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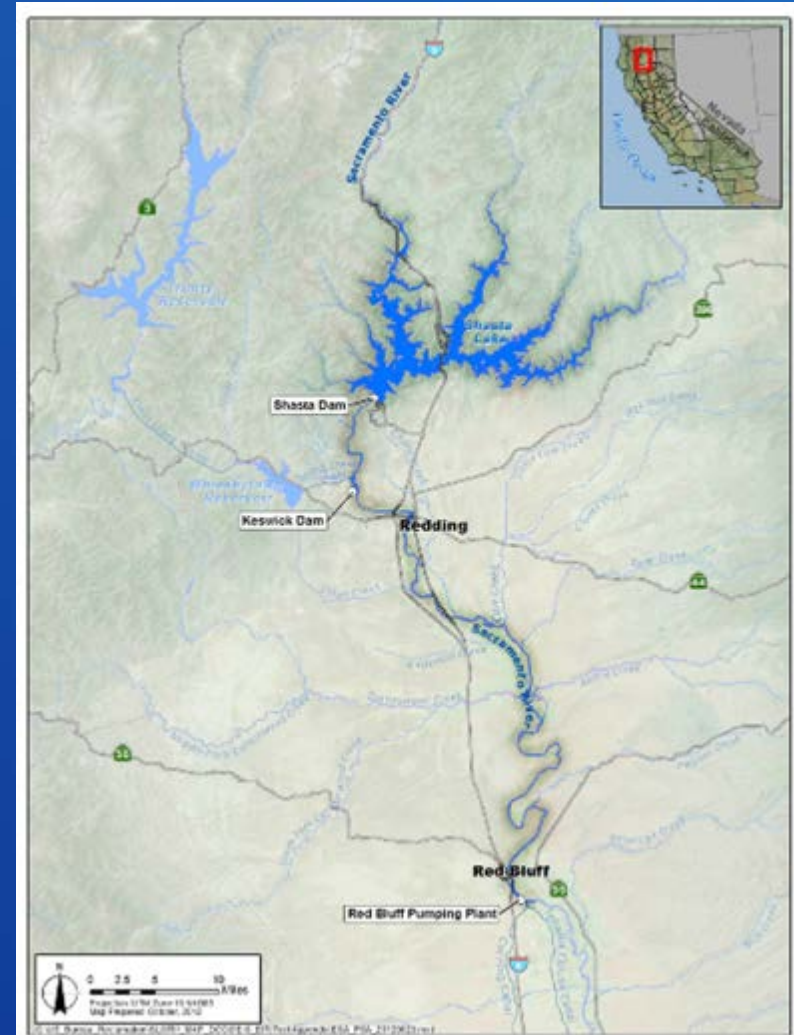
Managing Water in the West

Shasta Dam Fish Passage Evaluation

John Hannon
US Bureau of Reclamation
Willamette Fisheries
Science Review 2/9/2016



