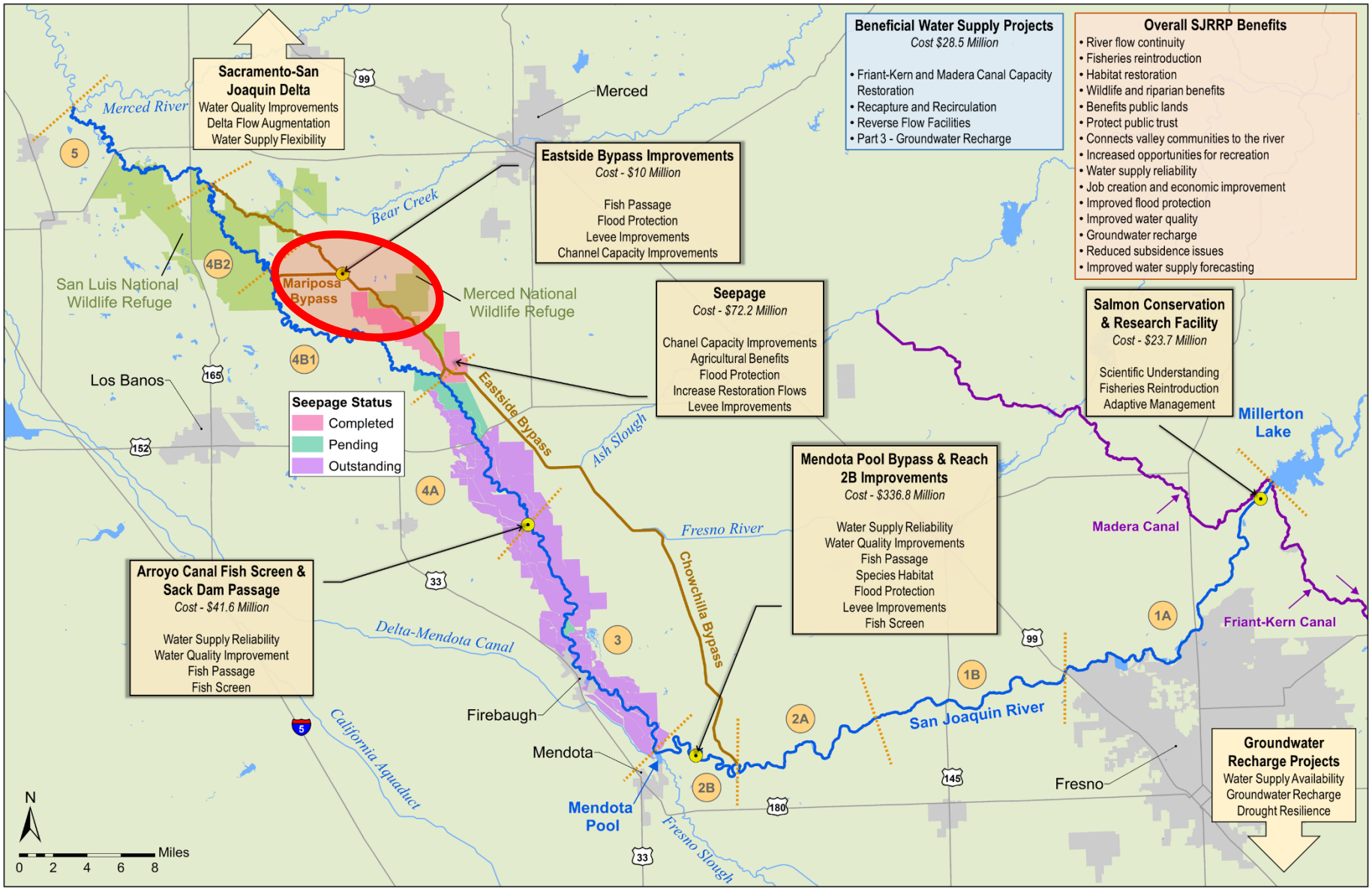
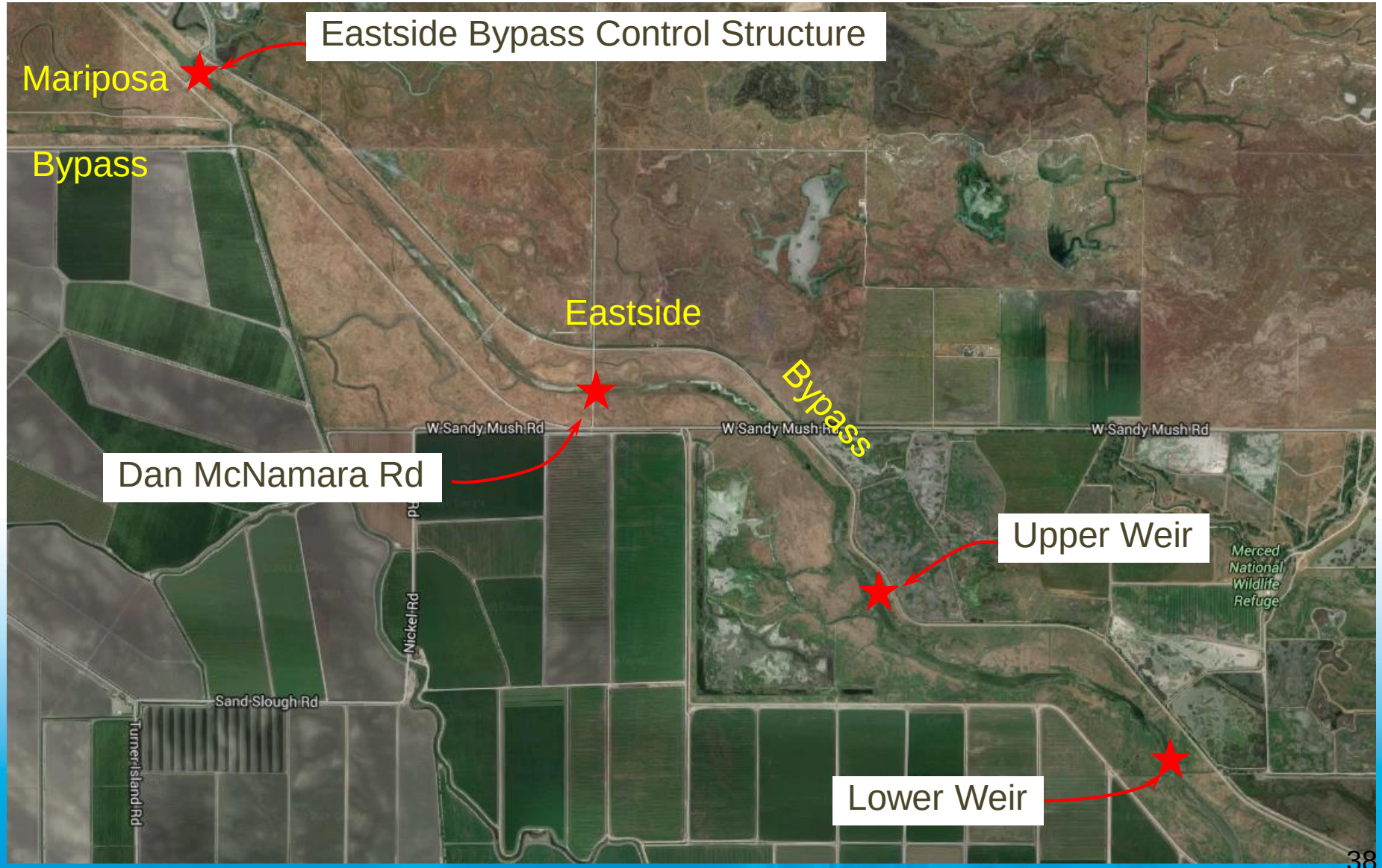


Eastside Bypass Fish Passage Projects



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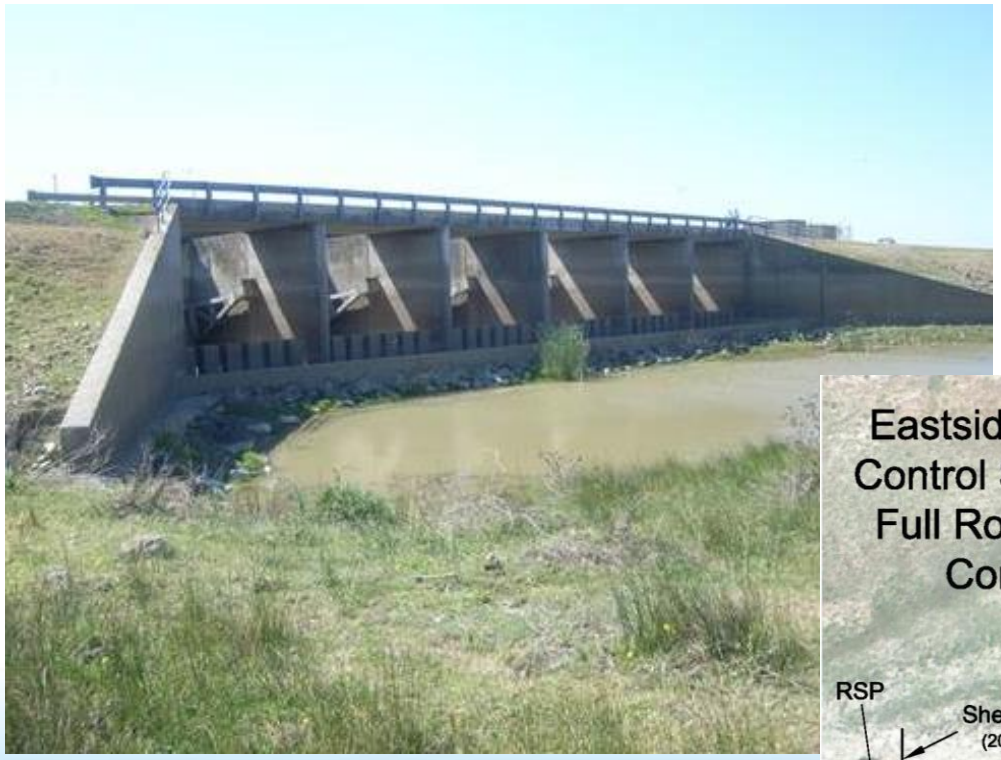
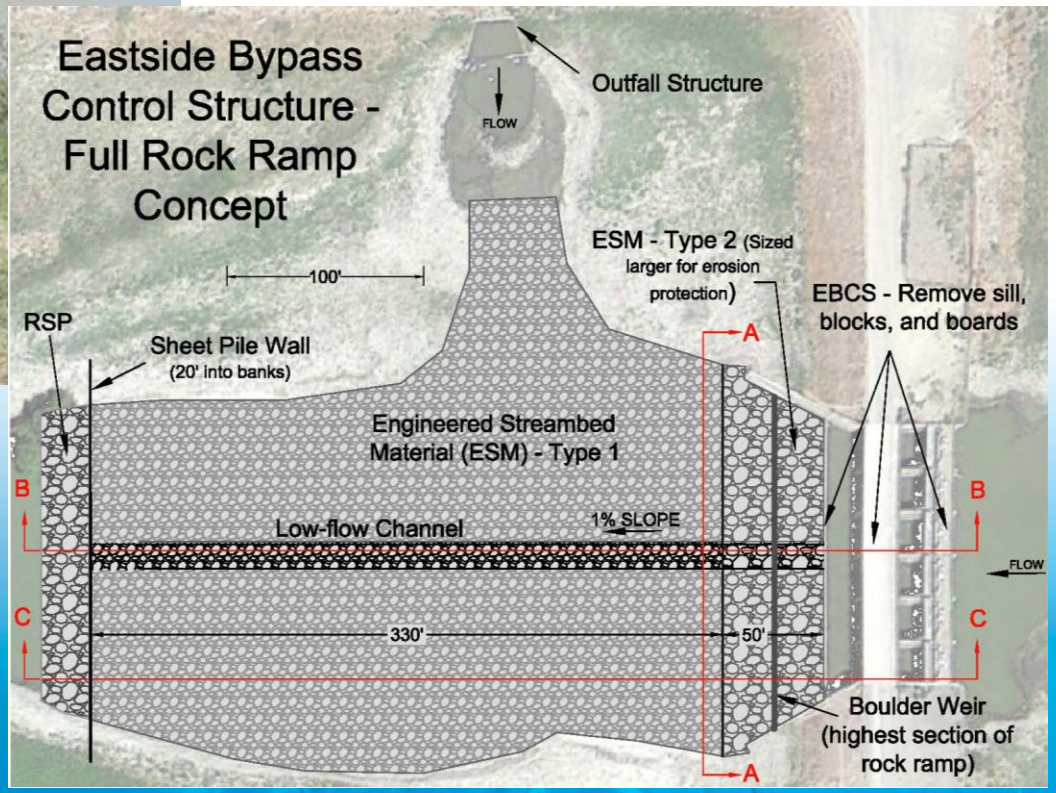
ESBP Control Structure Rock Ramp





National Wildlife Refuge Weirs

•Lower Weir

•Upper Weir

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Salmon Reintroduction

Salmon Conservation and Research Facility (SCARF)

- Broke ground in April 2017 with construction complete in 2019
- Construction Cost = $23.7 million (state $)
- Develop captive broodstock
- Create experimental population (Feather River stock)
- 1M juvenile annually

Salmon Reintroduction

- Settlement requires reintroduction of spring-run and fall-run Chinook salmon
- Spring-run broodstock efforts began in 2012 at the Interim Salmon Conservation and Research Facility
- April 2014: First direct release of juvenile spring-run into the river for study purposes; continued annually since then.

