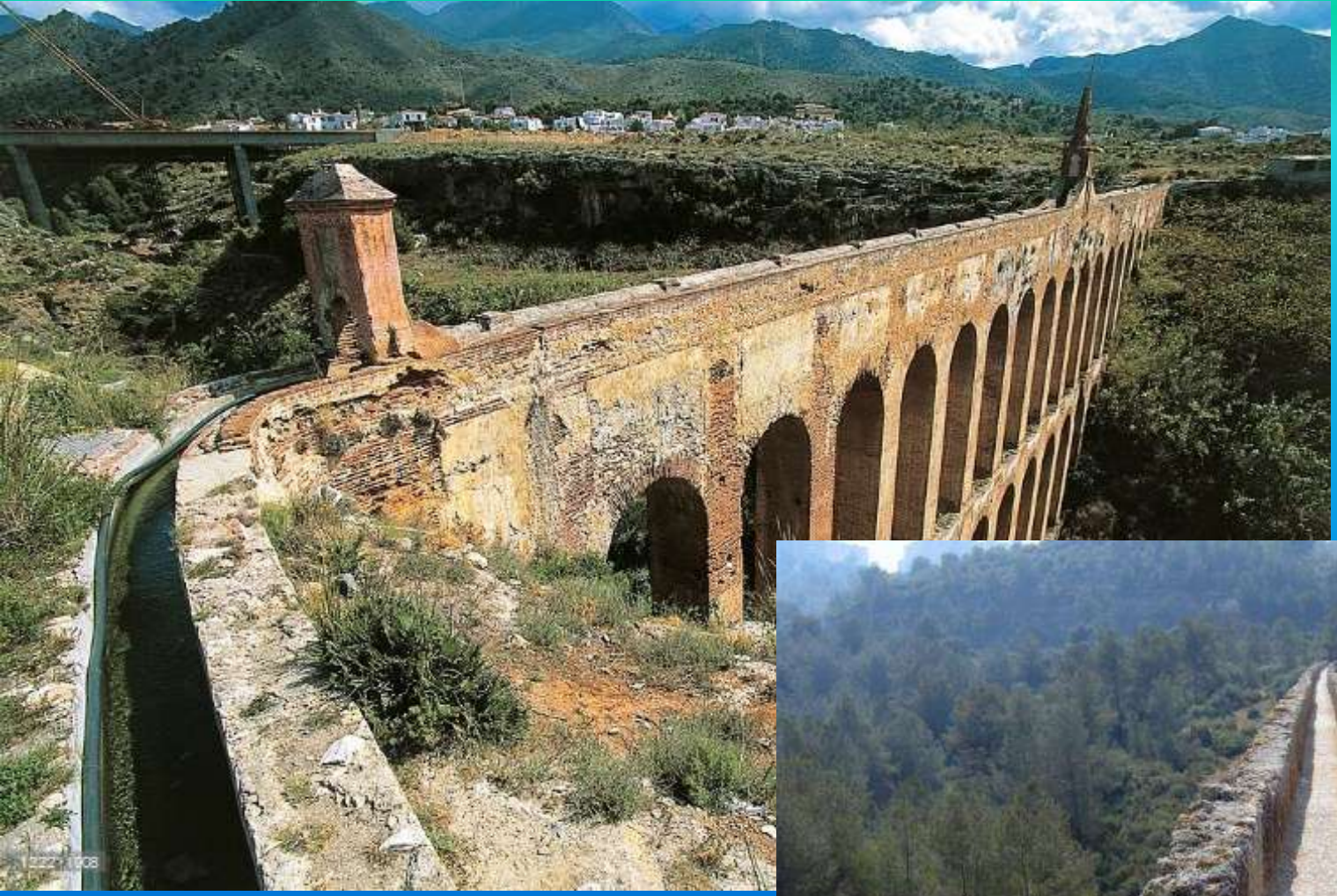
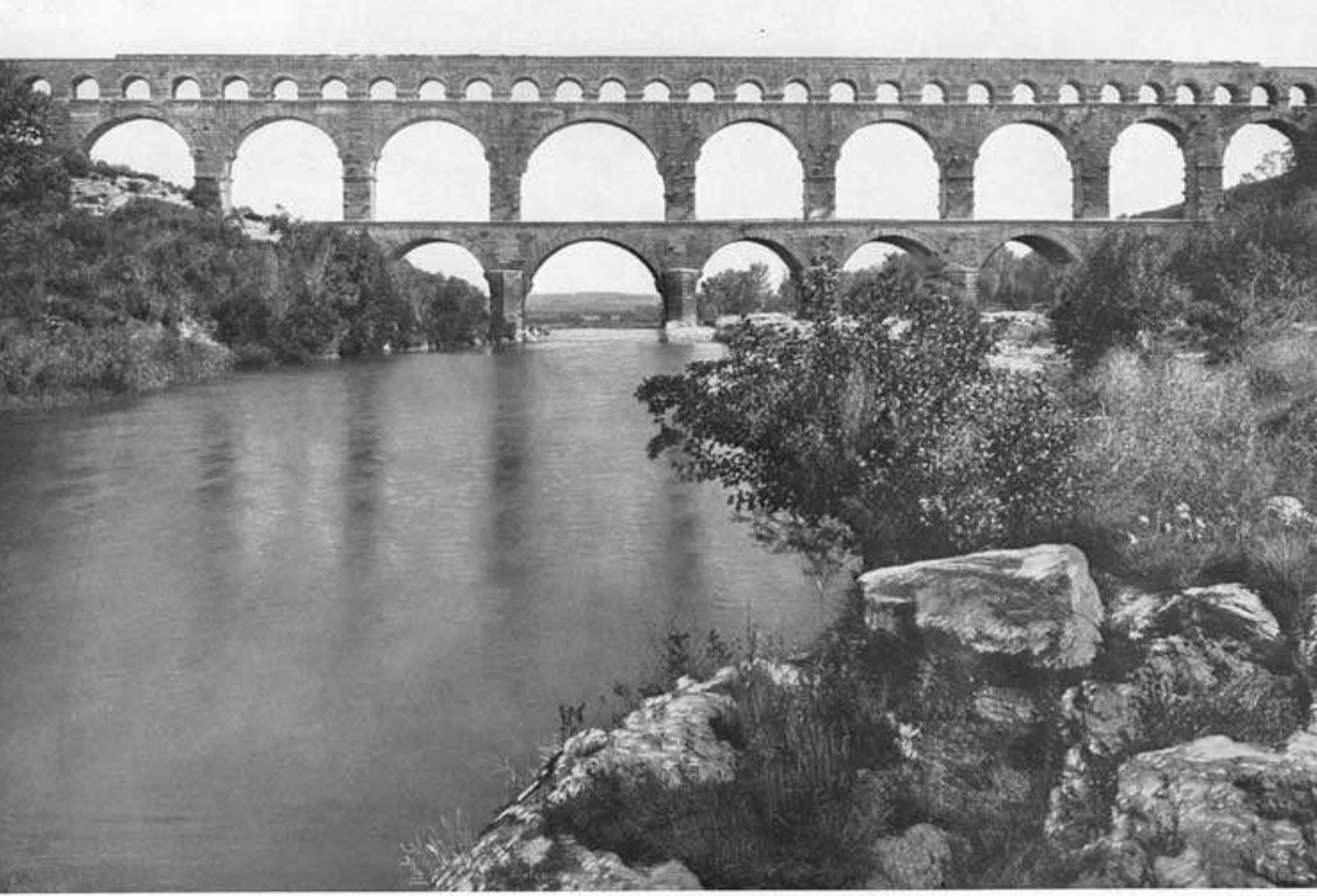
Adapting Aging Infrastructure to Sustain Listed Salmonids

36th Annual Salmonid Restoration Conference
Fortuna, CA
April 14, 2018

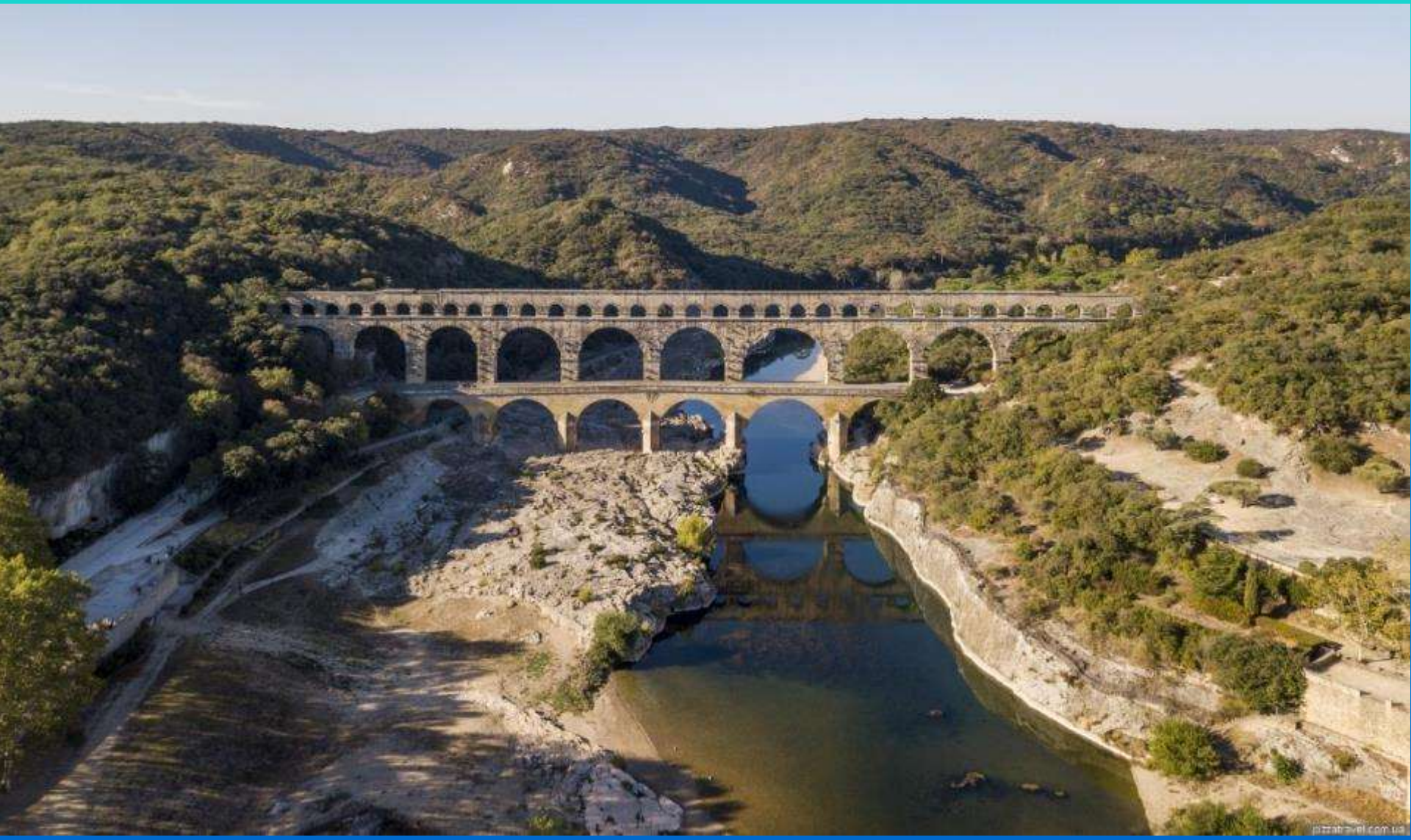
Eric Ginney - Environmental Science Associates (ESA)





PONT DU GARD

An old Roman aqueduct near Nîmes, France, ascribed to Agrippa, son-in-law of Augustus (B.C. 19)
The structure is 883 feet long and 160 feet high

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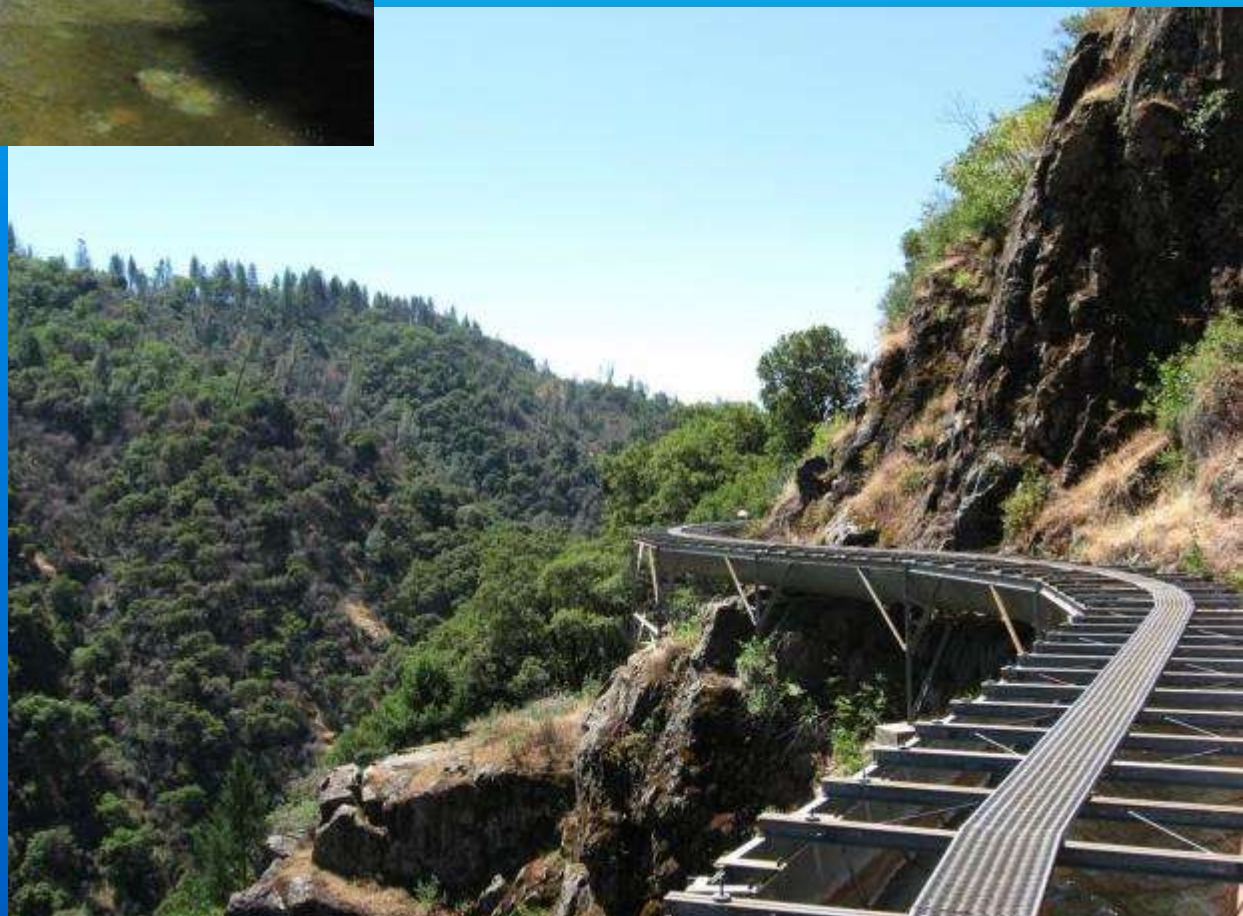
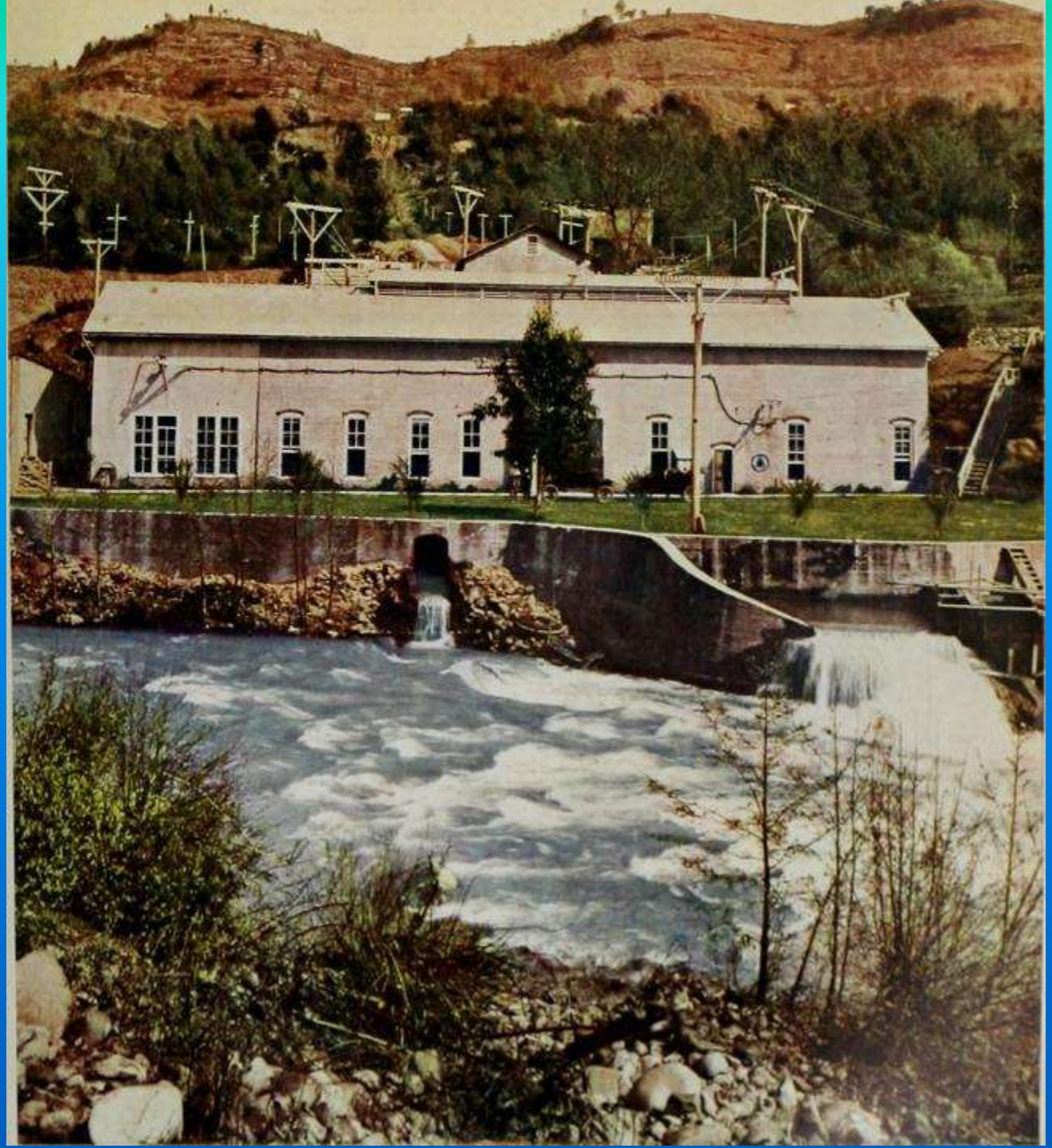
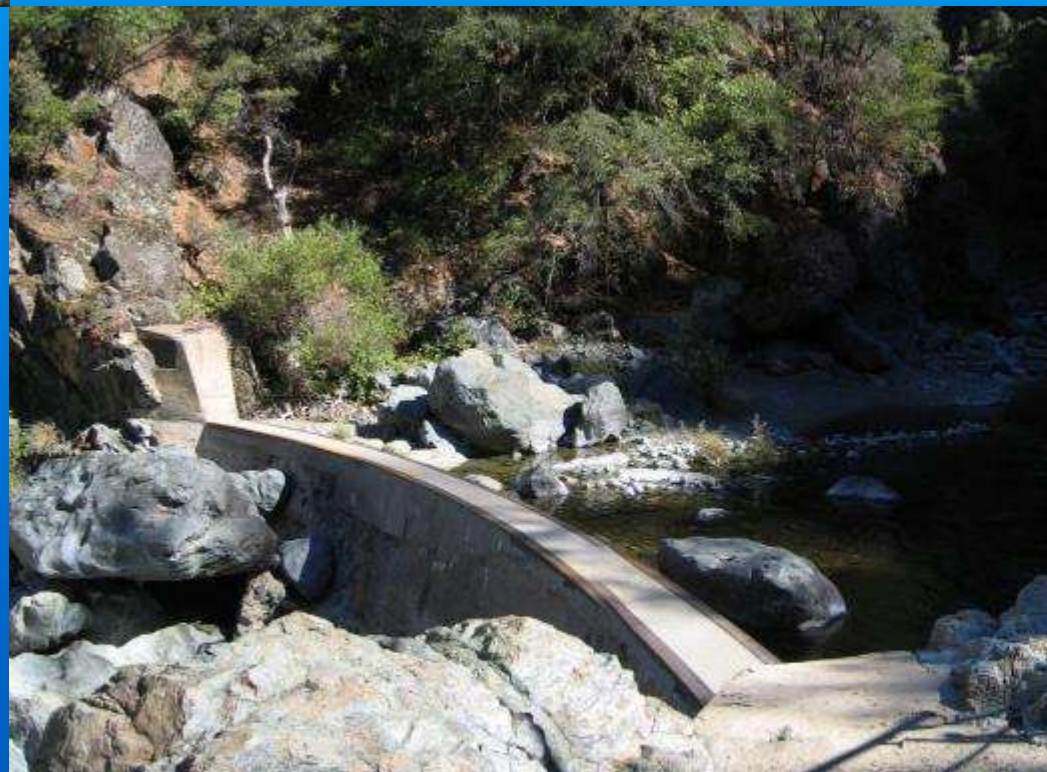


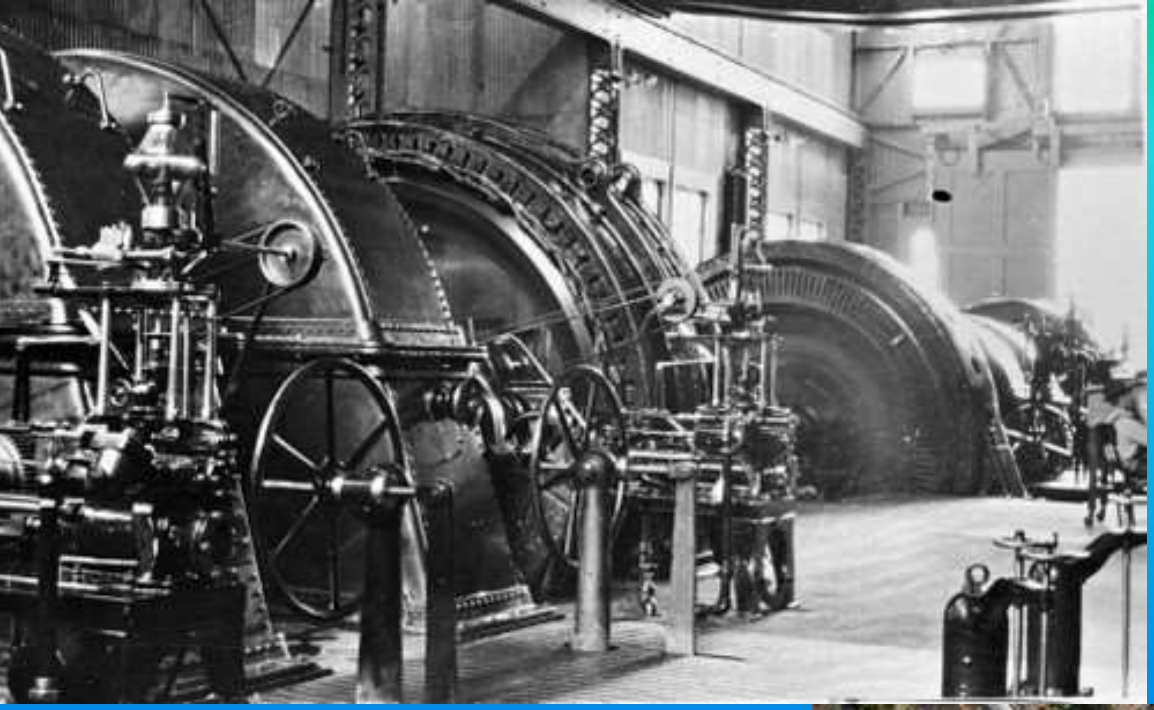


Butte Creek examples:
Centerville
Powerhouse,
1909

Centerville Powerhouse, 2009



Centerville Head Dam, 2009



DeSabla Powerhouse, 1913

DeSabla Powerhouse, 2013


8/2/2016
6. Consideration of a proposed Order addressing Pacific Gas and Electric Company's petition for reconsideration of the water quality certification issued for the DeSabla-Centerville Hydroelectric Project.
SWRCB BOARD MEETING


ACTION
NEWS
NOW
5:37
PG&E WITHDRAW FROM HYDROELECTRIC FACILITY
BUTTE COUNTY

''Dams are not like the pyramids of Egypt that stand for eternity. They are instruments that should be judged by the health of the rivers to which they belong.”

''Dams are not like the pyramids of Egypt that stand for eternity. They are instruments that should be judged by the health of the rivers to which they belong.”

Interior Secretary Bruce Babbitt, 1998 – McPherrin Dam, lower Butte Creek

The Butte Creek Fish Passage Improvement projects are located along the middle reach of Butte Creek, a tributary of the Sacramento River in California's Central Valley. The various projects together comprise one of the nation's most significant fisheries restoration efforts, with 90 miles of Butte Creek restored for the benefit of spring-run salmon. These projects also divert water for the benefit of farms, birds and other species along the Pacific Flyway.

BUTTE CREEK FISH PASSAGE IMPROVEMENT PROJECTS:

Water management in the upper reach of Butte Creek provides well-timed functional flows for spawning and holding habitat.

Rancho Esquon Diversion and Fish Ladder

Gorrill Ranch Diversion and Fish Ladder

Western Canal Gary N. Brown Butte Creek Siphon

Remove four dams from Butte Creek, restoring about 25 miles of unimpeded flow

Parrot-Phelan Diversion and Fish Ladder

Durham Mutual Water Company Diversion and Fish Ladder

Lake Oroville

Butte Creek

Feather River

Sacramento River

Sutter Buttes

East-West Diversion Weir

Sutter Bypass

Weir 1

Sutter Bypass

The passage improvements, combined with fish food production and safe rearing habitat for juvenile fish in the lower reach of the creek flowing through the wetlands created by the Sutter Bypass, have provided functional flows and an excellent environment for spring-run salmon and other species to thrive.

Partnerships

Cooperation among the agricultural, urban and environmental communities—with funding partnerships—were essential to the success of the projects. The key stakeholders and participants included:

- **Local water suppliers and farmers (see map), owner and funding partner;**
- **California Urban Water Agencies, funding partner;**
- **U.S. Department of Interior (USFWS and USBR), funding partner;**
- **California Department of Fish and Game**

Adapting Aging Infrastructure to Sustain Listed Salmonids

Session Chair: Eric Ginney, Central Valley/Sierra/Cascade Director, ESA

Changing energy markets, changing needs: rethinking hydropower dams and infrastructure
Dave Steindorf, Special Projects Director, American Whitewater

New ownership of the DeSabla Hydropower Project: Stakeholders creating regulatory process from scratch.
Chris Shutes, FERC Projects Director and Water Rights Advocate, California Sportfishing Protection Alliance

Butte Creek DeSabla-Centerville Hydroelectric Project: Decommission or Retool? Salmon want to know!
Allen Harthorn, Executive Director, Friends of Butte Creek

The Potter Valley Project: Fish Passage and Flow Opportunities
Patrick Samuel, Bay Area Program Manager, CalTrout

New Federal Interagency Guidance on Managing Infrastructure in the Riverine Environment
Caroline Ubing, U.S. Bureau of Reclamation

Cultivating Ecological Solutions On Agricultural Lands
Jacob Katz Ph.D., Senior Scientist, CalTrout


Thank you!

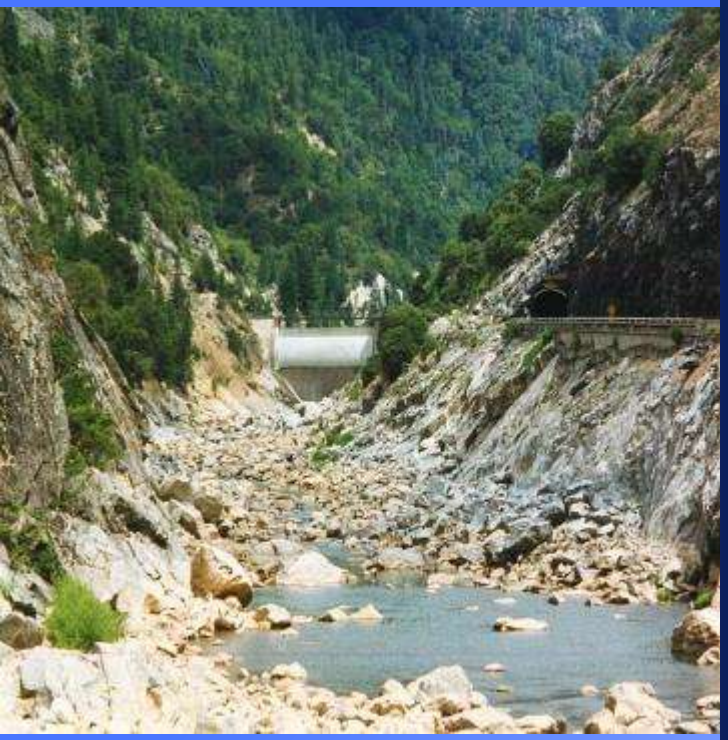
California Energy Market Overview
Emphasis on Hydroelectric Generation

Staying in Your Lane

Is Not Always the Answer

HYDROPOWER REFORM COALITION

Putting water, wildlife, and people back in rivers.



287 Hydropower Plants in California

California Hydropower Project Licenses Expiring from 2005 to 2020

The Federal Energy Regulatory Commission regulates over 300 hydropower dams in California. Over half these projects will expire by 2020 and new licenses must comply with today's environmental laws and standards. The federal licensing process offers a significant and unique opportunity to reduce hydropower's impacts to restore functioning ecosystems.

California ISO Tasks

Long-Term Planning
- Resource Adequacy, Outage Planning, etc.
- May start months ahead!

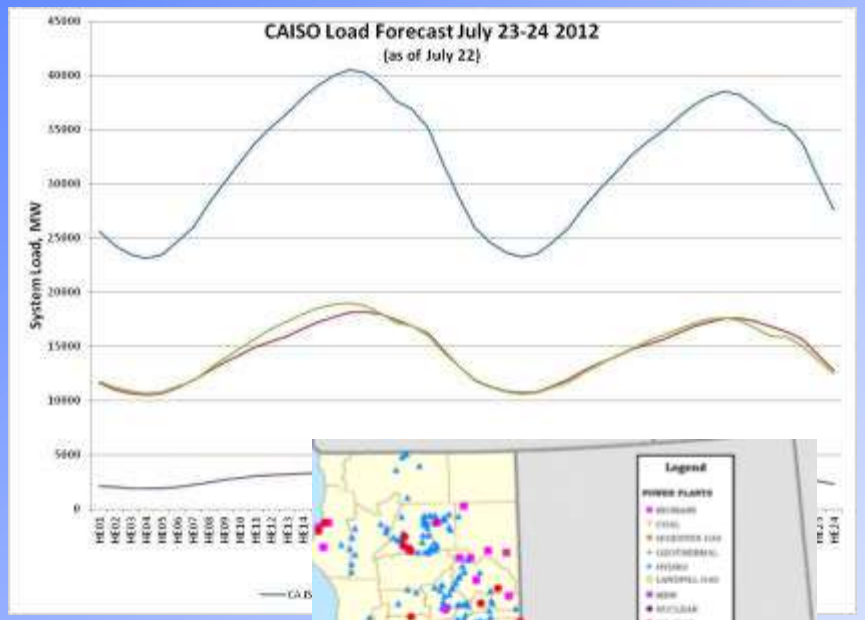
Load Forecast
- incorporates weather, other variables

Day Ahead Market
- Formal process, ALL loads and generation

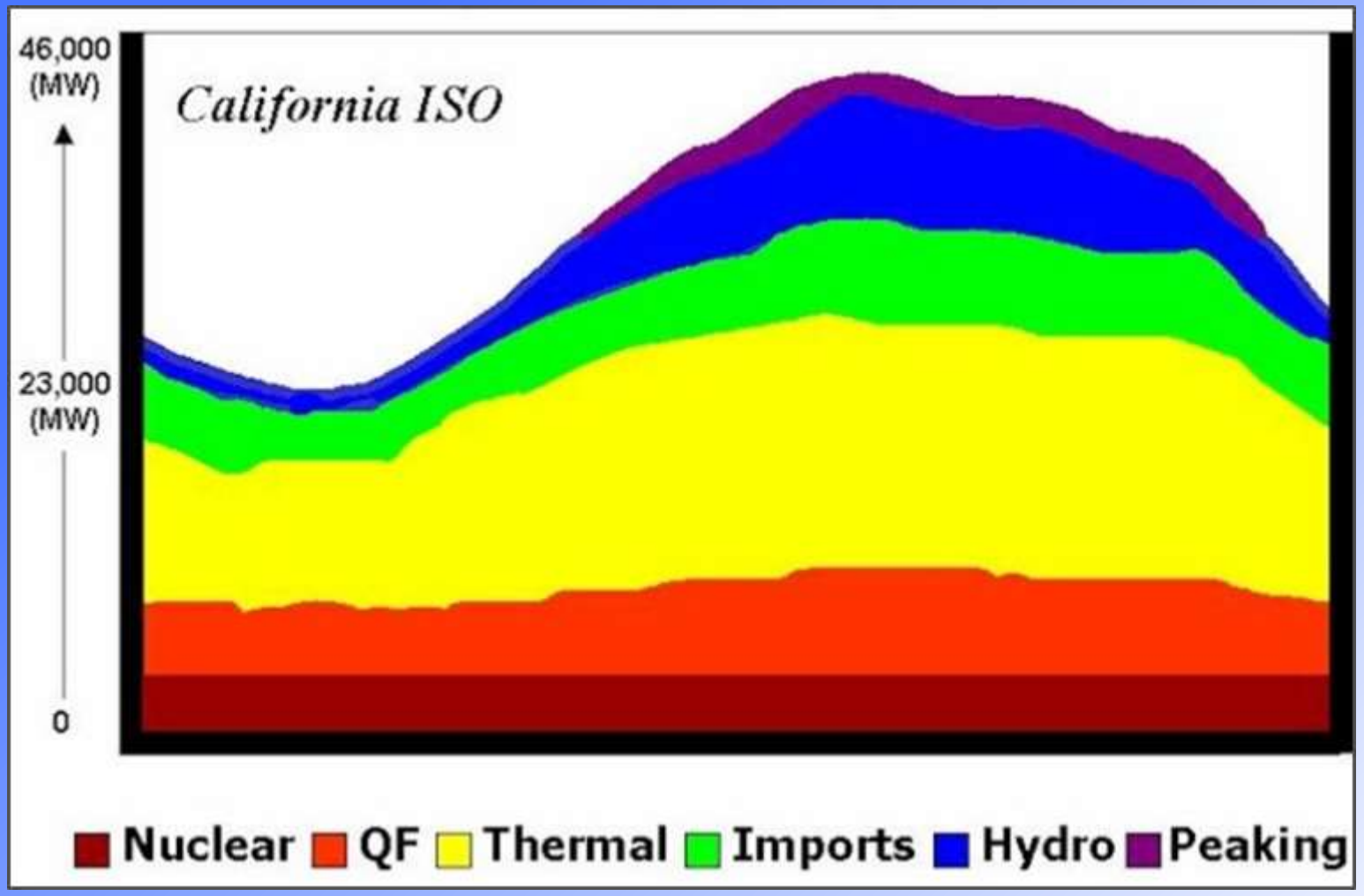
Real Time Market
- Five-minute intervals to balance grid