Geographic Location



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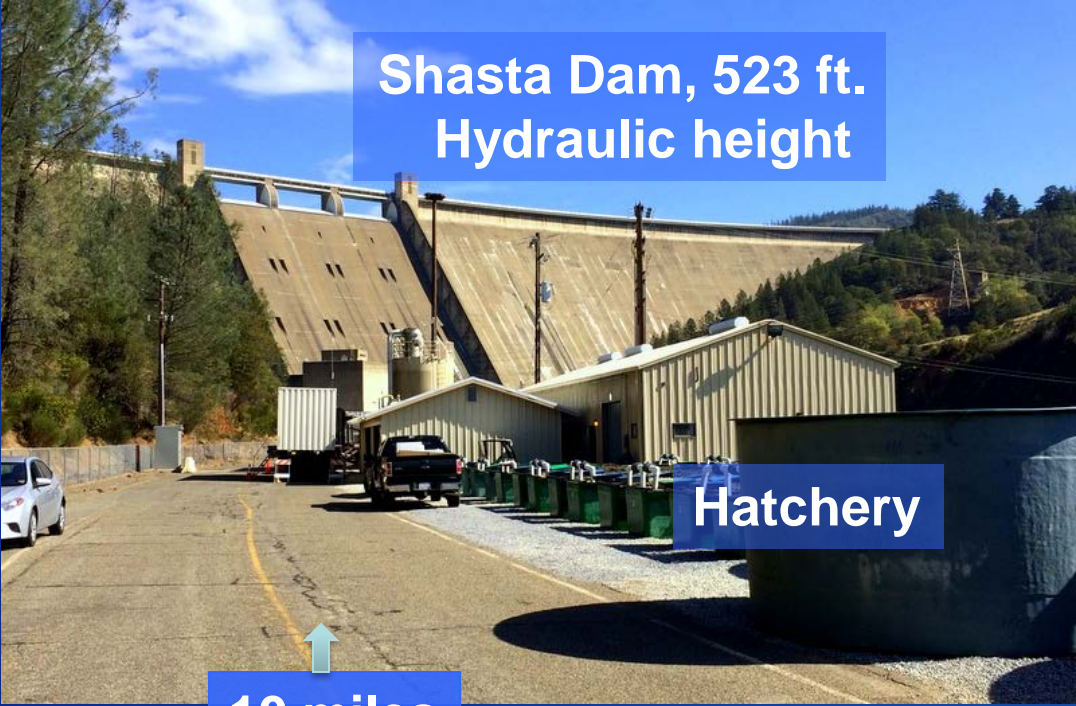
**Sacramento River
in Redding, CA - RM 296**

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- Fall Run: 33 mm
- Spring Run: 40 mm
- Winter Run: 81 mm
- Late-Fall Run: 130 mm
- *O. mykiss*: 162 mm



**Shasta Dam, 523 ft.
Hydraulic height**

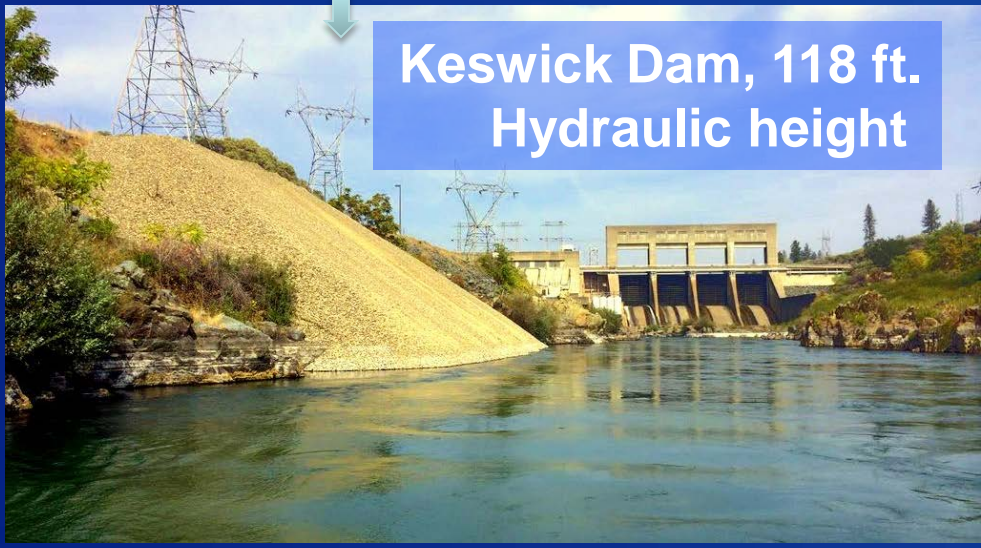


Hatchery

10 miles



**Keswick Dam, 118 ft.
Hydraulic height**



**Shasta Temperature
Control Device**



Sacramento R.

McCloud R.

Pit R.