SJRRP Biologists release juvenile spring-run Chinook salmon to river

Juvenile Chinook Salmon

Juvenile Salmon Monitoring


Coded Wire Tag Implantation

2018 Juvenile releases:

January 19th: 31,184

January 26th: 49,549

March 2nd: 87,115


Rotary screw trap monitoring


Juvenile Salmon Acoustic Telemetry Transmitter Surgery

Salmon Reintroduction

- 2012 – 2016: Adult fall-run Chinook salmon trapped and transported from Reach 5 to spawning habitat in Reach 1
- 2016 – 2018: Adult spring-run Chinook salmon released to holding areas below Friant Dam to begin to assess holding and spawning habitat

Fall-run Chinook salmon released to Reach 1

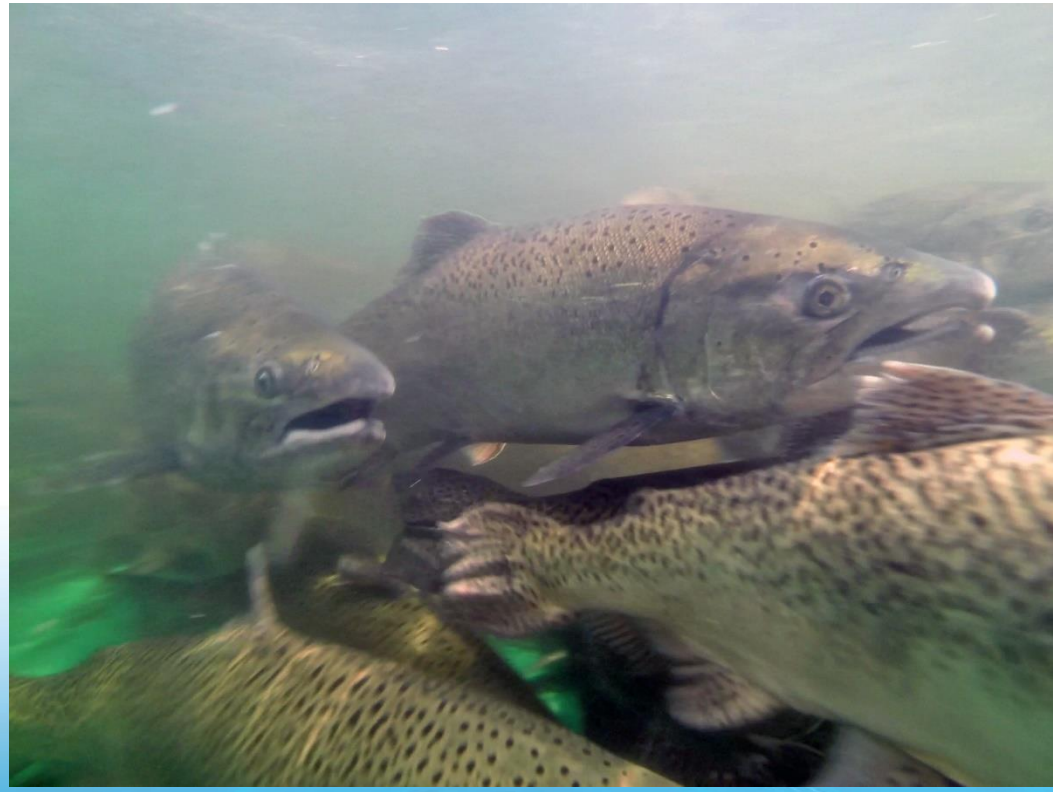

Spring-run Chinook salmon equipped with acoustic telemetry transmitters before release

Fish Monitoring

Adult spring-run Chinook salmon releases of ancillary broodstock

2017: 115 adult spring-run Chinook released; 13 redds confirmed.

2018: 179 adult spring-run Chinook released; 41 redds confirmed to date!



Juvenile Salmon Monitoring

2017 – 2018: First Confirmed Successful Spawning of spring-run Chinook salmon on the San Joaquin River in over 60 years

The Fresno Bee

FRIDAY FEBRUARY 2 2018 $1.50

Trump clears way for release of GOP memo

FBI Director Christopher Wray opposes release of the GOP memo, citing "grave concerns."

Chinook salmon reach milestones in San Joaquin

Tagged juvenile spring run chinook salmon swim in a tank at the Salmon Incubation and Rearing Facility near Friant Dam on Jan. 26. Tagging helps biologists monitor spring run chinook salmon numbers, which is part of the San Joaquin River restoration program.

A tagged juvenile spring run chinook salmon is seen at the Salmon Incubation and Rearing Facility near Friant Dam.

LOCAL
VALLEY UNDER AIR ALERT
The Valley Air District warns residents to avoid strenuous outdoor activity as a high-pressure weather system traps pollution in the area. 4A

STATE
DROUGHT DEEPENS DRAMATICALLY
California is rapidly plunging back into drought, with severe conditions now existing in Santa Barbara, Ventura and Los Angeles counties. 6A

BUSINESS
UNITED'S NEW RULES FOR SUPPORT ANIMALS
United Airlines announced Thursday that it is joining Delta Air Lines in tightening rules for passengers flying with emotional support animals. 6B

ENTERTAINMENT
DISNEY ON ICE IS BACK IN FRESNO
"Follow Your Heart" is a revamped live tour with new Disney and Pixar characters, and is set to play eight shows at Selland Arena, through Monday. Inside 7

ReclamationCVP
@ReclamationCVP
Follow

Confirmed for first time in 60+ years, spring-run Chinook salmon have successfully spawned in the San Joaquin River restoresjr.net/seasonal-fish- ... #SJRRP

11:27 AM - 18 Dec 2017

131 Retweets 281 Likes

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Not just Chinook Salmon…

Over 12,000 Pacific lamprey were detected in the Restoration Area in 2018.

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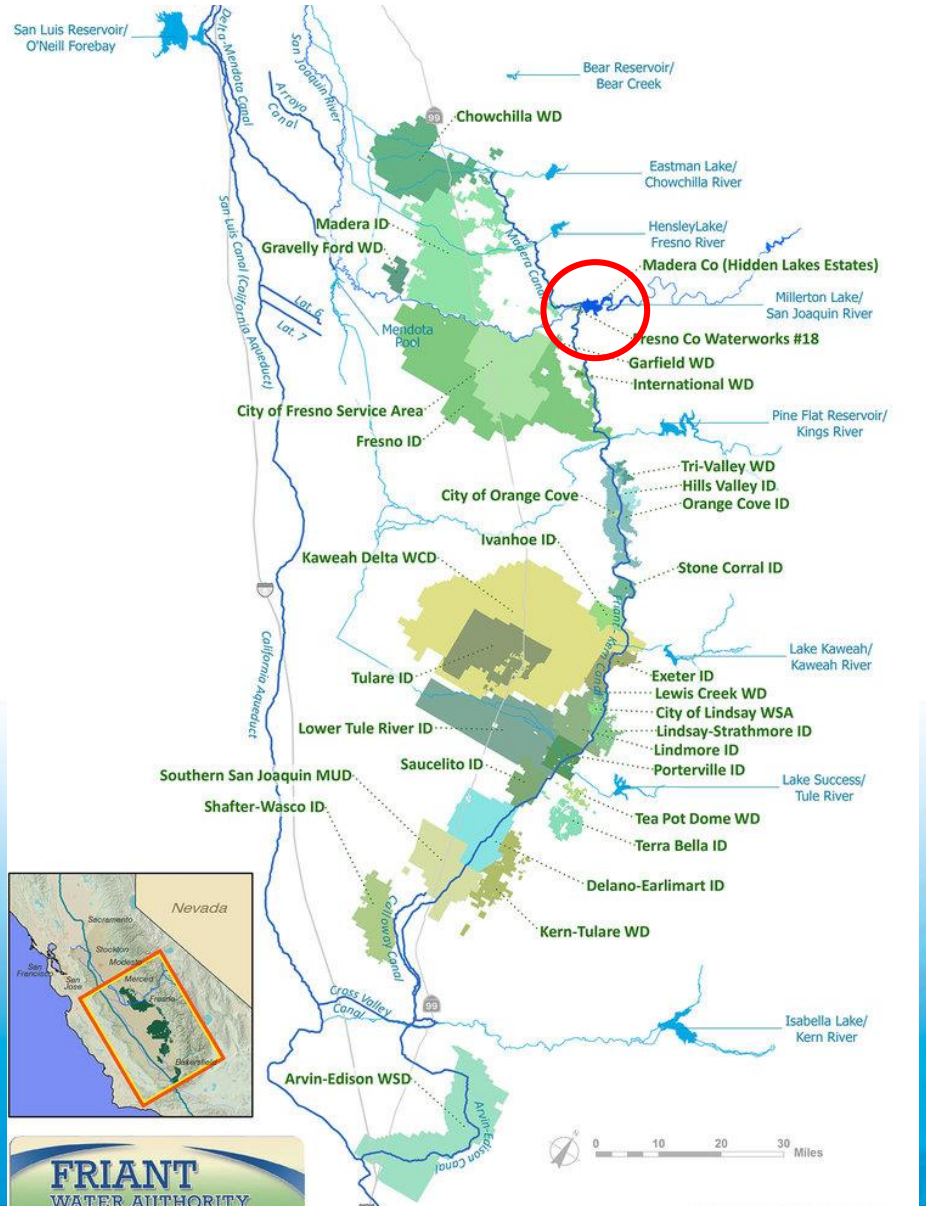
Water Management Area

Friant Dam



Friant Division Contractors stretch from Chowchilla to Bakersfield along the Madera and Friant-Kern Canals

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Questions?

Restoration Challenges

SJRRP = Many Challenges

1. Flows
2. Passage Barriers
3. Suitable Spawning Habitat
4. Suitable Rearing Habitat
5. Suitable Water Temperatures
6. Predation

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Projects Objectives

- Provide unimpeded fish passage for spring-run and fall-run adult Chinook salmon
- Minimize impacts to flood operations
- Minimize impacts to adjacent landowners
- Provide provisions within the designs to account for ground subsidence
- Implement fish passage improvements in 2019

San Joaquin River Restoration Program

Fisheries Projects & Monitoring

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Flows

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Salmon Culture

Providing juvenile fish for SJRRP studies

- 58 spawning events from 2012-2016
- Fecundity: avg = 5402

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Salmon Culture

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Adult Salmon Monitoring

2011

Adult Salmon Monitoring

Adult Fall-run Trap and Haul:

Methods – Fish Capture

Fyke-Nets: In-river netting

Dip-Netting: netting terminal ends of irrigation drainage ditches

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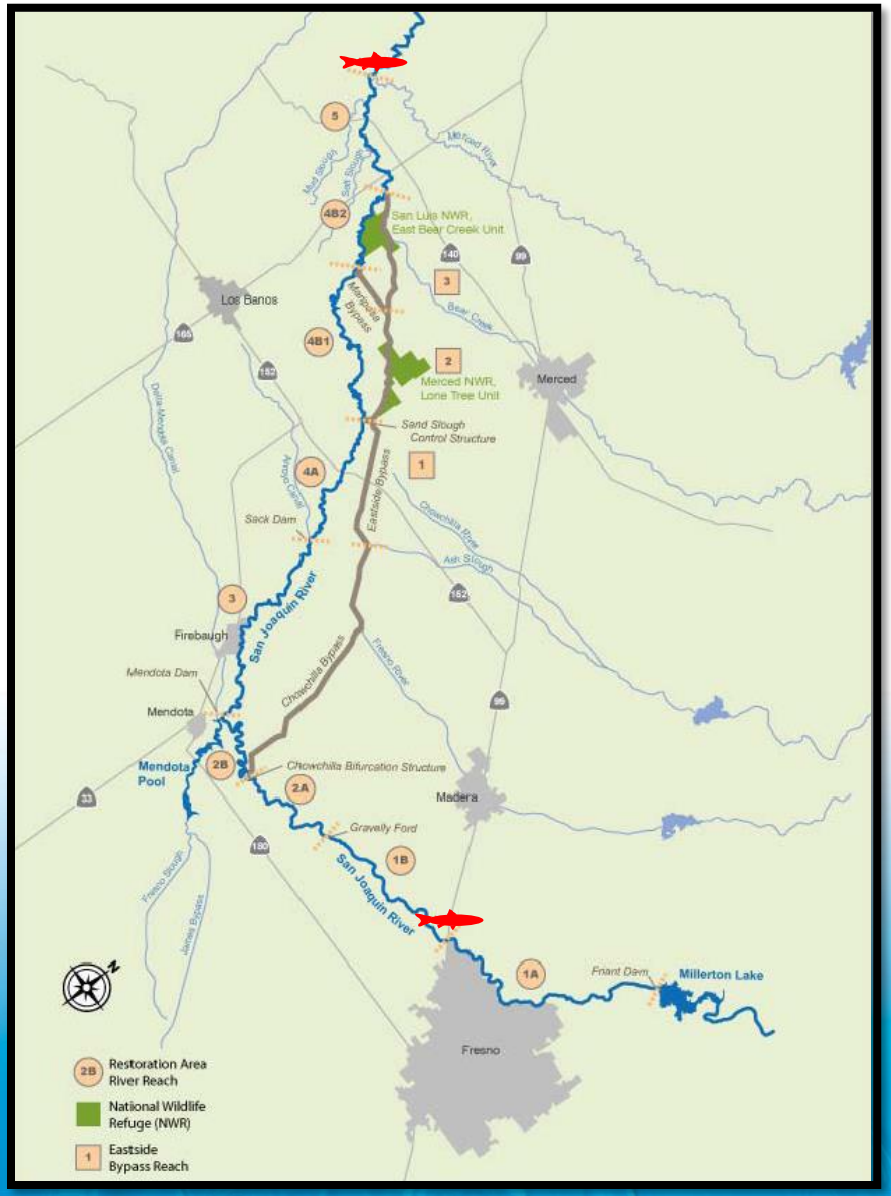
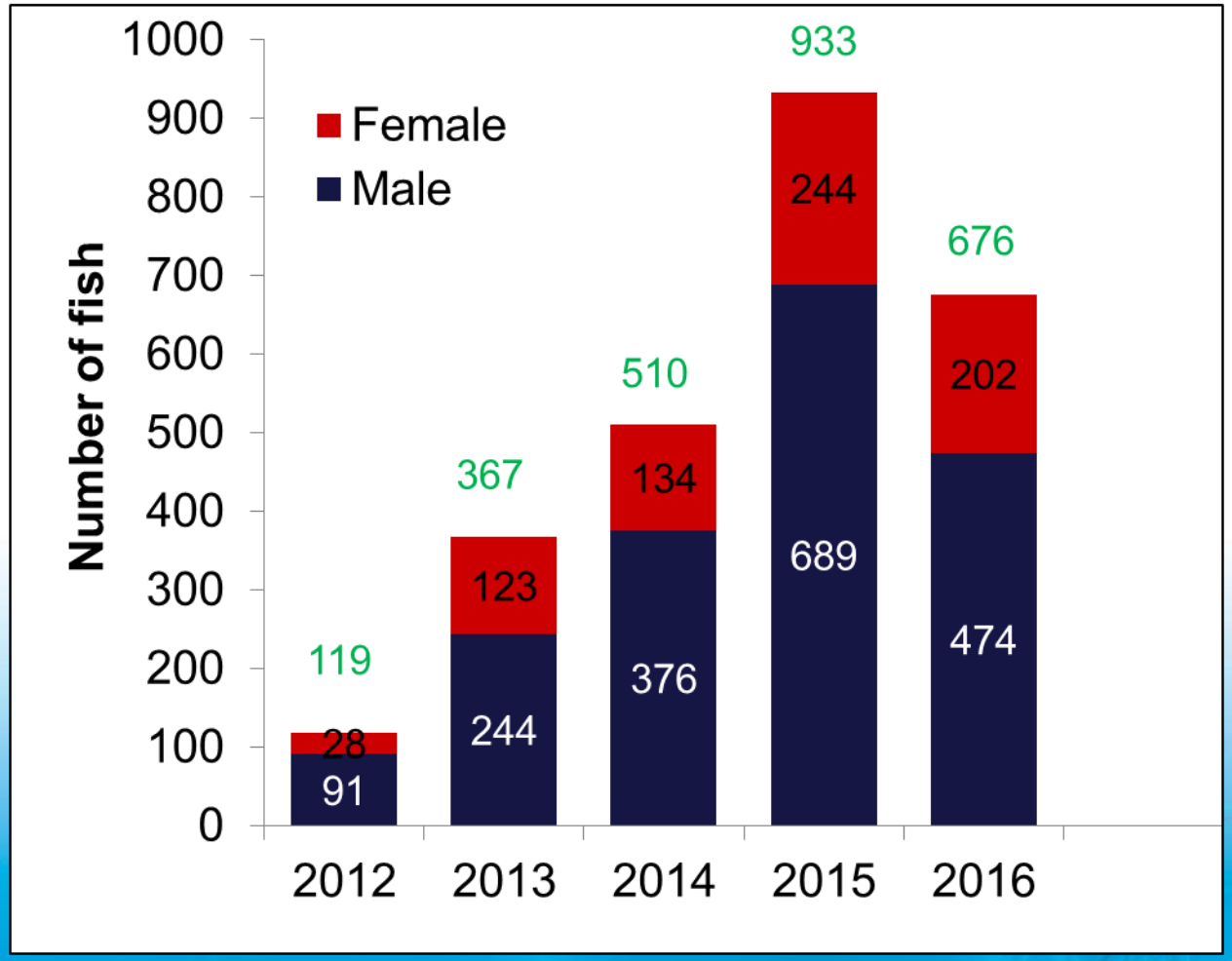
Adult Salmon Monitoring

- Capture Fall-run Chinook salmon upstream of the Hills Ferry Barrier
- 90 mile Fish Transport to Release Site
  - Bypassing two dams and 60 cumulative miles of dry river bed
  - 125 River Miles

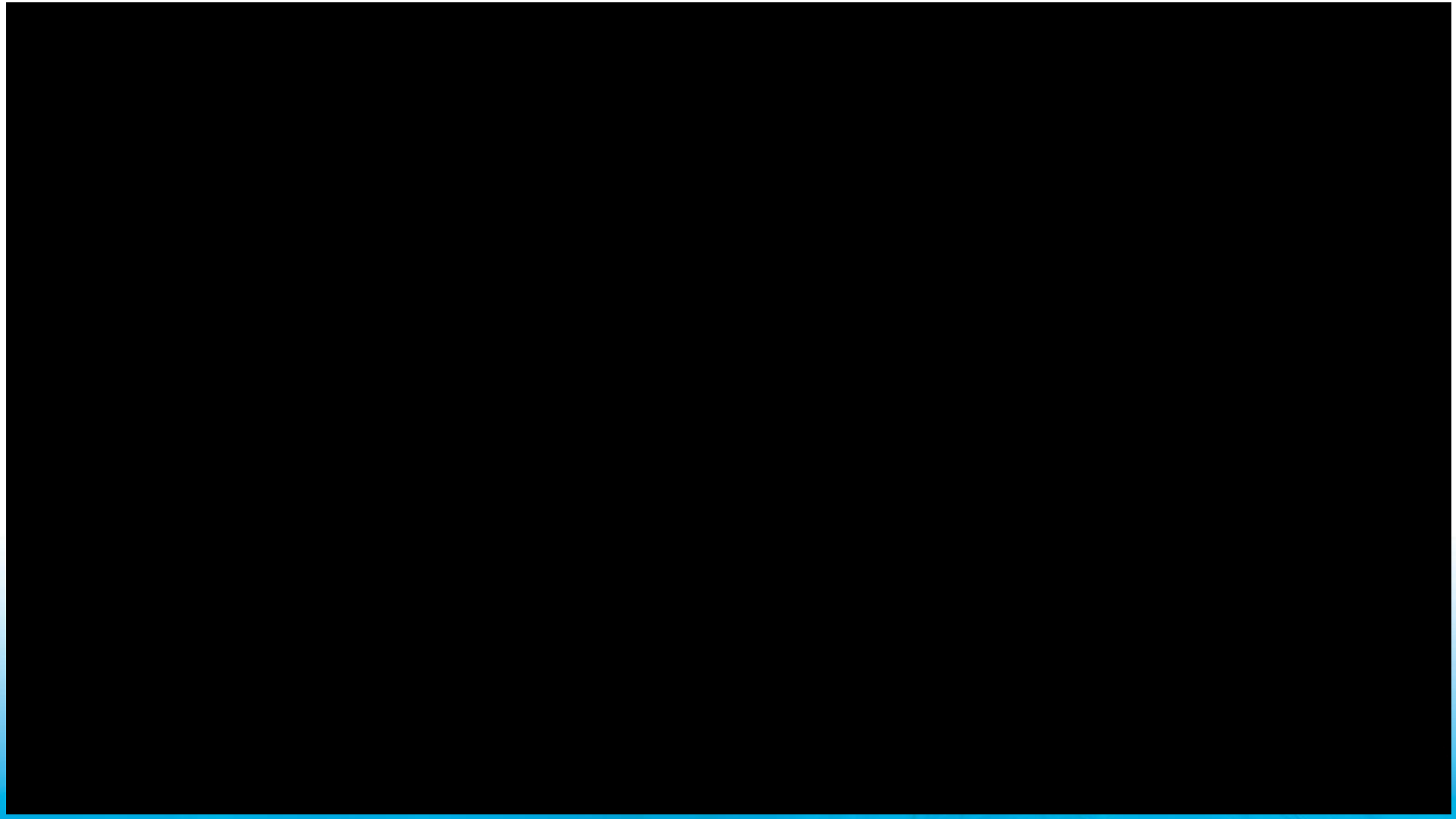


Adult Salmon Monitoring

- Results– Salmon Capture Data:

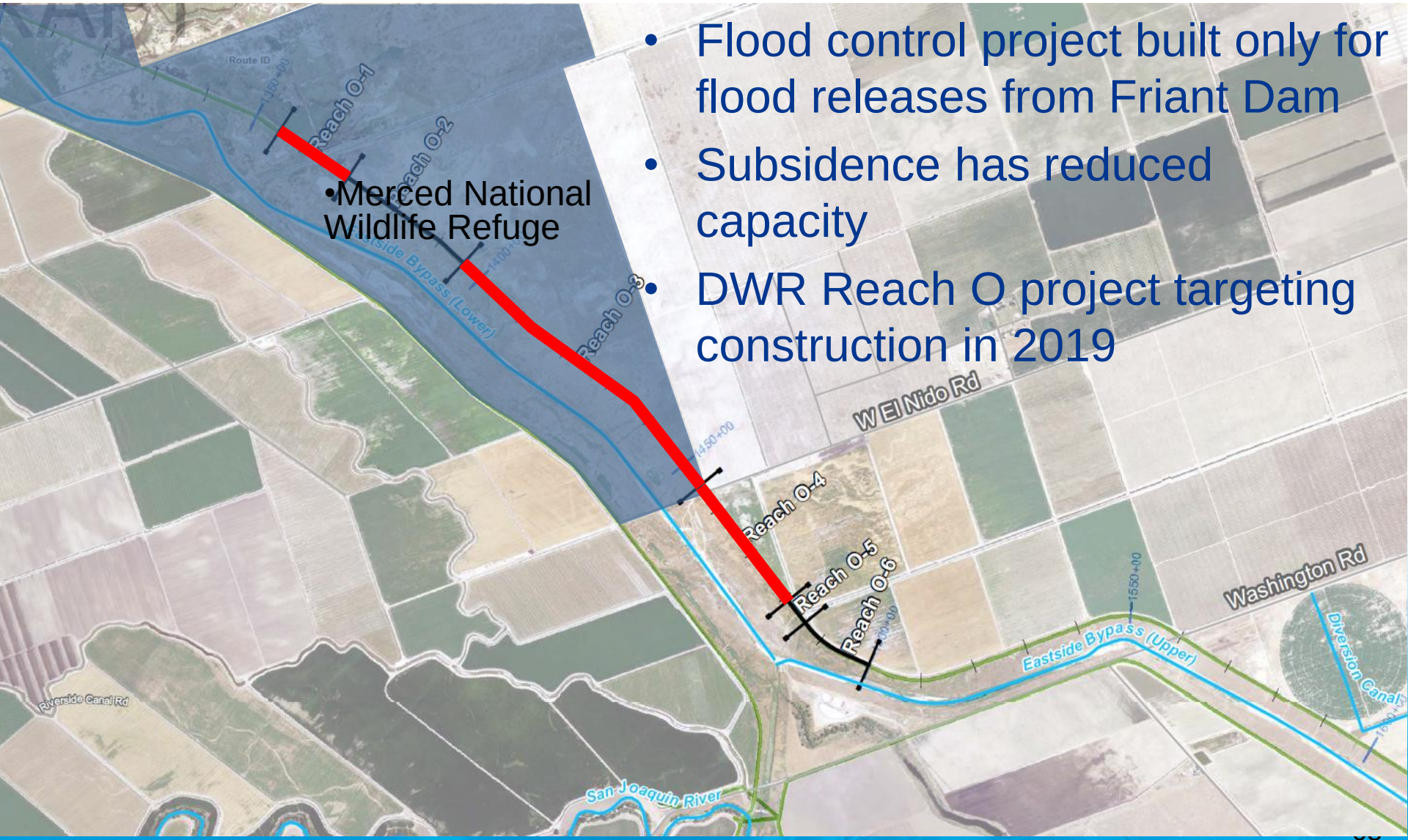


Adult Fall-run Trap and Haul



•Adult Chinook Salmon Trap and Haul Video

Flow Challenges – Levee Stability



- Flood control project built only for flood releases from Friant Dam
- Subsidence has reduced capacity
- DWR Reach O project targeting construction in 2019