Delivery
- Maintain system balance

Settlement
- Meter data, invoice & payment
- May take months to complete



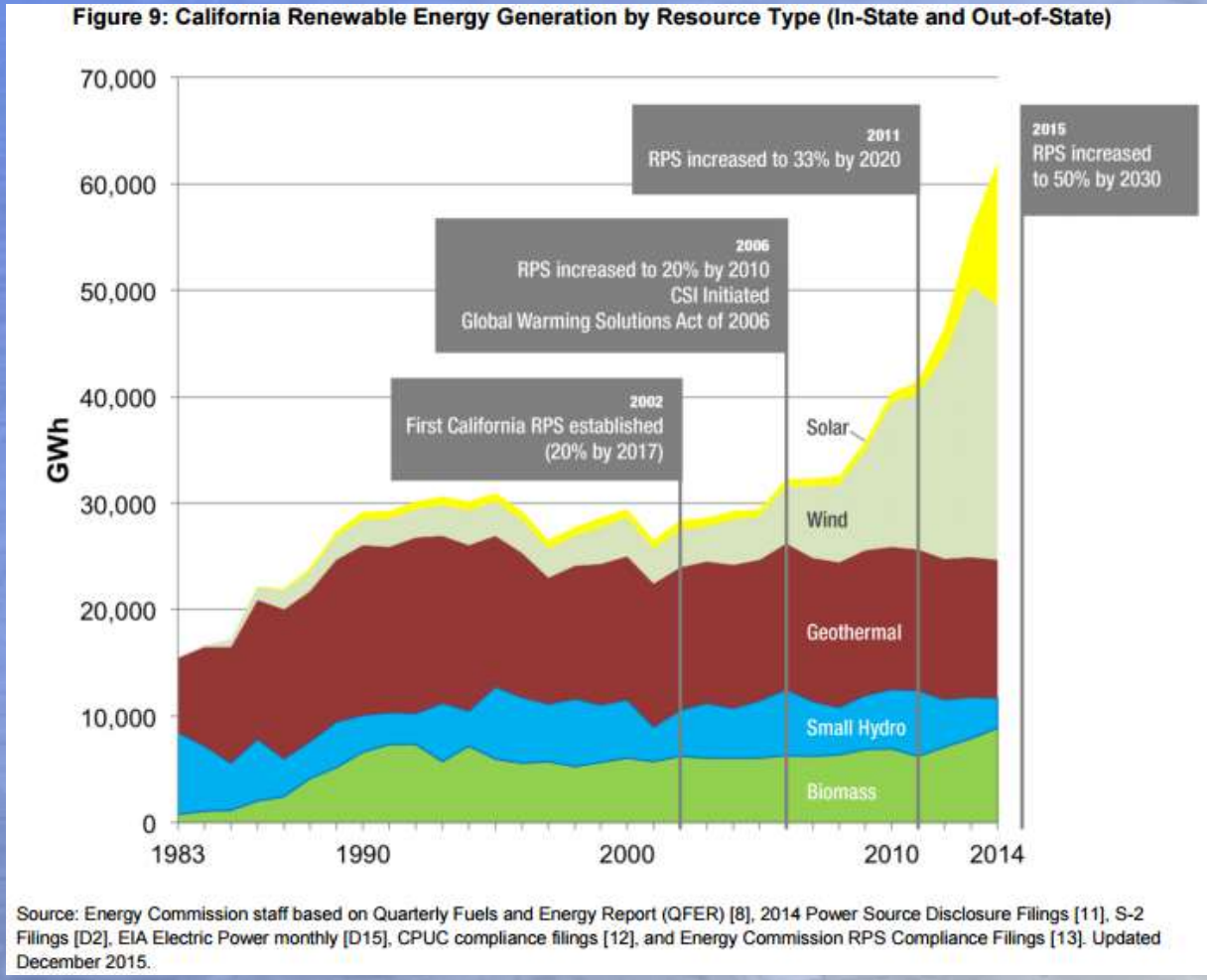
California Generation Sources



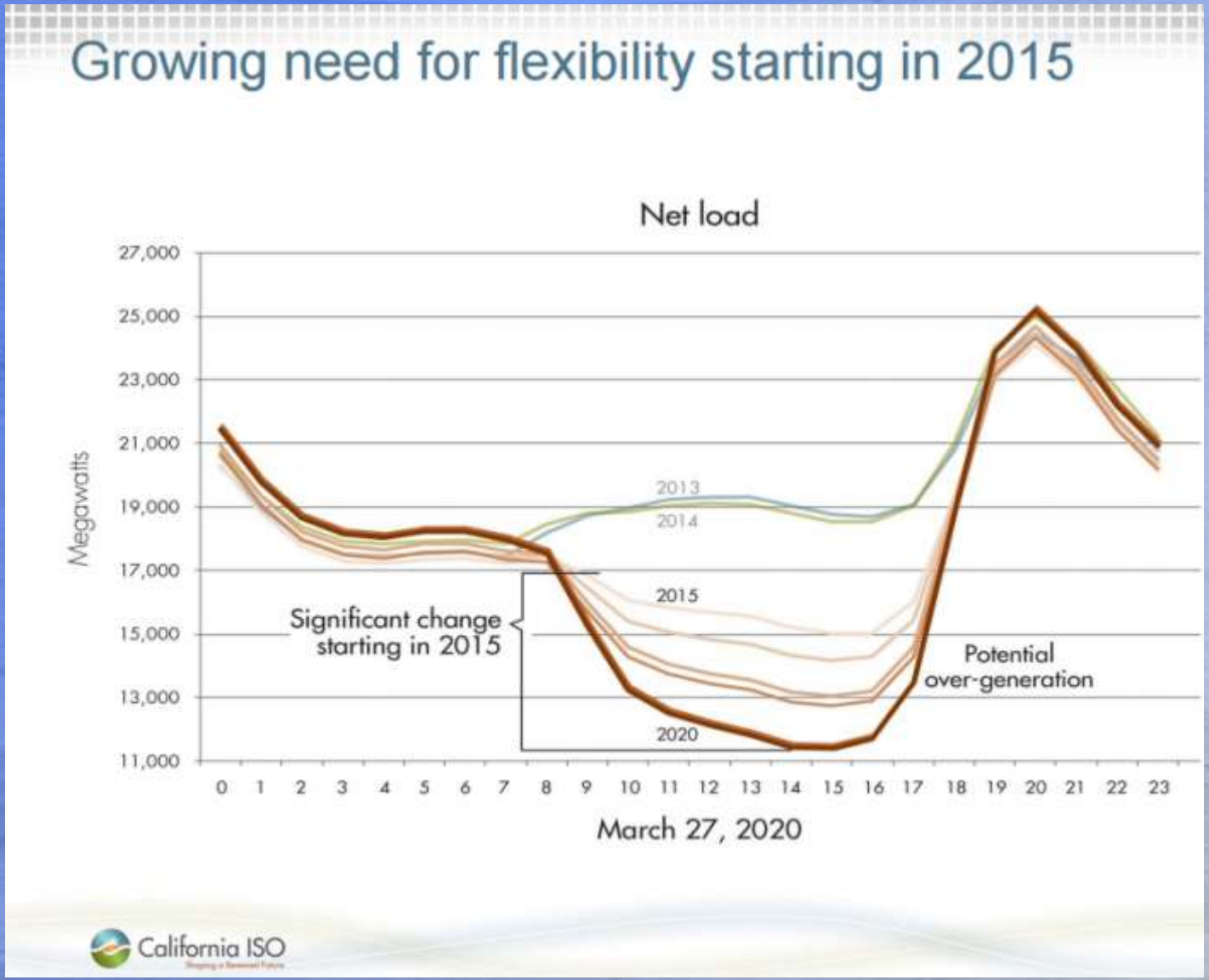
Renewable Energy in California

SB 350 (October, 2015)

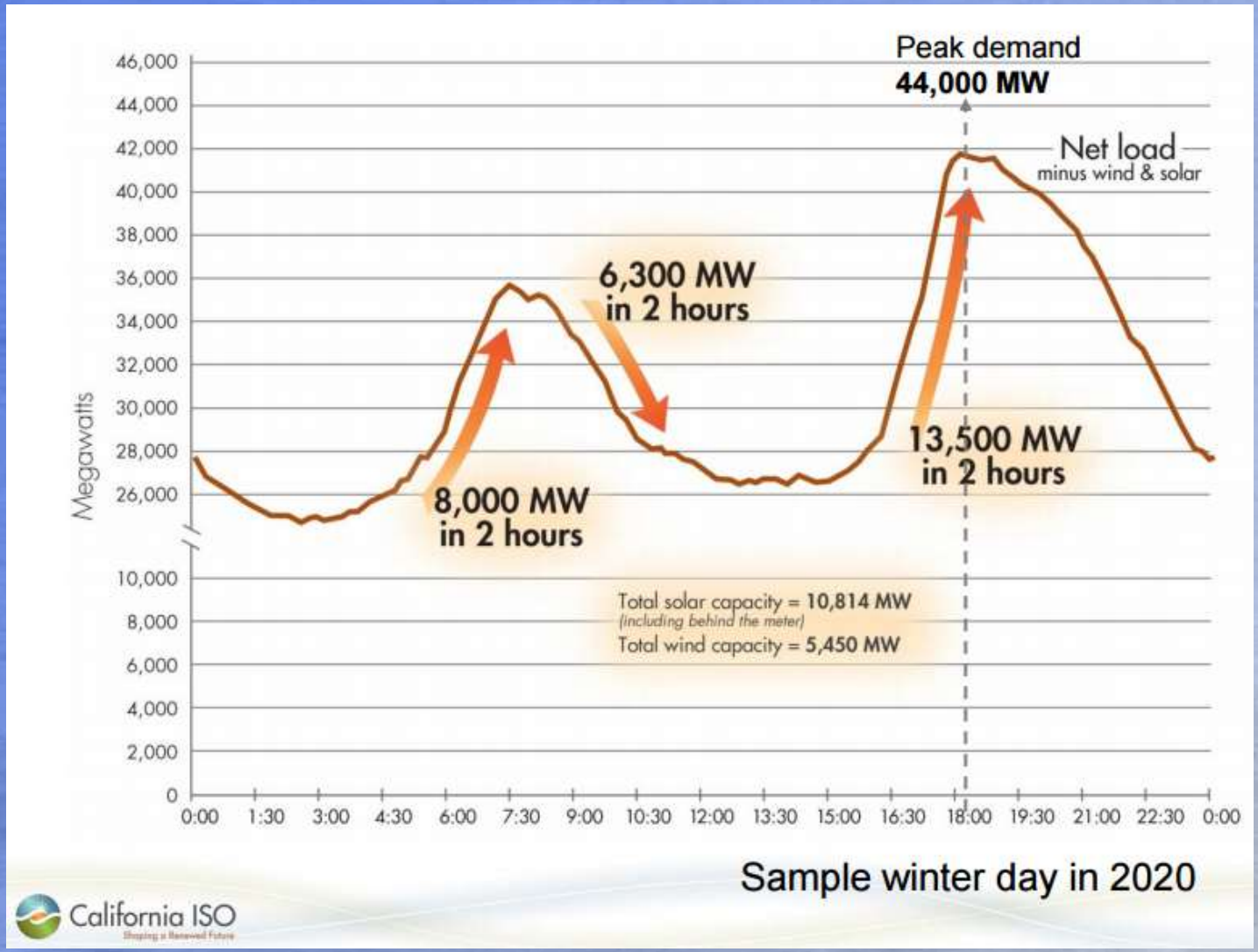
Utilities must procure 50% of electricity from eligible renewable energy sources by 2030.



The Duck Curve

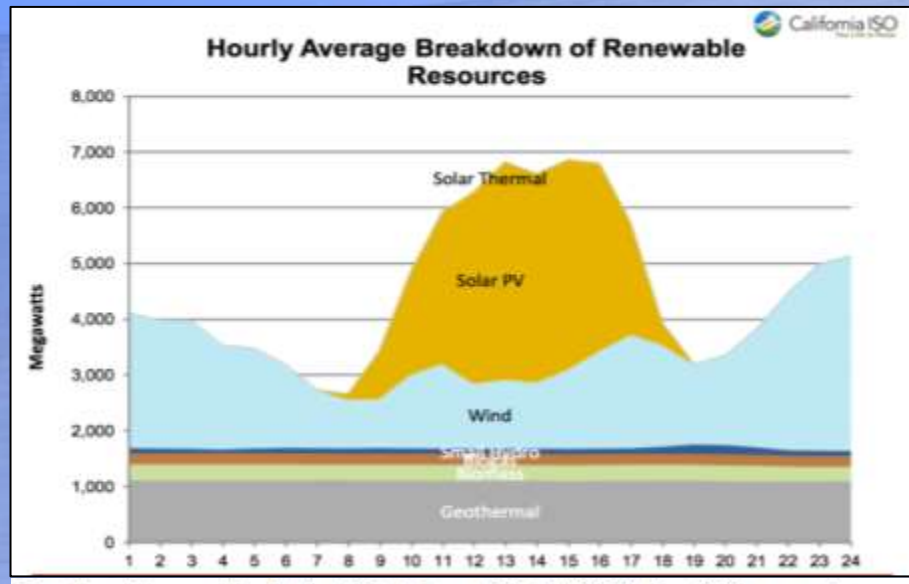


Interaction of Wind & Solar on Net-Load (2)

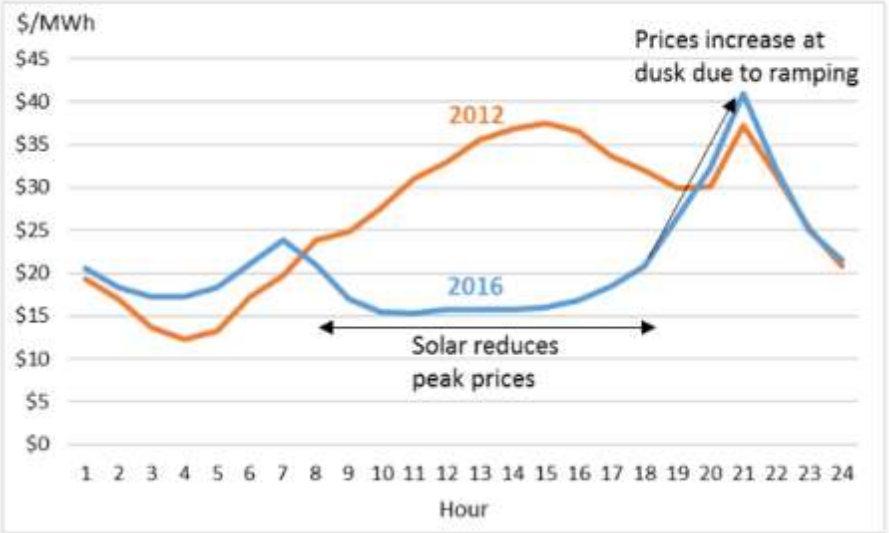


What Does This Mean for Prices??

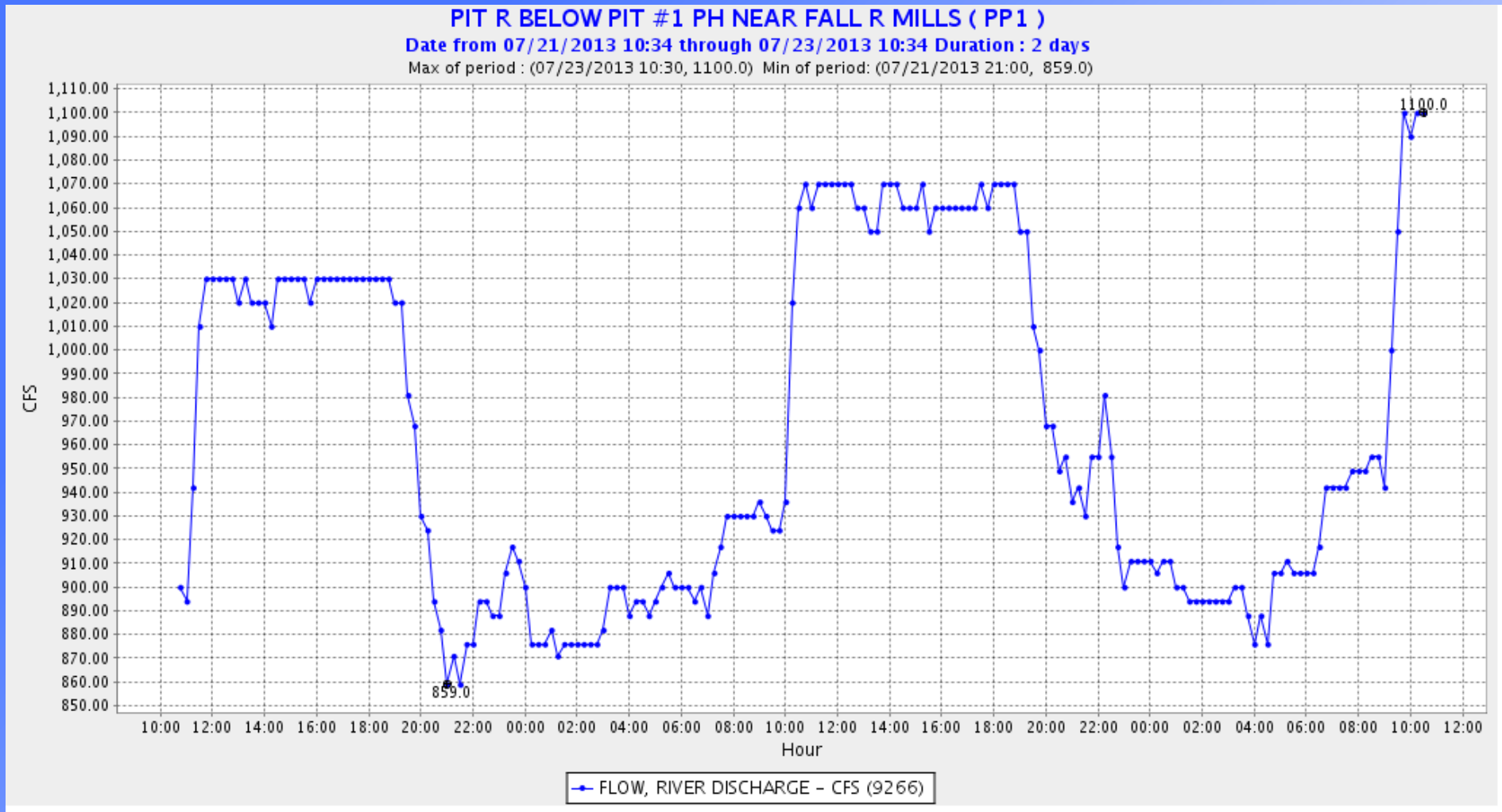
- Increasing solar generation will likely depress wholesale prices during mid-day
- But afternoon ramping requirement will increase prices during those hours
- Increased need for flexible capacity (load following) and ancillary services (regulation)
- Flexible power will be highly valuable, and necessary to enable wind & solar integration



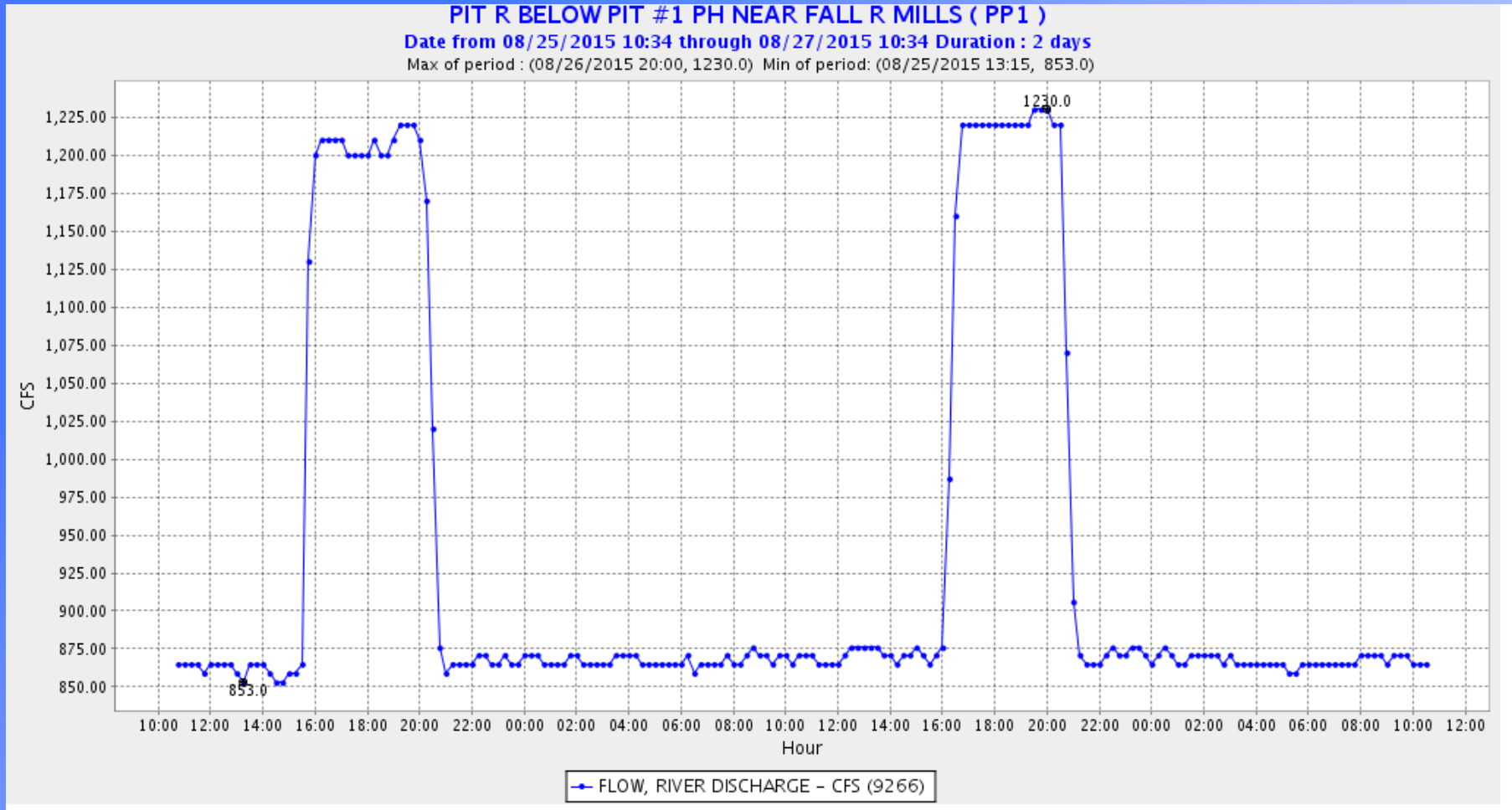
Day-Ahead Average Hourly Electricity Prices at SP-15 (CAISO), May 2012 versus May 2016



Change In Release Patterns



Change In Release Patterns



Yuba River Development Project
P-2246

Base Case: 2016 prices, compared to 2012 prices					
	generation	reg down	reg up	spin	total revenue
Revenue	-11.6%	53.7%	31.0%	-11.8%	-7.7%

Community Choice Aggregation

How CCAs Function in Electricity Distribution [edit]

CCAs are local, not-for-profit, public agencies that take on the decision-making role about sources of energy for electricity generation. Once established, CCAs become the default service provider for the *power mix* delivered to customers. In a CCA service territory, the incumbent utility continues to own and maintain the transmission and distribution infrastructure, metering, and billing. In some states, CCAs may be considered *de facto* public utilities of a new form that aggregate regional energy demand and negotiate with competitive suppliers and developers, rather than the traditional utility business model based on monopolizing energy supply.

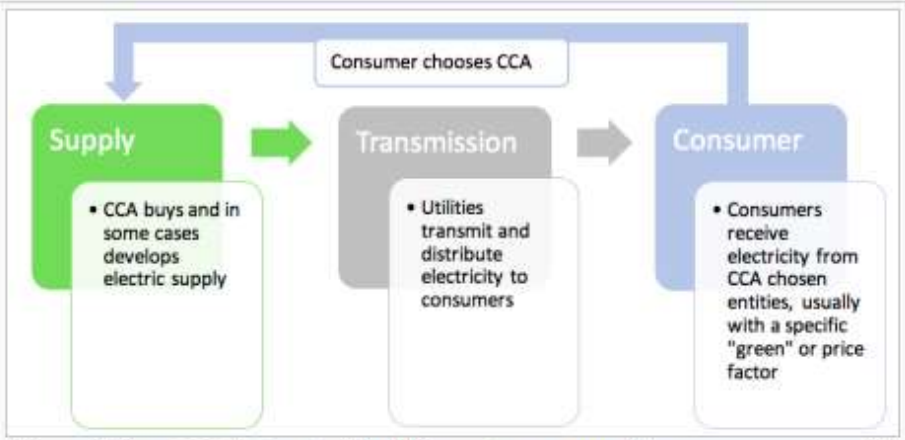


Figure 1: How CCAs interact with utilities and consumers[3]

Butte Creek

PG&E announces it may decide to sell Potter Valley Project

Humans began diverting water from the Eel River in the early 1900s to create more electricity for the Ukiah Valley through the Potter Valley Project. Nathan DeHart - Ukiah Daily Journal


Tule River
Project

Take Away

- Project Operations Will (Or Have) Changed
- Some Projects Will Be Sold
- Some Projects Will be Decommissioned

RMI OUTLET

Plug Into New Ideas

The Grid Needs a Symphony, Not a Shouting Match

We Cannot Afford to Stifle Innovation by Enforcing Outdated Notions of "Baseload" Power

June 12, 2017 | By Mark Dyson, Amory Lovins

RECENT POST

Making Transit Apps Work for All

The Billion-Dollar Costs of Forecasting Electricity Demand

A Tidal Wave of Local Clean Energy in California

The Corporate Renewables Market Is Ready for Smaller Buyers

Choosing to Ditch the Car Commute:

Creating Regulatory Process from Scratch:

Lessons from Money-Losing Power Projects on Butte Creek and Other Northern California Streams

Chris Shutes
California Sportfishing
Protection Alliance
SRF Conference, April 14, 2018

Overview

- How some California hydropower projects became uneconomic
- There's a clear process to relicense hydro projects that allows broad public participation
- There's no set process to transfer or decommission hydro projects and no clear avenues for public participation
- How river advocates can shape process for good outcomes when hydro projects go south

Hydropower Projects Don't Become Liabilities Overnight

- Many CA projects started with mining
- State of the art at commissioning remarkable for engineering but often lacking durability
- Effects of sedimentation often underestimated
- Many projects poorly maintained
- Economics of 50-100 years ago placed little value on in-river benefits like fish (no accounting for external costs)

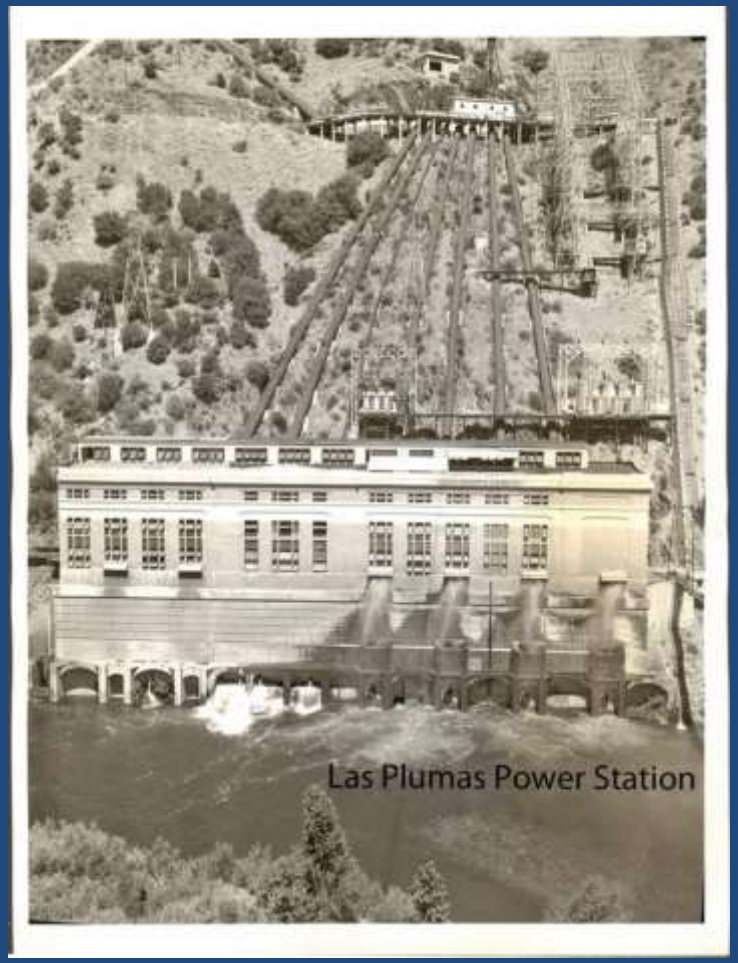
Confluence of Mining Era Canals, DeSabla – Centerville Project

Caribou 1 Powerhouse 2017

In California from 1910-1950, Hydro Was King

- Allowed development of the grid and consolidation by PG&E
- Provided widespread baseload power
- No direct fuel costs
- Major re-plumbing of upper elevation watersheds in CA based on principle of capturing all available water

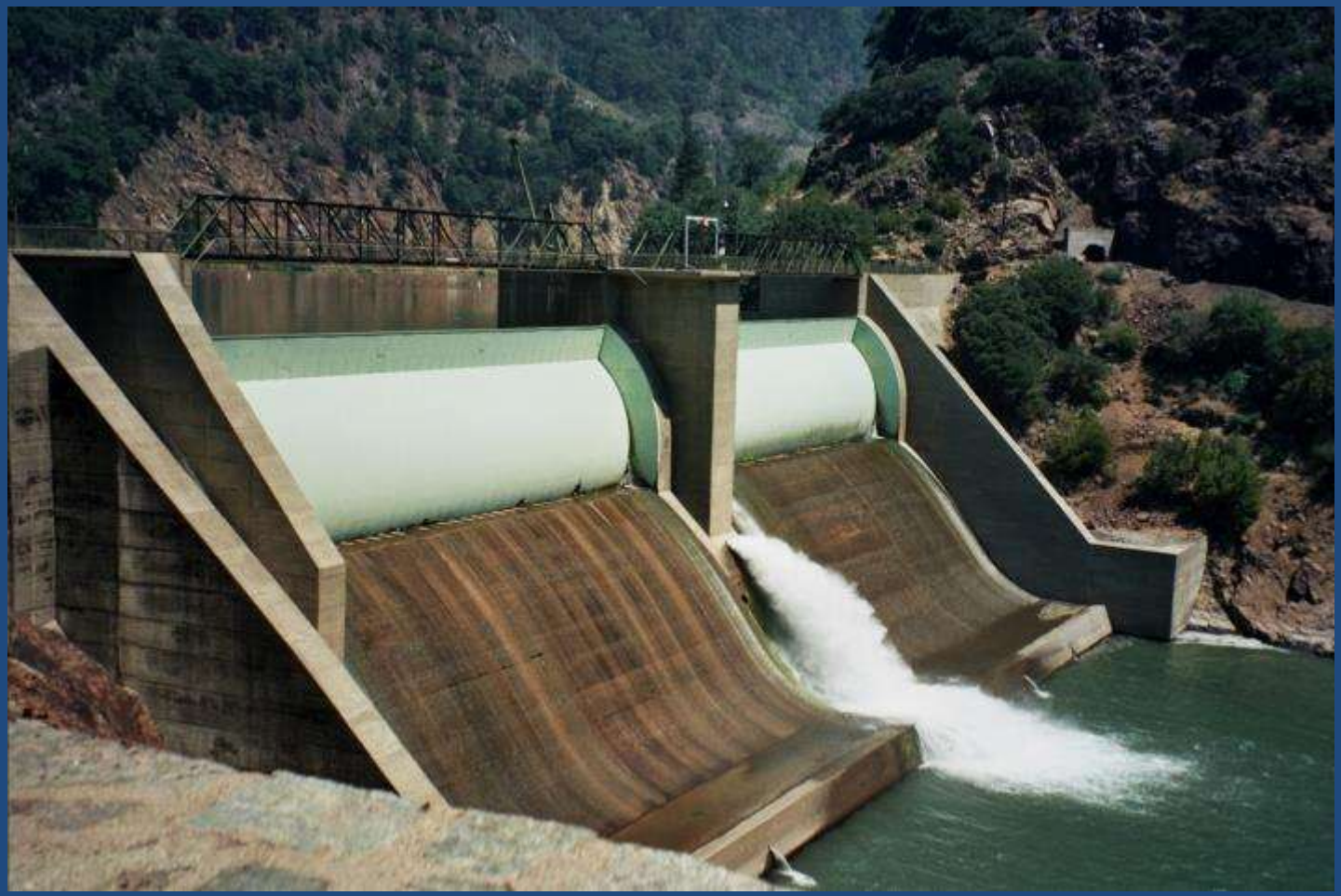
PG&E Picked Up Assets and by 1930 Dominated Power Market in Nor Cal



1950-1970: Golden Age of Dam Construction in CA

- PG&E hydro projects completed or expanded:
  - NF Feather River ("stairway of power")
  - McCloud – Pit
- PG&E financed half of major dams in exchange for control of power and most power revenues
  - New Exchequer (Merced River)
  - New Bullards Bar (North Yuba River)
  - Hell Hole and French Meadows (Middle Fork American River)

Rock Creek Dam
NF Feather River (1950)



New Bullards Bar Dam (1969)

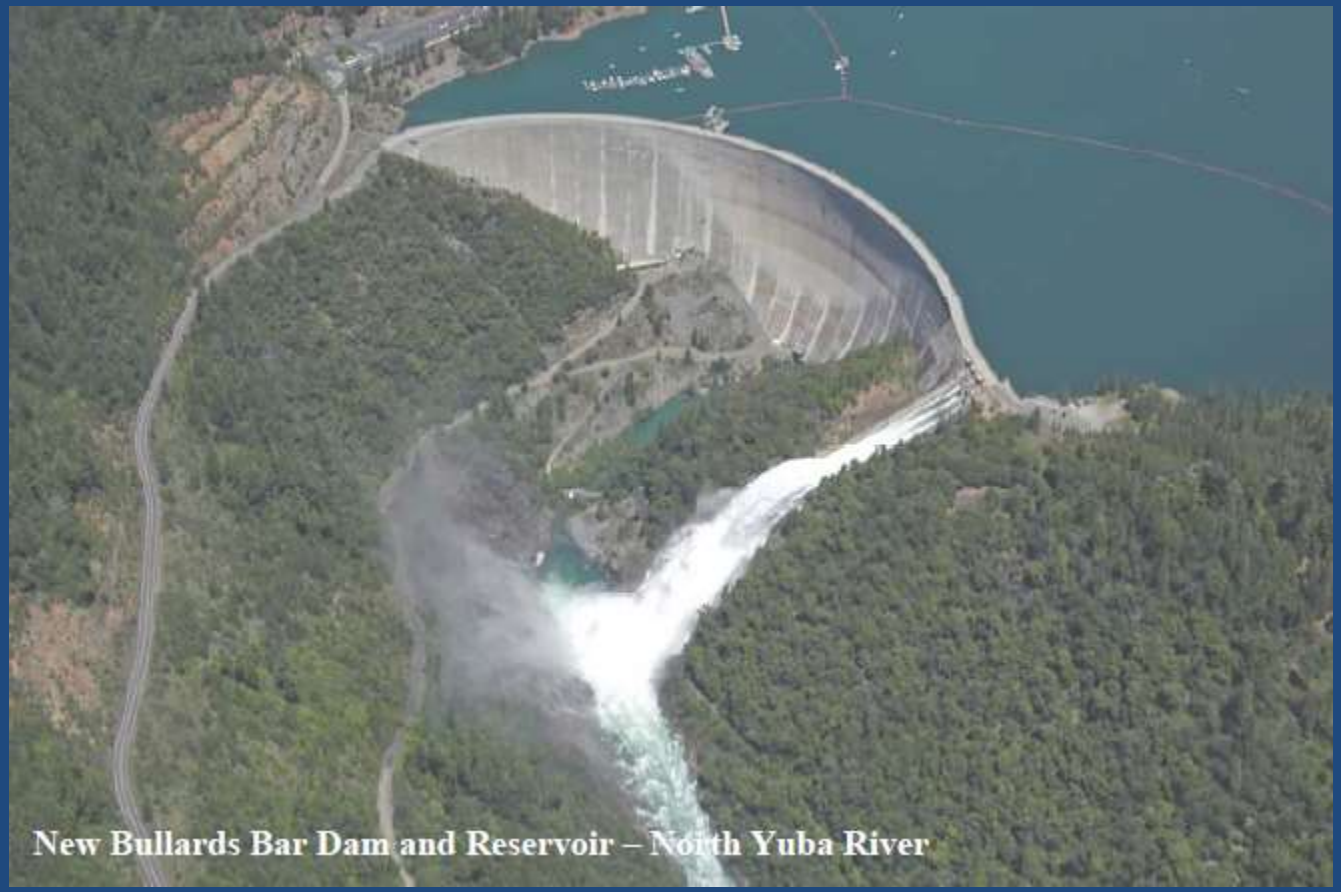


Photo credit: Yuba County Water Agency

1970-2010
Ch-Ch-Changes for Hydro Everywhere

- National Environmental Policy Act (1970) , Clean Water Act (1972), Endangered Species Act (1973)
- Reform of Federal Power Act § 4(e) requires Federal Energy Regulatory Commission to give non-power values equal consideration (1986)
- 1990's – 2000's relicensings and new laws vastly expand public role
- 2003 FERC's Integrated Licensing Process

FERC's Integrated Licensing Process

- Became default relicensing process in 2003
- Seven identified opportunities for public input
- Meeting-intensive process that favors collaborative development of studies and of environmental and recreational improvements
- Defined timelines and deadlines
- 5 year process

But Wait, There's More! Post-Licensing Processes

- Clean Water Act Water Quality Certification from State Water Board, including CEQA
- Biological Opinions for lists species from NMFS and/or U.S. Fish & Wildlife
- There are no set timelines for these processes
- There is often tug-of-war between licensees and agencies over scope, CEQA, costs
- Best case timeline: 4-5 years

1990's-Present
Changes in Hydro Operators' Culture

Old paradigm

- More water diverted from rivers is better for society
- The "DAD" method (Decide, Announce, and Defend)
- All hydropower projects are important parts of an integrated system

New official policy

- Environmental protection is also important
- Collaboration with agencies and sometimes others
- Hydro projects must pencil on stand-alone basis

PG&E Business Model for Relicensing Has Changed – to a Point

- Environmental protection is important, but more water diverted from rivers is still better
- PG&E will collaborate to start, but when it determines it has reached impasse will revert to the DAD method
- Delay is still preferred to difficult decisions, and relicensing is often a forcing mechanism

2017: PG&E Starts Letting Projects Go

- There is still a (variable) bias in favor of existing conditions (the “endowment effect”), BUT as of 2017 PG&E is cutting loose some uneconomic projects.
- Southern California Edison is also casting off some projects (e.g. San Gorgonio)
- THERE IS NO DEFINED PROCESS OR PUBLIC PROCESS FOR LICENSE TRANSFER OR SURRENDER

Different Types of California Hydro: Which Are on the Bubble?