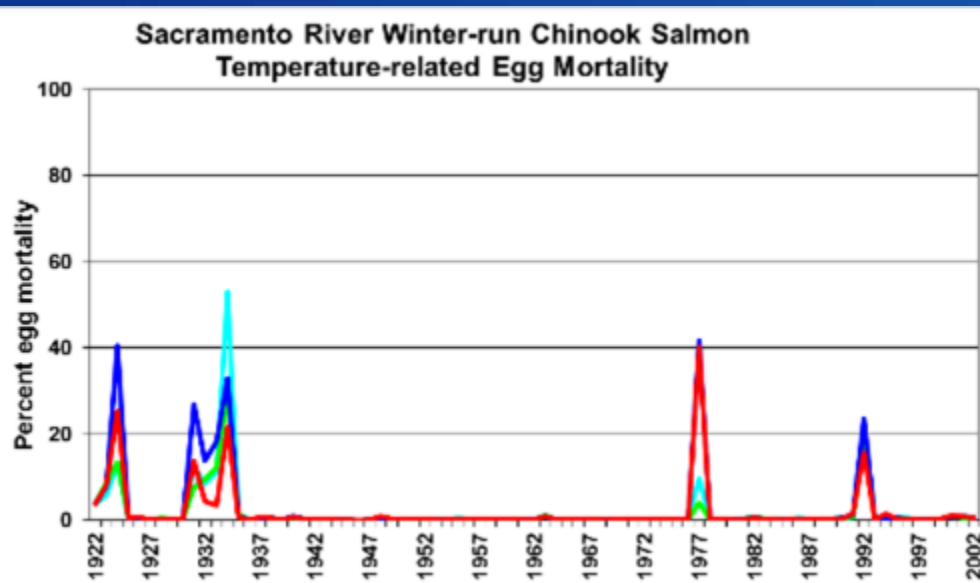


Shasta Dam

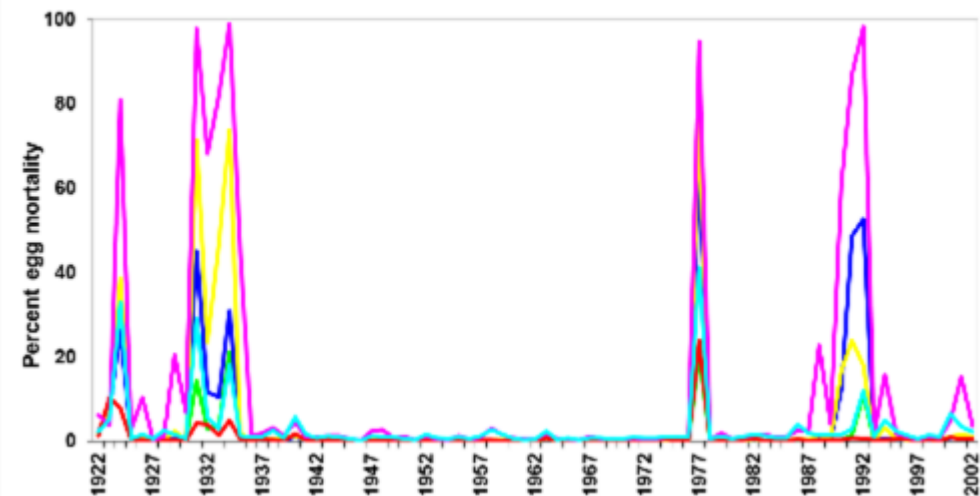
Image Landsat



Future Risk to Winter-Run Chinook



Historic Climate Condition



Future Climate Condition

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Salmon die-off fears at heart of latest California water conflict

By Peter Fimrite | December 11, 2015



Photo: Michael Macor, The Chronicle



Assistant Hatchery Manager John Rueth, tends to tanks full of endangered winter run Chinook Salmon, at the Livingston Stone Federal Fish Hatchery at Shasta Lake, Calif., on Wednesday December 9, 2015.