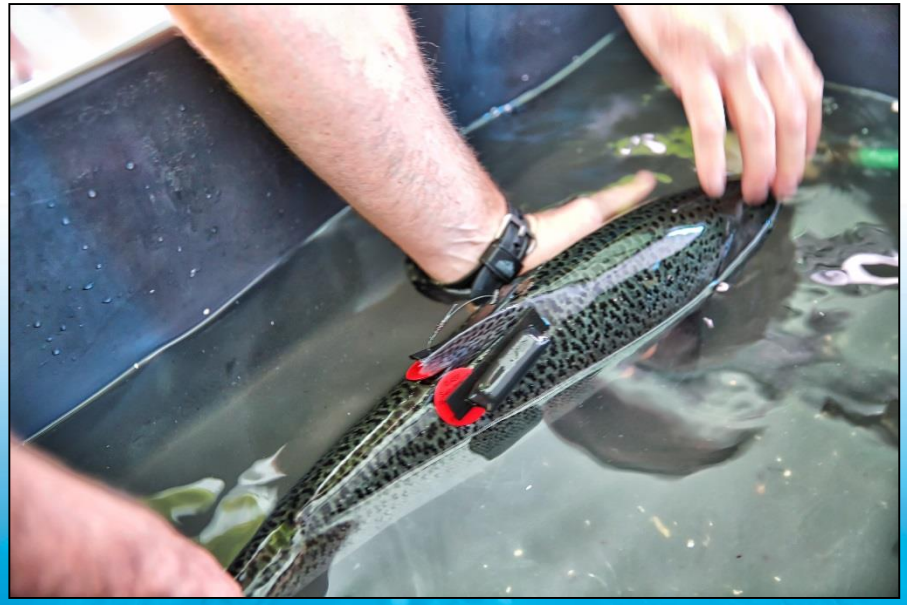
Adult Fall-run Trap and Haul Release

- https://www.youtube.com/watch?v=G2o56IT8NOE

SAN JOAQUIN RIVER RESTORATION PROGRAM

Adult Spring-Run Holding Monitoring

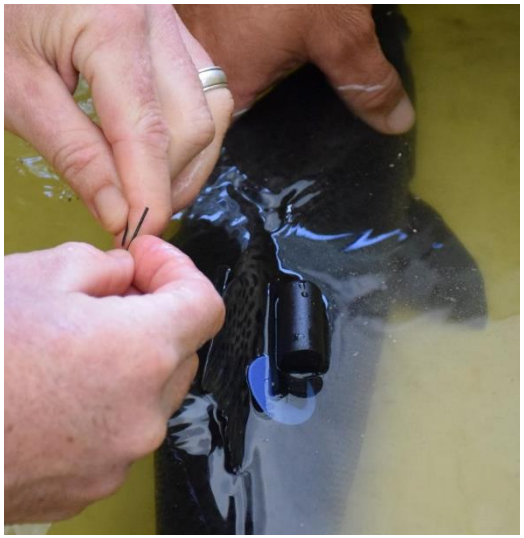
Spring-run Chinook holding habitat below Friant Dam