- Higher elevation projects, primarily power
  A. Peaking and ancillary services
  B. Run of river only
- Higher elevation projects, water and power
  A. Peaking and ancillary services
  B. Run of river only
- Rim dam projects, primarily water supply
  A. Peaking, ancillary services
  B. Incidental generation during irrigation deliveries

Higher Elevation Water and Power Projects

- Old upper elevation hydro projects often came with consumptive water rights
- PG&E largely carried water supply as a minimally reimbursed cost
- Examples: El Dorado Project (Placerville), Drum-Spaulding Project (Auburn), Potter Valley Project (Potter Valley ID), DeSabla (Butte Creek water right holders to West Branch Feather River water)

DeSabla – Centerville and Potter Valley: Water Delivered Free or Very Low Cost

- PG&E moves water from West Branch Feather to Butte Creek
- Butte Creek diverters don't pay PG&E
- Potter Valley Irrigation District pays PG&E for maximum 50 cfs, up to 19,000 acre-feet per year (afy) on contract at a very modest rate
- Water not delivered to PVID is considered abandoned and is up for grabs at no cost in lower Russian River

Potter Valley Powerhouse

Water passes through here

Water is “abandoned” here

El Dorado contrast

- El Dorado Project has 15,080 afy of associated consumptive water rights
- PG&E transferred El Dorado Project to El Dorado Irrigation District (EID) in 1999, giving EID $15 Million to repair of the flood damage to the El Dorado Canal and Powerhouse
- EID has spent more than $40 Million on project works since purchasing project
- EID received value by gaining control of water rights and infrastructure

Why El Dorado was different than DeSabla and Potter Valley

- El Dorado water supply beneficiary was willing to pay for operations to deliver water
- El Dorado water supply beneficiary was capable of operating hydro project facilities
- No DeSabla – Centerville Project or Potter Valley Project water supply beneficiaries have stepped up to assume operation and associated risks of project facilities

Run of river projects without ancillary services not economic

Butte Creek at Pool 4, August 2005 PG&E Photo

Uneconomic project example
DeSabla – Centerville

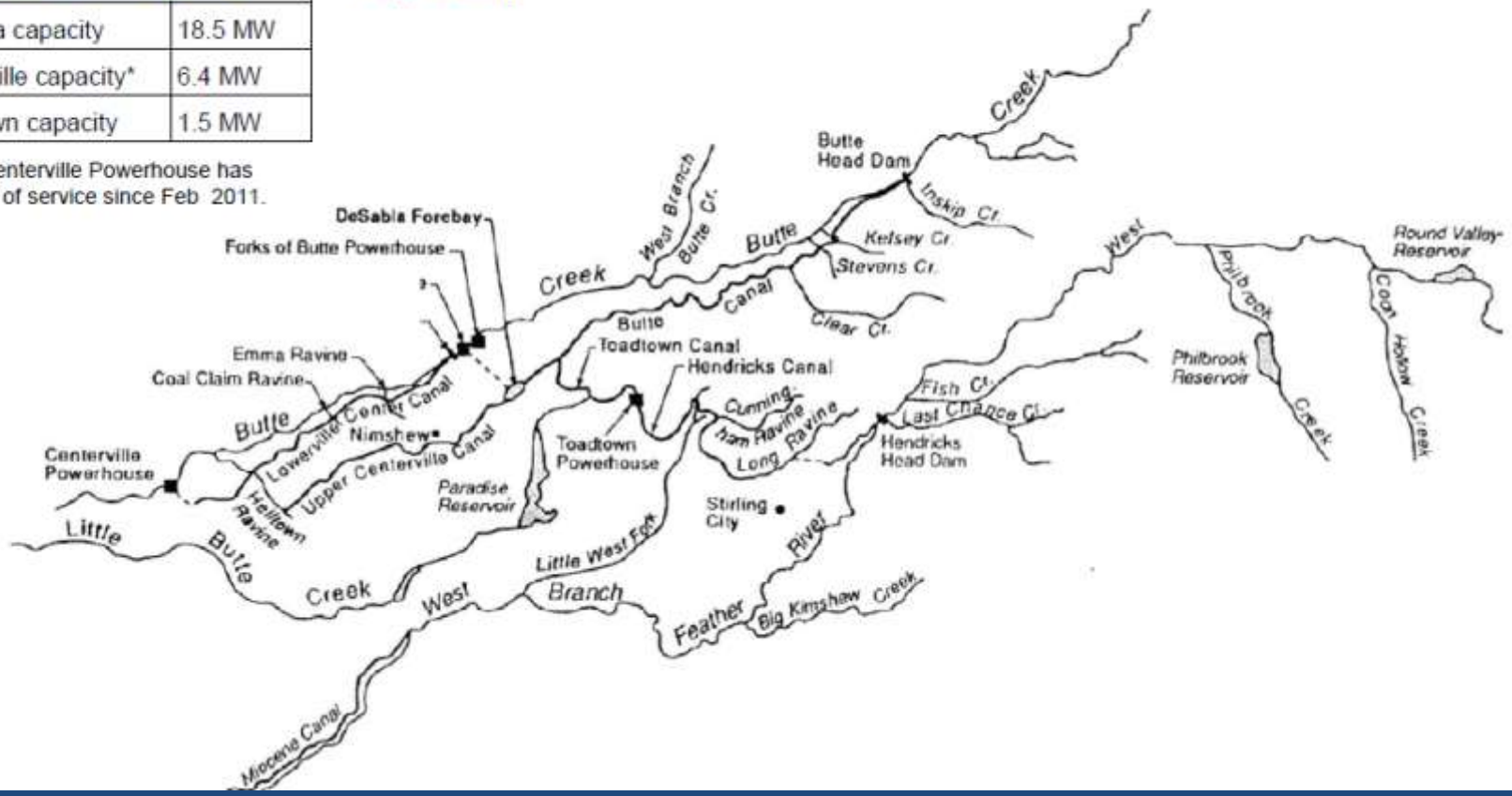
- Project imports West Branch Feather water to Butte Creek, cools Butte Creek in summer, benefits spring-run salmon
- No paying water supply beneficiary
- High maintenance; deferred PH rebuild
- Power values for run-of-river generation down about 50% from 2006
- Added mitigation costs from relicensing
- PG&E withdrew license application Feb 16, 2017

DeSabla – Centerville Project Map

Powerhouse Facts	
DeSabla capacity	18.5 MW
Centerville capacity*	6.4 MW
Toadtown capacity	1.5 MW

*Note: Centerville Powerhouse has been out of service since Feb 2011.

Project Map



FERC response to PG&E withdrawal of license application for DeSabla Project

- March 3, 2017:

  "PG&E's motion to withdraw its application is disallowed, in order to give notice to the public of the opportunity to express interest in acquiring the project."

PG&E Process Proposal 5/9/17 Accepted by FERC 6/16/17

1. Compile data, prepare documents (2-3 mos.)
2. Issue request for offers to purchase (3-4 mos.)
3. Evaluate offers, select “counterparty” (1-2 mos.)
4. Negotiate Asset Sale and License Transfer (6-18 mos.)
5. Seek and obtain regulatory approvals (6-18 mos.)

All Current Important Process for DeSabla Is Behind Closed Doors

- Private negotiations between PG&E and prospective new operators
- Non-disclosure agreements for negotiators
- Several offers received; no details released
- Vague “progress reports” from PG&E
- Limited contact between NGO’s and PG&E
- Limited contact between agencies and PG&E

Future Process Unclear

- Will FERC require any new project operator to start a licensing process from scratch?
- Would the cost of relicensing make project acquisition uneconomic?
- Will prospective operators seek concessions from agencies or regulators to reduce costs?
- How will agencies or regulators evaluate any potential concessions, and in what process?

Centerville Schoolhouse Workgroup

- Began from site visit of MWD biologists to Butte Creek, hosted by Friends of Butte Creek
- Fish agencies, Forest Service, State Board staff, NGO's, MWD, local residents, one group of potential buyers
- Different perceptions of potential benefits
- Recognized value of coordinated effort
- Hold monthly meetings or calls

Workgroup entities focused on fisheries defined two key interests:

1. Maintain or increase availability and reliability of water export from West Branch Feather River to Butte Creek.
2. Maintain or reduce water temperatures in Butte Creek compared to the FERC license and water quality certification conditions that were pending when PG&E withdrew.

Workgroup Gained Perspective on Interests of Potential Operators

Provide reasonable return on investment by:

1. Improving power revenues.
2. Developing revenue from other beneficiaries.
3. Exploring public funding for env. benefits.
4. Reducing costs and liabilities of acquisition
5. Reducing uncertainty regarding costs
6. Developing transfer process w/o starting over on relicensing.

Will workgroup cooperation succeed?

Positives

- Key stakeholders working together
- Collective knowledge of project and resources
- Multiple relationships in community
- Extensive negotiation experience

Difficulties

- No affirmative response from PG&E
- No buyer acceptable to PG&E
- No contact with prospective buyers
- Reluctance to modify previous decisions

FERC Unclear on Process for License Transfer

- PG&E seeks to sell Narrows 1 Project on lower Yuba River to Yuba County Water Agency
- YCWA asked FERC to include Narrows 1 in ongoing relicensing of Yuba River Development Project
- FERC delayed relicensing Narrows 1 but denied request to merge licensing processes
- To be seen if YCWA will acquire and relicense

Will FERC and PG&E Let NGO's Help Shape Transfer or Surrender Process?

- Neither FERC nor PG&E are particularly creative or flexible
- Agencies often freeze in face of hard choices
- PG&E and National Hydropower Association efforts to weaken agencies in legislation creates a lousy environment for cooperation
- Entities pursuing their interests to the exclusion of others often create bad outcomes
- NGO's and agencies may need to be hard-assed somewhere to shake things up, like insisting on removal of all abandoned infrastructure

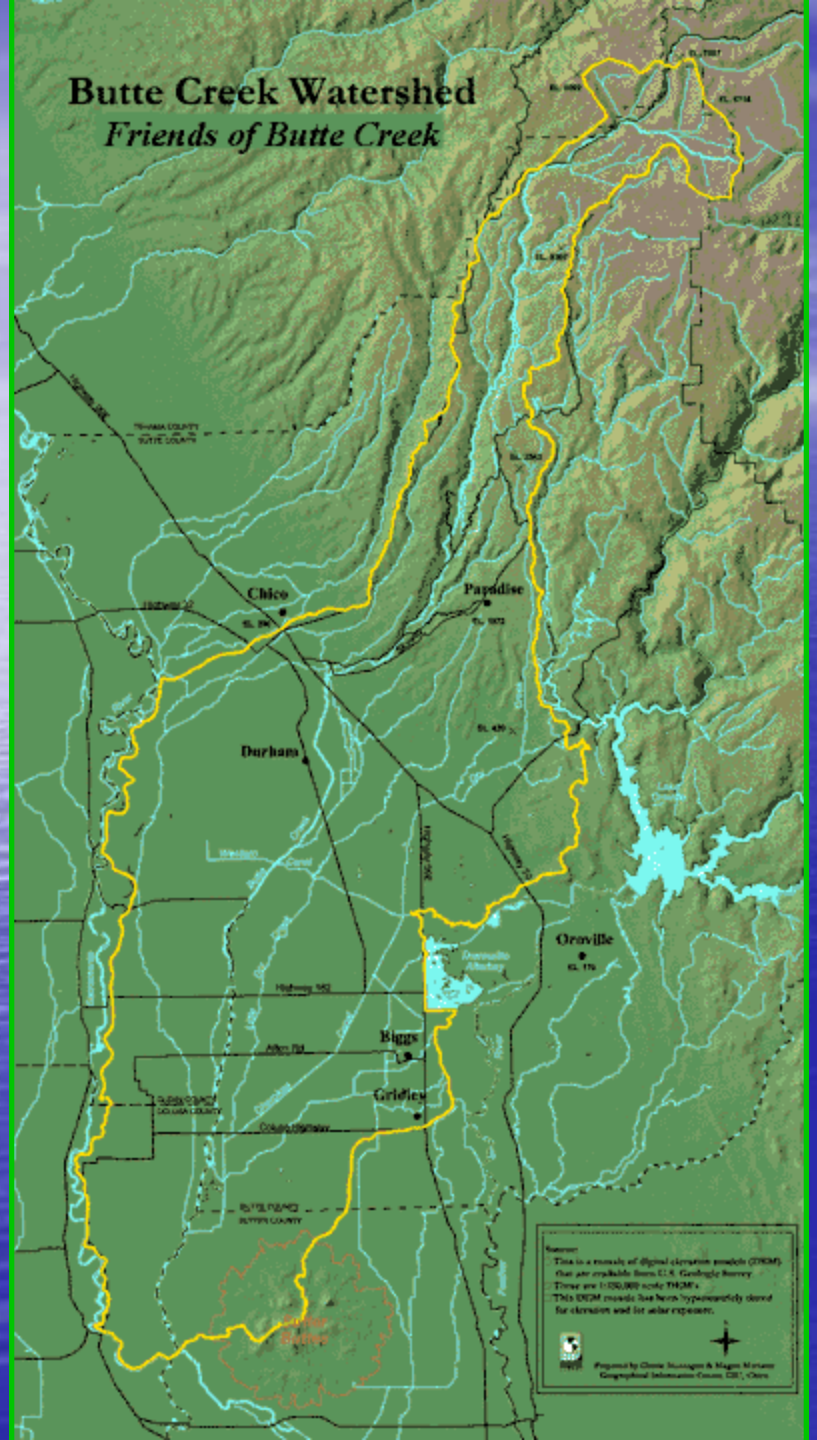
Thank you!


CALIFORNIA SPORTFISHING PROTECTION ALLIANCE
CSPA
* Since 1983 *

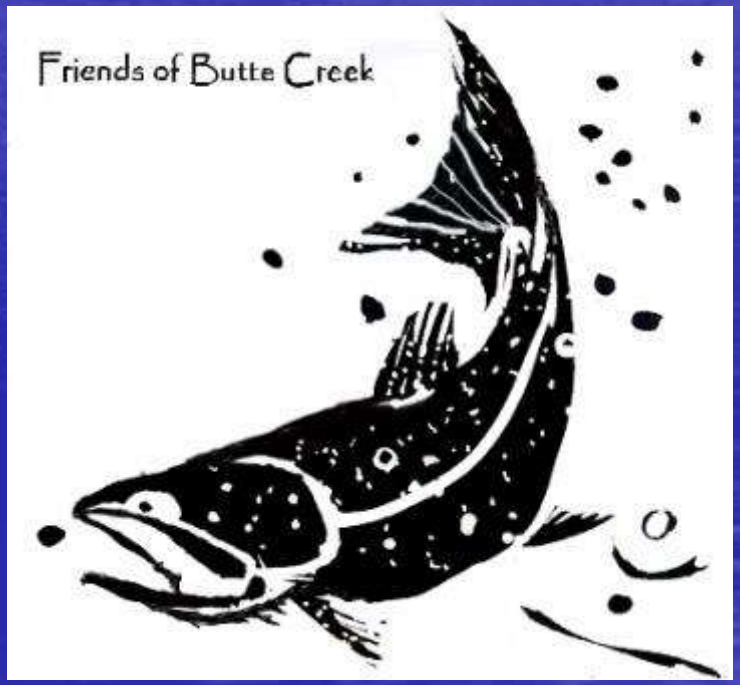
Butte Creek DeSabla-Centerville Hydro Project - Decommission or Retool? Salmon Want to Know

Allen Harthorn
Friends of Butte Creek

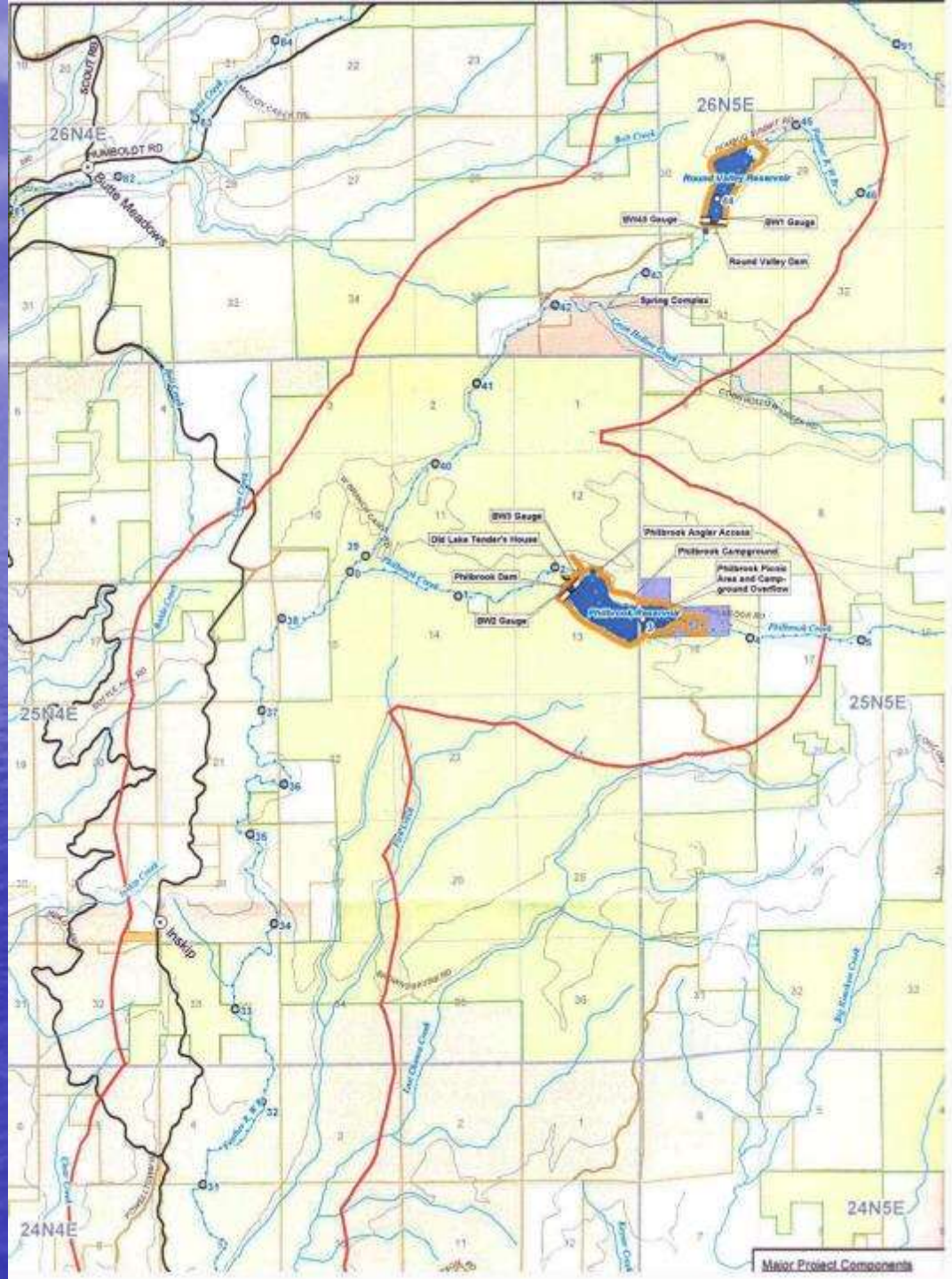
Salmonid Restoration Federation
April 13-14, 2018 Fortuna CA



Butte Creek Watershed



Upper West Branch
Feather River



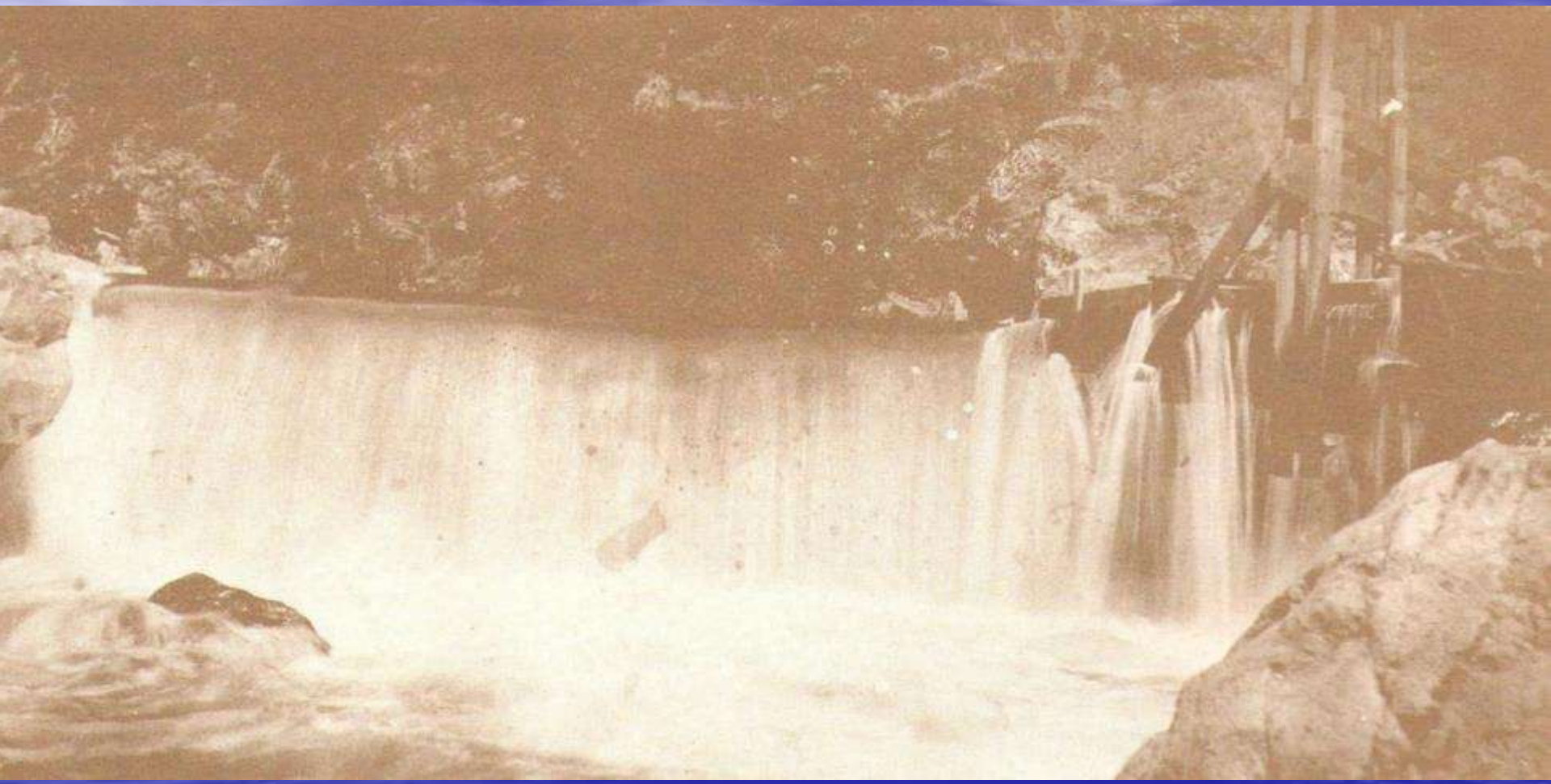
Sutter Bypass Butte Creek

Restoration projects

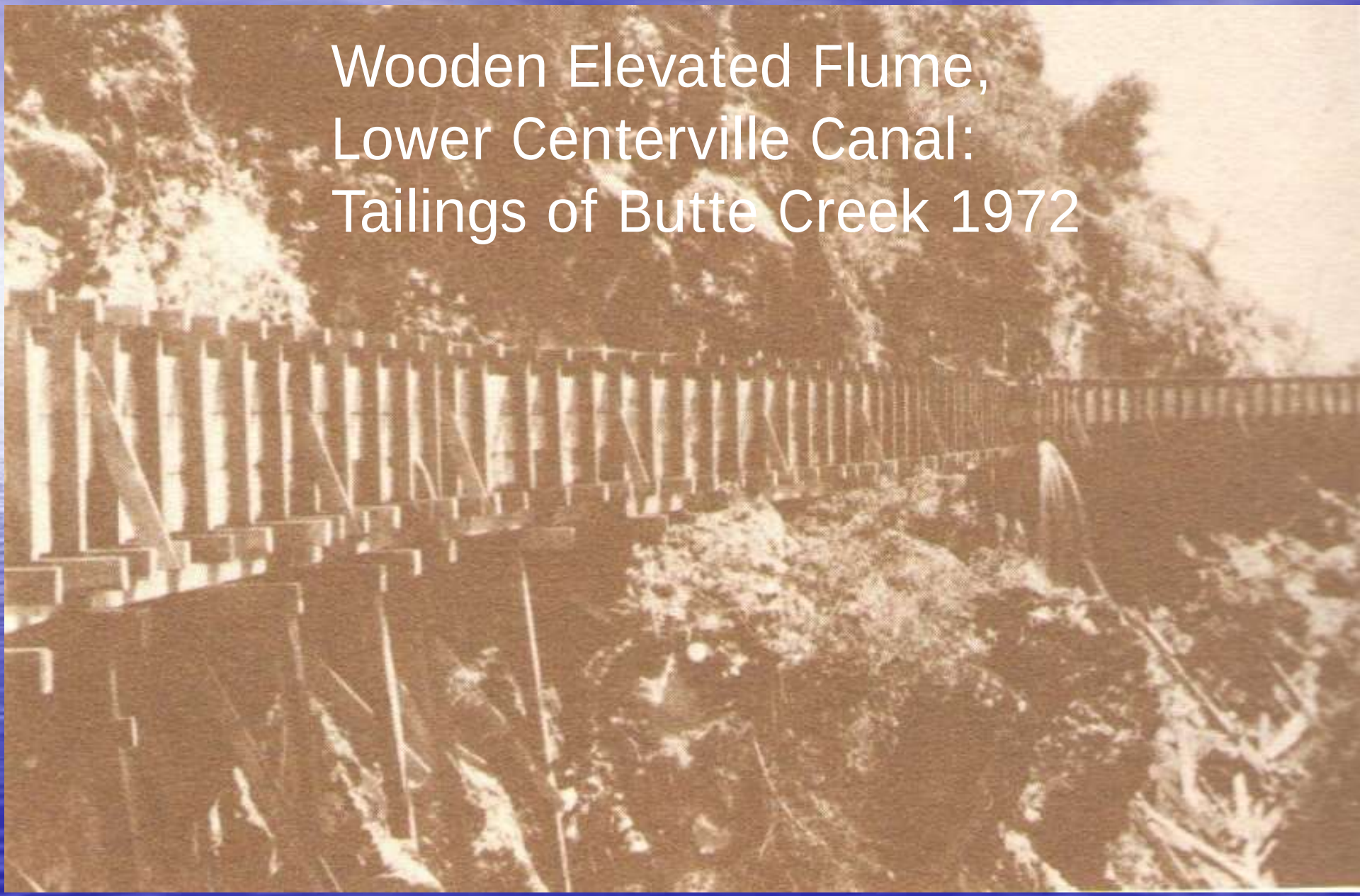
- 1992-increase flows above Centerville PH (PG&E)
- 1993-remove McFerrin and McGowan and Point Four dams
- 1995-new screen and ladder on Parrott/Phelan
- 1997-remove 4 dams, eliminate 12 unscreened diversions, open up 25 miles of unimpeded flow
- 1998-2000-new ladders and screens on Adams, Gorrill and Durham Mutual dams
- 1999 –Sanborn Slough, Drumheller Slough dams
- 2002-Sutter Bypass East/West, and SB Weir #3 and #5
- 2003-Butte Sink Weir upgrades, drain exclusions
- 2005-date Sutter Bypass East and West upgrades; Willow Slough ladder, Weir #2 ladder and others

DeSabla-Centerville Hydro Timeline

1906 Centerville PH operational
1926 DeSabla PH operational-New Philbrook Dam built
1930's Butte Head Dam Rebuilt
1968 California State Water Project begins pumping
1980 FERC issues 30 year License to Operate-Flows increased in Butte Creek
1988 Severe summer pre-span mortality above Centerville PH
1992 PG&E applies to upgrade Centerville PH-CDFG/USFWS demand flow study-Flows increased above CPH
1995 7500 Spring Run return from parent population of 750 fish
1998 All time record, 20,000+ salmon return to Butte Creek
2002-2003 Severe pre-spawn mortality; 7000 and 11,000 deaths
2004 ILP FERC Relicensing Process begins
2007 PG&E submits License Application
2009 ILP Process end
2015 SWRCB 401 Water Quality Certification
2017 PG&E Withdraws License Application-FERC denies withdrawl, orders sale or decommissioning.
2018 PG&E Interviewing prospective buyers

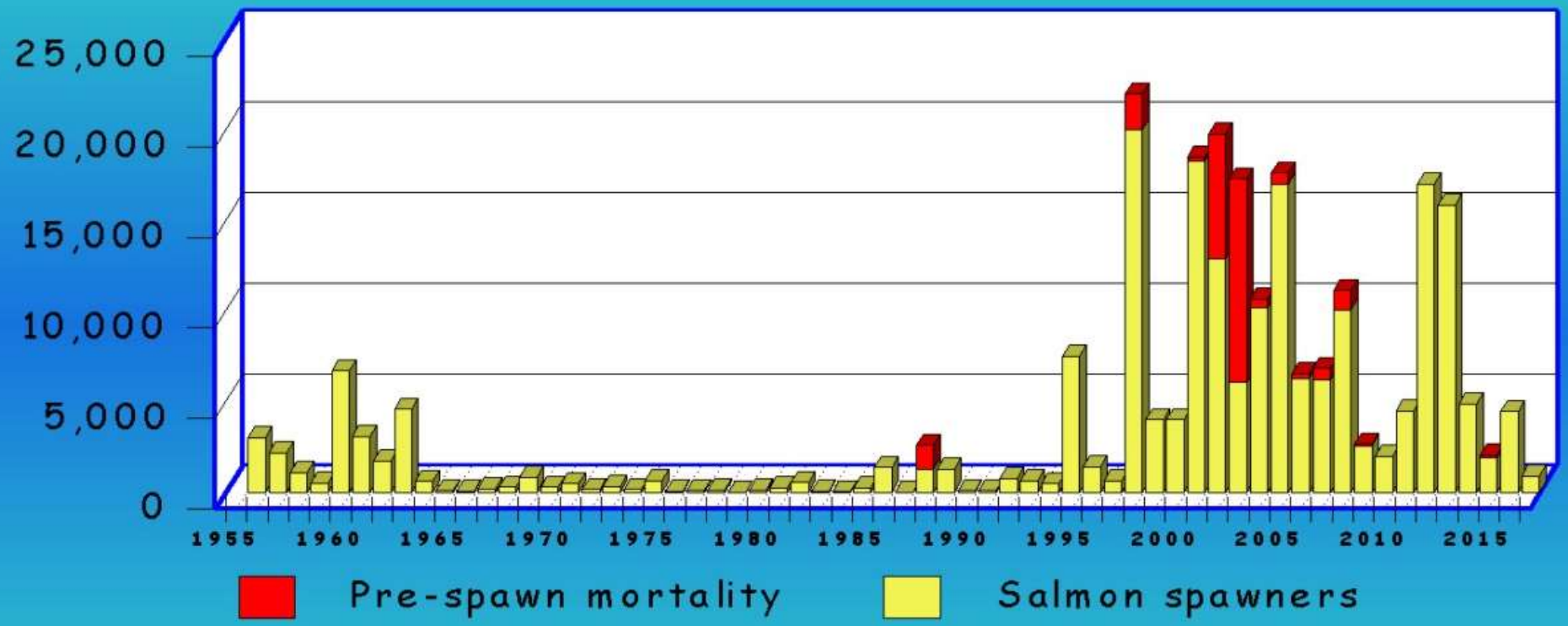


Centerville Head Dam, Early 1900's: Tailings of Butte Creek, 1972



Wooden Elevated Flume,
Lower Centerville Canal:
Tailings of Butte Creek 1972

Butte Creek Spring Run Salmon Population

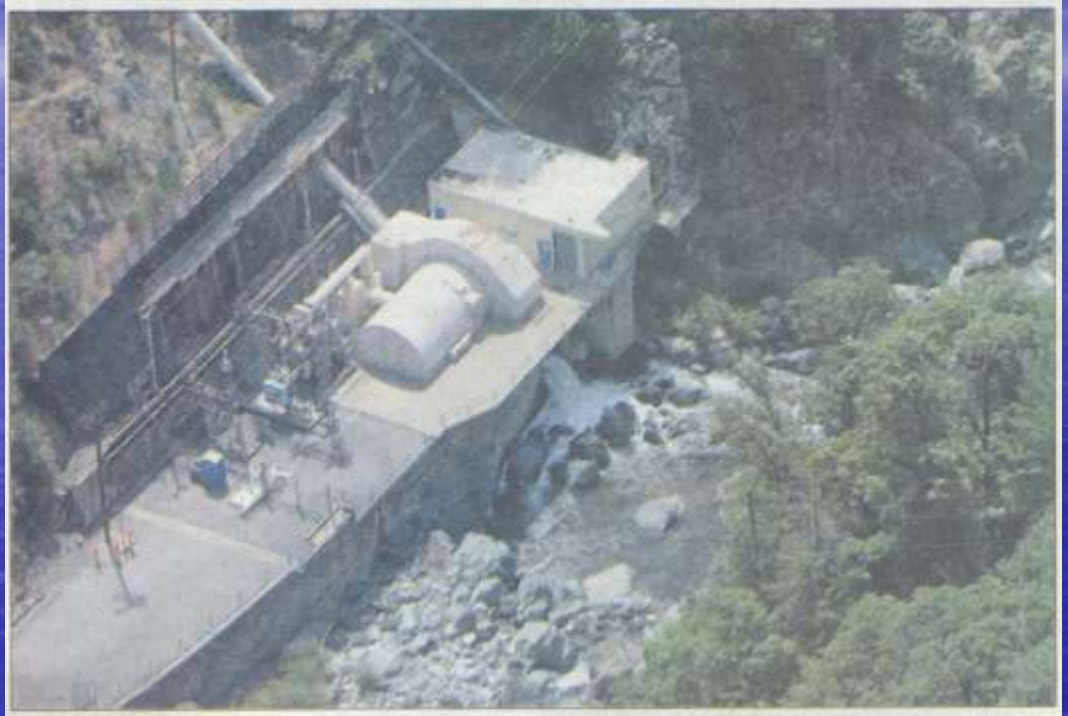


Chico ER 2/3/17

Friday, February 3, 2017

POWER AND ENVIRONMENT

PG&E TO WITHDRAW LICENSE APPLICATION



DAN REIDEL — ENTERPRISE-RECORD FILE PHOTO

Water flows into Butte Creek from PG&E's De Sabla Powerhouse in this aerial photo from July 2015. The utility isn't planning to renew its federal power generation license for the project.

Changes to FERC license agreement could affect salmon in Butte Creek

By Dan Reidel
dreidel@chicoer.com
@danthephotog on Twitter

DESABLA » Operating the hydroelectric plants on Butte Creek just isn't worth it to PG&E anymore, and that's a potential threat to a rare strain of salmon.

population of threatened spring-run chinook salmon in Butte Creek will die.