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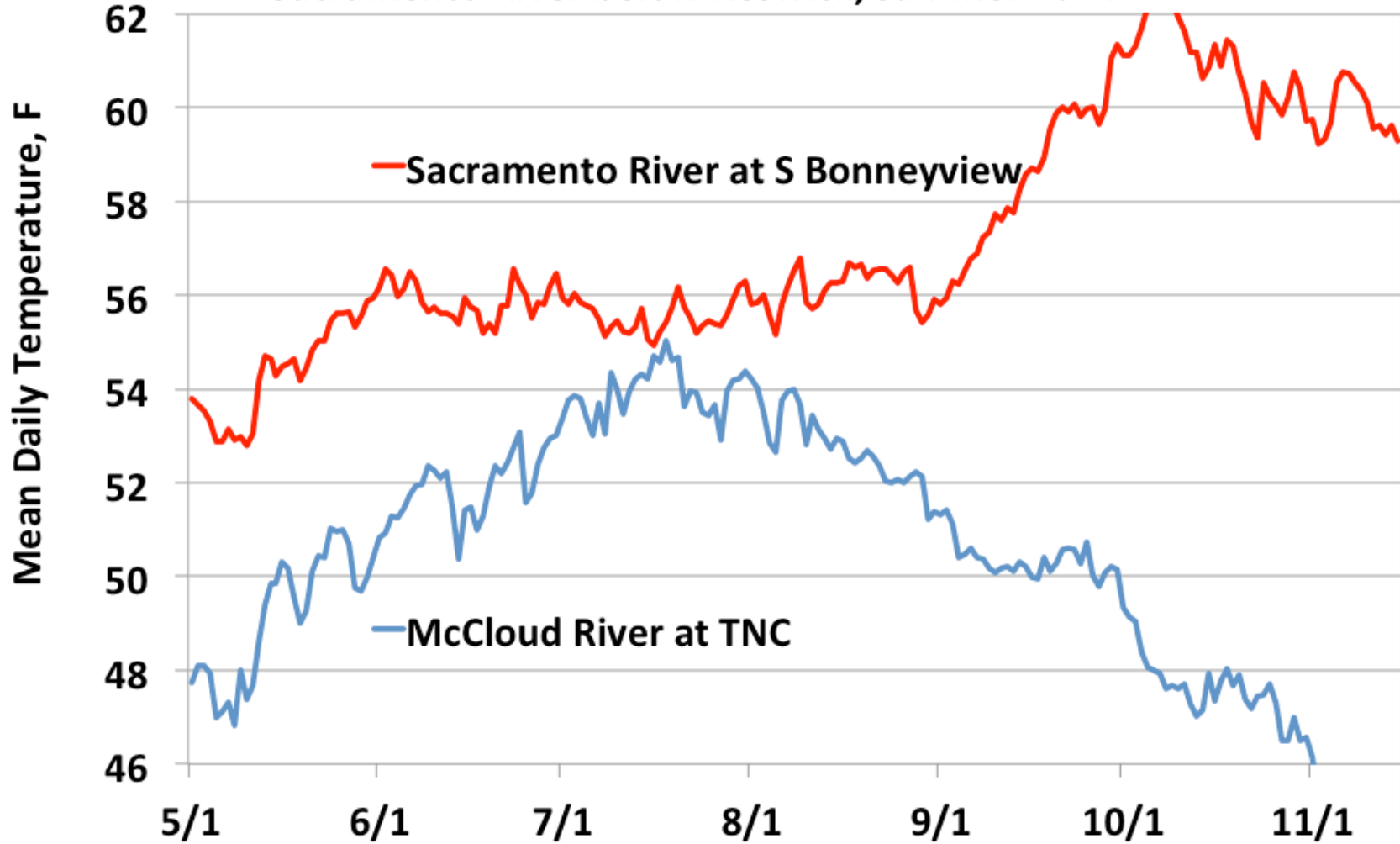
Project Purpose

Evaluate feasibility of passage for ESA-listed Chinook around Shasta Dam to make a well informed decision about initiating a long-term fish passage program.



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Comparison of water temperature in McCloud River and Sacramento River below Keswick, summer 2014





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Habitat Assessment



**Georeferenced
Aerial Video of
Mainstem McCloud
and Sacramento
Rivers**

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Winter-run Chinook Female Spawner Capacity

River	River Length (miles)	Thermally Optimal Length (miles)	Estimated Spawner Capacity (Number of Females)		
			6 m ² Spawning Territory	10 m ² Spawning Territory	20 m ² Spawning Territory
Sacramento	37.0	9.0	224	134	68
McCloud	23.2	11.6	3,382	2,029	1,014

Winter-run Chinook Salmon Timing

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult migration ¹	Light Blue	Light Blue	Dark Blue	Light Blue	Light Blue	Light Blue	Light Blue	White	White	White	Light Blue	Light Blue
Spawning ²	White	White	White	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	White	White	White	White
Egg incubation/emergence ³	White	White	White	Light Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	White	White
Rearing / emigration ⁴	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	White	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue

Sources:

¹ Moyle 2002, NMFS 2014a

² Vogel and Marine 1991, NMFS 2014a

³ NMFS 1997, Fisher 1994

⁴ Poytress and Carillo 2010, 2011, 2012; Snider and Titus 2000a, 2000b

Note:

Darker shades indicate months of peak activity, white indicates no activity.