Vemco V-13 transmitter attached to salmon

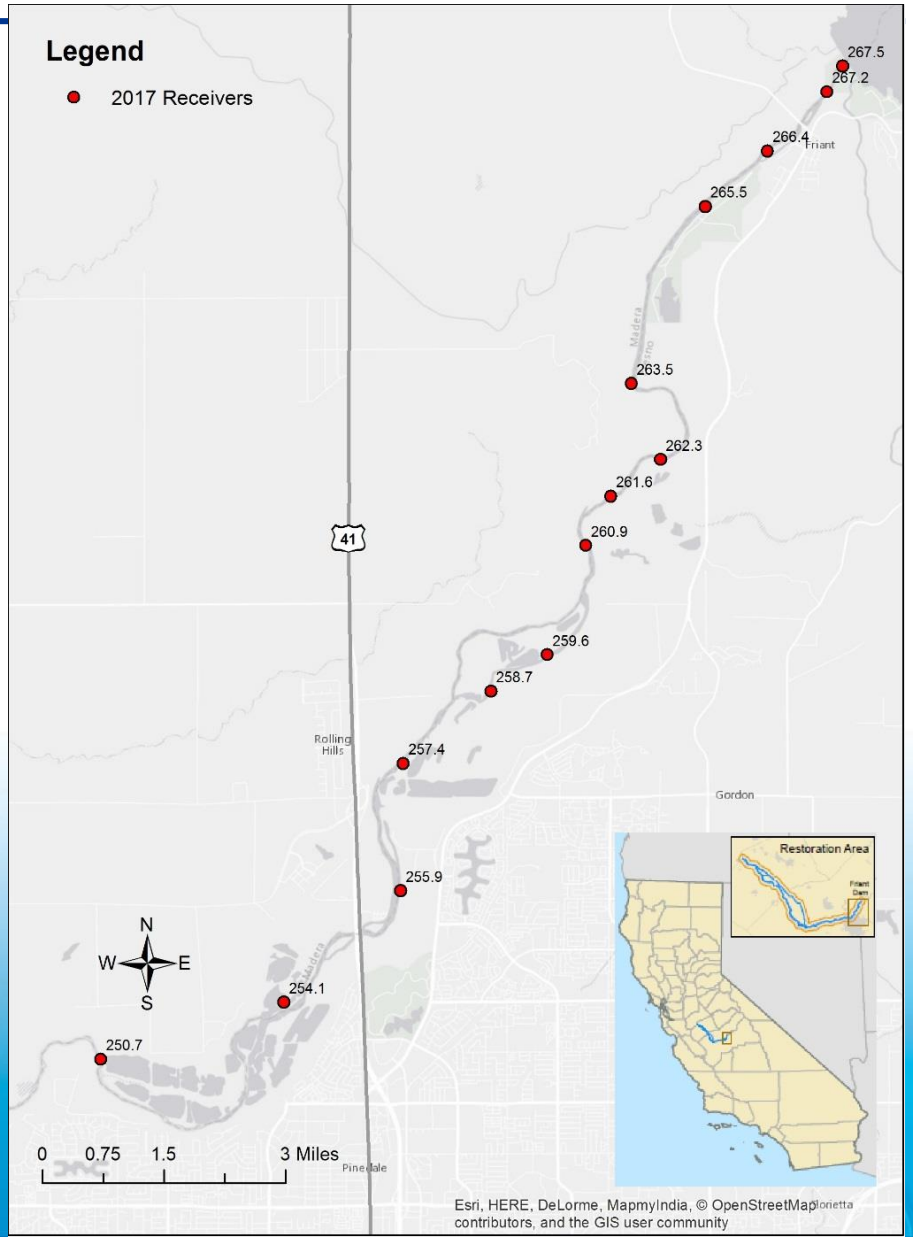
SAN JOAQUIN RIVER RESTORATION PROGRAM

Spring-run Holding Monitoring



SAN JOAQUIN RIVER RESTORATION PROGRAM

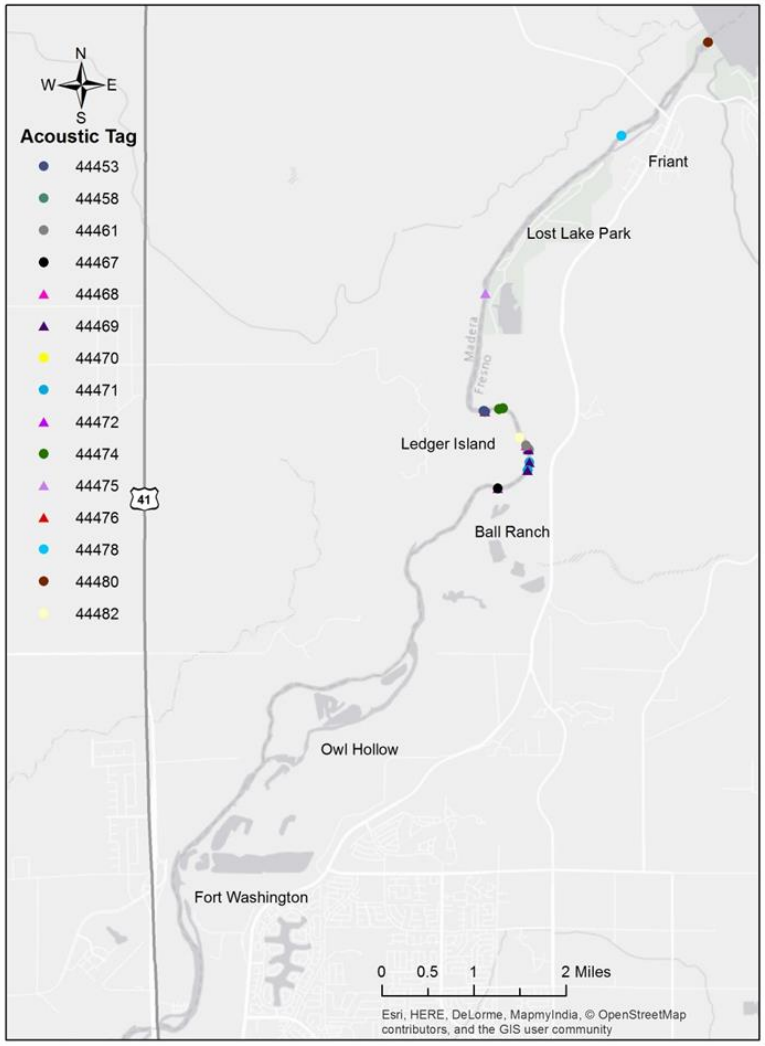
Adult Spring-run Holding Monitoring



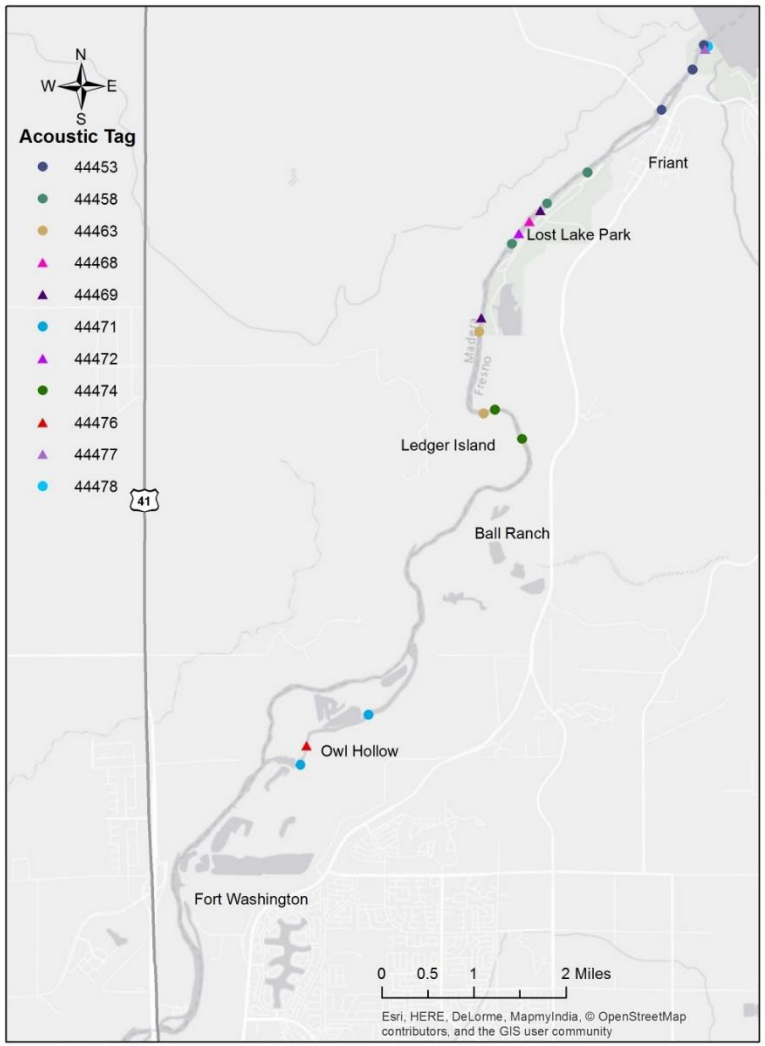
SAN JOAQUIN RIVER RESTORATION PROGRAM

Adult Spring-run Holding Monitoring

July



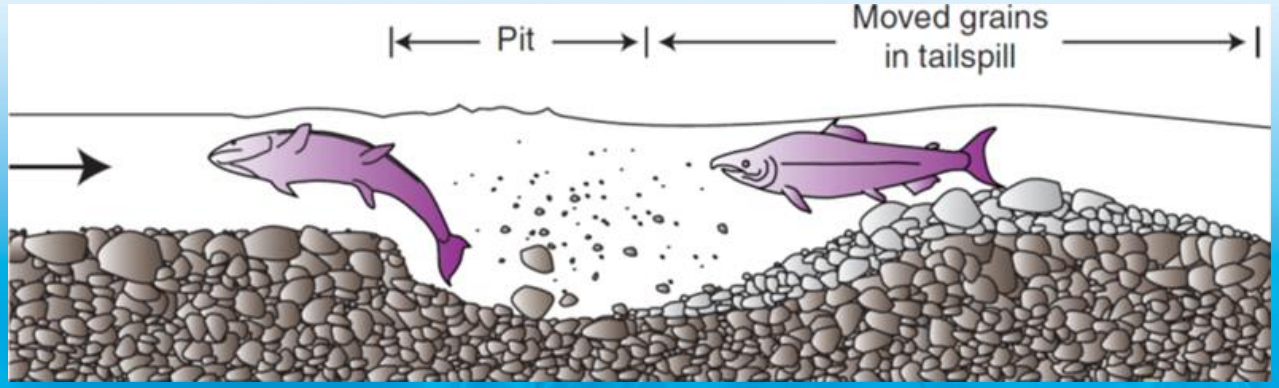
September



Chinook Salmon Redd Monitoring

- **2015: 202 redds**
- **2016: 128 redds**
  +3 redds*
- **2017: 13 redds***

* spring-run



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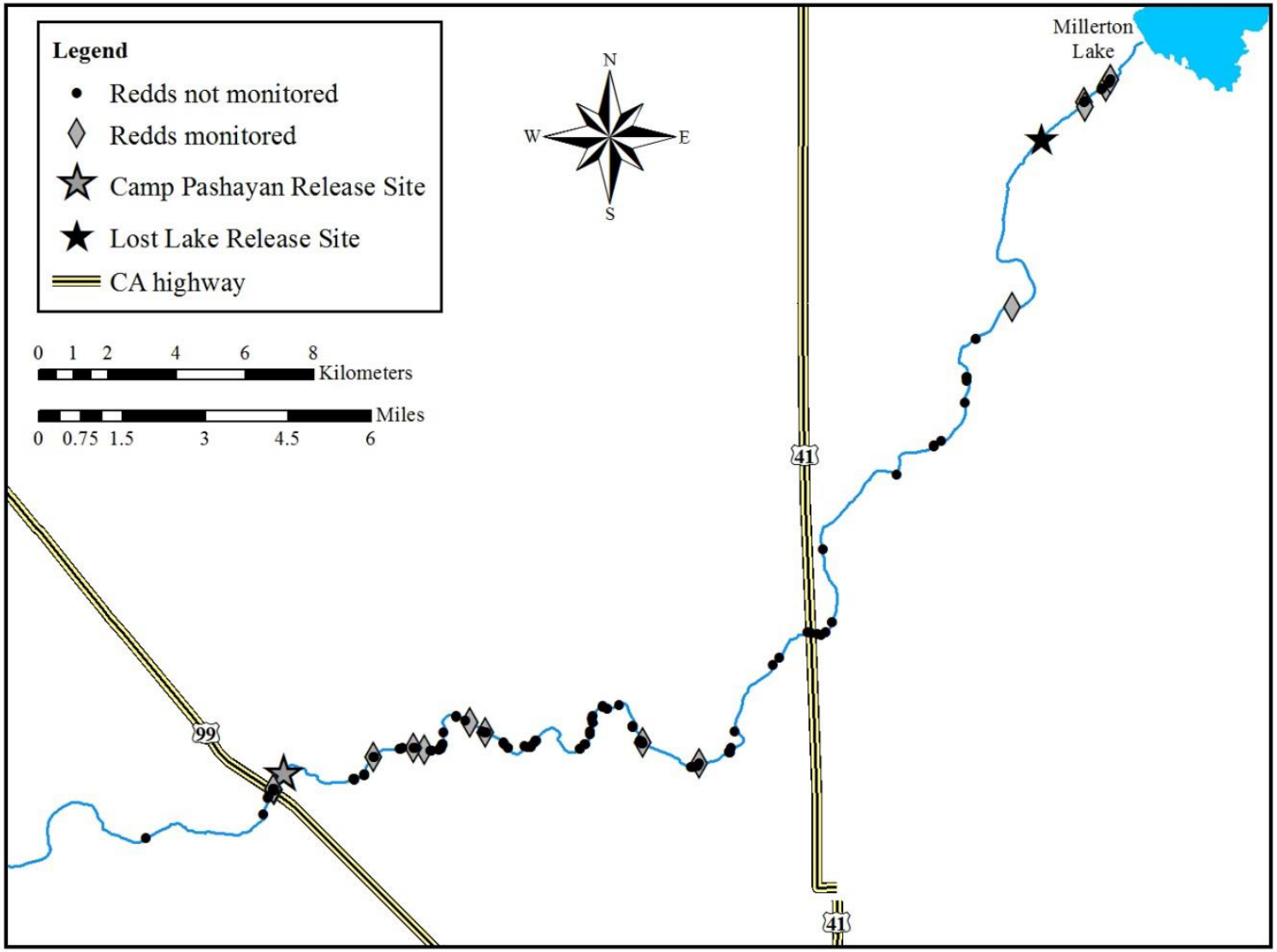
Fall-run Chinook Salmon Redd Monitoring



Juvenile Salmon Monitoring

https://www.fresnobee.com/news/local/article197475654.html

Juvenile Salmon Monitoring

- Fence weirs utilized in three locations in Reach 1A (2014–2016)
- Constructed of 1.2 X 2.4 m panels and 1.3 cm mesh, and set at angles to promote suitable sweeping velocities towards collection boxes
- Weirs commonly utilized throughout Pacific Northwest to capture emigrating juvenile salmonids
- Diffuser box upstream of capture box designed to increase velocities into diffuser box, but reduce velocities in capture box
- Collection boxes designed to maintain fish in low velocity environment until processing and transport

SAN JOAQUIN RIVER RESTORATION PROGRAM

Juvenile Salmon Monitoring

Rotary Screw Trap

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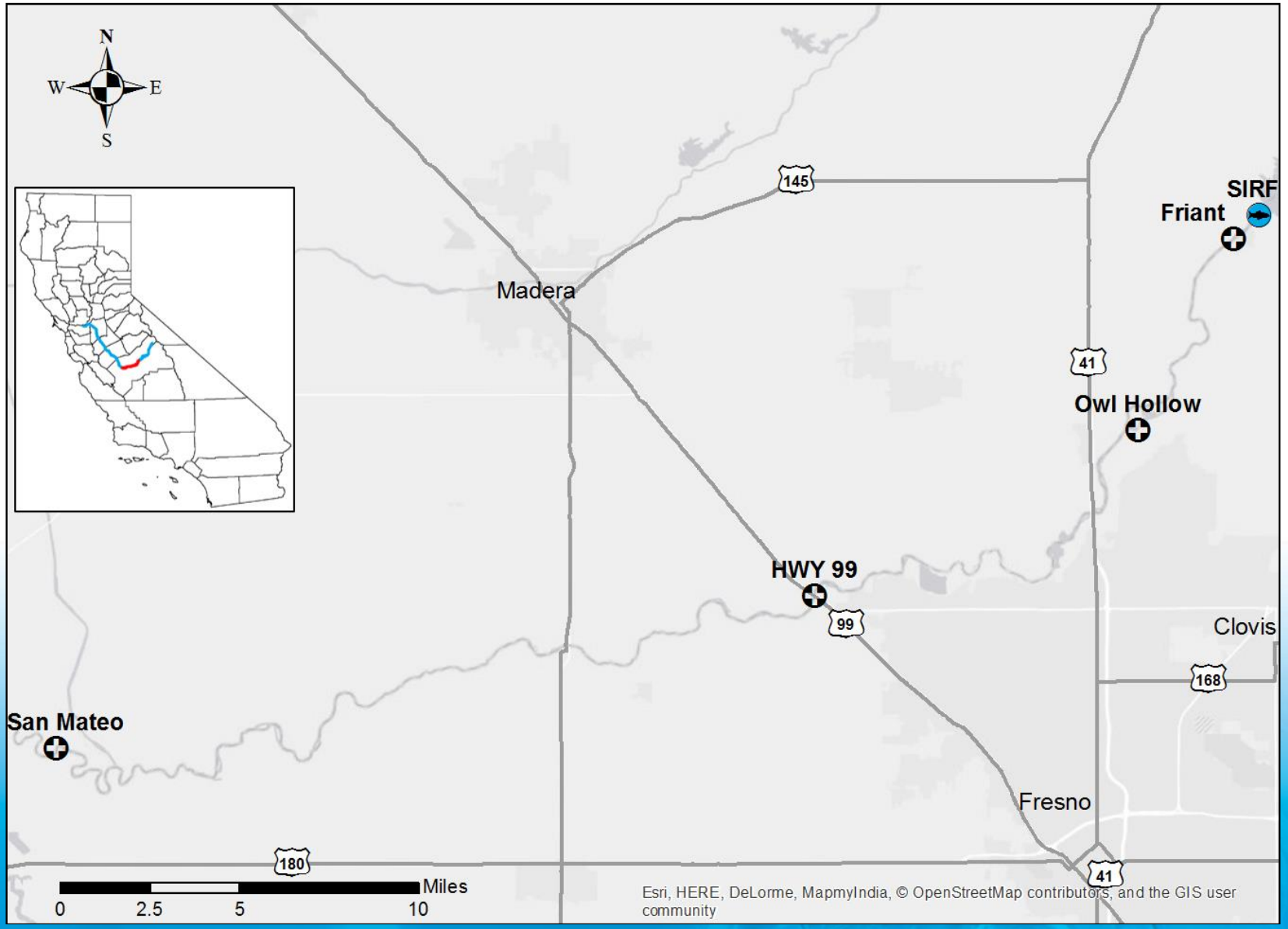
Juvenile Salmon Monitoring



SAN JOAQUIN RIVER RESTORATION PROGRAM

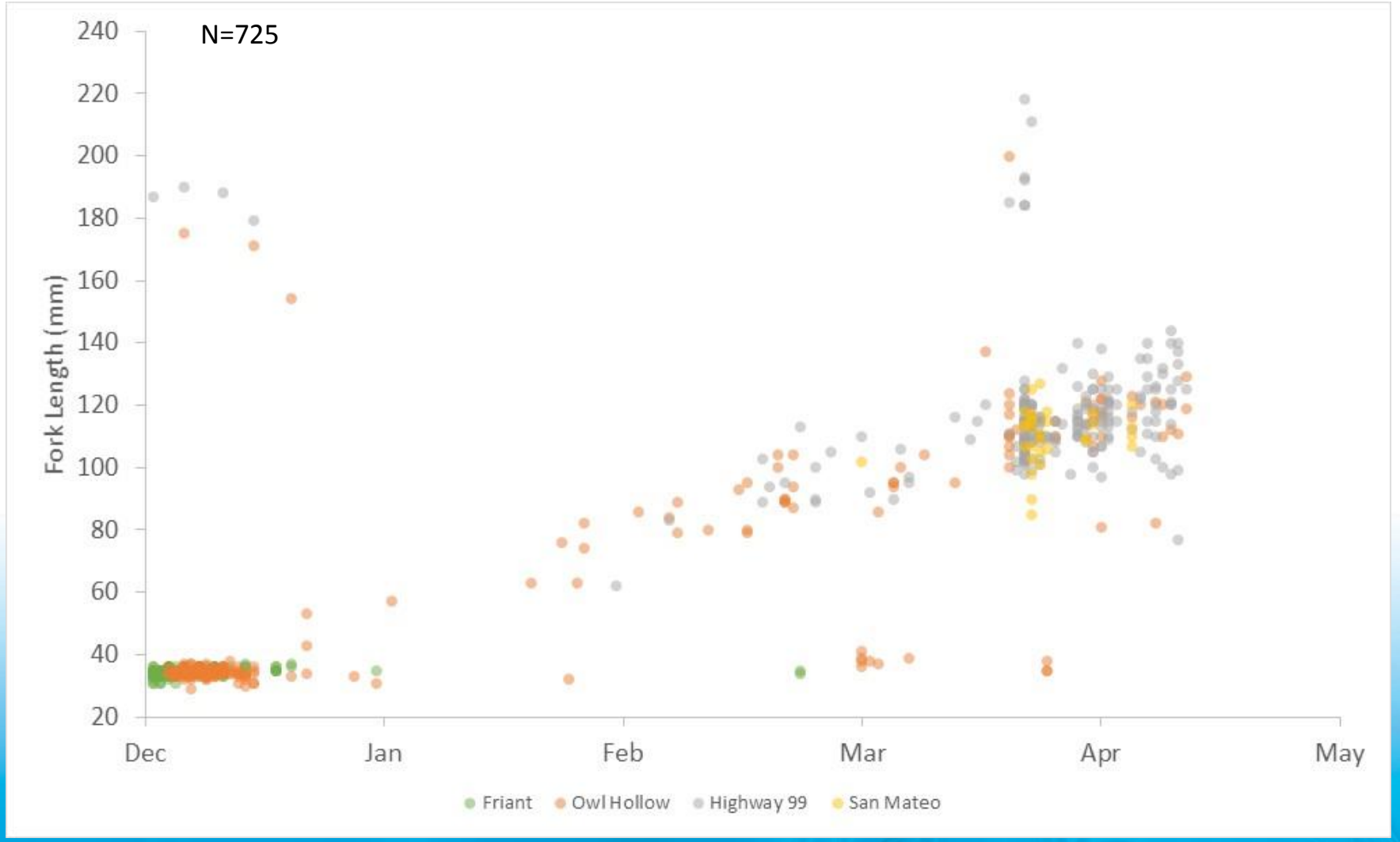
Juvenile Salmon Monitoring

Smolt index used to categorize life stage of captured Chinook Salmon:

Smolt Index	Life Stage	Criteria
1	Yolk-sac Fry	• Newly emerged with visible yolk sac
2	Fry	• Recently emerged with sac absorbed (button up fry) • Seam along mid-ventral line visible • Pigmentation undeveloped
3	Parr	• Seam along mid-ventral line not visible • Scales firmly set • Darkly pigmented with distinct to slightly faded parr marks • No (to slight) silvery coloration
4	Smolt	• Parr marks highly faded or absent • Bright silver or nearly white coloration • Scales easily shed (deciduous) • Black trailing edge on caudal fin • More slender body

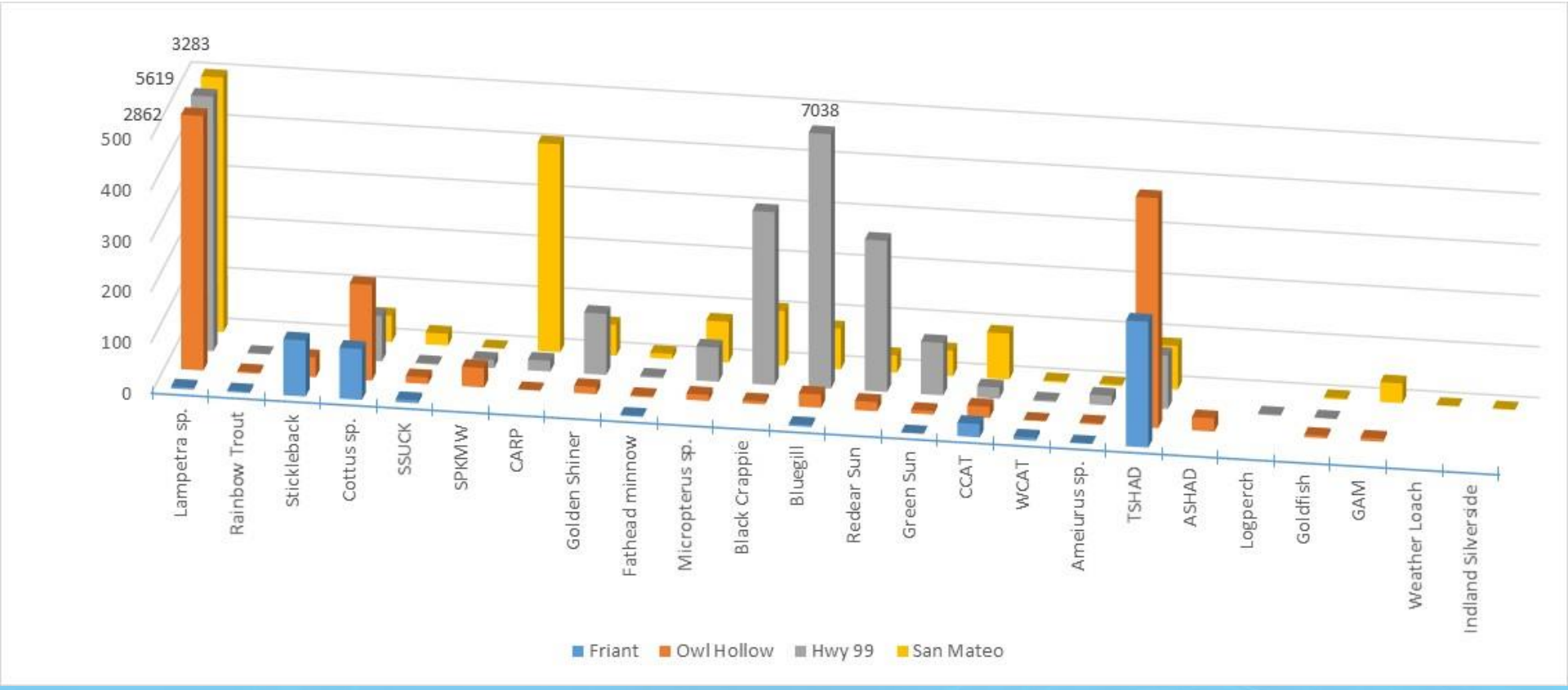
SAN JOAQUIN RIVER RESTORATION PROGRAM

Juvenile Salmon Monitoring



- *PROVISIONAL DATA, SUBJECT TO REVISION*

Juvenile Salmon Monitoring

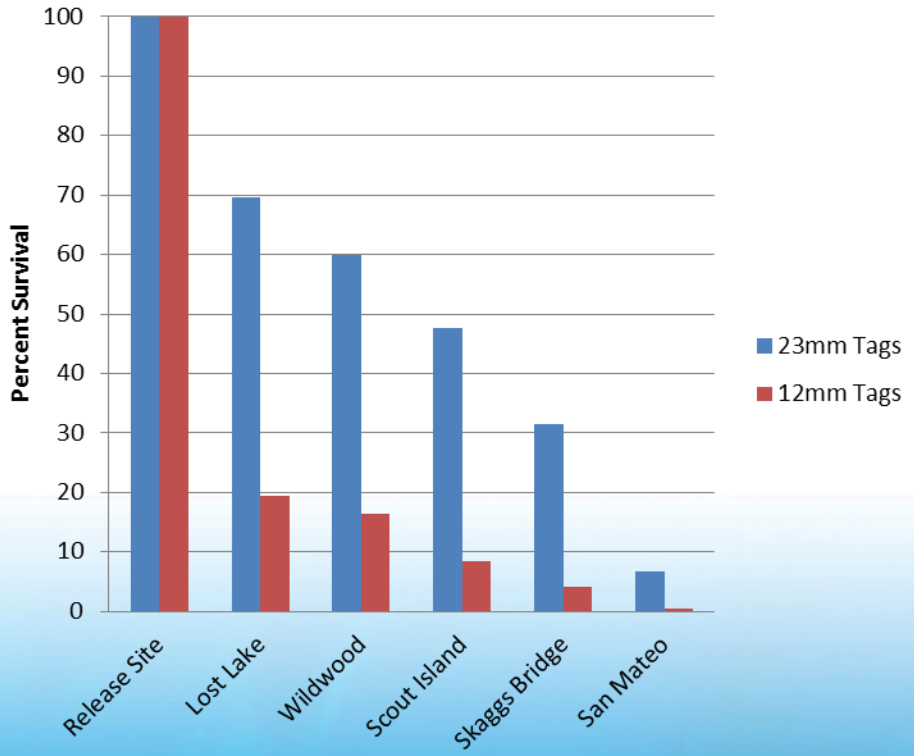


- *PROVISIONAL DATA, SUBJECT TO REVISION*

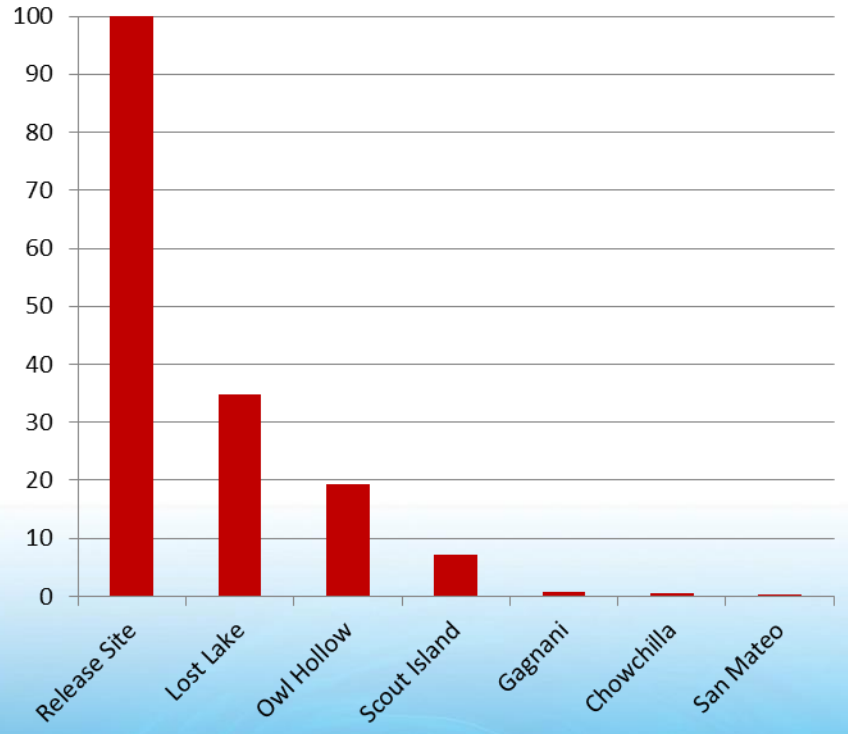
Juvenile Salmon Monitoring

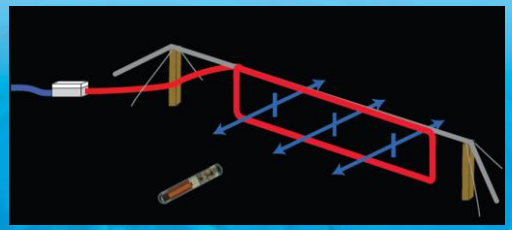
Survival: 2012-2013 PIT tag study Survival Results

2012



2013





SAN JOAQUIN RIVER RESTORATION PROGRAM

Juvenile Salmon Monitoring

Oh where, oh where have the salmon gone???

Juvenile Salmon Monitoring

Benefits of Telemetry Projects

- Survival
  - Predation
  - Entrainment
  - Other Losses
- Migration Routes
  - Migration, movement, timing
- Movement in relation to flows and Temperatures
  - Water-type year
  - Pulse flows
  - Temperature preference and barrier
- Passage Delays and Impediments
- Habitat identification and use (rearing habitat)
- Downstream survival (Delta) and successful ocean migration

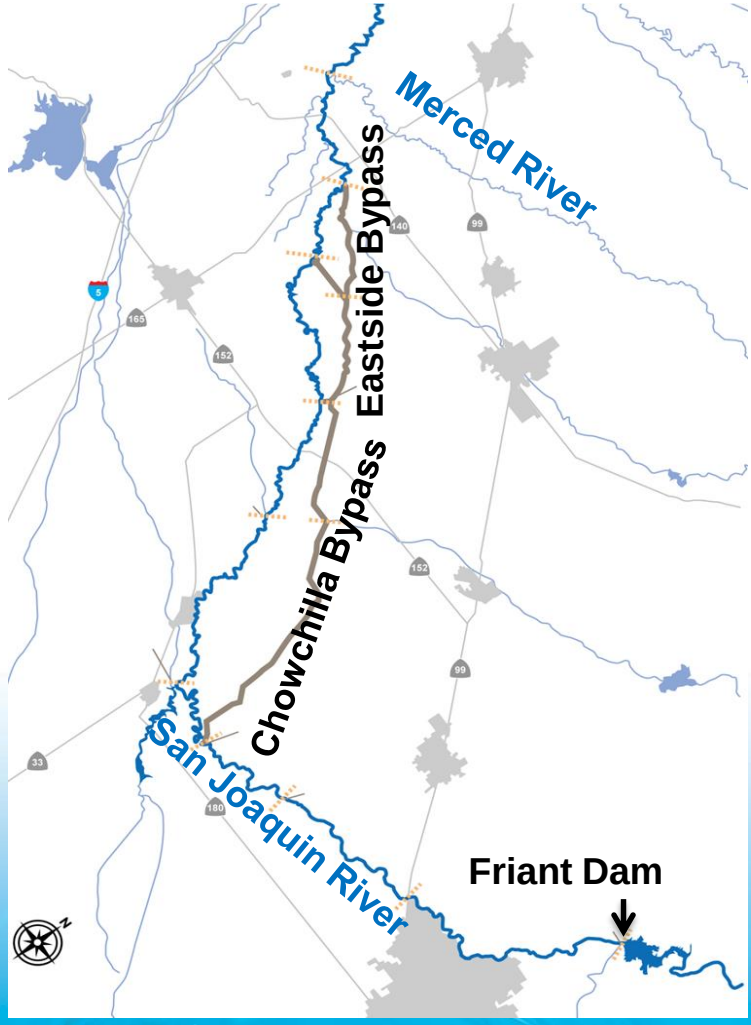
Juvenile Salmon Monitoring

Survival: 2011-2014 Acoustic tag study

- 2011 55% to Hills Ferry
- 2012 0% to Hills Ferry
- 2013 34% to Hills Ferry
- 2014 3% to Hills Ferry