Round Valley to Centerville

The license with FERC includes a project that runs from Round Valley Reser-

Upper Butte Creek (Existing Conditions)


DeSabla Powerhouse


Forks of Butte Head Dam


Butte Creek Head Dam


Forks of Butte Powerhouse


Centerville Head Dam


Butte Creek Canal

LEGEND

- Dam
- Powerhouse
- Tunnel
- Canal
- Stream
- 1 Tributary Diversion

Butte Creek

Butte Creek Head Dam
2,912'

Forks of Butte Head Dam
2,000'

Centerville Head Dam
1,150'

Forks of Butte Powerhouse
1,280'

DeSabla Powerhouse
1,220'

Butte Creek Canal

DeSabla Penstock

280 acre-feet

DeSabla Reservoir
2,770'

Lower Centerville Canal

Upper Centerville Canal

Centerville Powerhouse
520'

To Sacramento River

Toadtown Powerhouse
2,847'

Hendricks Canal

Hendricks Head Dam
3,250'

West Branch Feather River

1,200 acre-feet

Round Valley Reservoir
5,647'

Philbrook Reservoir
5,591'

5,000 acre-feet

To Lake Oroville


Centerville Powerhouse


Toadtown Powerhouse


Hendricks Head Dam

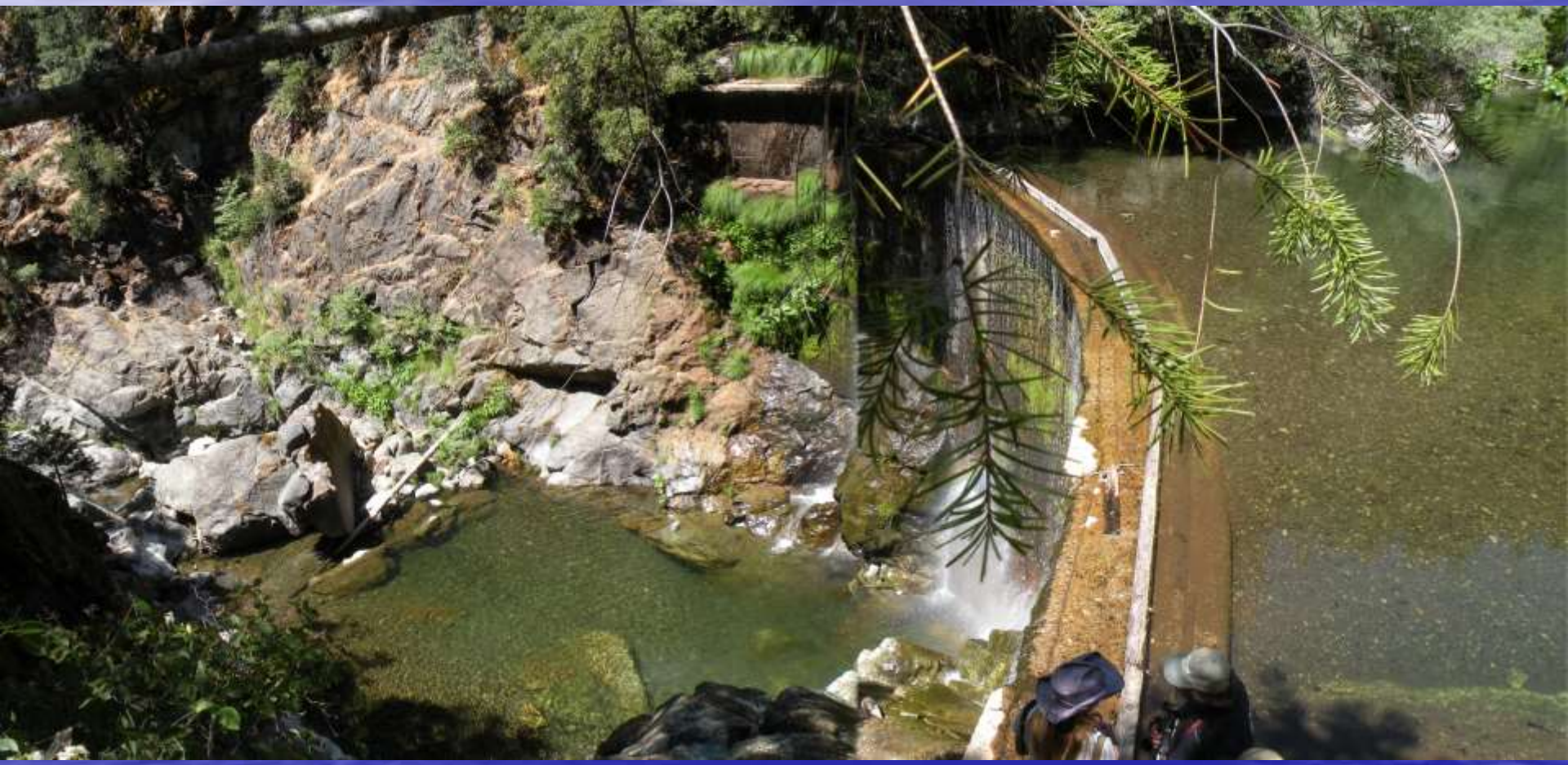

Philbrook Reservoir


Round Valley Reservoir

TRIBUTARIES AND DIVERSION WATER RIGHTS

1. Inskip Creek (20 cfs)
2. Kelsey Creek (2 cfs)
3. Stevens Creek (? cfs)
4. Clear Creek (40 cfs)
5. Long Ravine (5 cfs)
6. Cunningham Ravine (5 cfs)
7. Little West Fork (5 cfs)
8. Little Butte Creek (10 cfs)
9. Oro Fino Ravine (? cfs)
10. Emma Ravine (? cfs)
11. Coal Claim Ravine (? cfs)
12. Helltown Ravine (? cfs)

Maps courtesy of Metropolitan Water District



Butte Head Dam 2912 feet elevation


Butte Canal Elevated Sections

Centerville Head Dam 1150 feet elevation

Centerville Powerhouse 520 feet elevation

Centerville PH Update 2018

Powerhouse originally started in 1906

- Main Turbine offline since 2009
- Repairs completed 2011
- Start-up attempted Feb. 2011
- Penstock pressure fluctuations indicate failing integrity
- Both units taken offline
- Flow maintained in canal through 2013
- No diversions since 2014

Round Valley Reservoir

Philbrook Reservoir

Hendricks Head Dam And Canal

PG&E License Application 2007

Figure A7.1-1. Round Valley Reservoir.

Figure A7.1-2. Round Valley Reservoir.

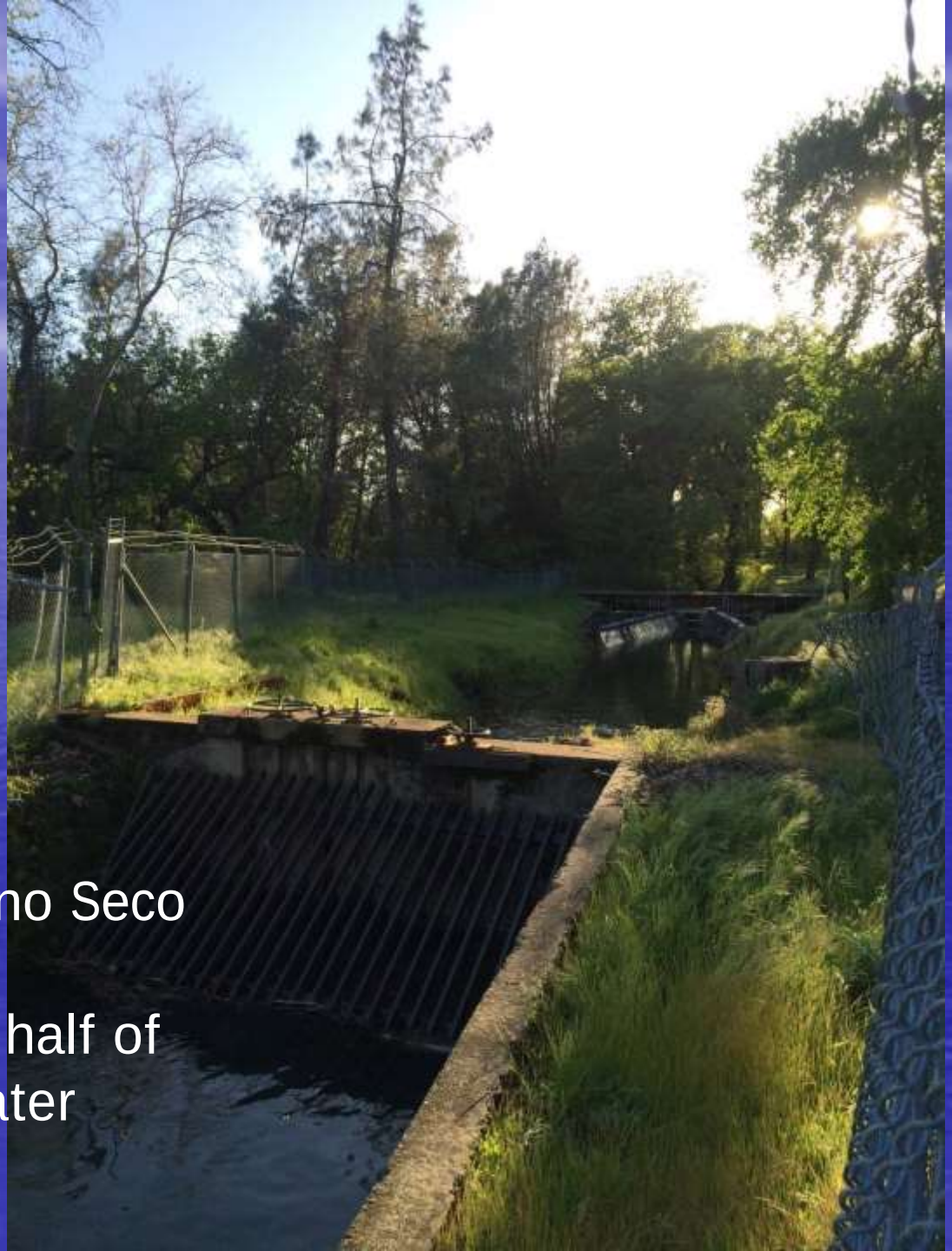
Figure A7.1-3. Philbrook Reservoir with Dock.

Figure A7.1-4. Philbrook Reservoir.

Figure A7.1-5. Hendricks Diversion Dam.

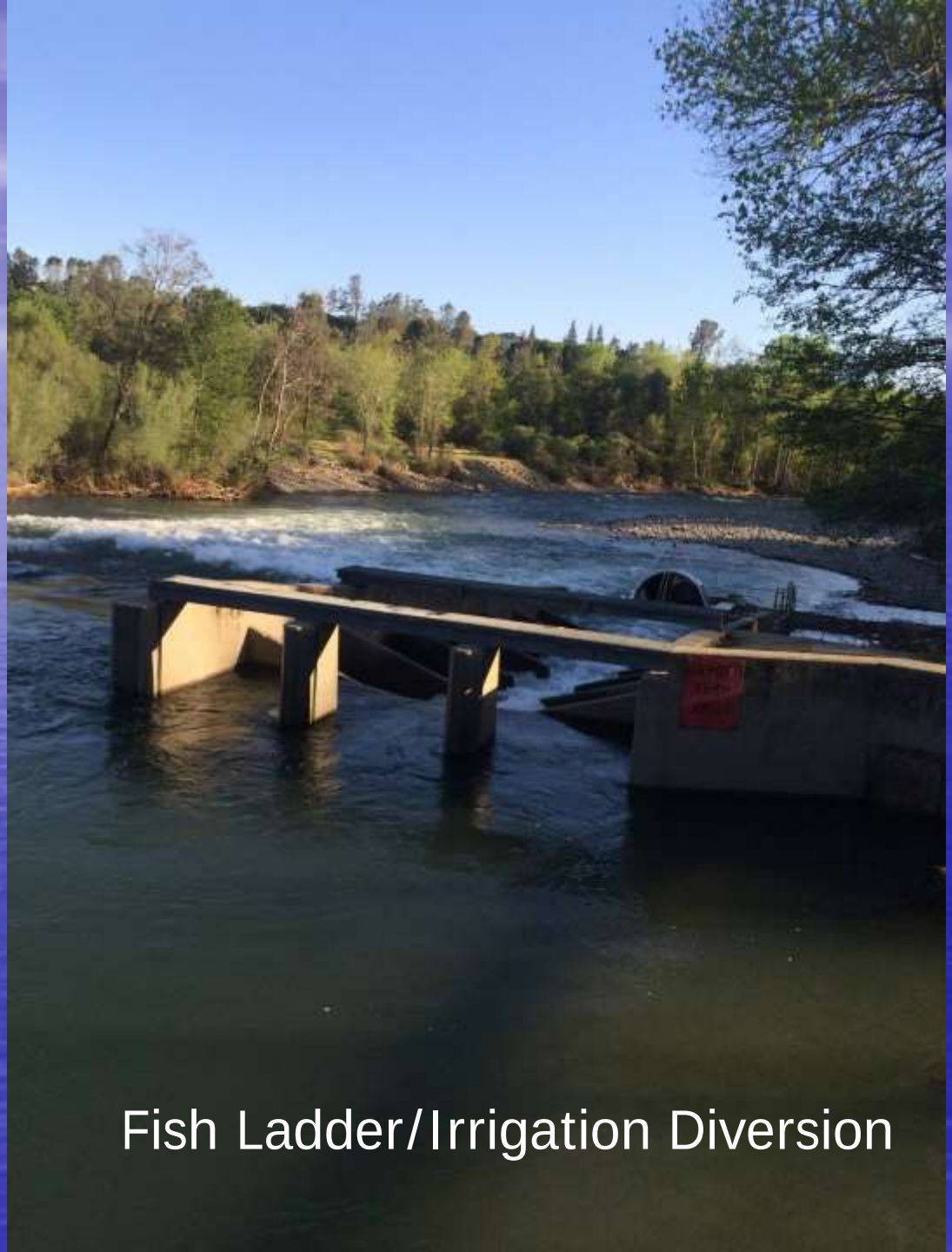
Figure A7.1-6. Hendricks Canal.

Hendricks Head Dam-West Branch Feather River



Parrott/Phelan
Diversion
M&T Ranch, Llano Seco

Water Rights to half of
the imported water



Fish Ladder/Irrigation Diversion

Decommission, Retool or Repurpose

Centerville System is no longer viable:

Decommission Centerville Head Dam
Repurpose Powerhouse
Repurpose Flume System and protect from failure

Butte Canal

Provides 1/3 water(power) yet 2/3 maintenance cost
System prone to failure
Drastically reduced stream flows in viable upper Butte Creek habitat
Butte Head Dam is old, sediment filled and no fish passage

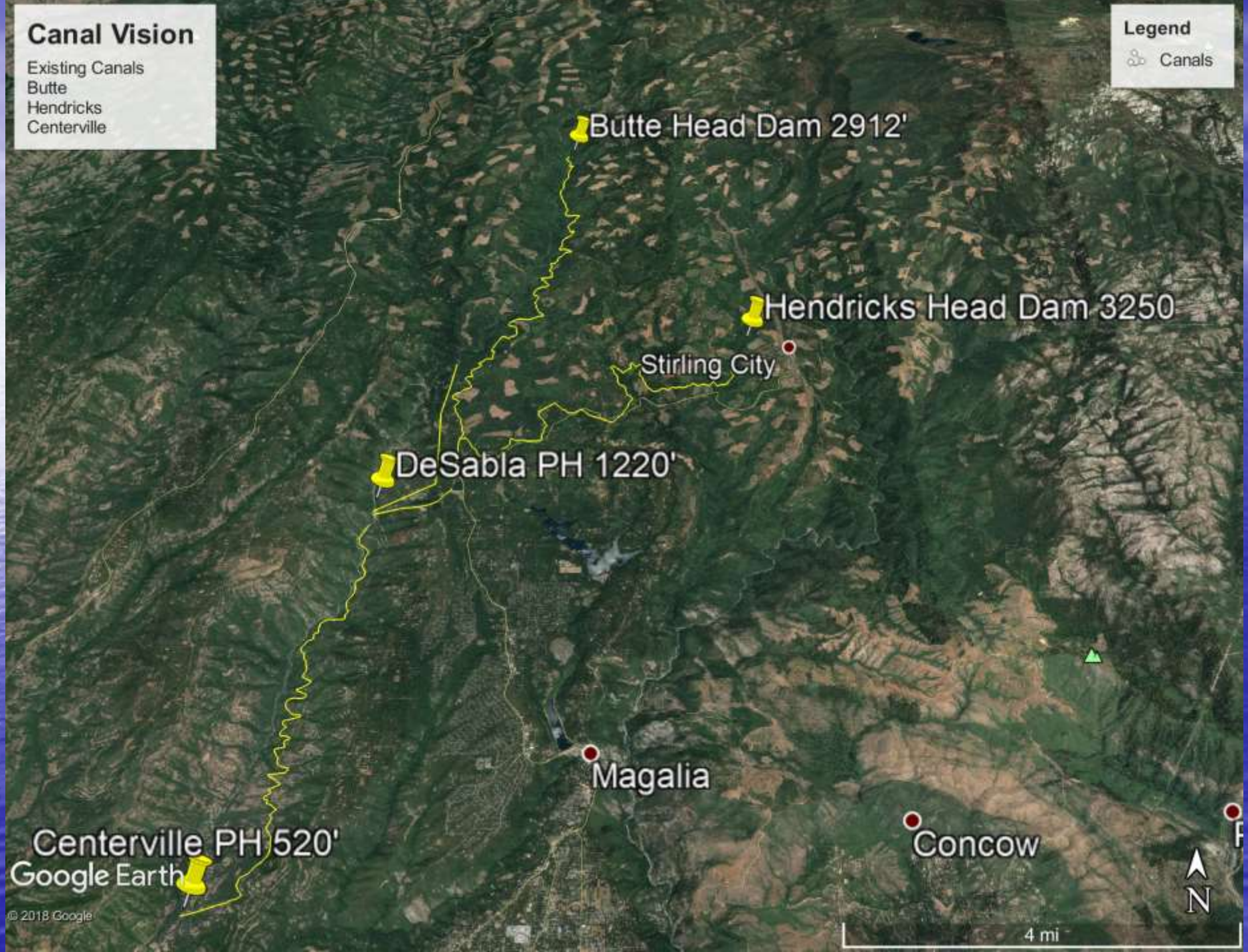
Hendricks Canal

2/3 water, 1/3 maintenance costs
Prone to failure, flow limited by failure potential
Leakage
Temperature increase

DeSabla Reservoir

Serious temperature increase – Decommission, retool or repurpose

Round Valley Reservoir - Restore to wet meadow


Canal Vision
Existing Canals
Butte
Hendricks
Centerville
Legend
Canals
Butte Head Dam 2912'
Hendricks Head Dam 3250
Stirling City
DeSabla PH 1220'
Magalia
Concow
Centerville PH 520'
Google Earth
© 2018 Google
N
4 mi

Upper Butte Creek (Proposed Future Conditions)


DeSabla Powerhouse


Forks of Butte Head Dam


Butte Creek Head Dam


Centerville Head Dam


Forks of Butte Powerhouse


Butte Creek Canal


Centerville Powerhouse


Toadtown Powerhouse


Hendricks Head Dam


Philbrook Reservoir


Round Valley Reservoir

Butte Creek
Butte Creek Head Dam
2,912'
Forks of Butte Head Dam
2,000'
Centerville Head Dam
1,150'
Forks of Butte Powerhouse
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1,220'
Butte Creek Canal
Lower Centerville Canal
DeSabla Penstock
280 acre-feet
DeSabla Reservoir
2,770'
Upper Centerville Canal
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520'
To Sacramento River
Toadtown Powerhouse
2,847'
Hendricks Canal
Hendricks Head Dam
3,250'
West Branch Feather River
1,200 acre-feet
Round Valley Reservoir
5,647'
Philbrook Reservoir
5,591'
5,000 acre-feet
To Lake Oroville

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4. Clear Creek (40 cfs)
5. Long Ravine (5 cfs)
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8. Little Butte Creek (10 cfs)
9. Oro Fino Ravine (? cfs)
10. Emma Ravine (? cfs)
11. Coal Claim Ravine (? cfs)
12. Helltown Ravine (? cfs)

Upper Butte Creek (Future Restored Conditions)


DeSabla Powerhouse


Forks of Butte Head Dam


Forks of Butte Powerhouse

LEGEND

- Dam
- Powerhouse
- Tunnel
- Canal
- Stream
- Improved Screens and Ladders
- New Tunnel/Pipeline

Butte Creek

Forks of Butte Head Dam
2,000'

Forks of Butte Powerhouse
1,280'

DeSabla Powerhouse
1,220'

280 acre-feet
DeSabla Reservoir
2,770'

Toadtown Powerhouse
2,847'

Hendricks Head Dam
3,250'

West Branch Feather River

1,200 acre-feet
Round Valley Reservoir
5,647'

Philbrook Reservoir
5,591'

5,000 acre-feet

To Sacramento River

To Lake Oroville

TRIBUTARIES

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2. Kelsey Creek
3. Stevens Creek
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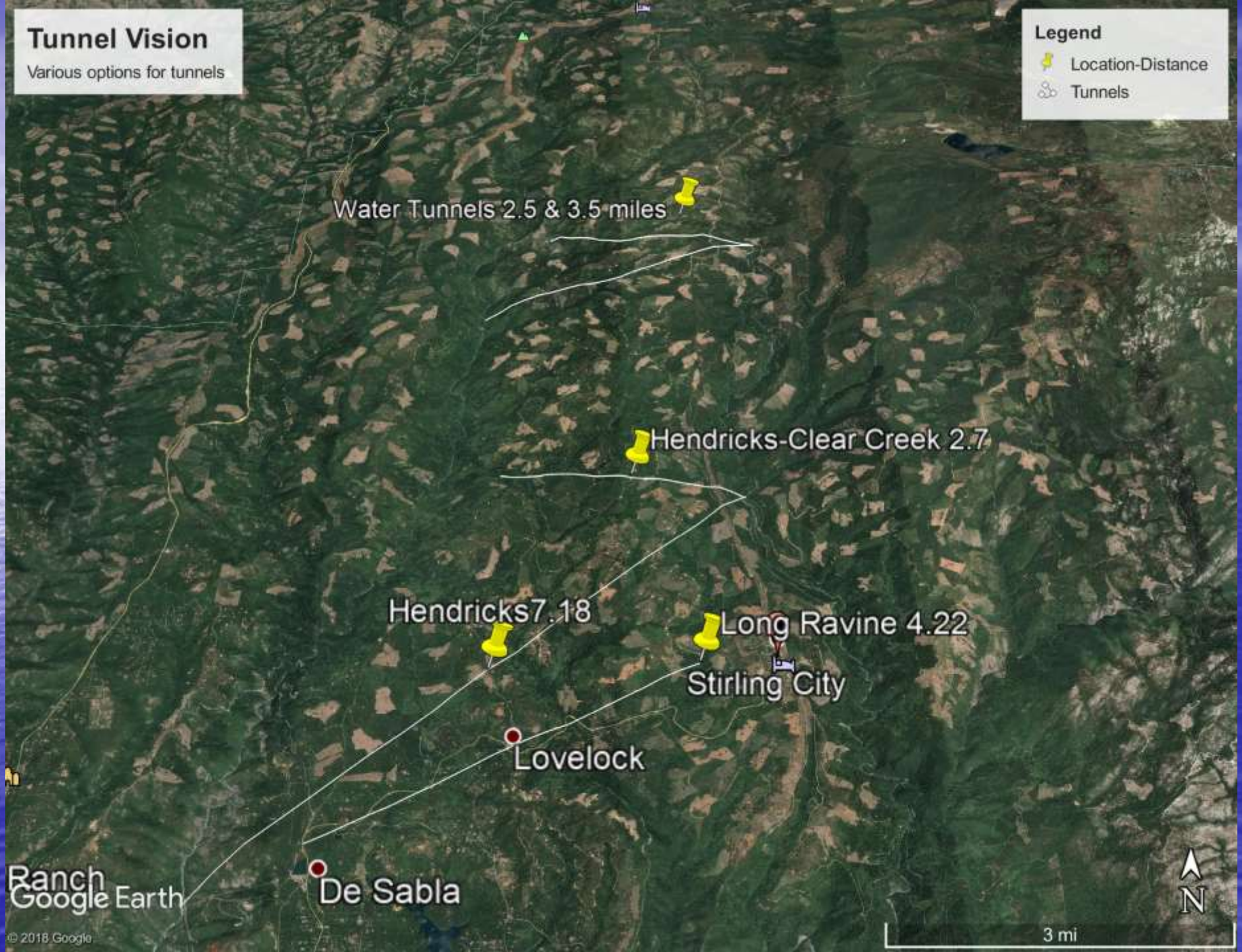
7. Little West Fork
8. Little Butte Creek
9. Oro Fino Ravine
10. Emma Ravine
11. Coal Claim Ravine
12. Helltown Ravine


Toadtown Powerhouse


Hendricks Head Dam


Philbrook Reservoir


Round Valley Reservoir


Tunnel Vision
Various options for tunnels
Legend
Location-Distance
Tunnels
Water Tunnels 2.5 & 3.5 miles
Hendricks-Clear Creek 2.7
Hendricks7.18
Long Ravine 4.22
Stirling City
Lovelock
De Sabla
Ranch
Google Earth
© 2018 Google
N
3 mi

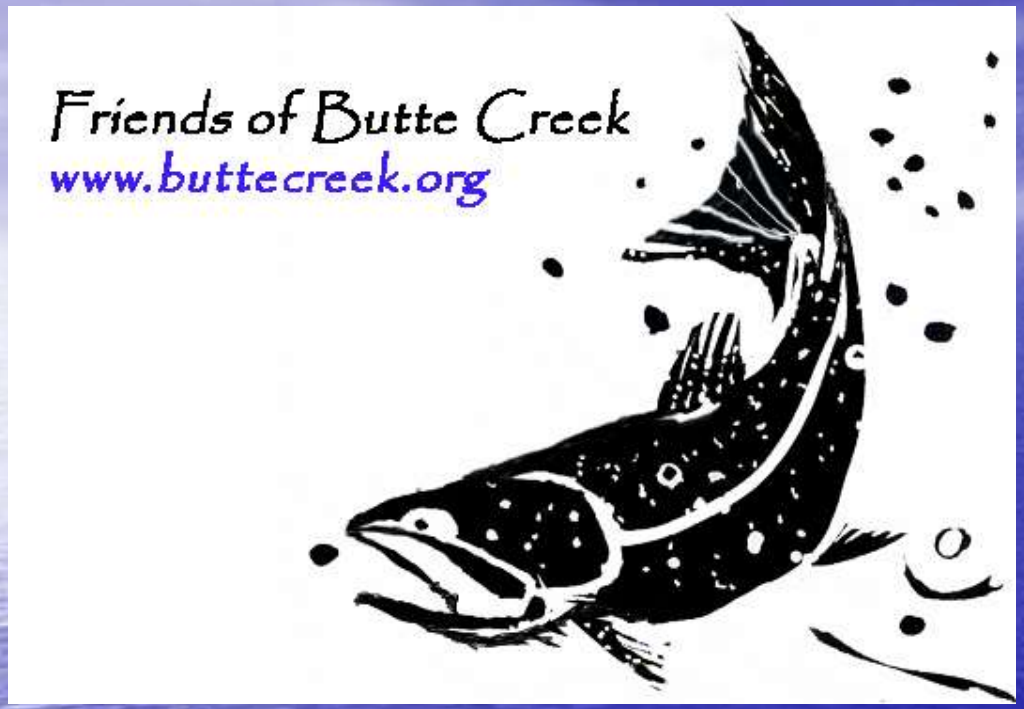
Salmon Pool July 12, 2003

Salmon Pool August 12, 2003

Butte Creek Quartz Bowl

Mostly promise….

but problems will persist

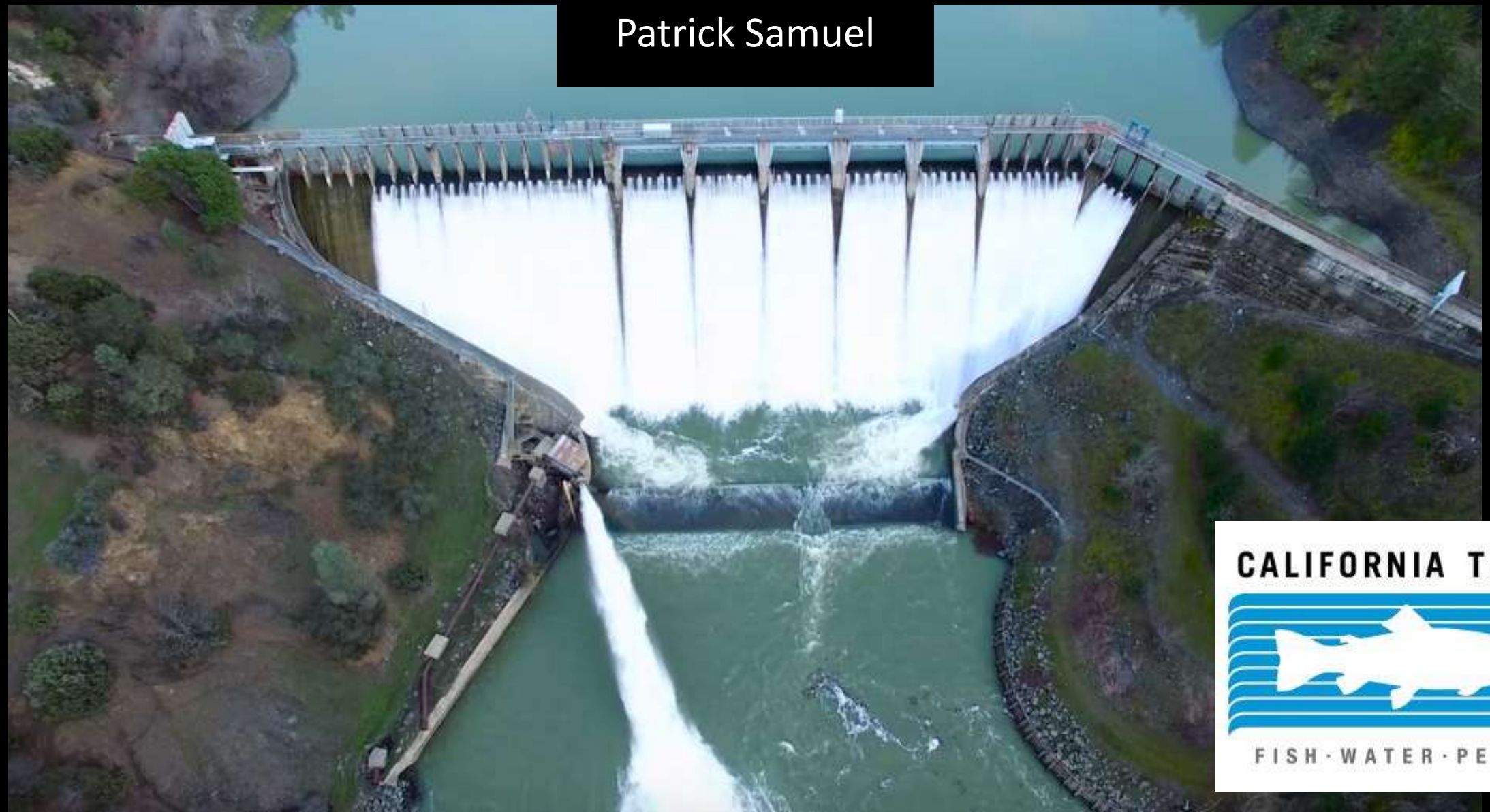


Butte Creek DeSabla-Centerville Hydro Project - Decommission or Retool? Salmon Want to Know

Allen Harthorn
Friends of Butte Creek

Potter Valley Project:
Fish Passage, Streamflow Opportunities

Patrick Samuel



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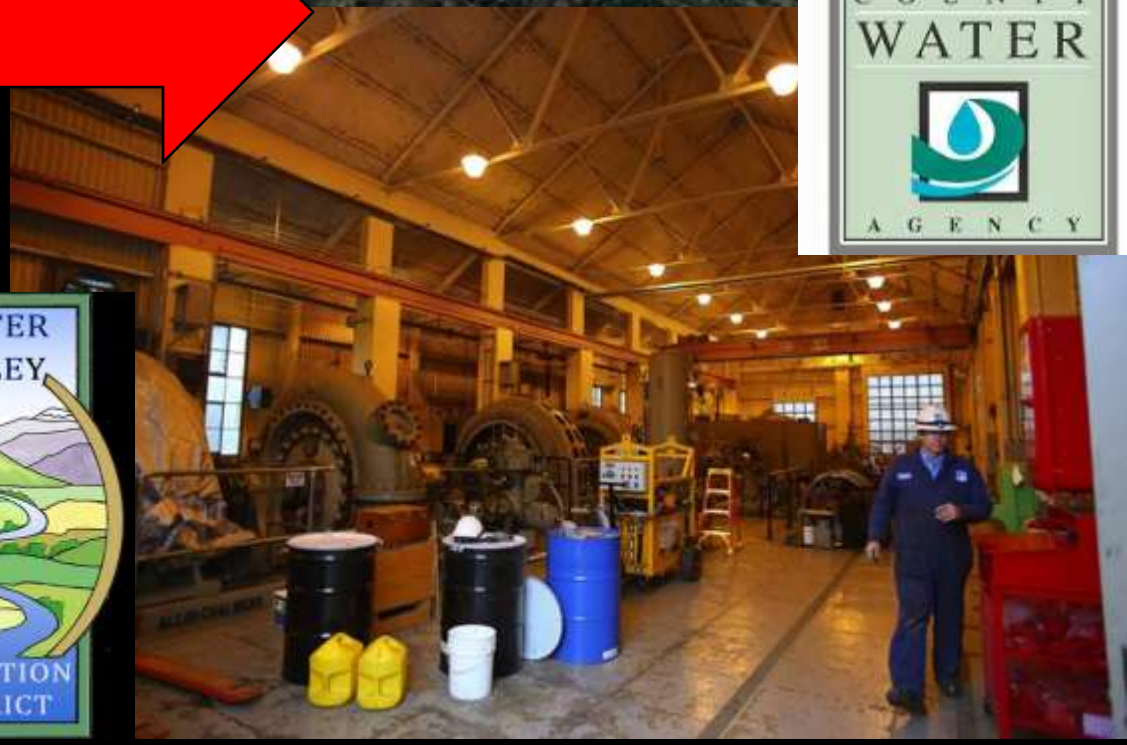
FISH · WATER · PEOPLE

Potter Valley Project (FERC #77): Bringing the Upper Eel, Russian together since 1908

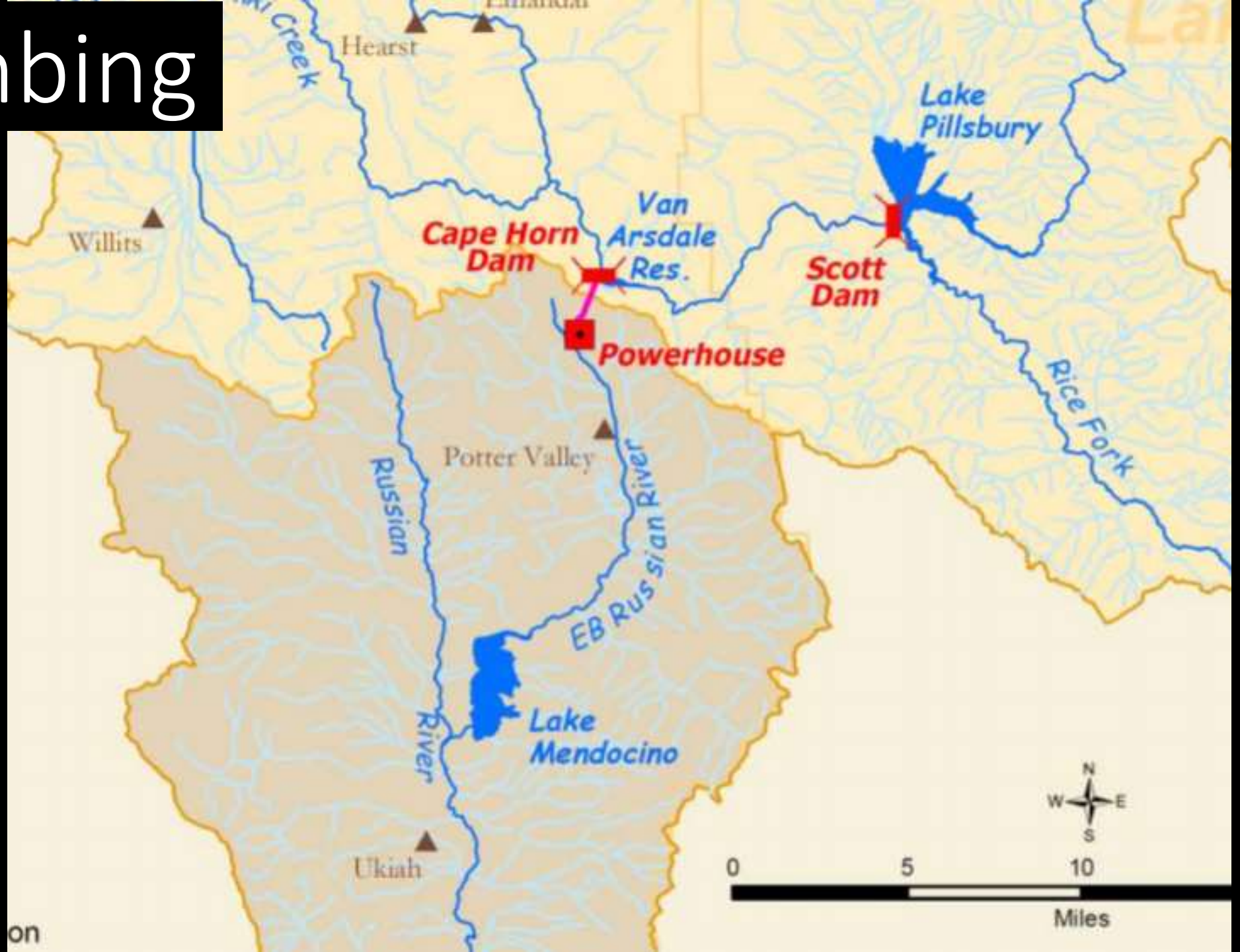


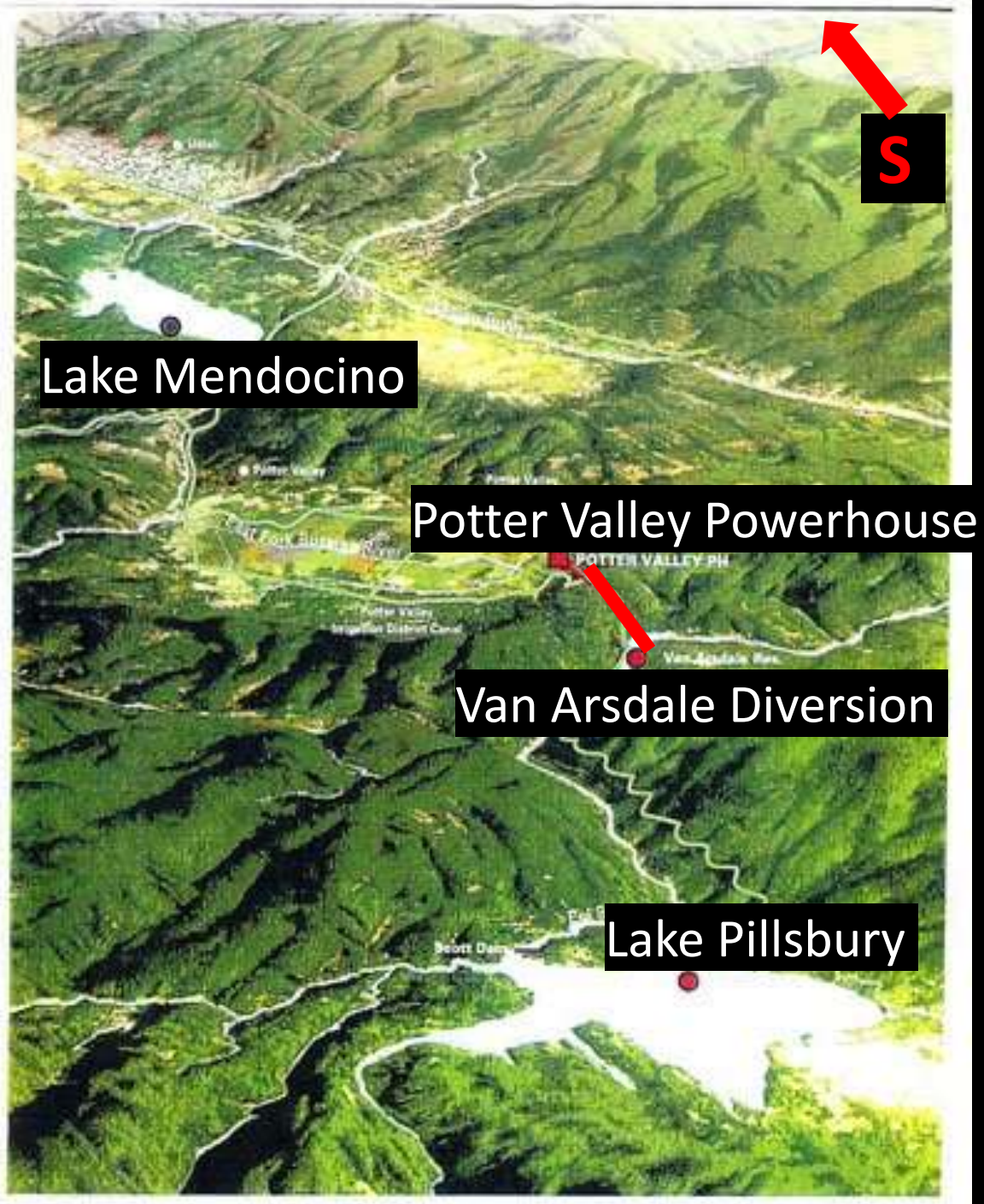
SONOMA COUNTY WATER AGENCY

POTTER VALLEY IRRIGATION DISTRICT

PG&E Pacific Gas and Electric Company

Plumbing


Hearst
Willits
Cape Horn Dam
Van Arsdale Res.
Lake Pillsbury
Scott Dam
Powerhouse
Rice Fork
Potter Valley
Russian River
EB Russian River
Lake Mendocino
Ukiah
N
W
E
S
0
5
10
Miles



- Scott Dam - Lake Pillsbury (~75,000 acre-feet); capacity decreasing w/ sediment
- Cape Horn Dam - Van Arsdale Reservoir (~190 acre-feet), diverts 250-300cfs into tunnel
- Potter Valley Powerhouse on East Branch Russian River, Lake Mendocino (~122,000 acre-feet)
  - Since 2007, avg. annual diversion dropped to ~90,000 acre-feet
- NMFS' 2002 BiOp required minimum flows to support salmon, steelhead below dams and powerhouse: upstream migration in fall, juvenile outmigration in spring, and summer rearing
  - 2,500 acre-feet block releases provided

PG&E FERC License expires in 4 yrs; submitted NOI to File an Application for New License

Streamflows

2002 NMFS BiOp-mandated releases to sustain temps. ~15^0 C; 20-100cfs

Annually, 2,500 acre-ft for block release at discretion of CDFW, NMFS; first “block water” release in May 2012

Outcome: cool, suitable conditions downstream of Scott and Cape Horn dams, powerhouse, and in 12mi. between Scott, Cape Horn

- Support spawning and rearing, may discourage juvenile outmigration, especially of *O. mykiss*

Listed Salmonids Impacted

Eel: SONCC coho (endangered), California Coast Chinook (threatened, likely to become endangered), NC steelhead (winter/summer – threatened)

Russian: CCC coho (endangered), CCC steelhead (threatened)

- Volitional passage is necessary for recovery



Opportunity for Salmonids

Wild, abundant populations

- size, undeveloped condition, restoration, and cold headwaters

291-463km for steelhead, 89-127km for Chinook for potential migration, spawning, and rearing upstream of Scott Dam

Potential for multiple life histories: fall and spring-run Chinook, winter and summer steelhead; plus coho and lamprey

Some areas > 5,000 ft elevation, reliable snowpack into summer – Native Fish Society, most within Mendocino National Forest, Snow Mountain Wilderness

Cooper, E. J., A. P. O'Dowd, J. Graham, D. Ward, D. Mierau, and R. Taylor. 2017. “An Estimation of Potential Salmonid Habitat and Carrying Capacity in the Upper Mainstem Eel River, California.” Master's Thesis, Humboldt State University, Arcata, CA.