Upper Sacramento River Watershed

Upper Sacramento River

37 miles

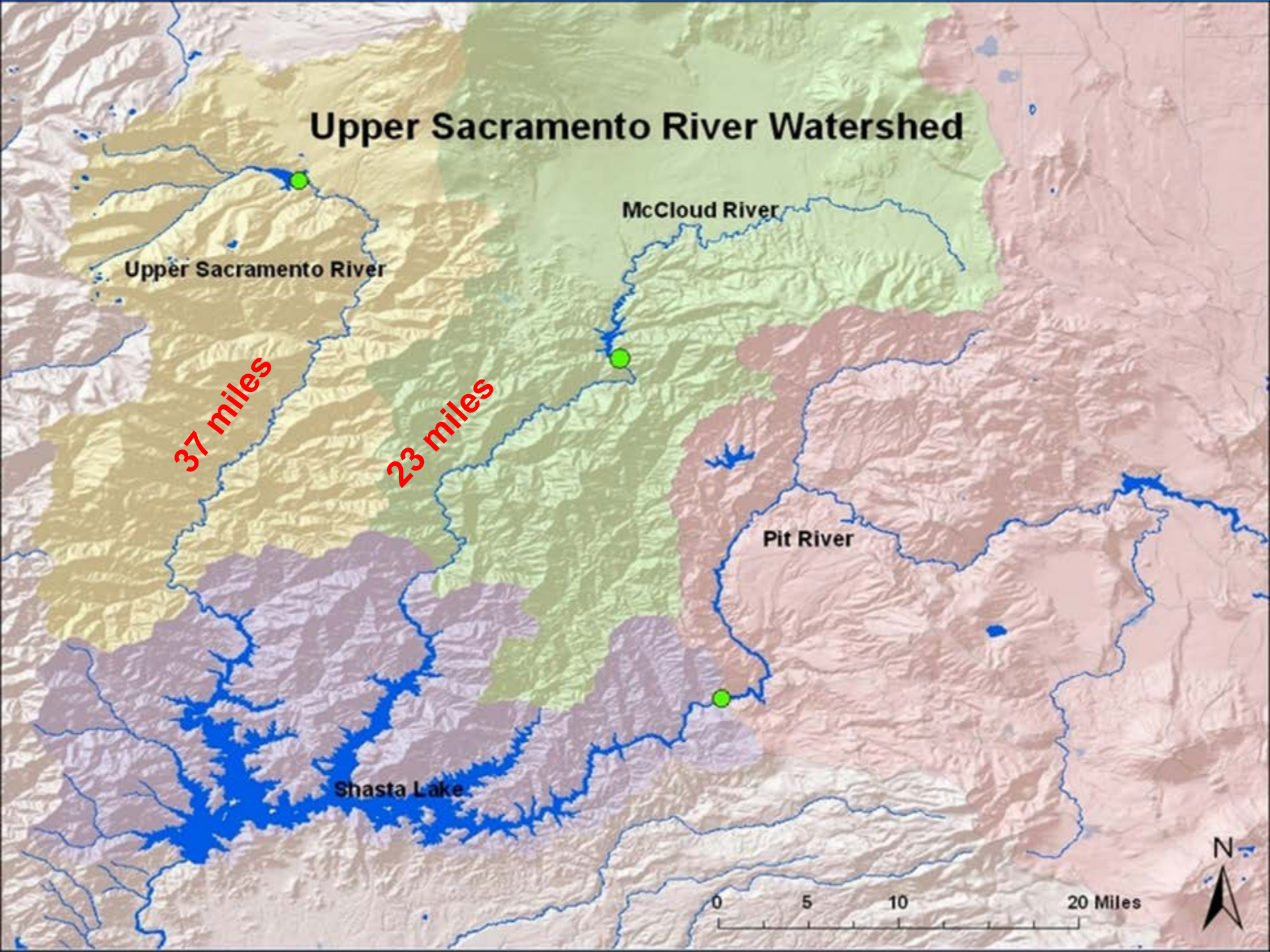
McCloud River

23 miles

Pit River

Shasta Lake

0 5 10 20 Miles



Keswick Dam Adult Trap



R

Loading Adult Chinook At Keswick



Captive Broodstock Program at Livingstone Stone National Fish Hatchery

- 1,035 juveniles held back in February 2015 (3 per family group)
- Reared 2-3 years to maturity at the hatchery
- Produce 250 males and 250 females total
- Spawned as adults to produce eggs and juveniles

Pilot Implementation Plan

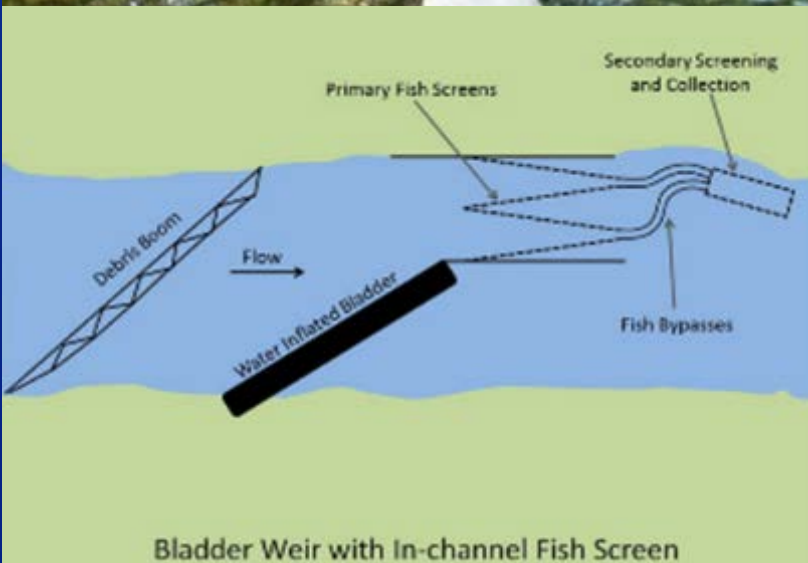
- Separates the Pilot Program into three study years
- Describes engineering options for upstream and downstream passage
- Lists key questions, objectives, metrics for different life stages for each year
- Describes pilot studies
- Includes Pilot Program timeline

Year 1: Fry/Juveniles



Key questions focused on:

- Survival rates
- Collection recovery efficiency
- Collection location and method
- Transport method/release location
- Timing of migration
- Size and distribution (growth rates)
- Differences in productivity between the tributaries
- Competition/predation with trout
- Number of smolts-per-female



Year 2: Fry/Juveniles and Instream/ Streamside Egg Incubation

Questions from Year 1 plus:

- Survival of egg-to-fry to emigrant reaching lake
- Method for egg transplant
- Location for egg incubation/planting



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Eggs are placed in the top compartment

Boxes with eggs are placed within the fridge's 'channels'



Egg Introduction



**Livingston Stone
National Fish Hatchery**

**Shasta Reservoir
Water Supply Treatment
Study**

Prepared for:

**The United States
Fish and Wildlife Service**

January 2016



MWH

BUILDING A BETTER WORLD

**Have to build
water treatment
System at hatchery
Before adults can
Be released upstream
Of dam**

**Resident fish
Health study in
Progress in upstream
tributaries**

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Year 3: Fry/Juveniles, Instream/ Streamside Egg Incubation, and Adults



Questions from Y1 and Y2 plus those focused on:

- Prespawn mortality rates
- Release location
- Juveniles reaching lake per adult female
- Sufficient holding and spawning habitat
- Distribution of holding and spawning adults