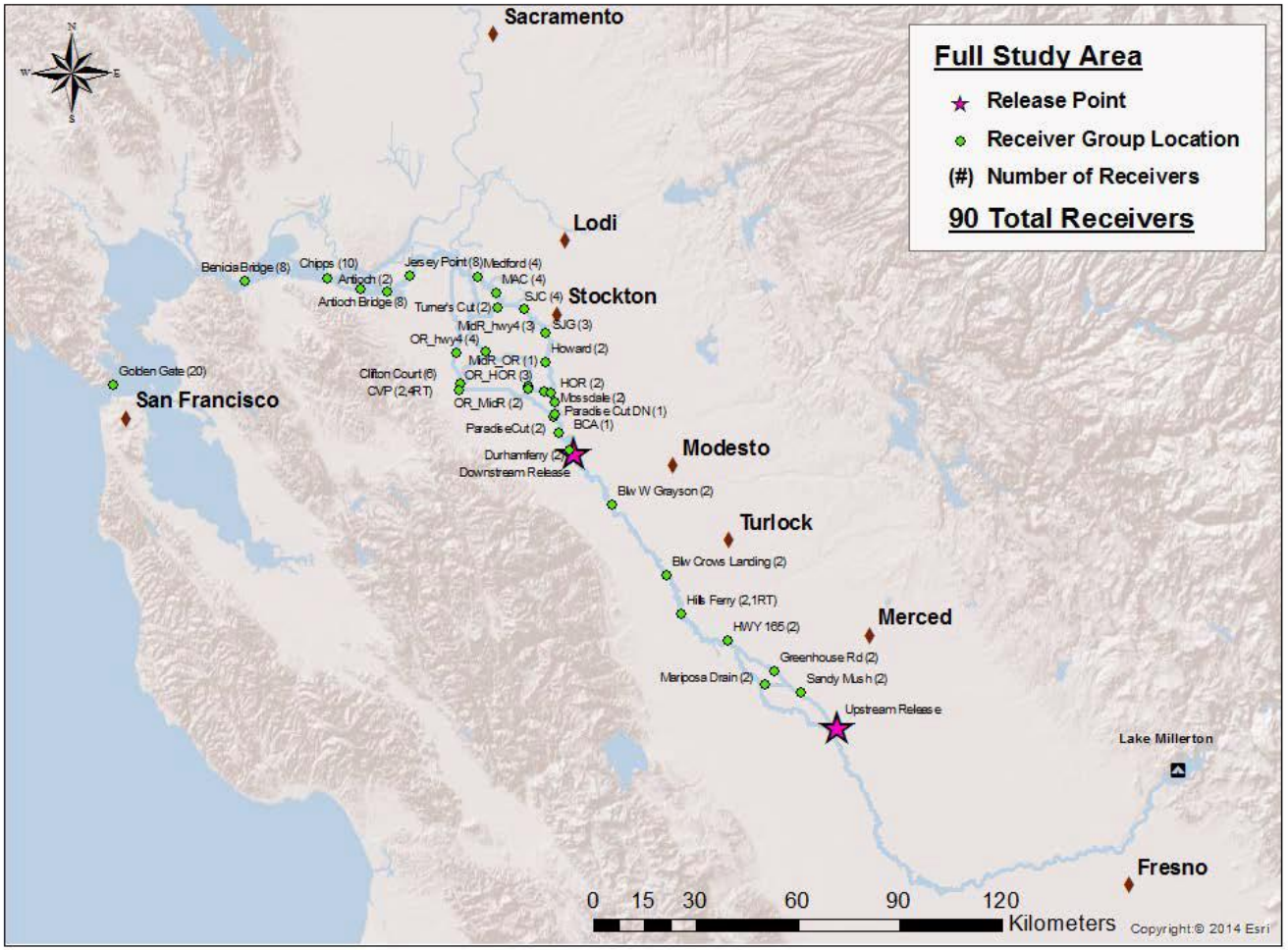
❖ Higher flows and larger fish have better survival

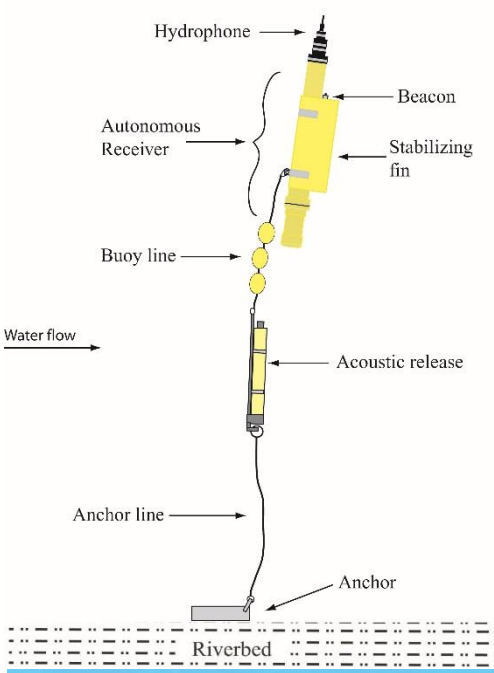
❖ Survival during drought years may not be adequate to support sustainable populations