Next Steps

- Do releases improve conditions for salmonids (cooler temps., better flows, (but suppressing outmigration?)
- Block water releases in different water years – are new habitat rule curves needed?
- Date of water allocation decision from Oct. 1 to after storm events (March or April) for block release
- Tradeoffs and costs/benefits of volitional passage for recovery, balancing needs of people in Potter Valley, Russian River
- PG&E, state and federal resource agencies, tribes, other stakeholders engage in discussions on relicensing

FERC and Ad Hoc Committee Pathways

- FERC process has own jurisdiction, timeline - if re-licensing application is not withdrawn by PG&E - by 2022
- Congressman Huffman convened Potter Valley ad hoc Committee: potential alternatives for fish passage, water delivery and supply, and social, economic considerations
  - Not bound by FERC jurisdiction, deals with where Potter Valley will get its water, fish passage alternatives, water delivery to Russian River, etc.
- Eel/Russian Commission: Humboldt, Lake, Mendocino, Sonoma counties Joint Powers Authority
- Ad hoc Committee and JPA could inform a settlement agreement

Infrastructure Options

2 Facilitated Technical Working Groups

- Fish Passage
  - Assess passage obligations, liability costs for ongoing maintenance, feasible alternatives
  - Dam removal feasibility assessment, cost-benefit analysis, liability study
- Water Supply
  - 1) Potter Valley dams and powerhouse decommissioning w/ no diversion
  - 2) Decommissioning Scott Dam, powerhouse w/ (winter-only) diversion at Van Arsdale
  - 3) Decommissioning Scott Dam, modifying Van Arsdale diversion conduit/piping for greater (winter) diversion; raising Coyote Dam
    - Consider water storage options that allow irrigation water delivery to PPID

Current Discussions

- What is feasibility, infrastructure need, and cost/benefit analysis for each alternative for: salmonid recovery, water supply, deliveries?
- What water volumes are necessary for winter run-of-river diversion?
- What are costs/liabilities associated with Coyote Dam raise on Lake Mendocino?
- What are dam safety considerations, what to do with potentially contaminated sediments stored behind dams?
- What impacts would removal of Scott Dam have on economy, recreation in the region?


CALIFORNIA TROUT
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M.Wier

Managing Infrastructure in the Stream Environment

36th Annual Salmonid Restoration Conference

April 14th, 2018

Team – Authors

Joel S Sholtes[1], Caroline Ubing[1], Timothy J Randle[1], Jon Fripp[2], Daniel Cenderelli[3], and Drew C Baird[1]

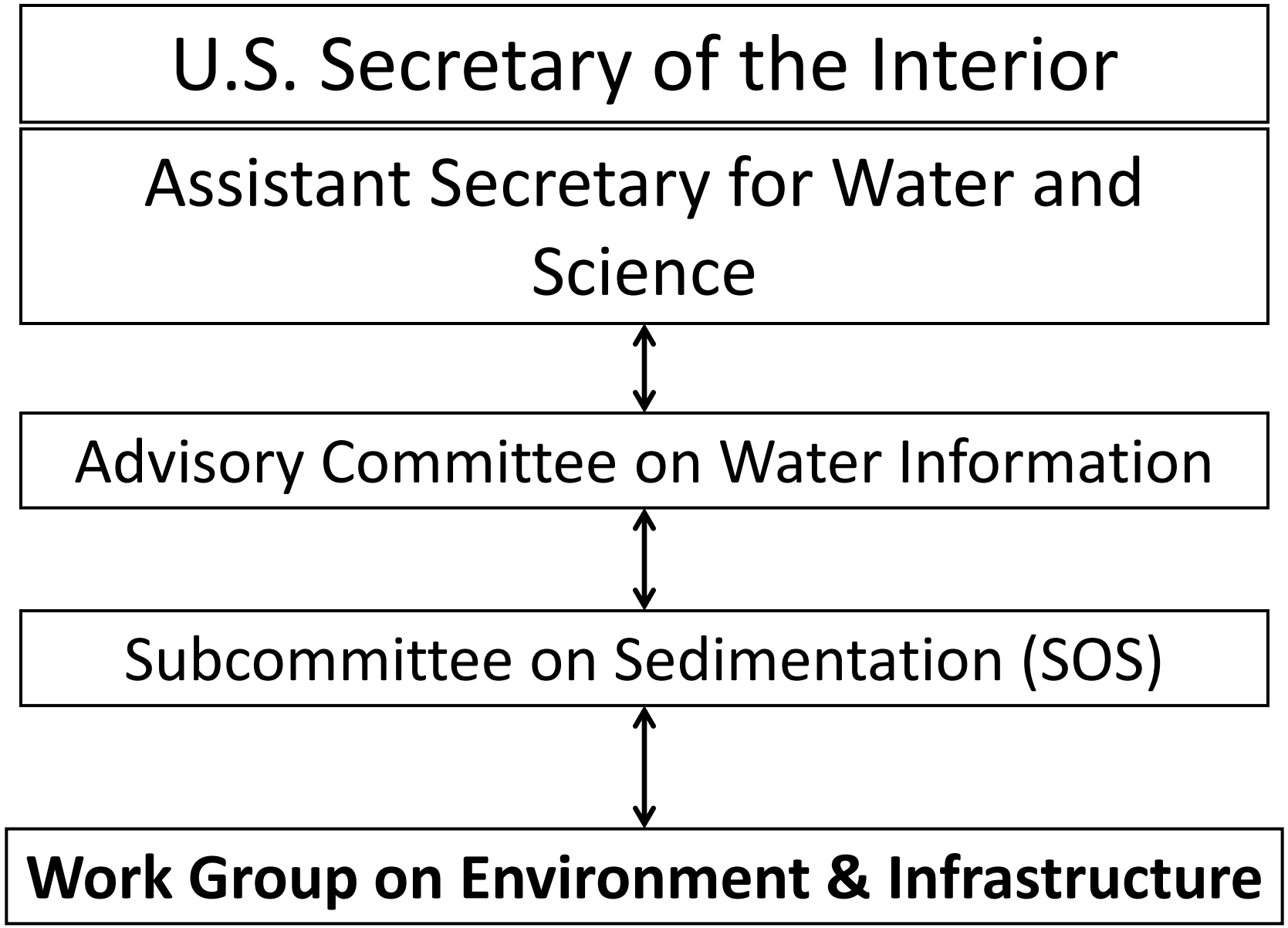
1 U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

2 U.S. Department of Agriculture
Natural Resources Cons. Service
National Design, Construction,
and Soil Mechanics Center
Fort Worth, Texas

3 U.S. Department of Agriculture
Forest Service
National Stream and Aquatic
Ecology Center
Fort Collins, Colorado

Team – Peer Review

Jennifer Bountry, Bureau of Reclamation
Brian Cluer, National Marine Fisheries Service
Mathias Collins, National Oceanic and Atmospheric Administration
Katherine Dahm, Bureau of Reclamation
April Fitzner, Bureau of Reclamation
Scott Hogan, Federal Highway Administration
Jo Ellen Johnson, Natural Resources Conservation Service
Eddy Langendoen, Agricultural Research Service
Paul Makowski, Federal Energy Regulatory Commission
Marion Muste, University of Iowa
John Remus, Army Corps of Engineers
Martin Teal, WEST Consultants, Inc.
Steven Yochum, U.S. Forest Service

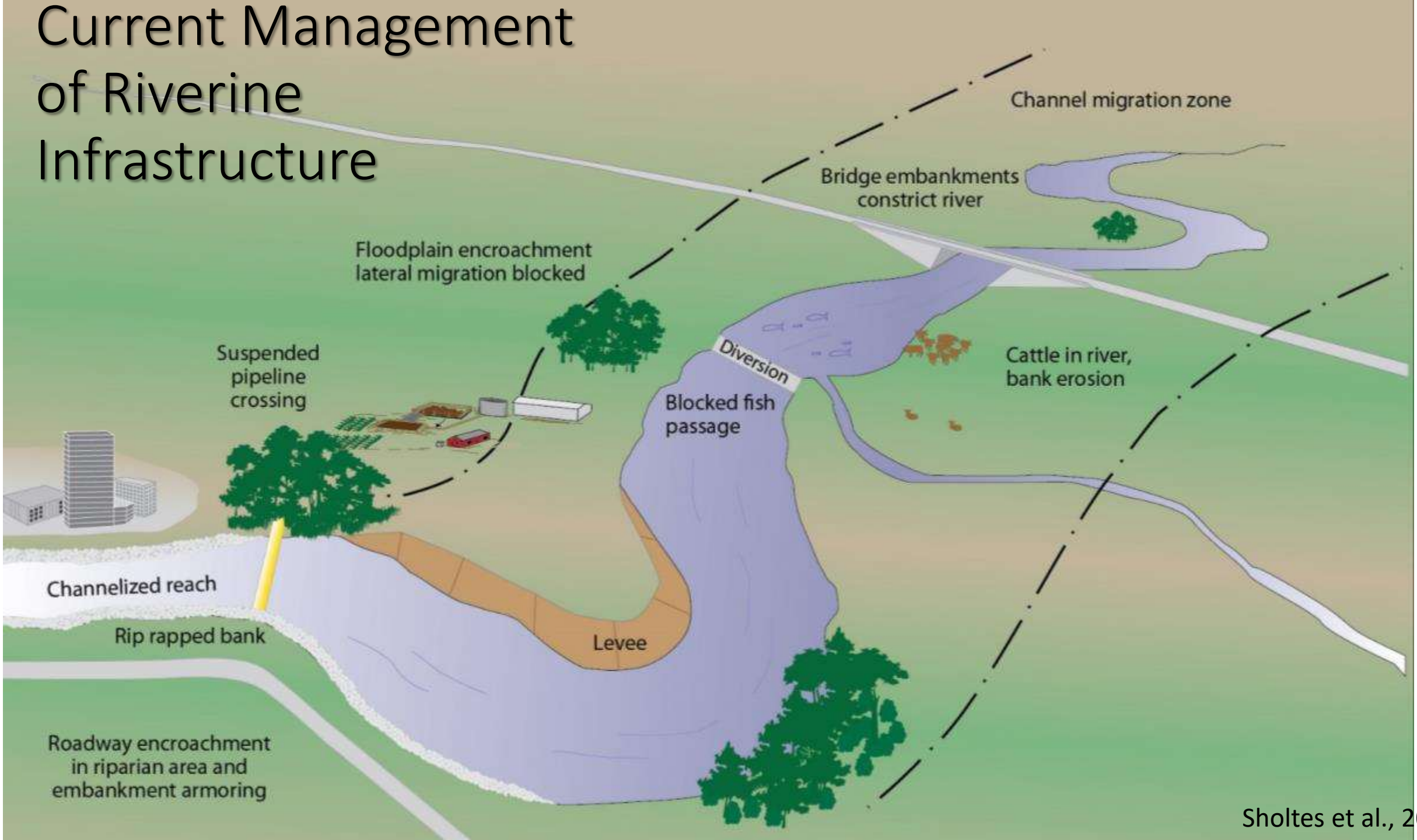

U.S. Secretary of the Interior
Assistant Secretary for Water and Science
Advisory Committee on Water Information
Subcommittee on Sedimentation (SOS)
Work Group on Environment & Infrastructure

Purpose

Introduce to managers/planners how to build, maintain, or repair infrastructure that is resilient to riverine hazards.

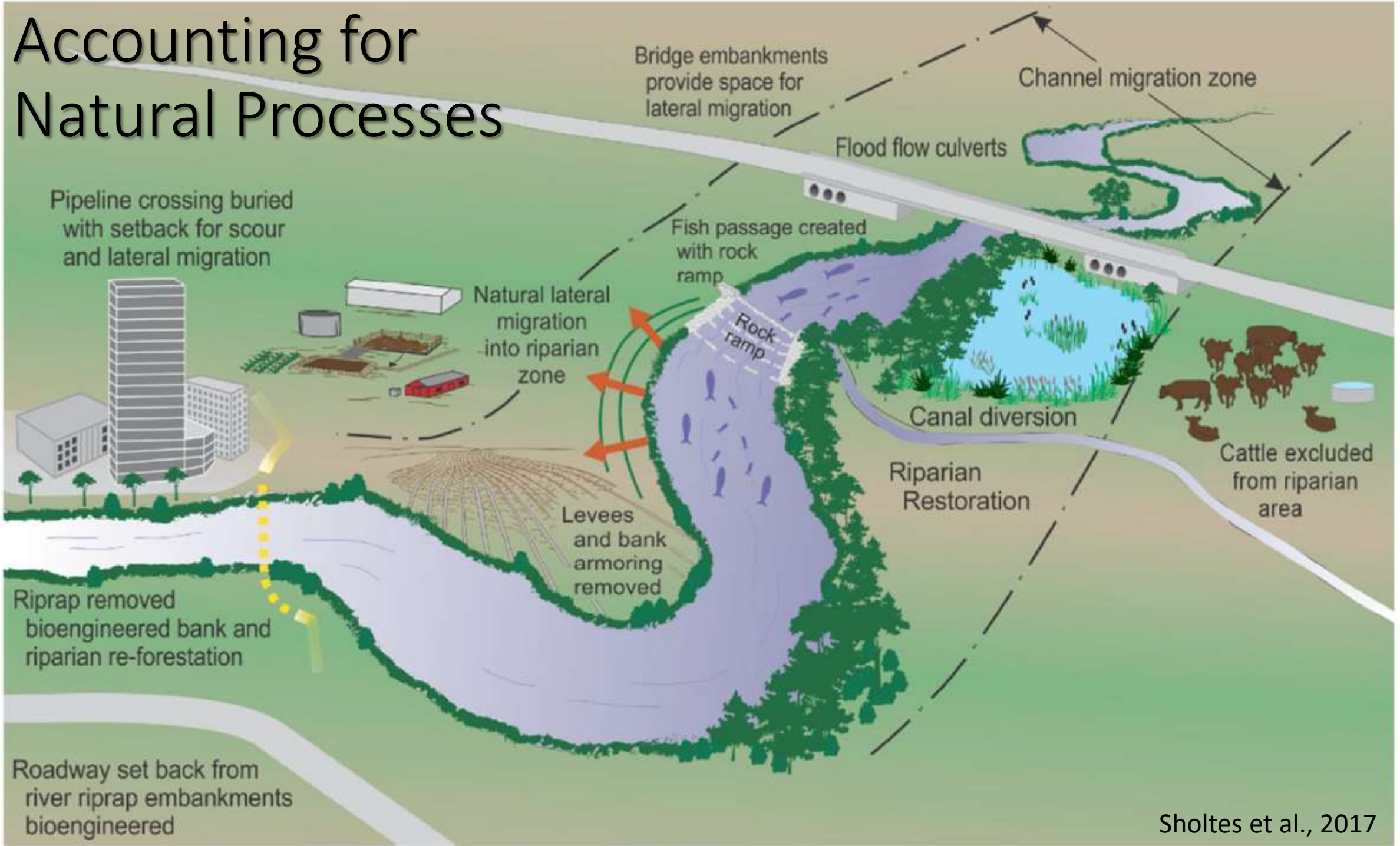
I. Introduce fundamentals of river processes and ecosystems
II. Provide a decision tool to replace, repair or build new infrastructure
III. Examine challenges & solutions associated with 11 infrastructure types
IV. Discuss managing riverine infrastructure under uncertainty

Current Management of Riverine Infrastructure



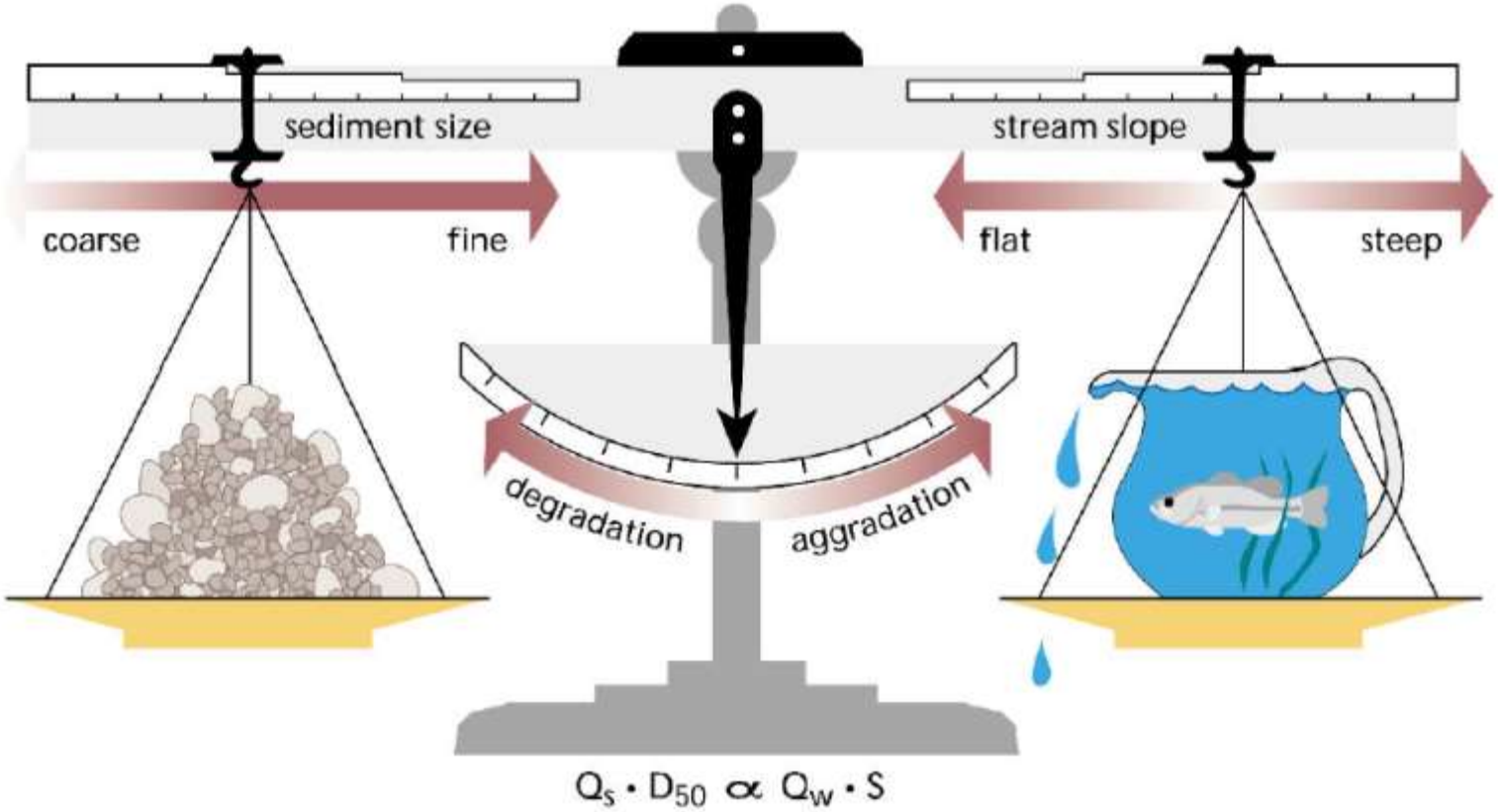
Sholtes et al., 2017

Accounting for Natural Processes



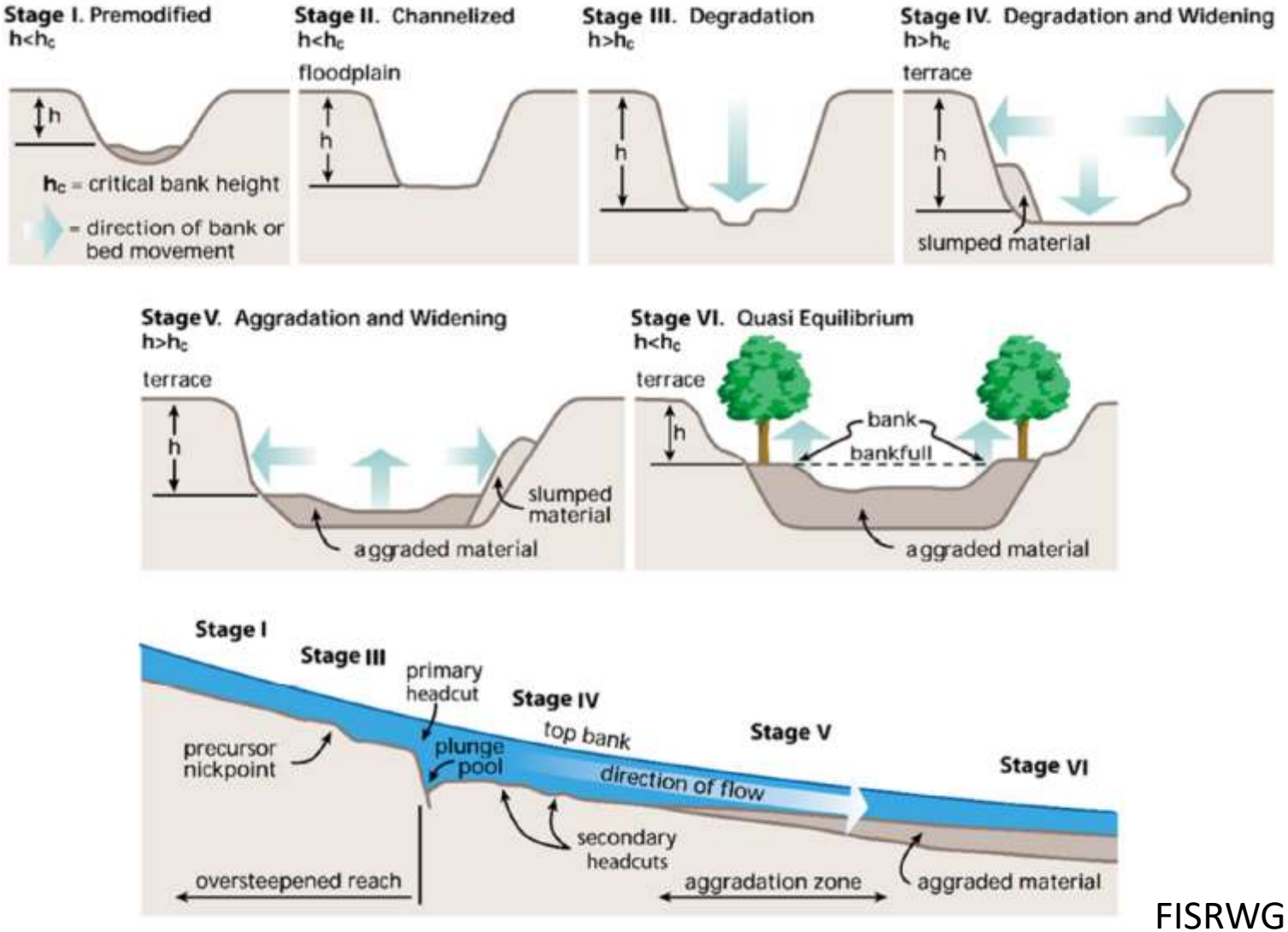
Sholtes et al., 2017

I. Introduce Fundamentals



www.fgmorph.com

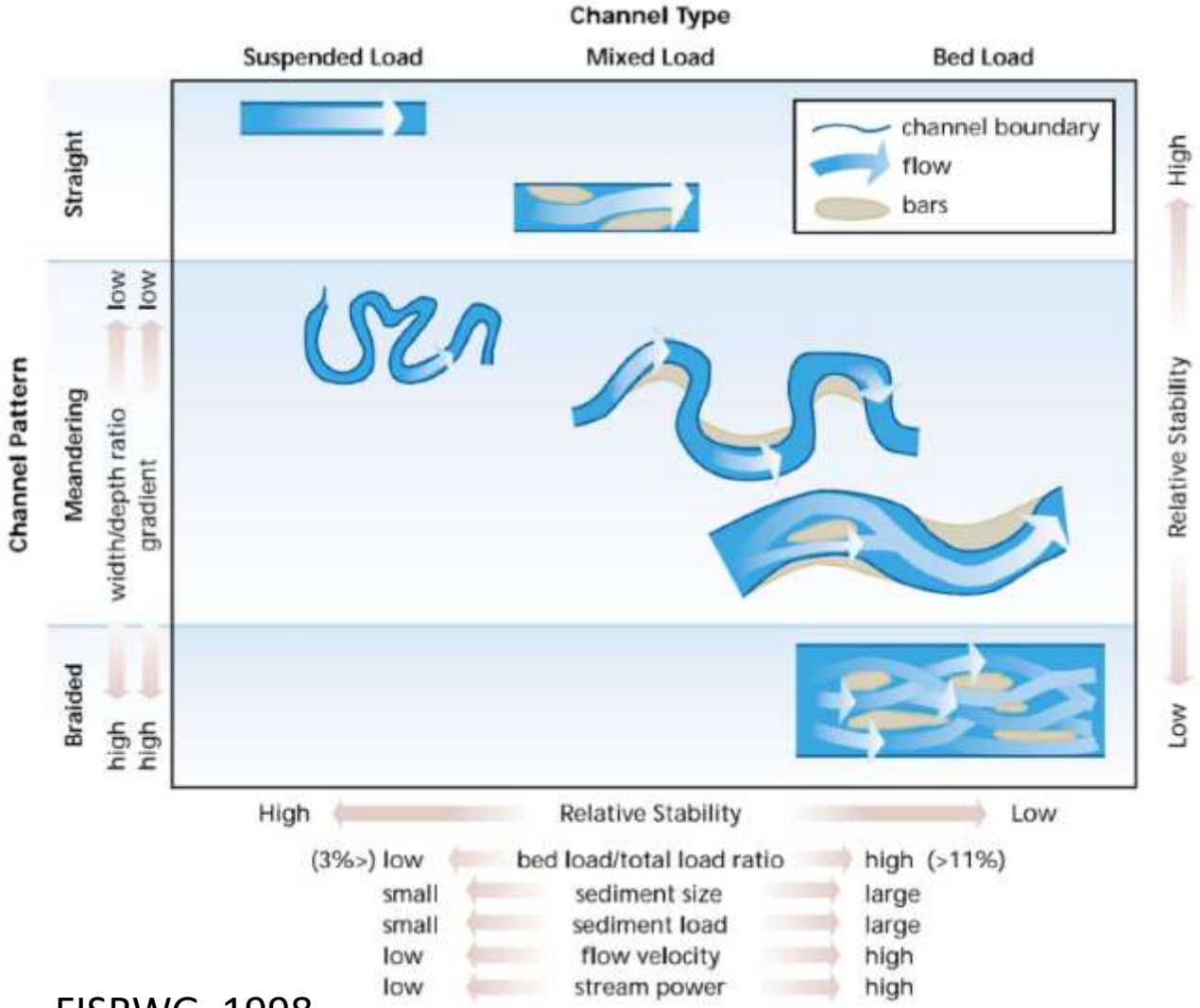
I. Introduce Fundamentals



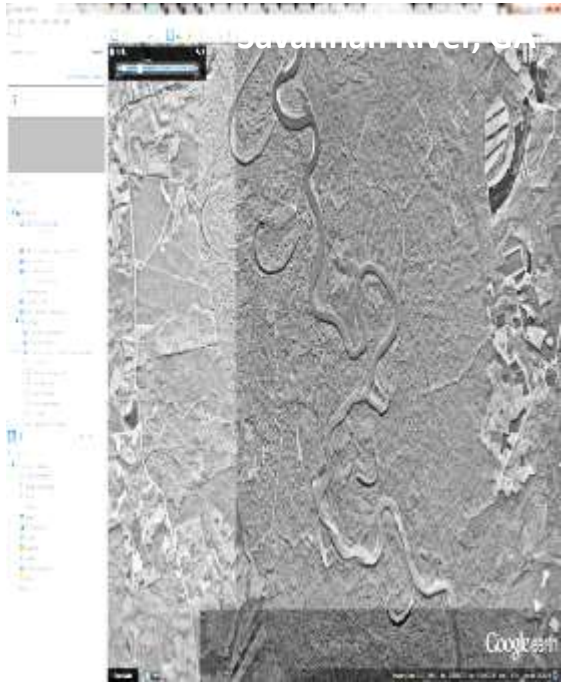
www.fgmorph.com

FISRWG, 1998

I. Riverine Fundamentals

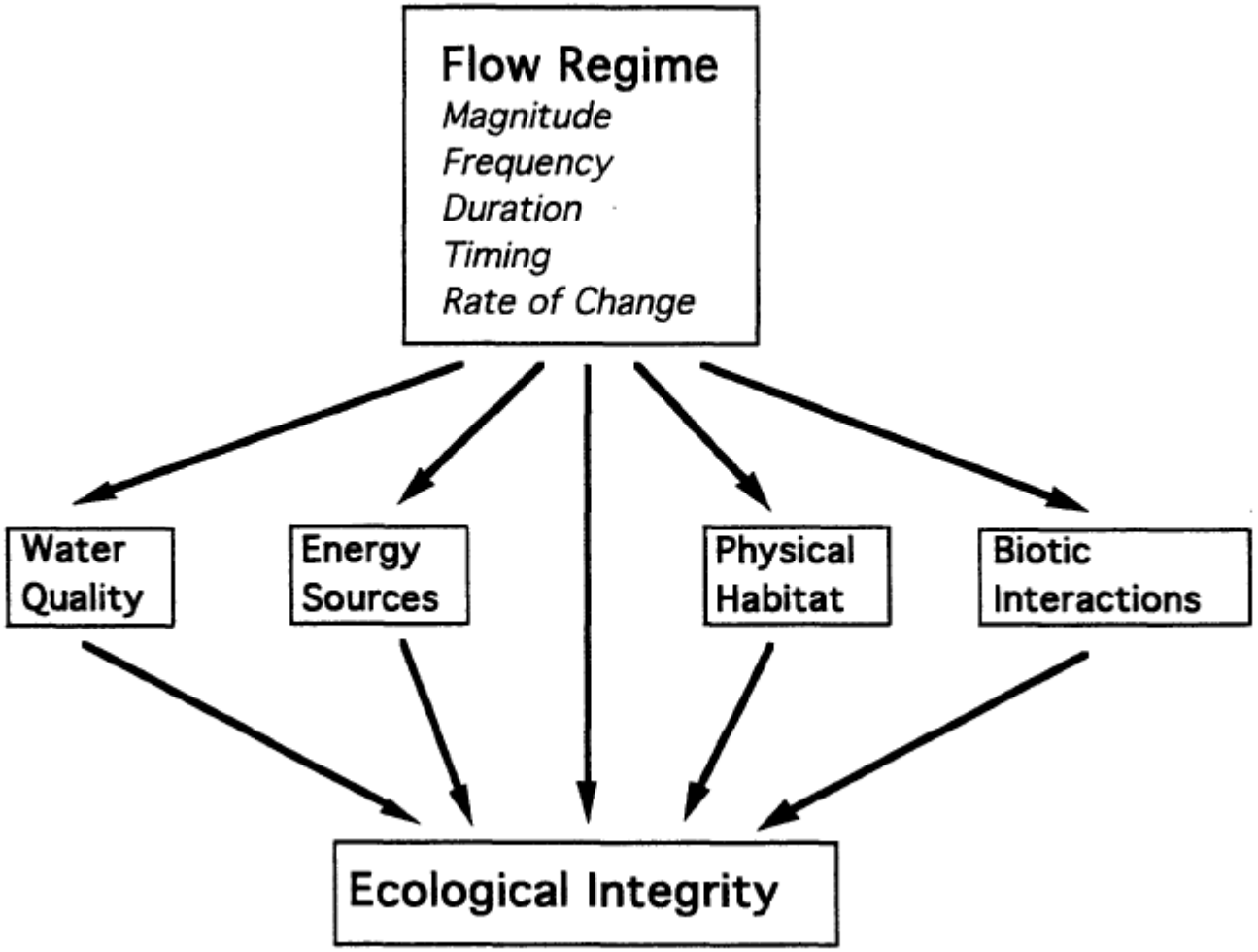


FISRWG, 1998

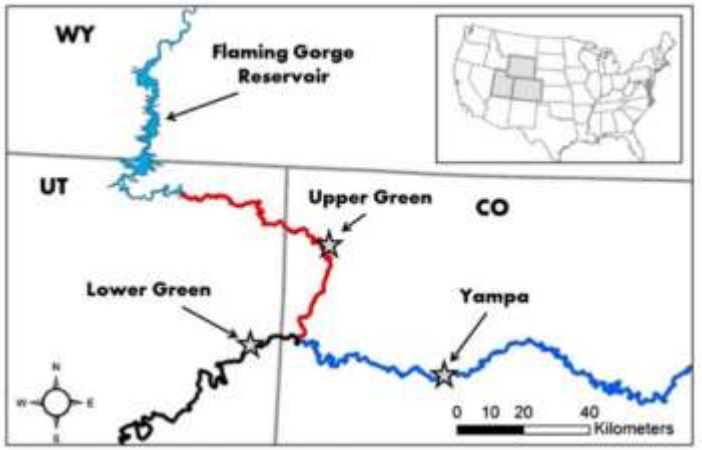


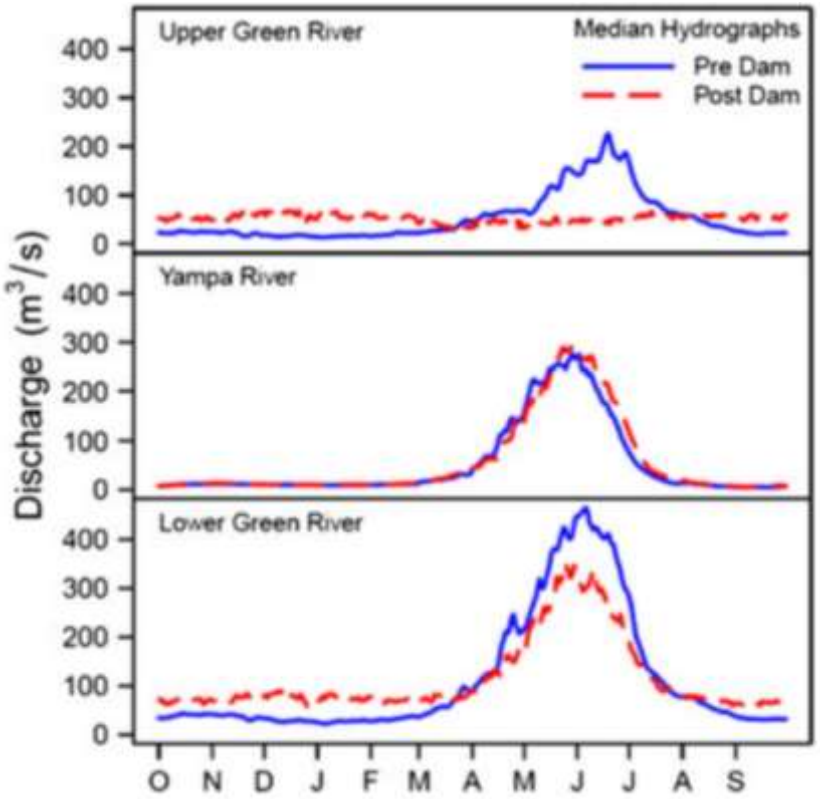
Google Earth

I. Riverine Fundamentals



Poff et al., 1997





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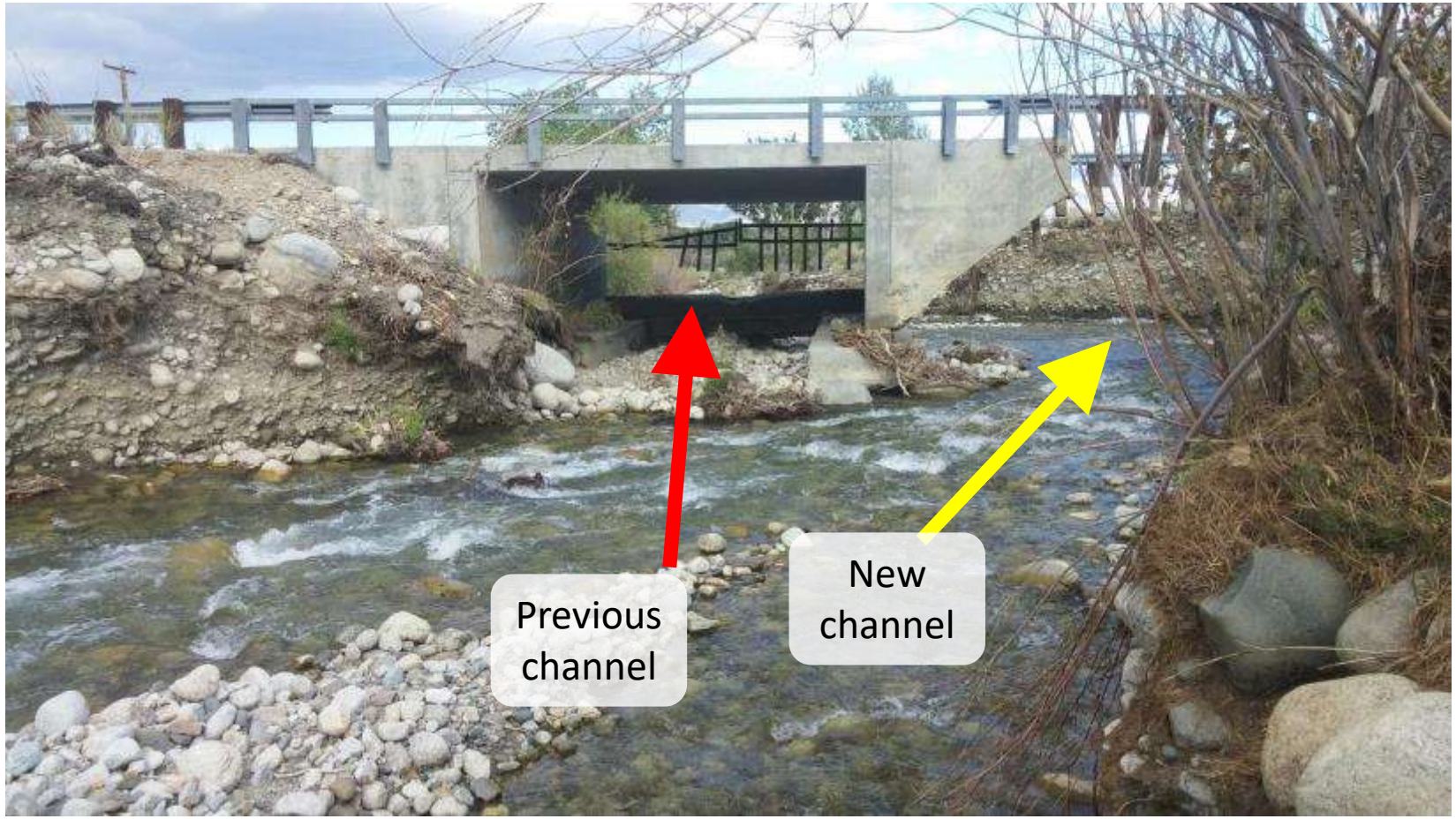
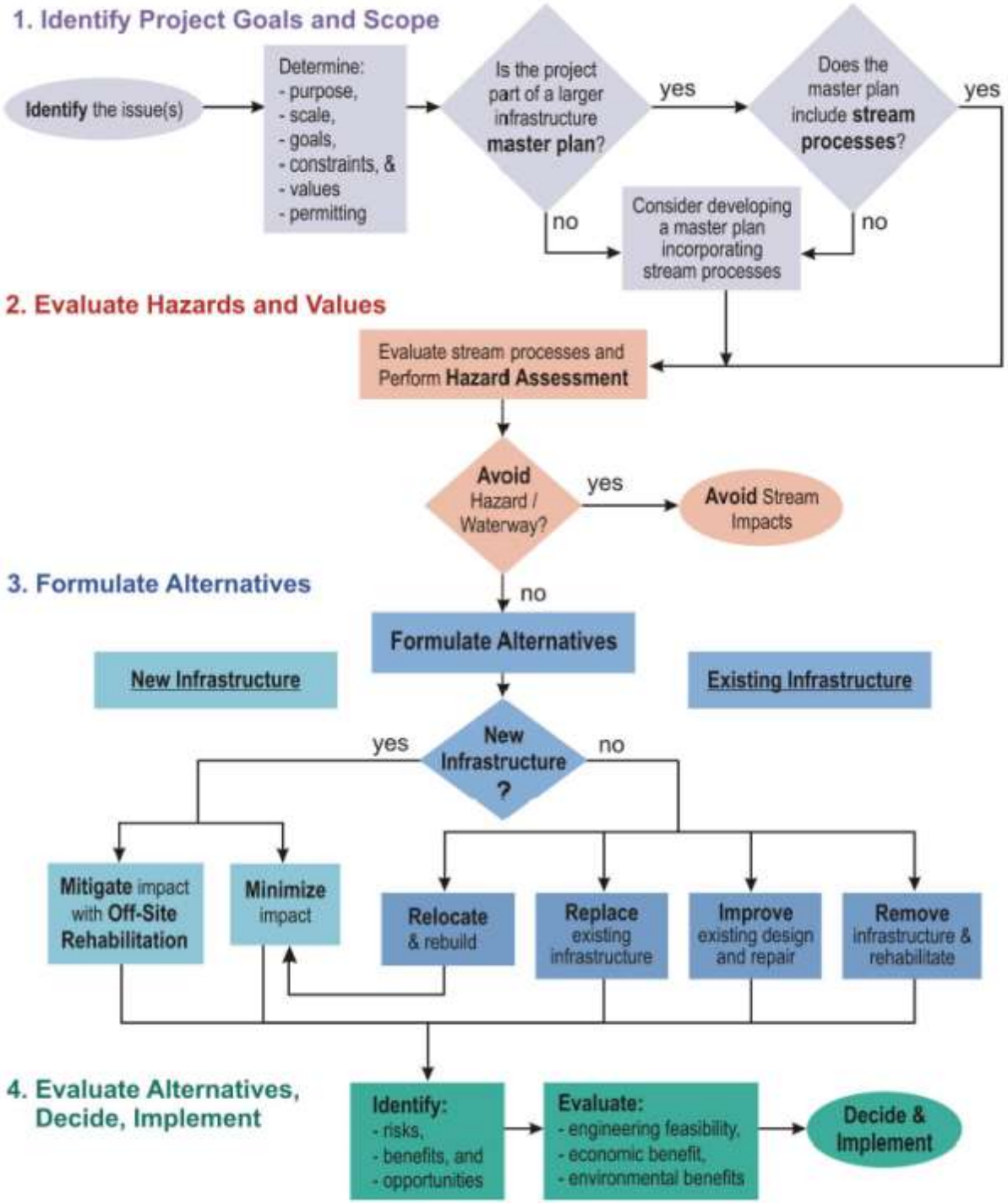
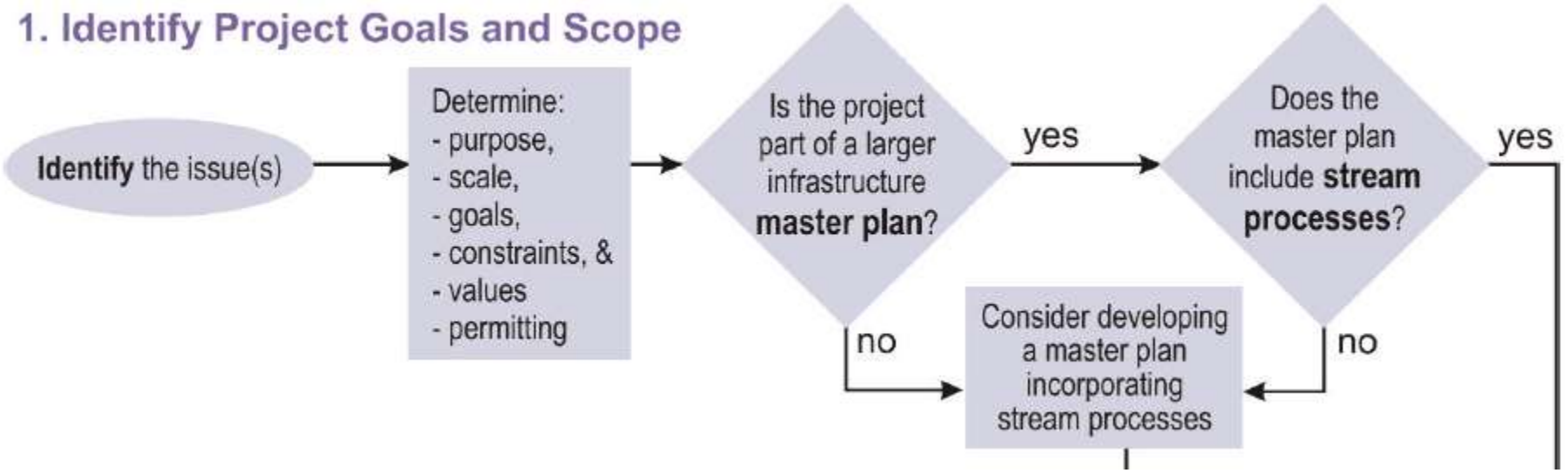


Photo Credit: Nathan Holste (USBR)

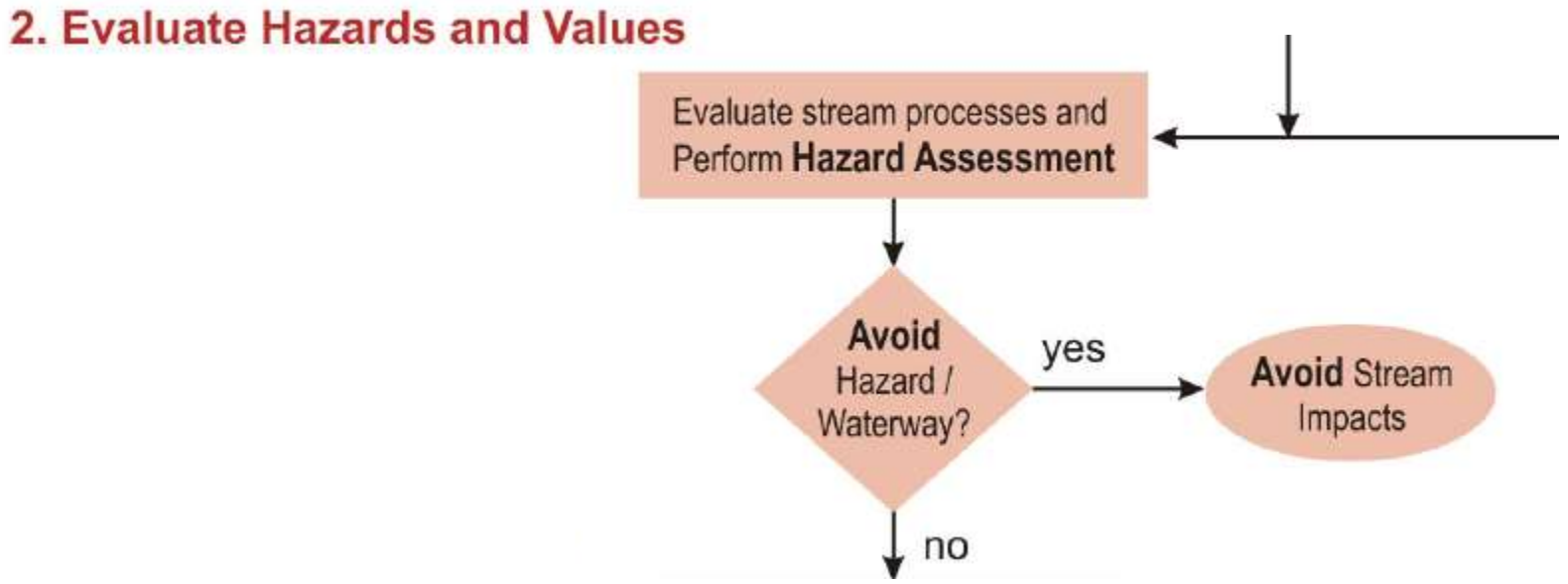
II. Provide a decision tool to replace, repair or build new infrastructure



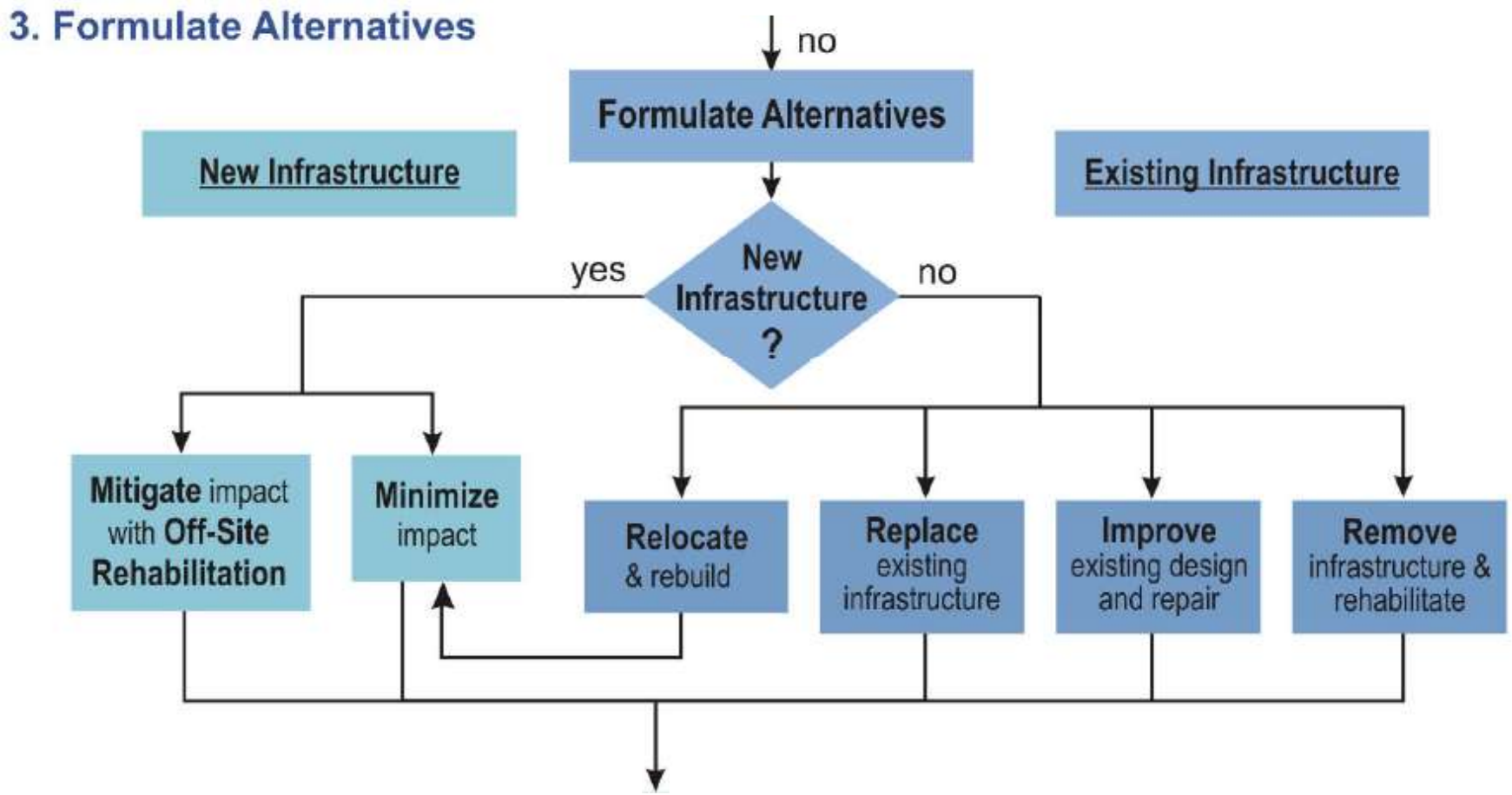
1. Identify Project Goals and Scope



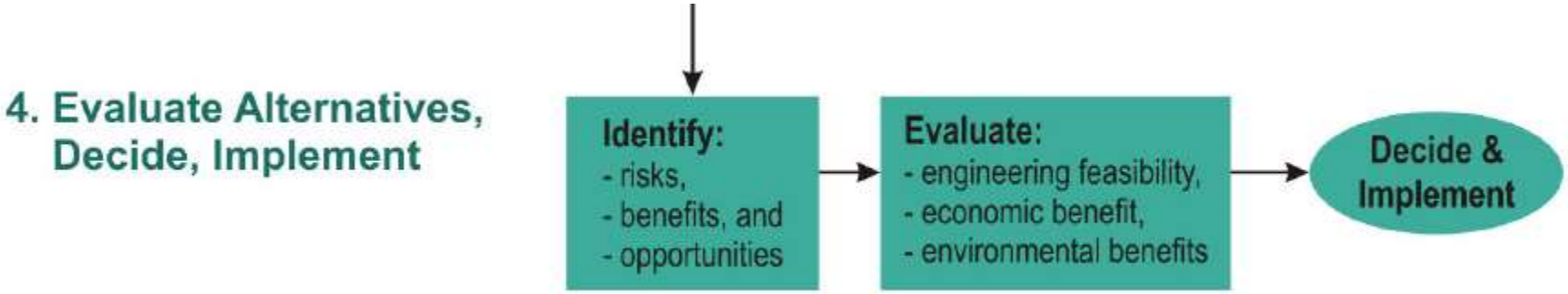
2. Evaluate Hazards & Values



3. Formulate Alternatives



4. Evaluate Alternatives, Decide, Implement



III. Examine Infrastructure Challenges & Solutions

1. Floodplain encroachment
2. Large wood management
3. Pipelines
4. Levees & dikes
5. Streambank protection
6. Stormwater infrastructure
7. Channelized rivers
8. Grade control structures
9. Transportation infrastructure
10. Dams and reservoirs
11. Surface water diversions

Management Questions

- How does infrastructure affect river processes and ecosystems?
- Does the cost of more resilient and ecologically sound infrastructure balance reduce maintenance costs?
- How can we better build, repair, decommission infrastructure in river environments?

Large Wood Management

National Large Wood Manual

Assessment, Planning, Design, and Maintenance of Large Wood in Fluvial Ecosystems: Restoring Process, Function, and Structure

January 2016

U.S. Department of the Interior
Bureau of Reclamation

US Army Corps of Engineers®
Engineer Research and Development Center

Grade Control Structures

Photo Credit: ARS

Photo Credit: Timothy Randle (USBR)

Transportation Infrastructure

Photo Credit: Colorado Department of Transportation

Transportation Infrastructure

Photo Credit: Daniel Cenderelli (USFS)

IV. Managing under Uncertainty

1. Incorporating tolerances for change in design
2. Robust Alternatives Analysis
3. Actionable Science: future land use and climate
4. Adaptive Management

Summary

Introduce to managers/planners how to build, maintain, or repair infrastructure that is resilient to riverine hazards.

I. Introduce fundamentals of river processes and ecosystems
II. Provide a decision tool to replace, repair or build new infrastructure
III. Examine challenges & solutions associated with 11 infrastructure types
IV. Discuss managing riverine infrastructure under uncertainty

References

- Sholtes J.S., Ubing C., Randle T.J., Fripp J., Cenderelli, D.A., Baird D.C. (2017). *Managing Infrastructure in the Stream Environment*. Advisory Committee on Water Information, Subcommittee on Sedimentation. 65p.
- Federal Interagency Stream Restoration Working Group (FISRWG). 1998.Stream Corridor Restoration: Principles, Processes, and Practices. U.S. Department of Agriculture. http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?cid=stelprd b1043448.
- Poff, N., J. Allan, M. Bain, J. Karr, K. Prestegaard, B. Richter, E. Sparks. and J. Stromberg. 1997. The Natural Flow Regime. *BioScience*, 47(11):769-784.
- Bureau of Reclamation and U.S. Army Corps of Engineers. 2015. National Large Wood Manual: Assessment, Planning, Design, and Maintenance of Large Wood in Fluvial Ecosystems: Restoring Process, Function, and Structure. www.usbr.gov/pn/.