SAN JOAQUIN RIVER RESTORATION PROGRAM

Juvenile Salmon Monitoring

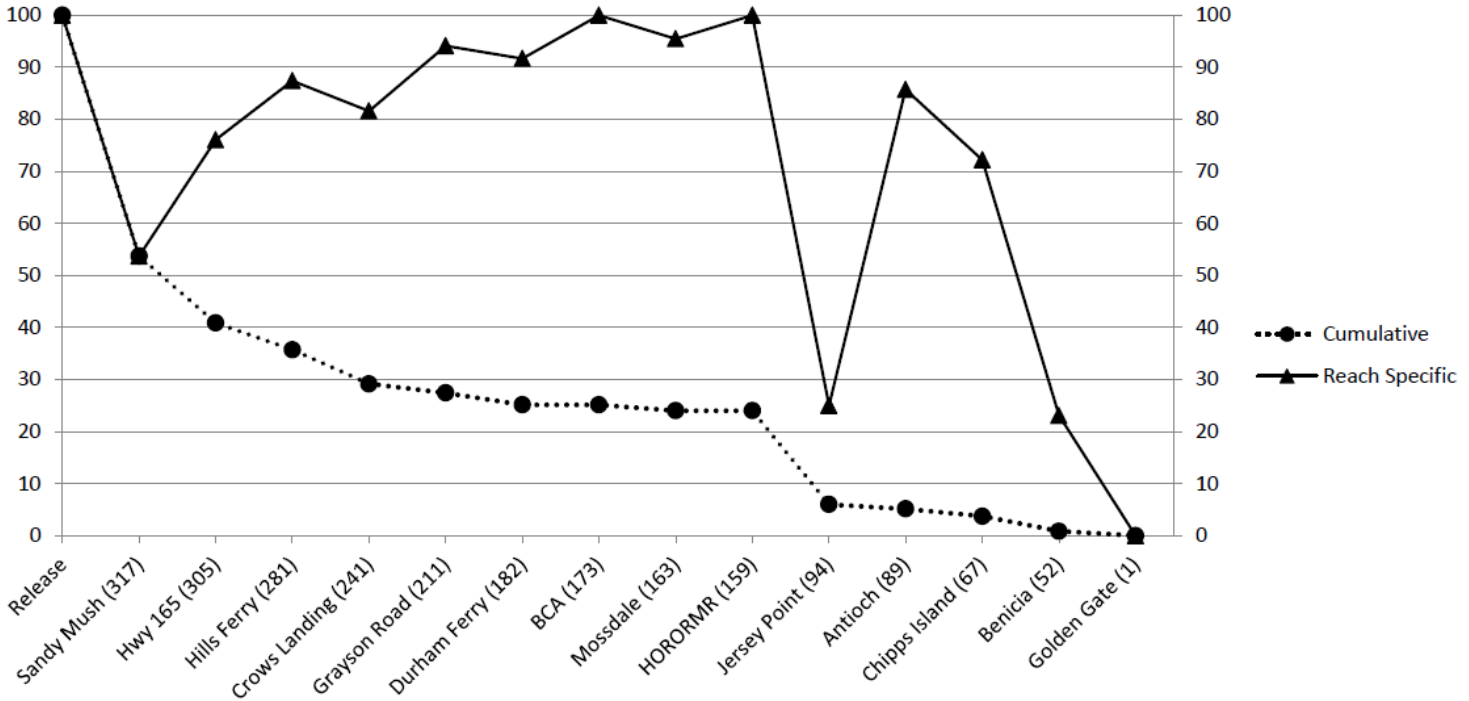




SAN JOAQUIN RIVER RESTORATION PROGRAM

Juvenile Salmon Monitoring

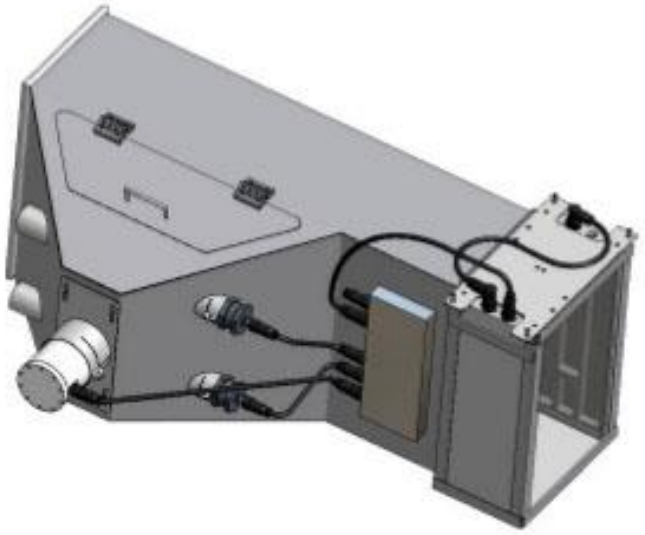
Upstream Release Overall Survival

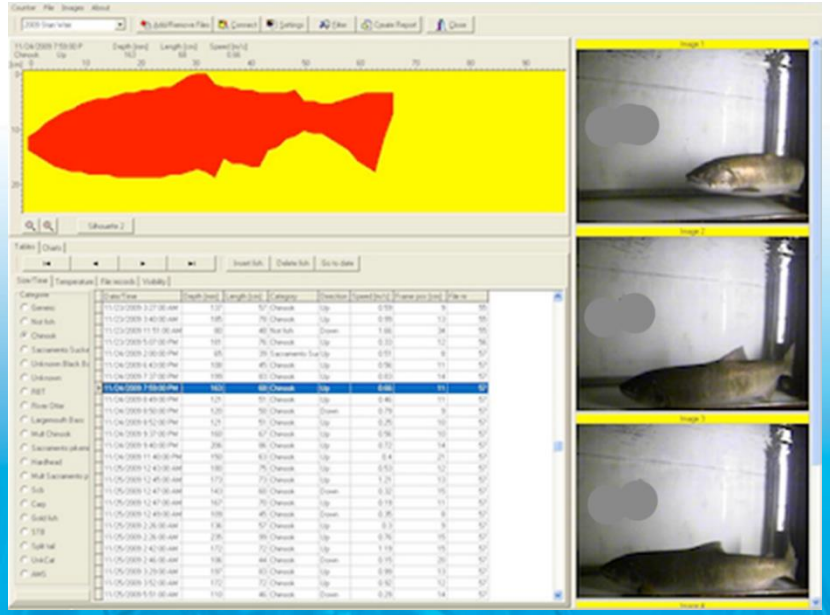


Adult Salmon Monitoring

Vaki RiverWatcher Spring-run Monitoring

Net weir to guide returning salmon into VakiWatcher





Vaki RiverWatcher

SAN JOAQUIN RIVER
RESTORATION PROGRAM

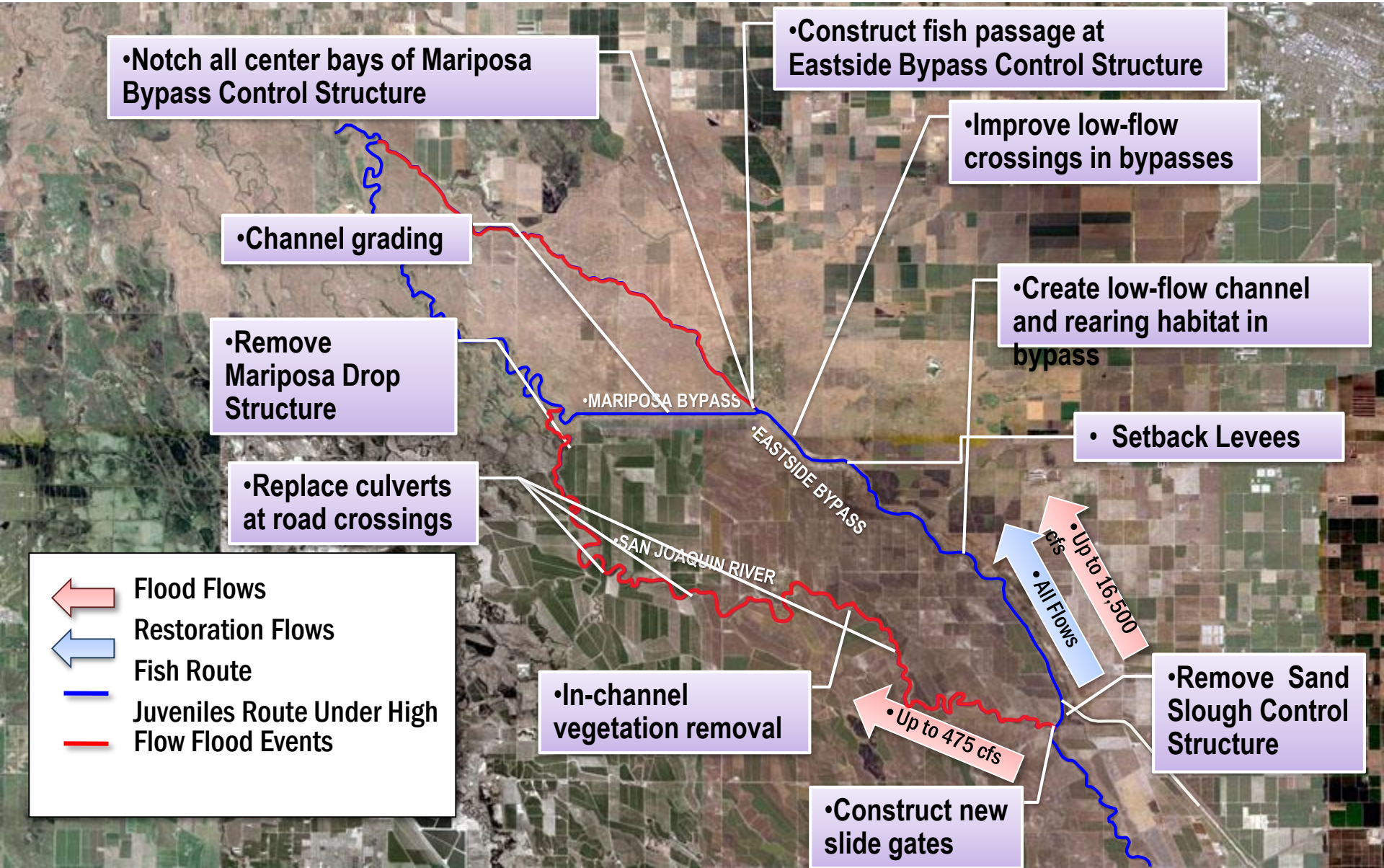
The Future?

Reach 4B Background

- Bounded by Sand Slough Control Structure and Mariposa Bypass
- Part of Flood Control Project
- Original design capacity was 1,500 cfs
- Current capacity is ~ 0 cfs
- No flows in Reach 4B for many decades
  - All flows routed down the Eastside Bypass in last half-century and probably for next 10-15 years.
- Overall Reach 4B Project on hold
  - Moving forward with fish passage and levee improvements projects in the Bypass

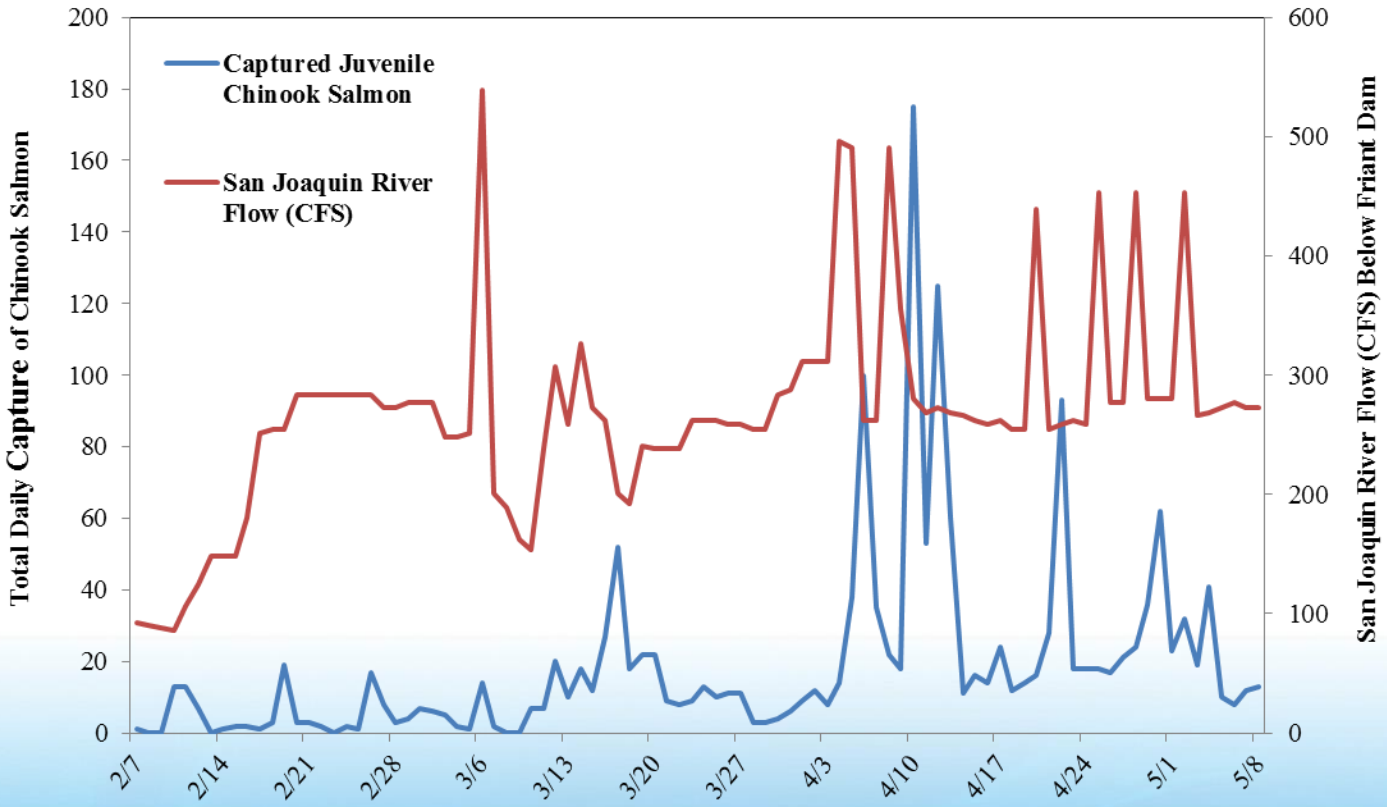
SAN JOAQUIN RIVER RESTORATION PROGRAM

Reach 4B Project - Alternative 2 Bypass Restoration (ESB to 4B2)



SAN JOAQUIN RIVER RESTORATION PROGRAM

Juvenile Salmon Monitoring



Data suggests that short-term (24-48 h) pulsed flows up to ~500 cfs serves to provide cues (flow, turbidity, combination) which results in increased downstream migration of juvenile Chinook salmon.

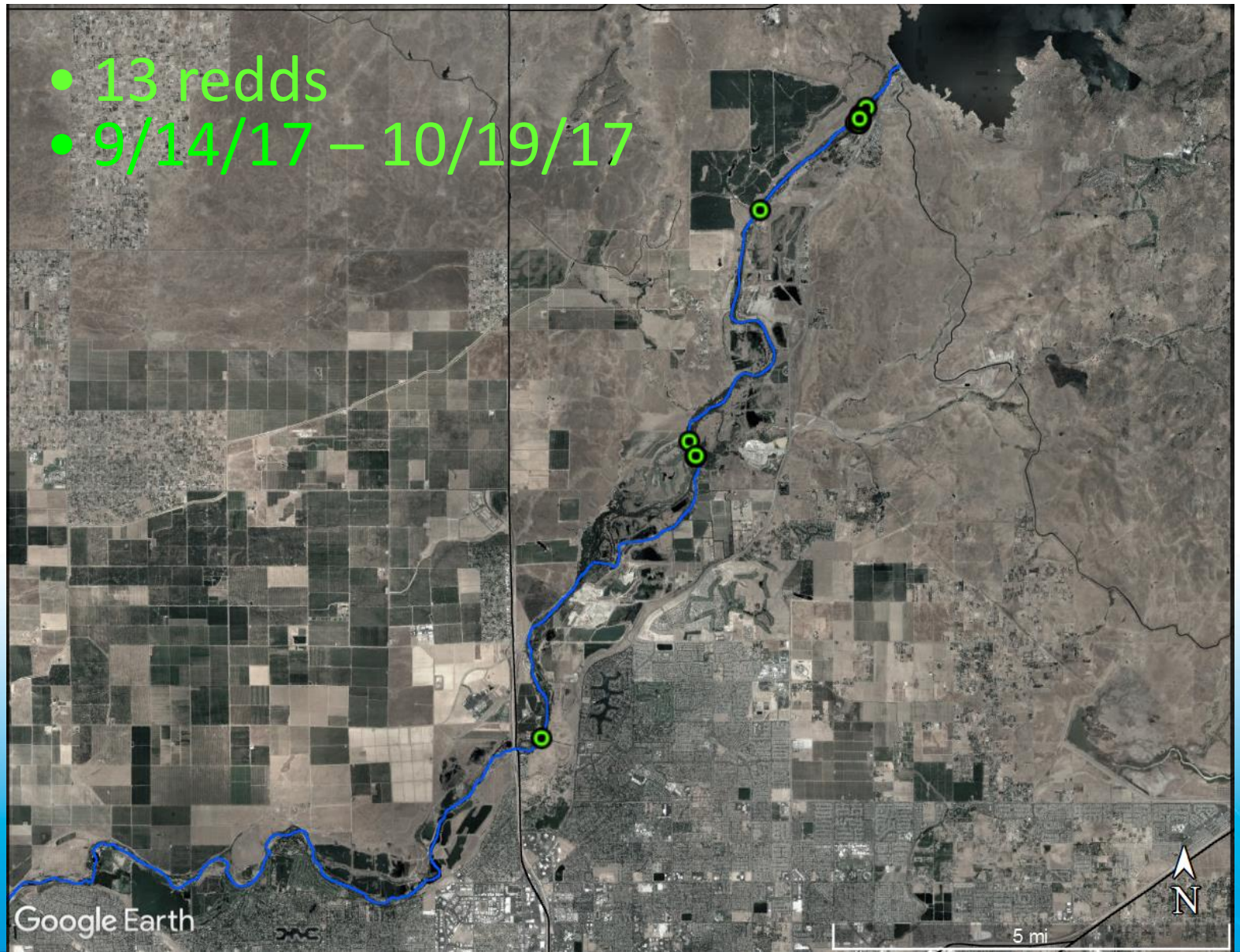
SAN JOAQUIN RIVER RESTORATION PROGRAM

Friant Dam and Millerton Reservoir

- Completed in 1942
- Authorized for:
  - Water Supply
  - Flood Control
- 520,500 Acre-feet Storage Capacity
- 1.8 Million Acre-feet Average Inflow
- 1.4 Million Acre-feet Average Deliveries
- No Carryover Storage
- Controlled Releases:
  - San Joaquin River (8,000 cubic feet per second (cfs))
  - Friant-Kern Canal (5,000 cfs)
  - Madera Canal (1,250 cfs)

SAN JOAQUIN RIVER RESTORATION PROGRAM

Adult Spring-run Holding Monitoring



SAN JOAQUIN RIVER RESTORATION PROGRAM

Dan McNamara Road

Key Guiding Program Documents