Managing Infrastructure in the Stream Environment

https://acwi.gov/sos/

Cultivating Ecological Solutions On Agricultural Lands

Jacob Katz – California Trout

CALIFORNIA TROUT

FISH · WATER · PEOPLE

C. Jeffres

Cultivating Ecological Solutions On Agricultural (Wet)Lands

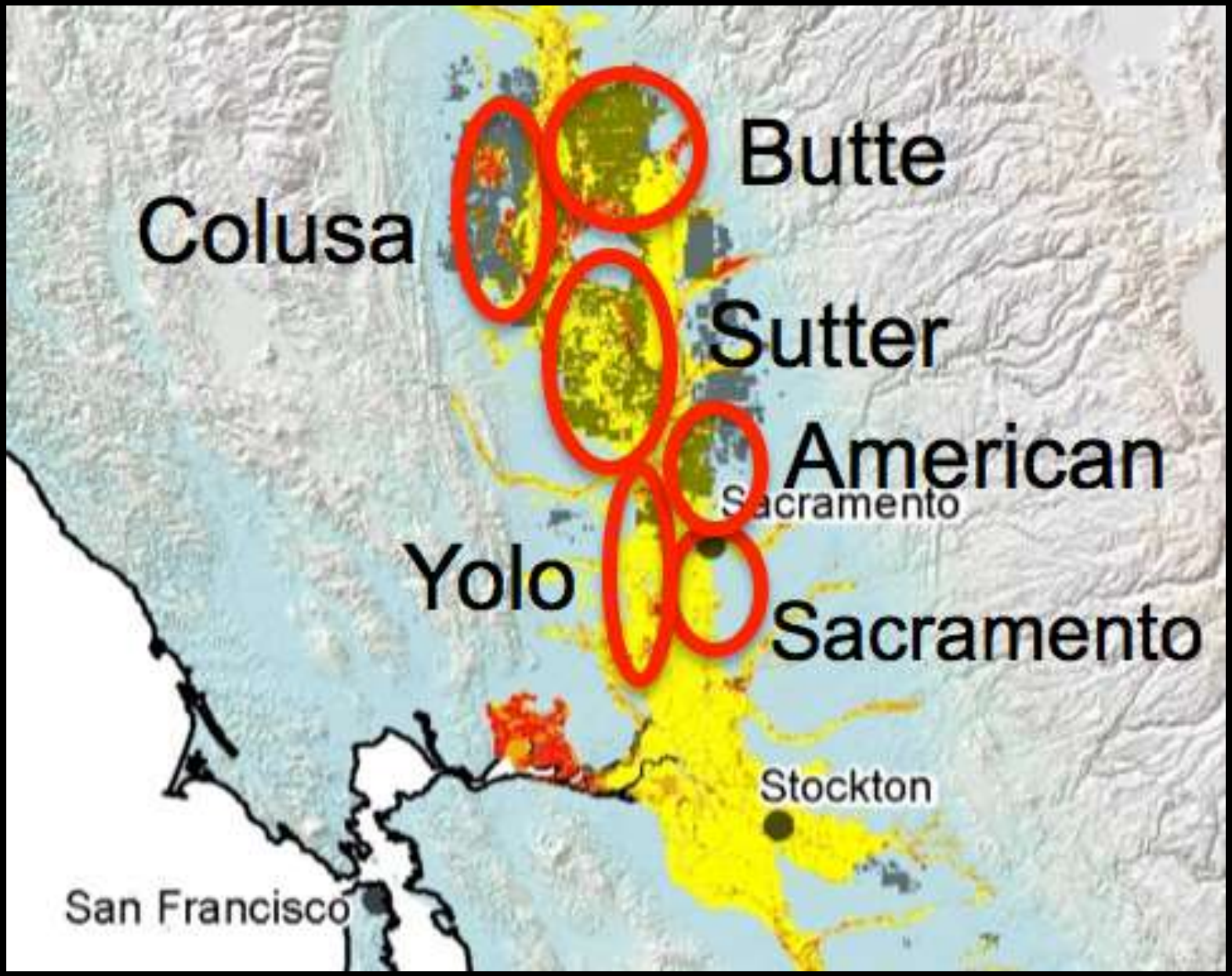
Jacob Katz – California Trout

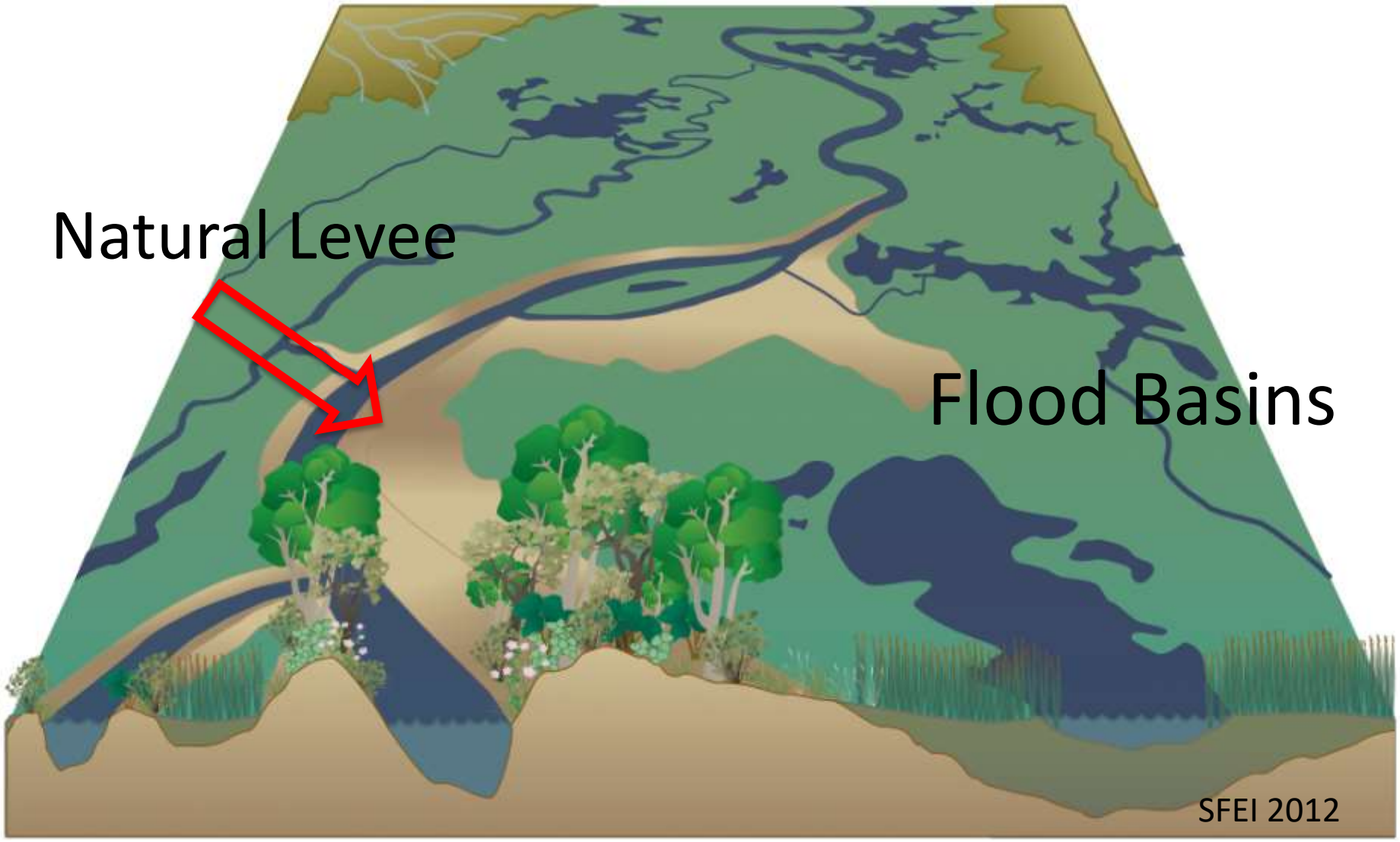
CALIFORNIA TROUT

FISH · WATER · PEOPLE

C. Jeffres

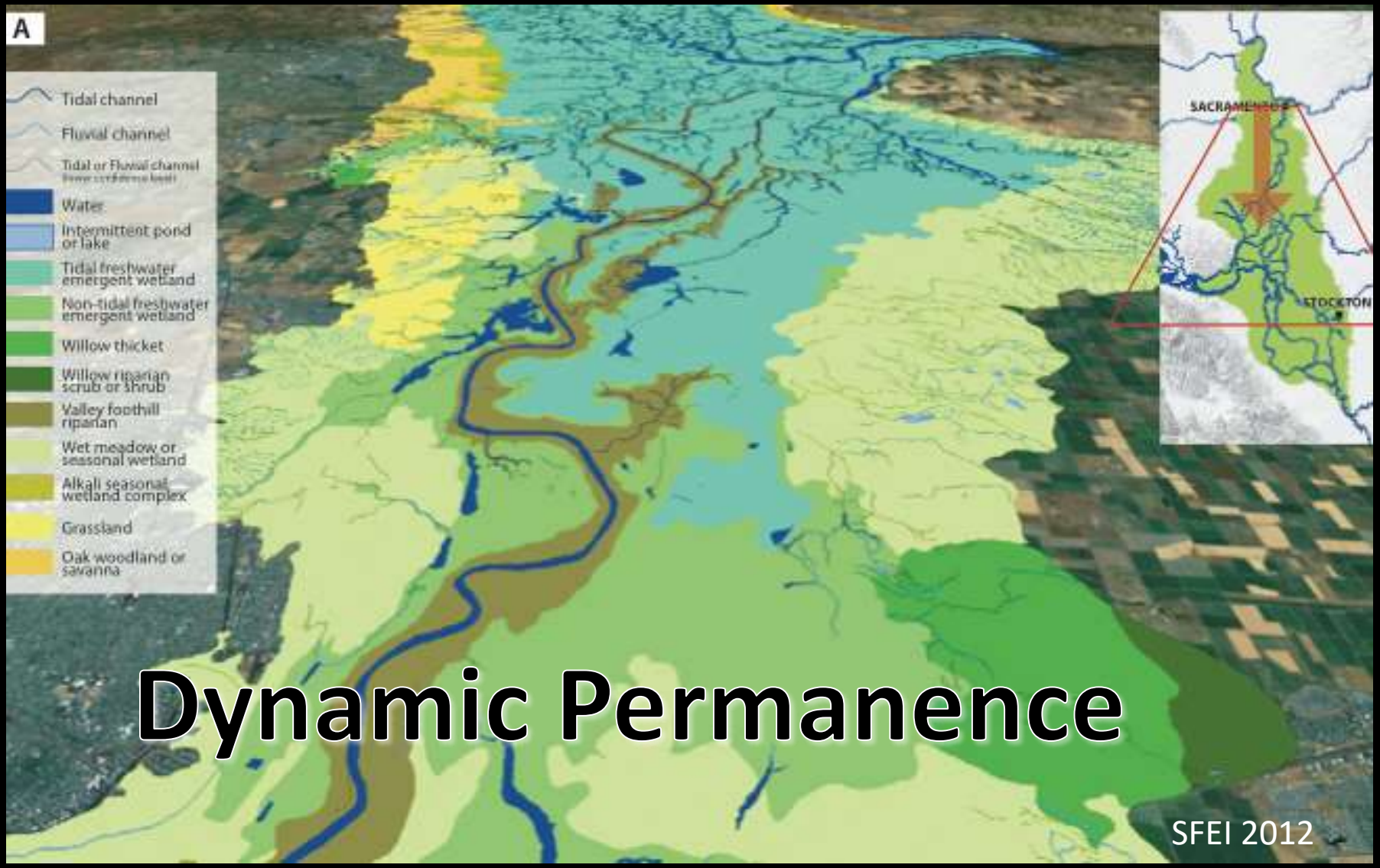
Sac Valley = Flood Basins





Fluvial Processes

A Shifting Mosaic of Wetland Habitat Types



Reclamation

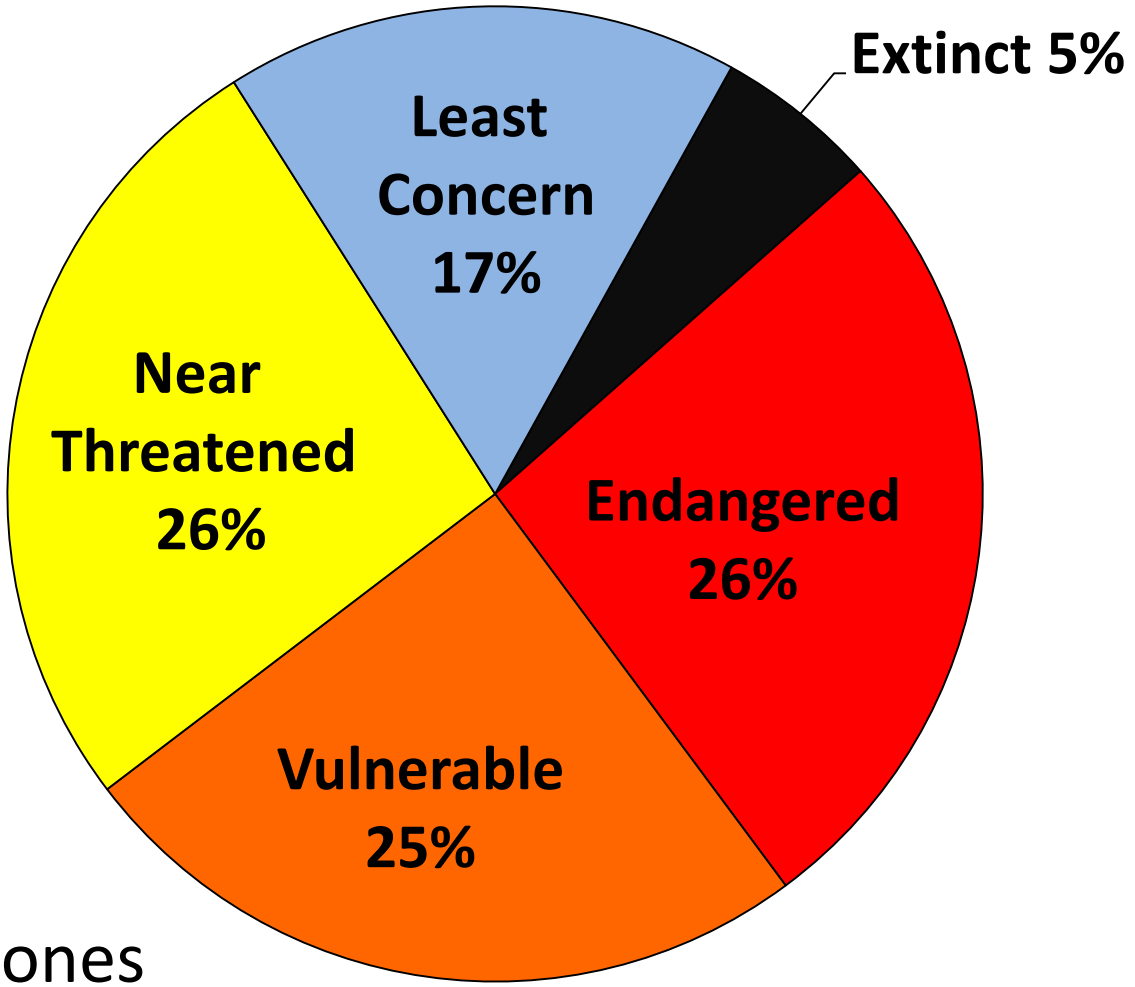
13,000 miles of levees

Drainage

CA NATIVE FISHES

83%

Extinct or in decline



Moyle, Katz & Quiñones
Biological Conservation,
Vol 144, issue 10, Oct. 2011

N=129

Central Valley Chinook

Of 4 runs

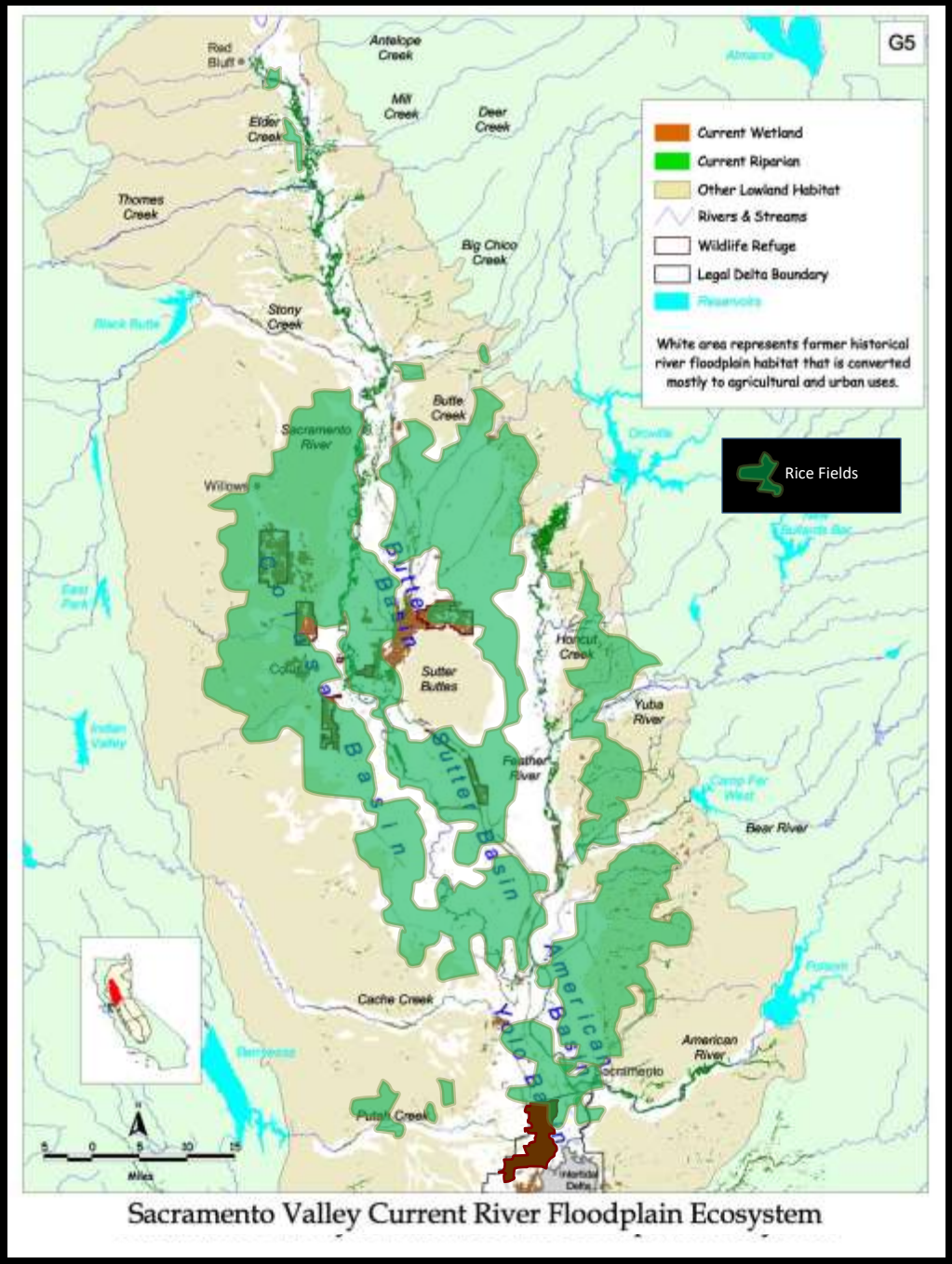
3 are endangered, the other is dominated by hatcheries

Historic:

Fall run Chinook evolved rearing on floodplains

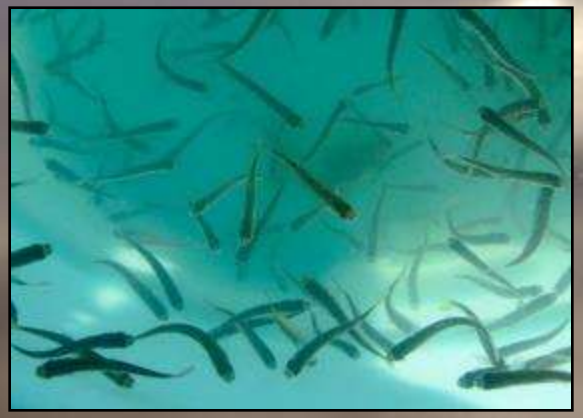
TODAY:

- 95% of floodplains lost
- drained and converted to rice.
- In California 550,000 acres of rice is farmed annually.
- Now, many of the rice fields are managed for migrating birds during winter months.



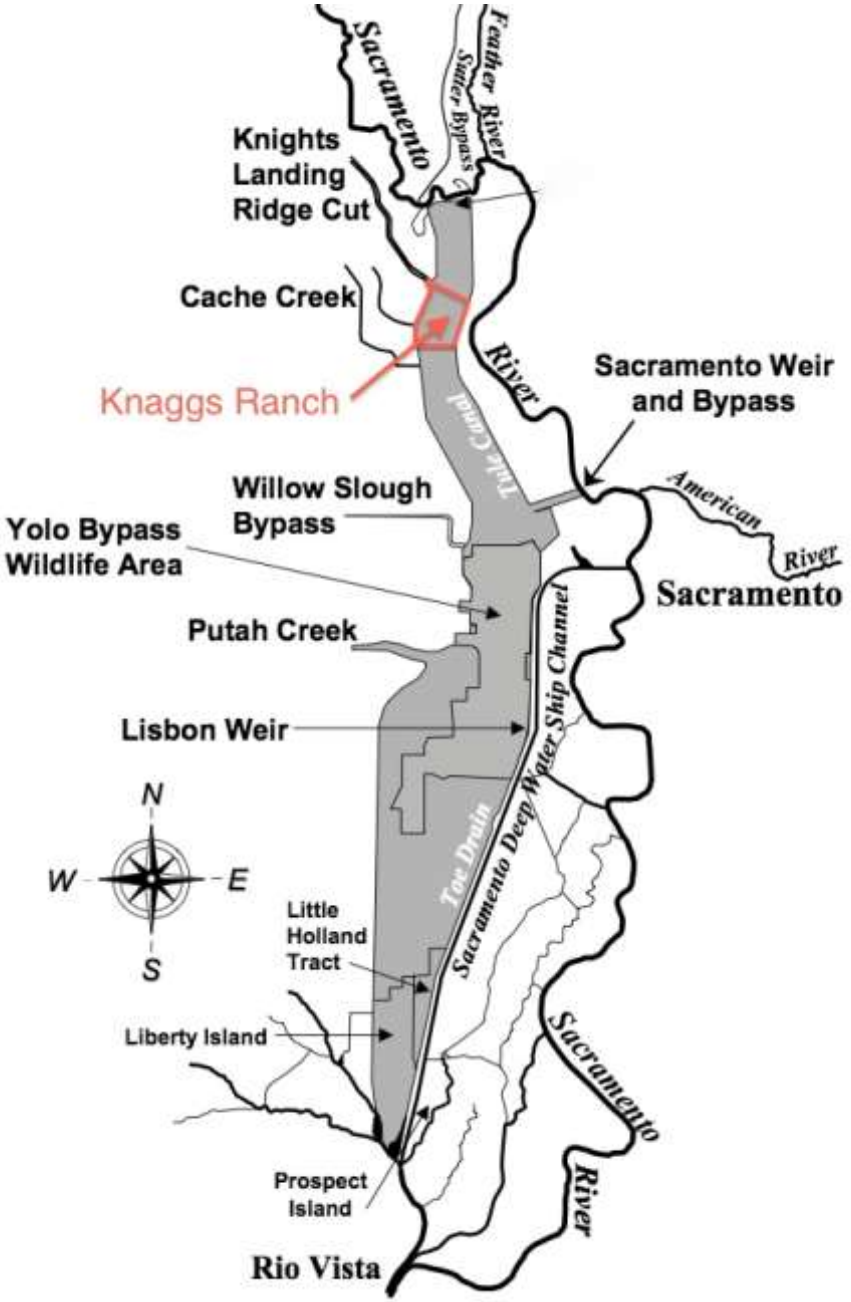
Sacramento Valley Current River Floodplain Ecosystem

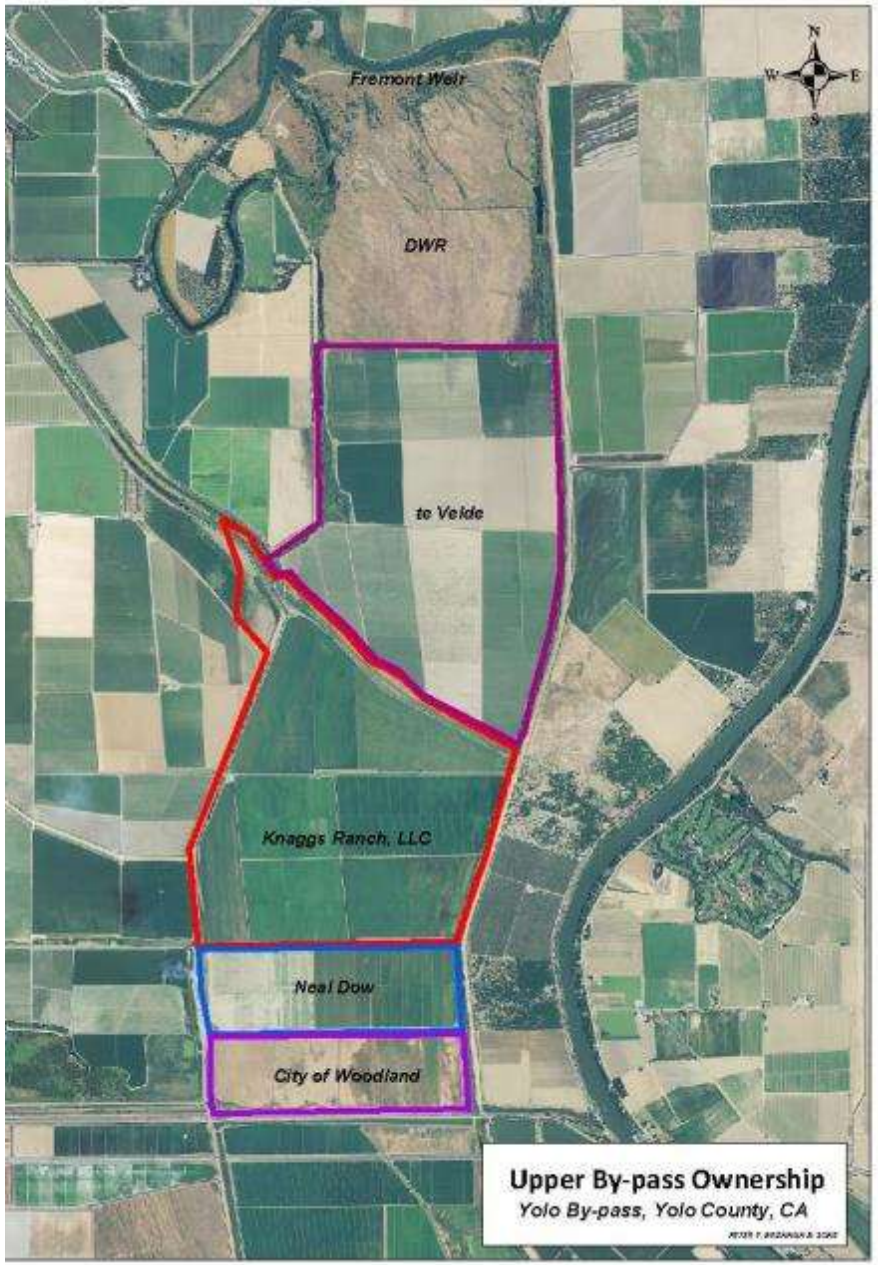
We are never going back



Mimicking natural floodplain processes in post-harvest floodplain rice fields

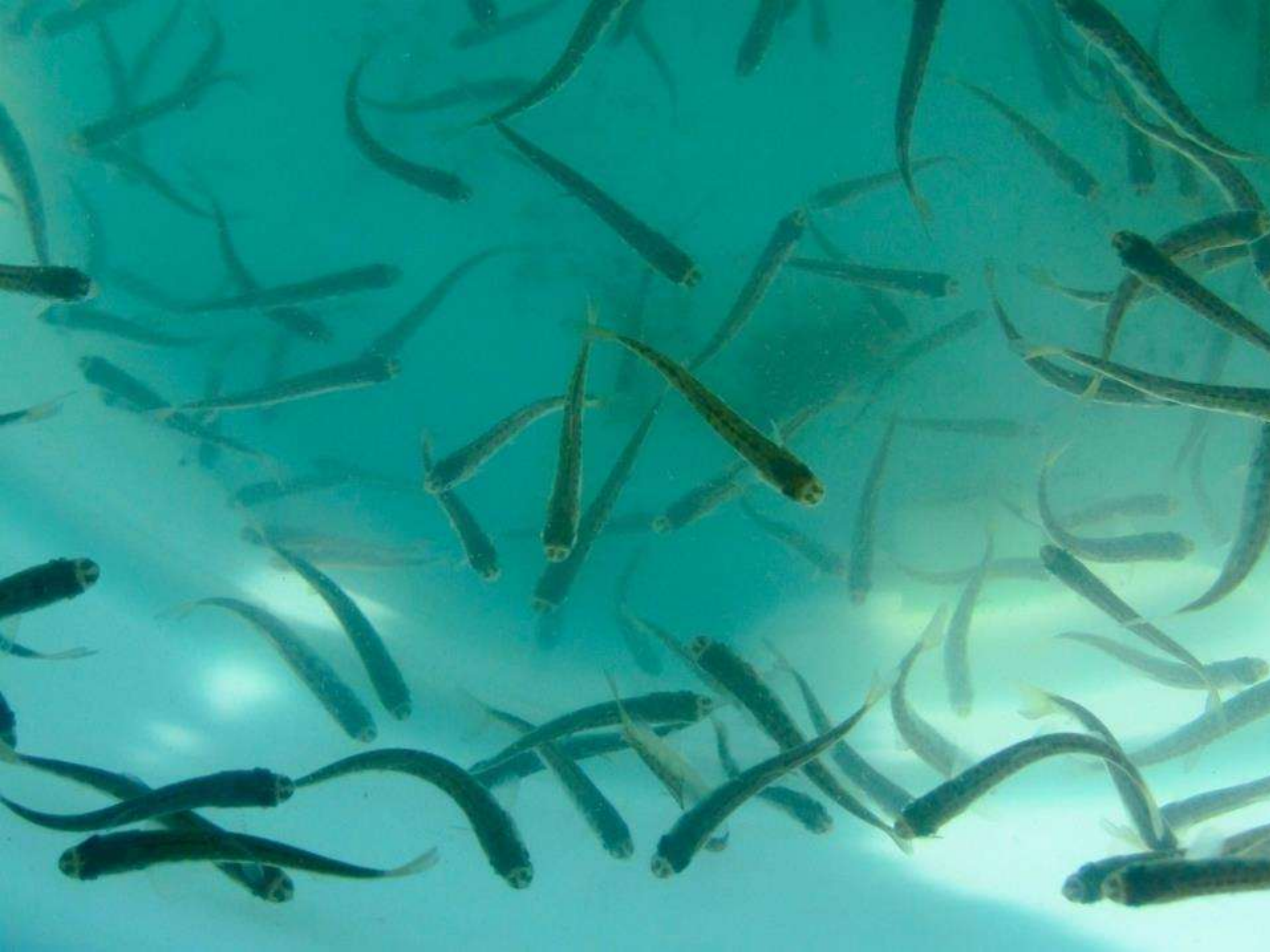
Knaggs Ranch on Yolo Bypass



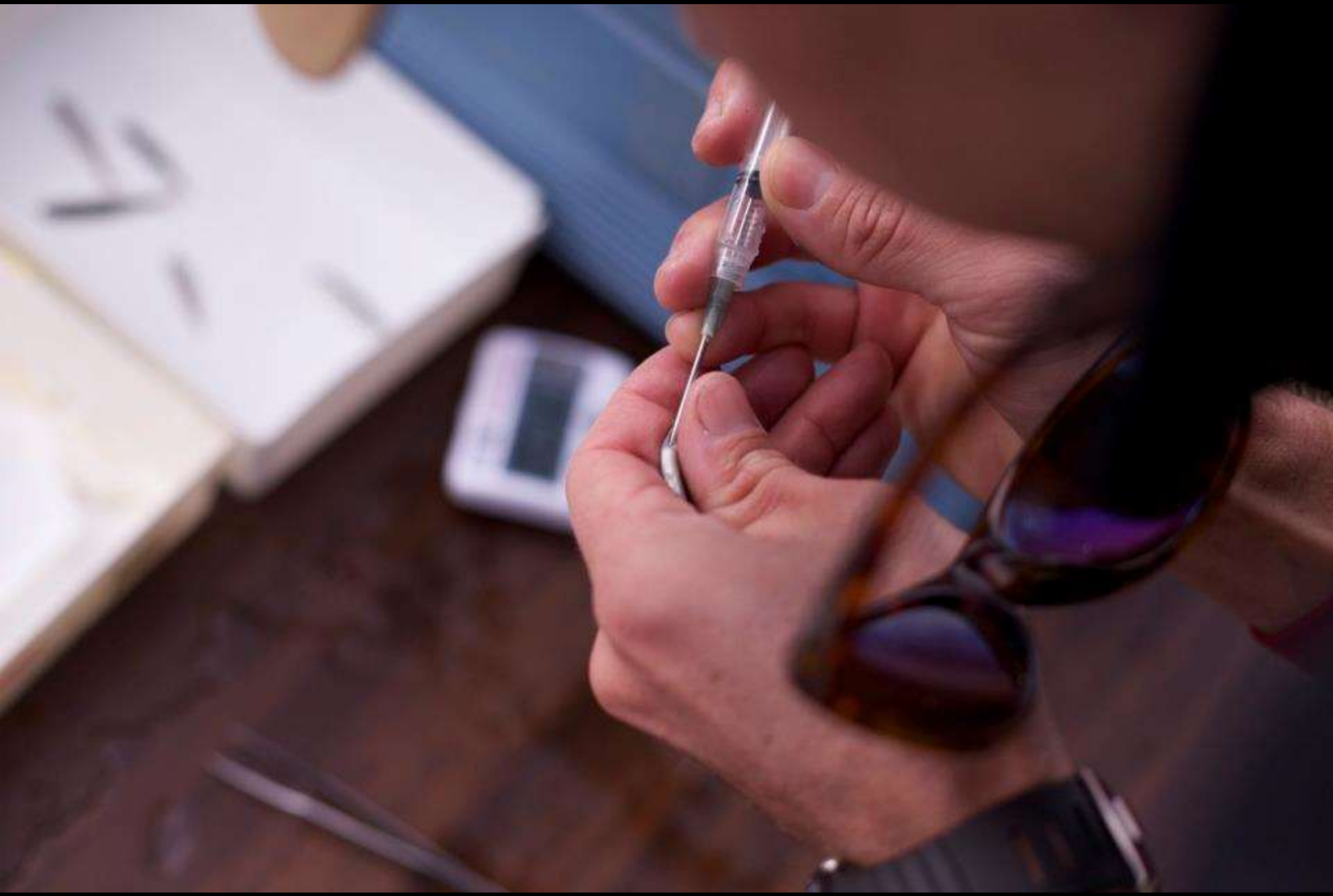


Post Rice Harvest - November


Carson Jeffres



Passive integrated transponder (PIT tags)



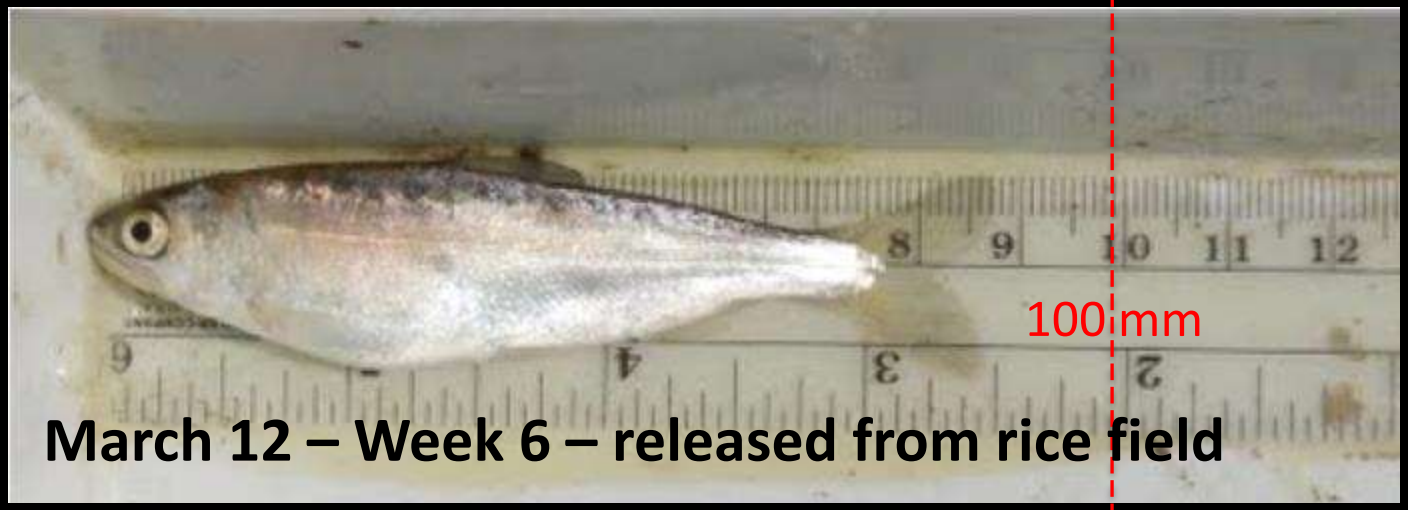
Fish measured every 2 weeks

After 6 weeks field drained


VVP

Fish measured and tags read


100 mm
Jan 31 – Week 0 – planted in rice field

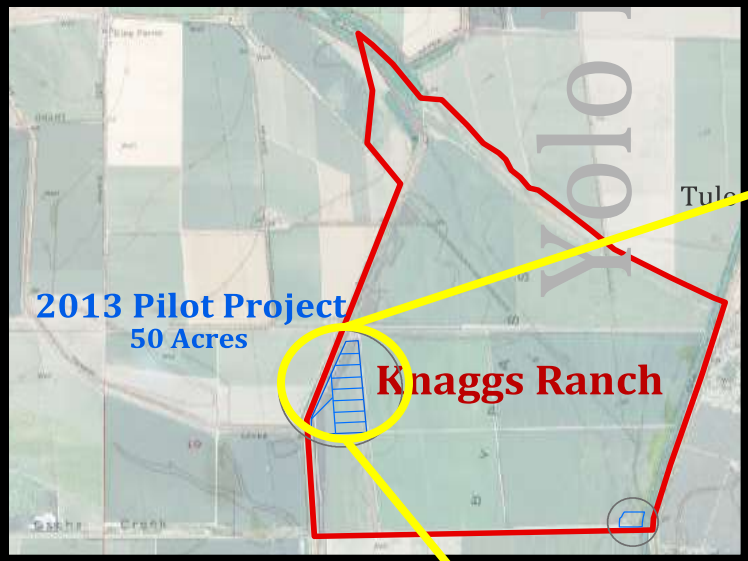

100 mm
March 12 – Week 6 – released from rice field


100 mm
April 13 – Week 10 – 13 miles downstream

GROWTH

Central Valley Waterfowl


Nine 2-acre fields



Farm Practices And Fish?

Substrate type?

Fallow

Stubble

Stomped

Replicated Ag Floodplains at Knaggs Ranch
Hypotheses tested

- 2013 — Substrate effects
- 2014 — Depth refugia
- 2015 — Draining techniques
- 2016 — Survival over time

Day 0

Day 38

2013

3/19

53 mm

1.5 g

4/27

90 mm

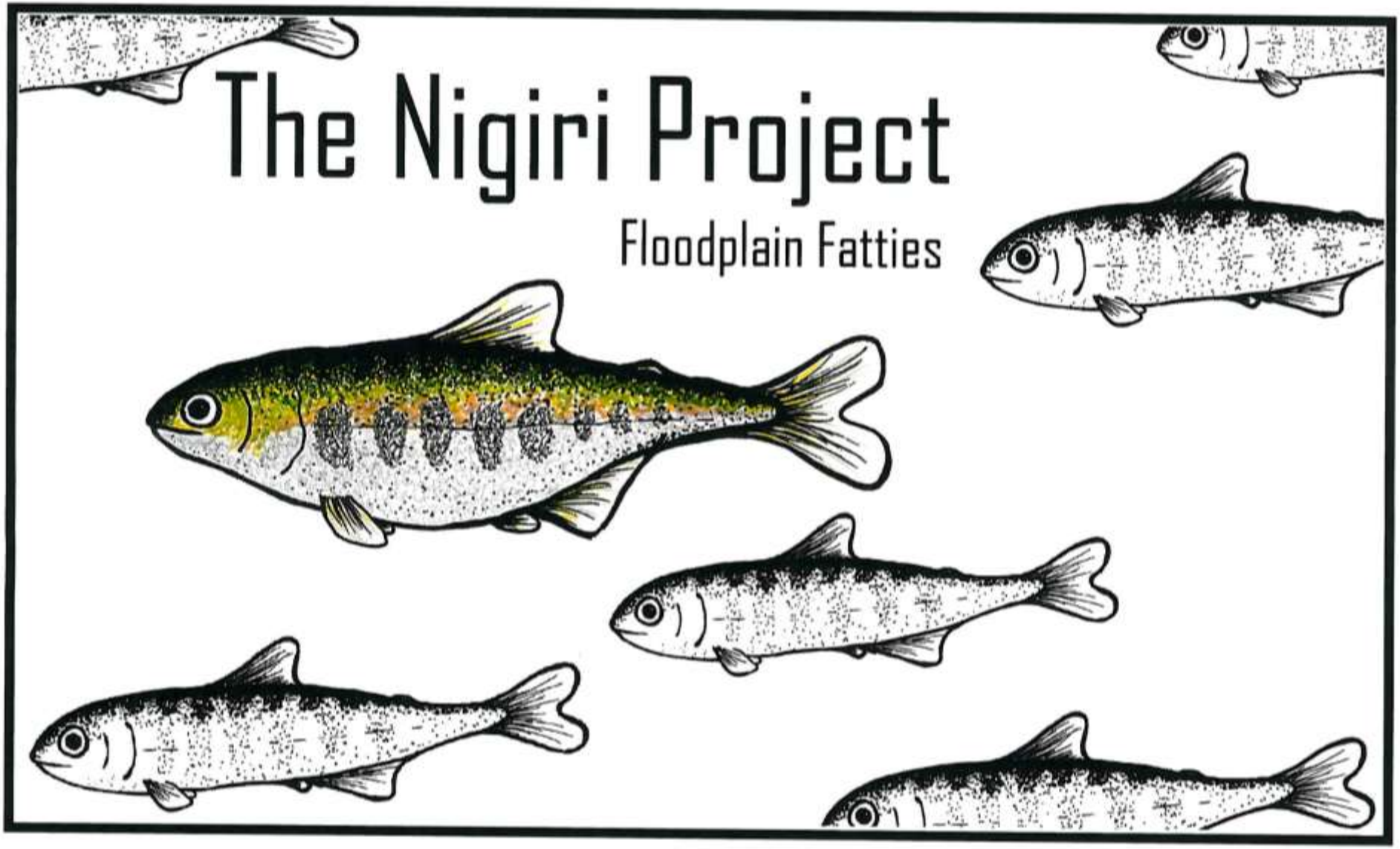
9.4 g

0.94 mm/d

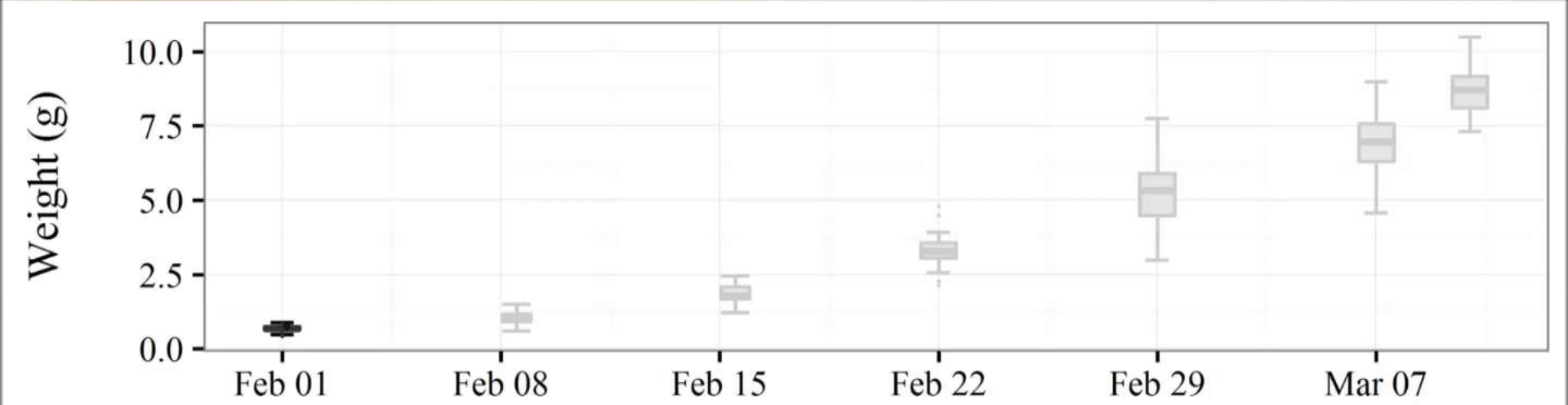
0.18 g/d

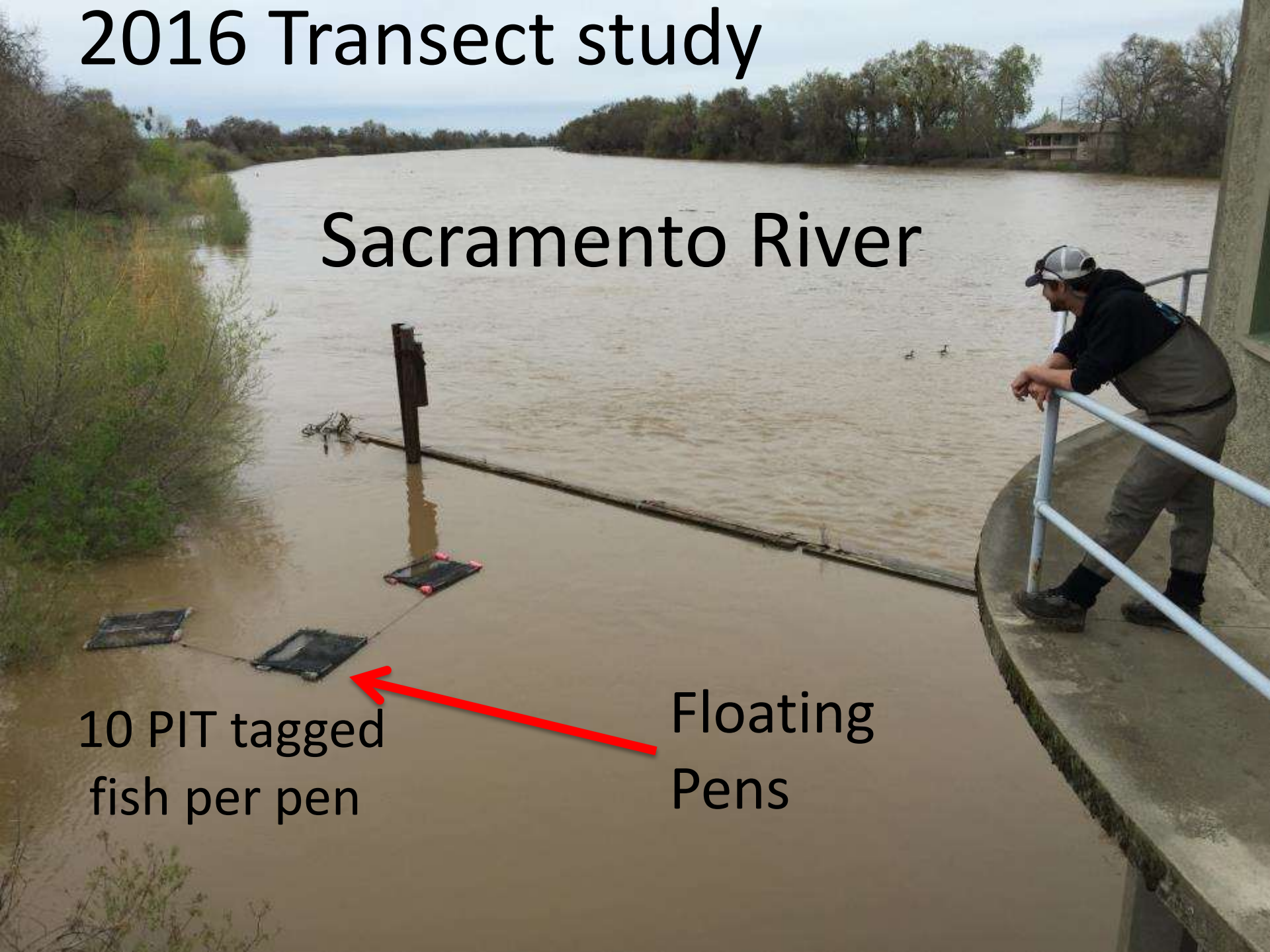

CENTRAL VALLEY PROJECT · · · CALIFORNIA ·
UNITED STATES · · · · DEPARTMENT OF THE INTERIOR · · · · · BUREAU OF RECLAMATION
2015:
Fish at
Multiple Locations
Sutter
Knaggs
Conaway
Cosumnes
Dos Rios
EXPLANATION
NEVADA
PACIFIC OCEAN

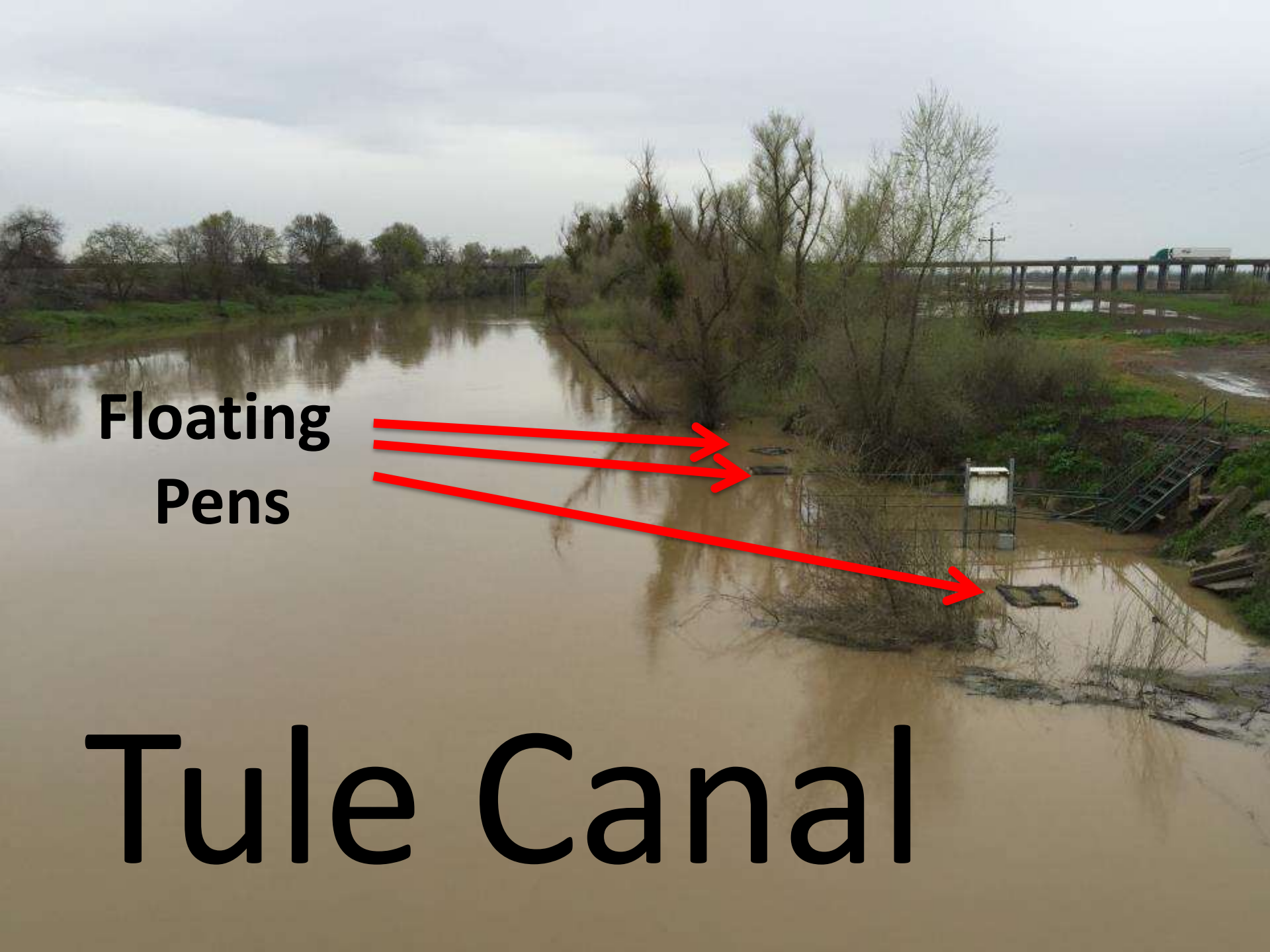
Same Results



Stocking day

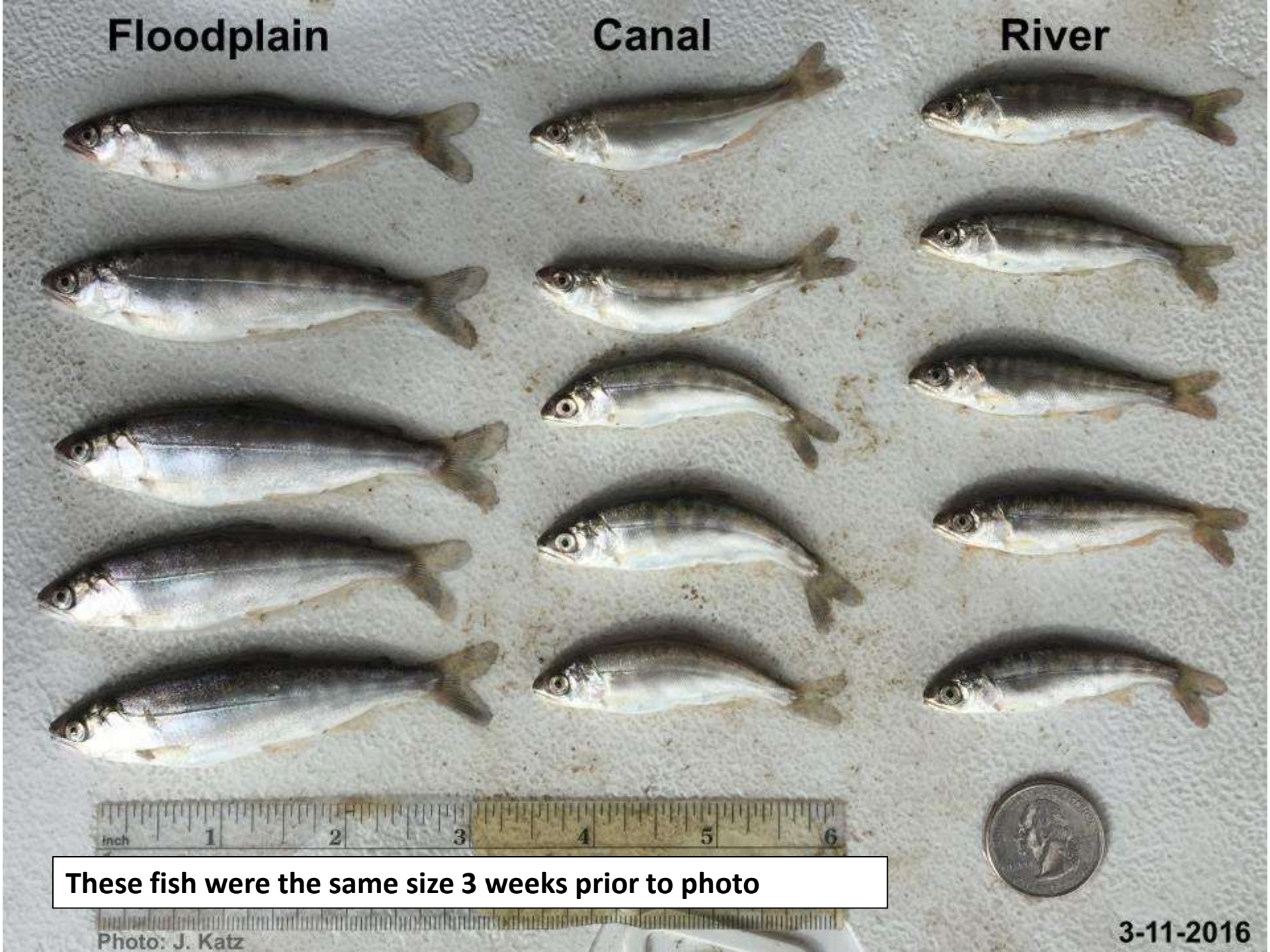


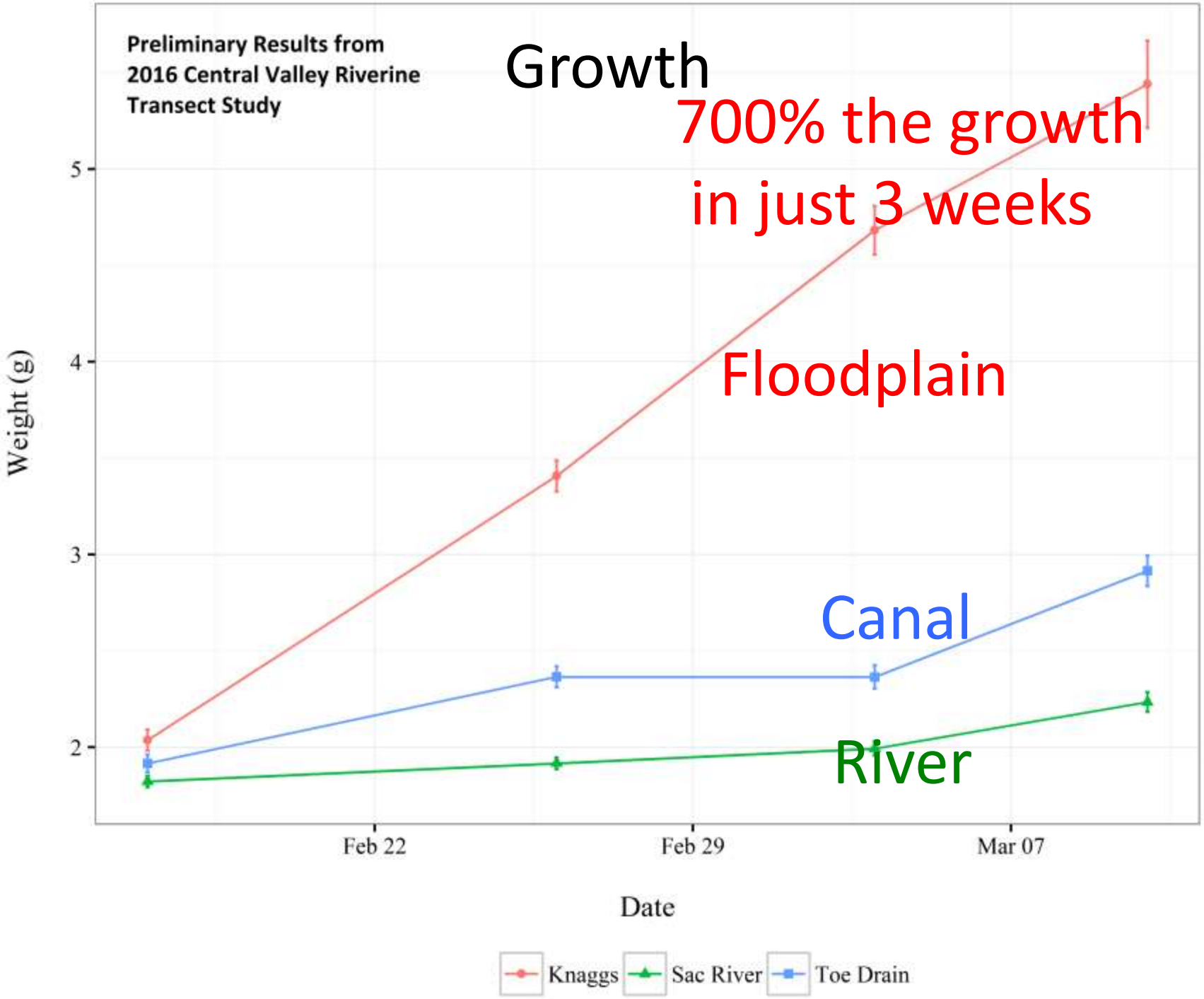

2016 Transect study
Sacramento River
10 PIT tagged fish per pen
Floating Pens



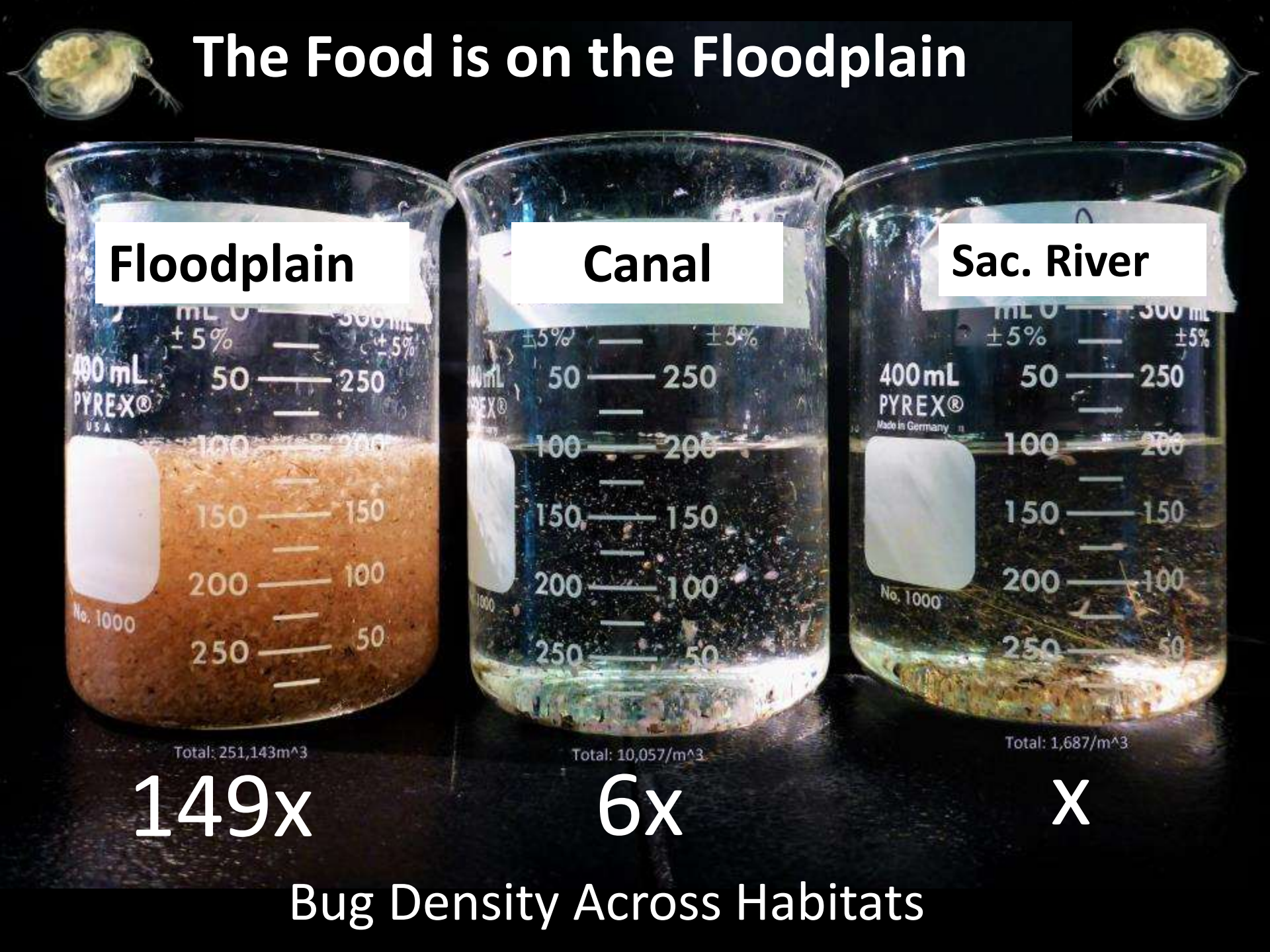
Tule Canal

Managed Agricultural Floodplain At Knaggs Ranch on Yolo Bypass


Floodplain
Canal
River
inch
1
2
3
4
5
6
These fish were the same size 3 weeks prior to photo
Photo: J. Katz
3-11-2016


Preliminary Results from
2016 Central Valley Riverine
Transect Study
Growth
700% the growth
in just 3 weeks
Floodplain
Canal
River
Weight (g)
5
4
3
2
Feb 22
Feb 29
Mar 07
Date
Knaggs
Sac River
Toe Drain

The Food is on the Floodplain

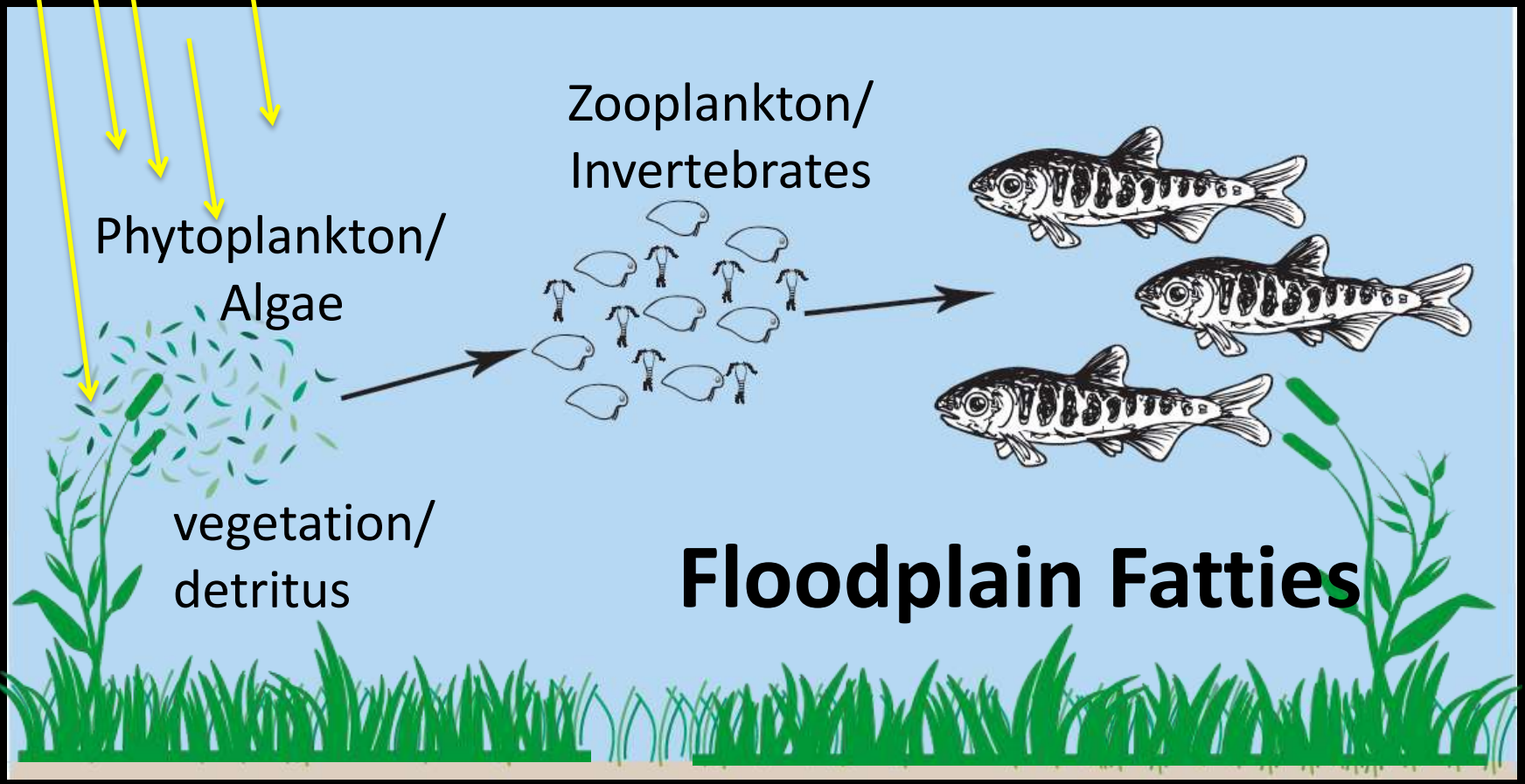


Bug Density Across Habitats

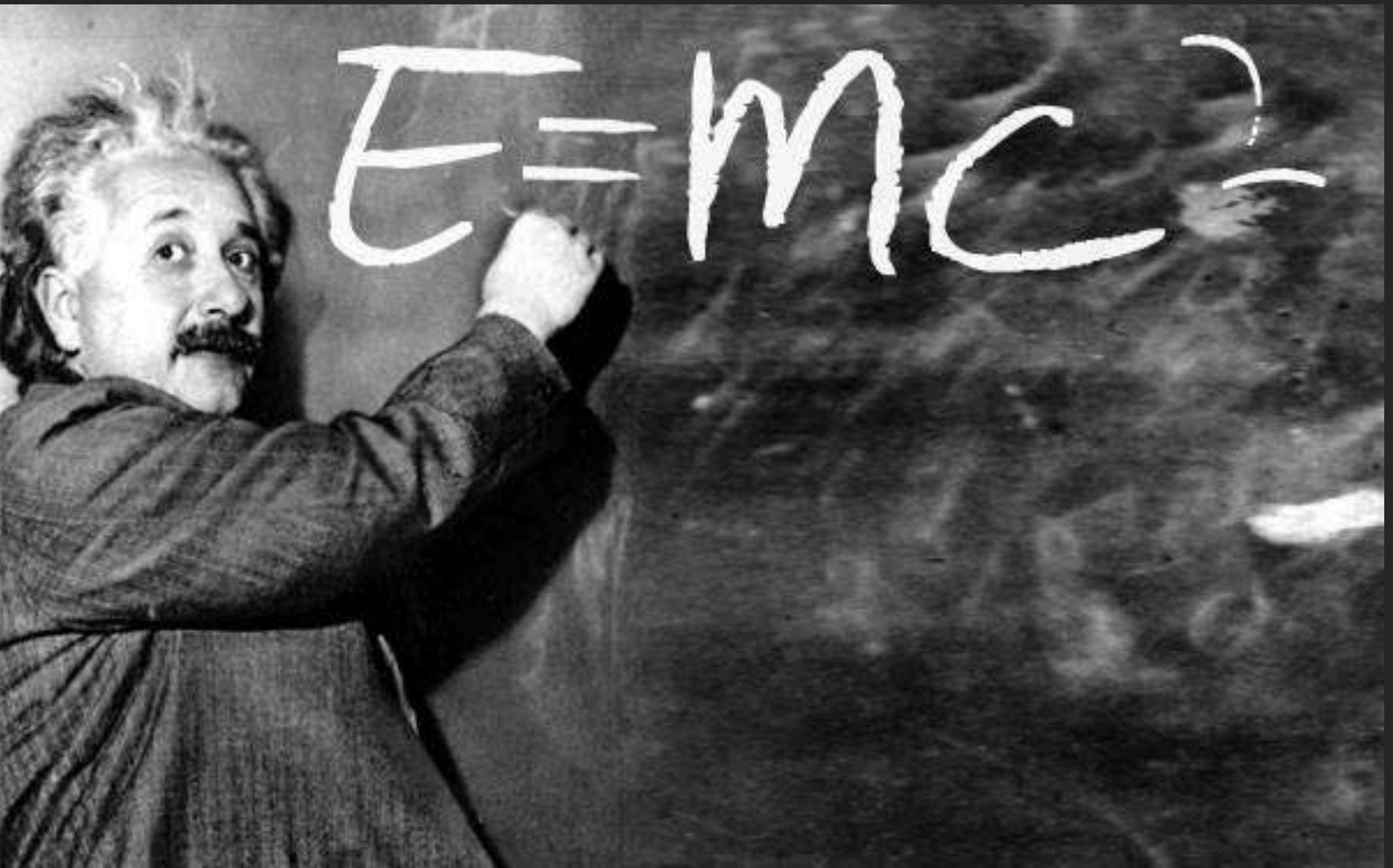
Floodplains are the

River’s solar panels

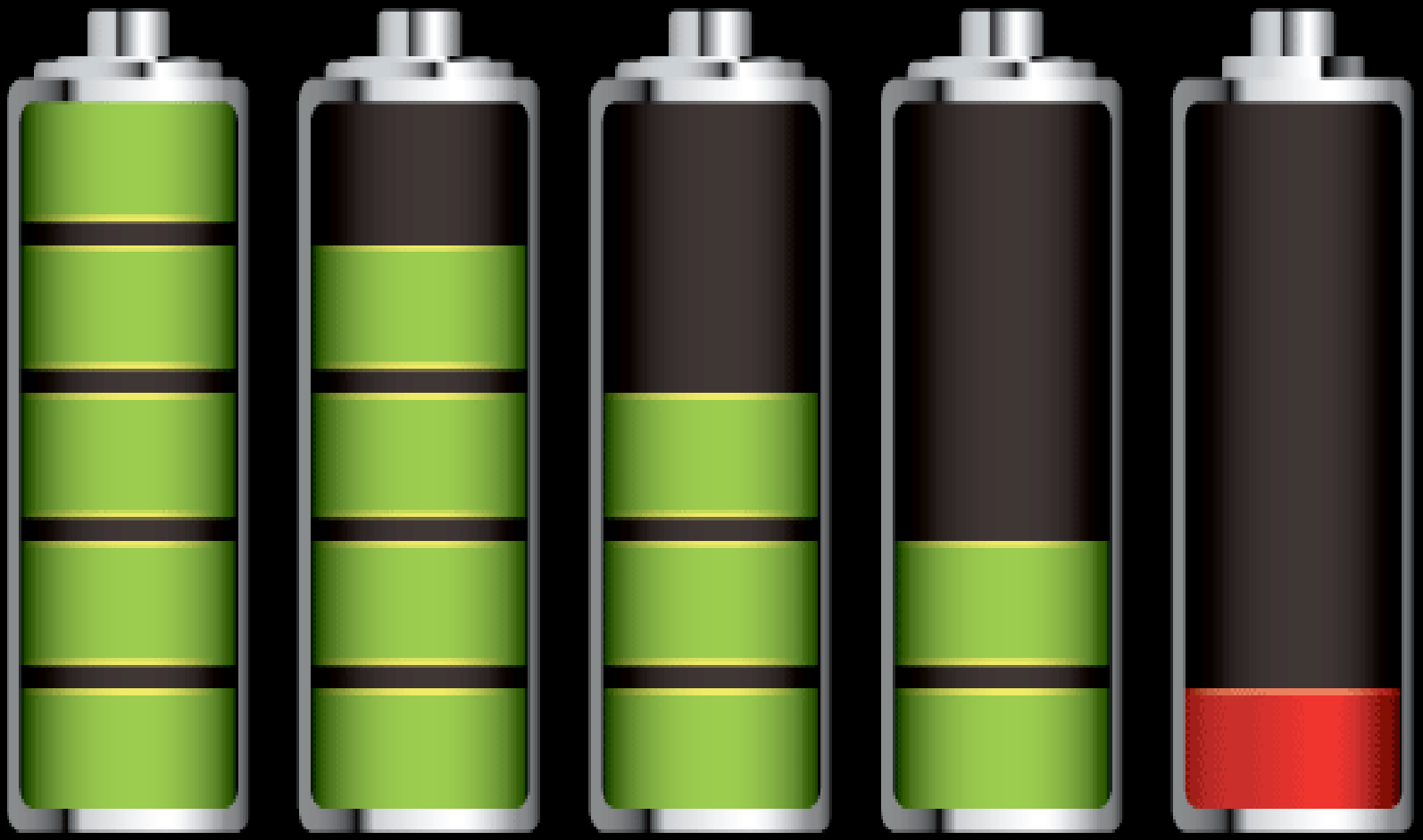
Mimicking Hydrologic Process To Restore Ecological Function



Not Rocket Science



Loss of Seasonally Inundated Floodplain



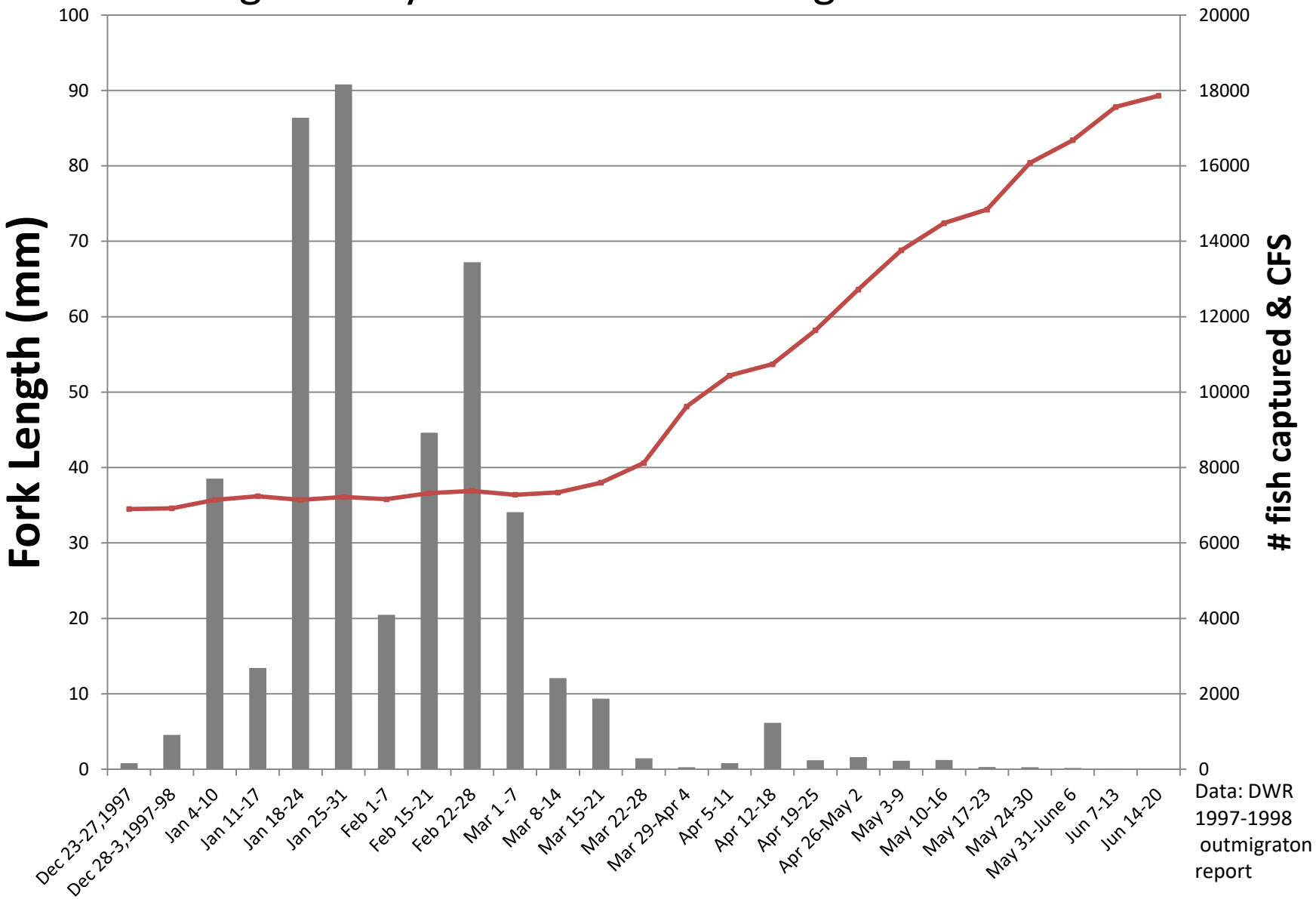
Pre-development → Today

Ecosystem Running Out of Power!

Feather River 1997-1988

Estimated number of outmigrants **43,707,500**

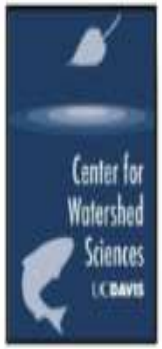
99.8% emigrated by mid March. Average size ~**38mm**



Data: DWR 1997-1998 outmigraton report

Fish Gotta Eat Too!

Fish Food on Floodplain Farm Fields

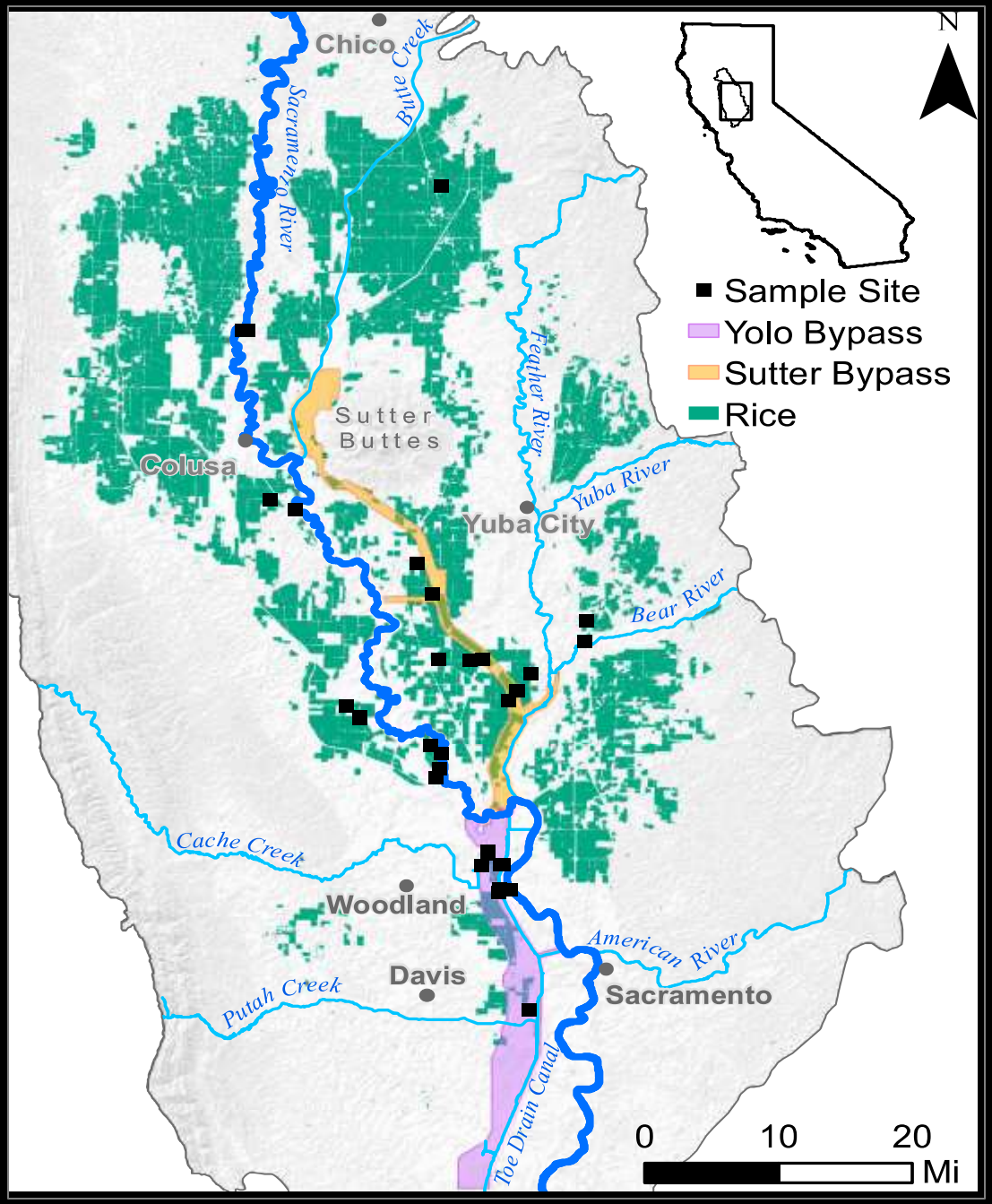


RECLAMATION DISTRICT 108

Knaggs Ranch

Davis Ranches

Next Generation Foods



Flooding Ag Tracts For Improved Salmon Habitat

Residence Time = Puddle Power

Spread it–Slow it–Sink it–Grow it

Its in the bag

Time for levee 2.0



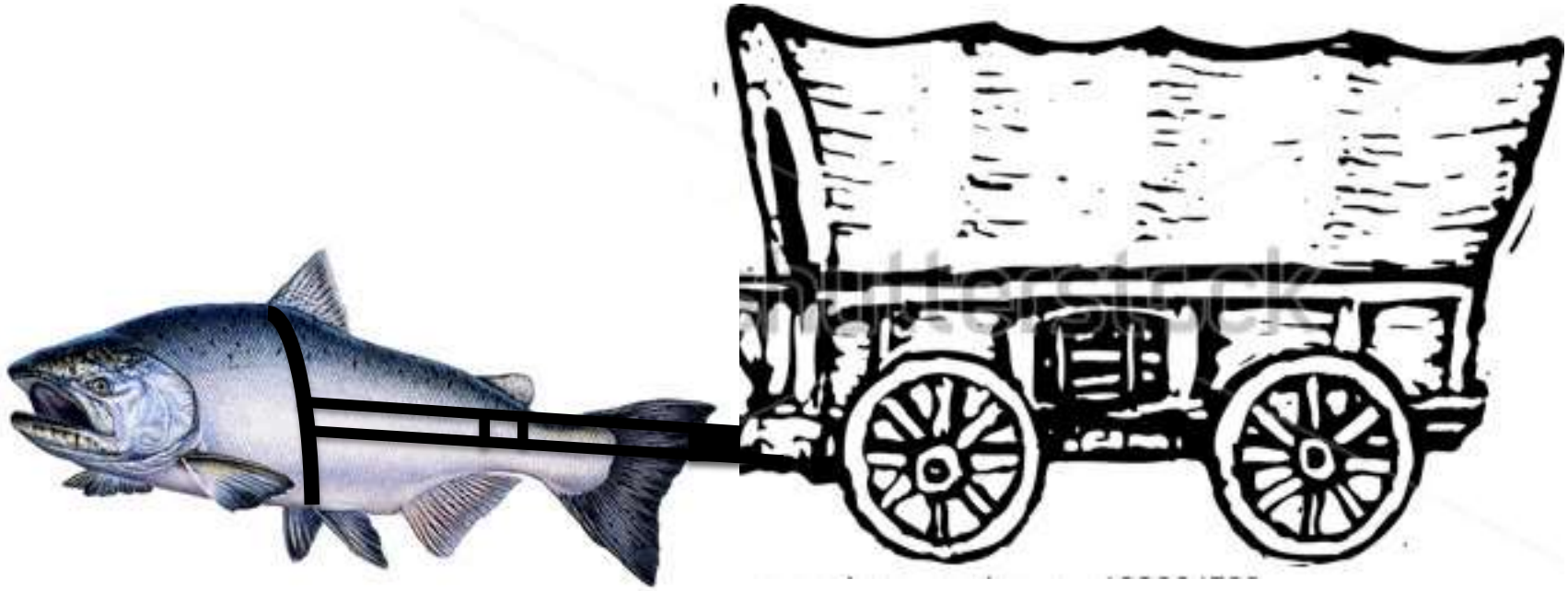




Managing floodplains for multiple uses:

- Flood protection
- Agriculture
- Aquifer recharge
- Critical habitat for native fish, birds and wildlife
- Food web production

Central Valley Salmon Habitat Partnership



‘bout time we circled the fish wagons

Process-Based Reconciliation

Integrating a working knowledge of natural process, into management of natural resources

Questions?

Carson Jeffres