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**McCloud
Bridge**

McCloud Bridge

**Head of reservoir
location can vary by
as much as 6 miles
on the McCloud River**

1 Mile

**Head-of-
reservoir**

Dekias Rock

Low Reservoir: 12/3/2014 image
Stage: 890



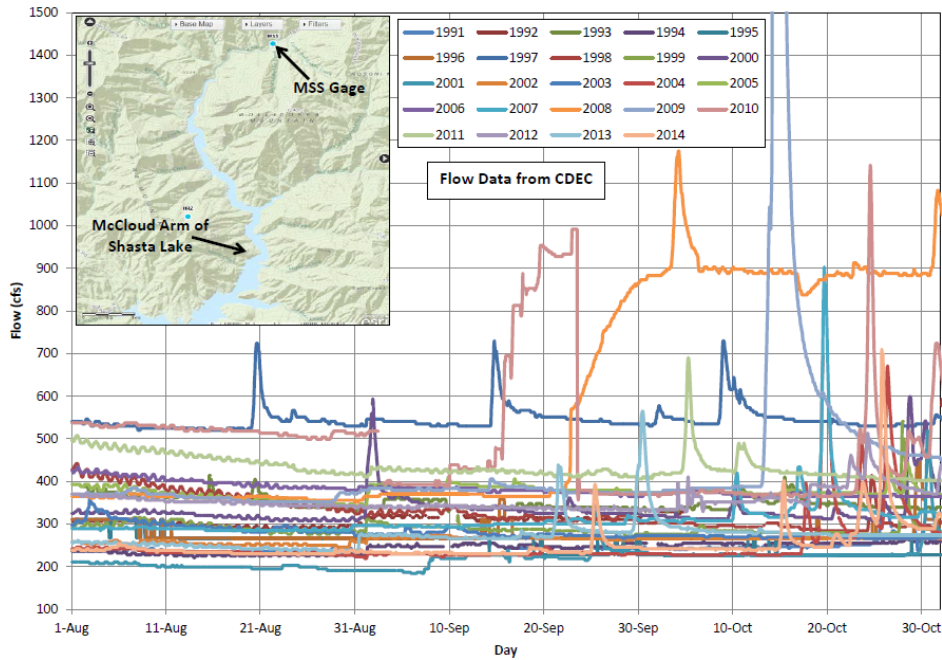
**Head-of-
reservoir**

McCloud Bridge

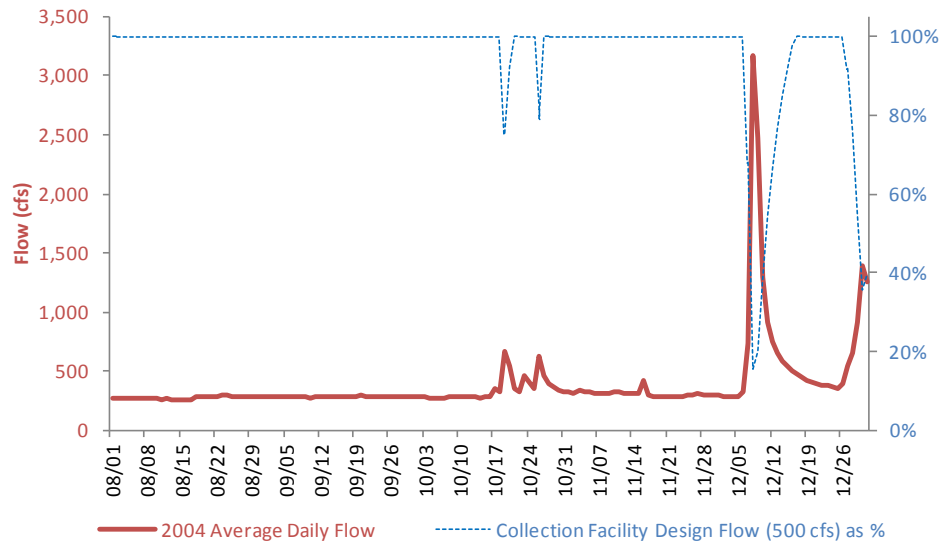
Dekias Rock

High Reservoir: 2012 NAPP image

Aug - Oct Hourly Flow at MSS Gage on the McCloud River



McCloud River Flow - Condition 4(e) vs. Collection Facility Design Flow



In-River Collection Site



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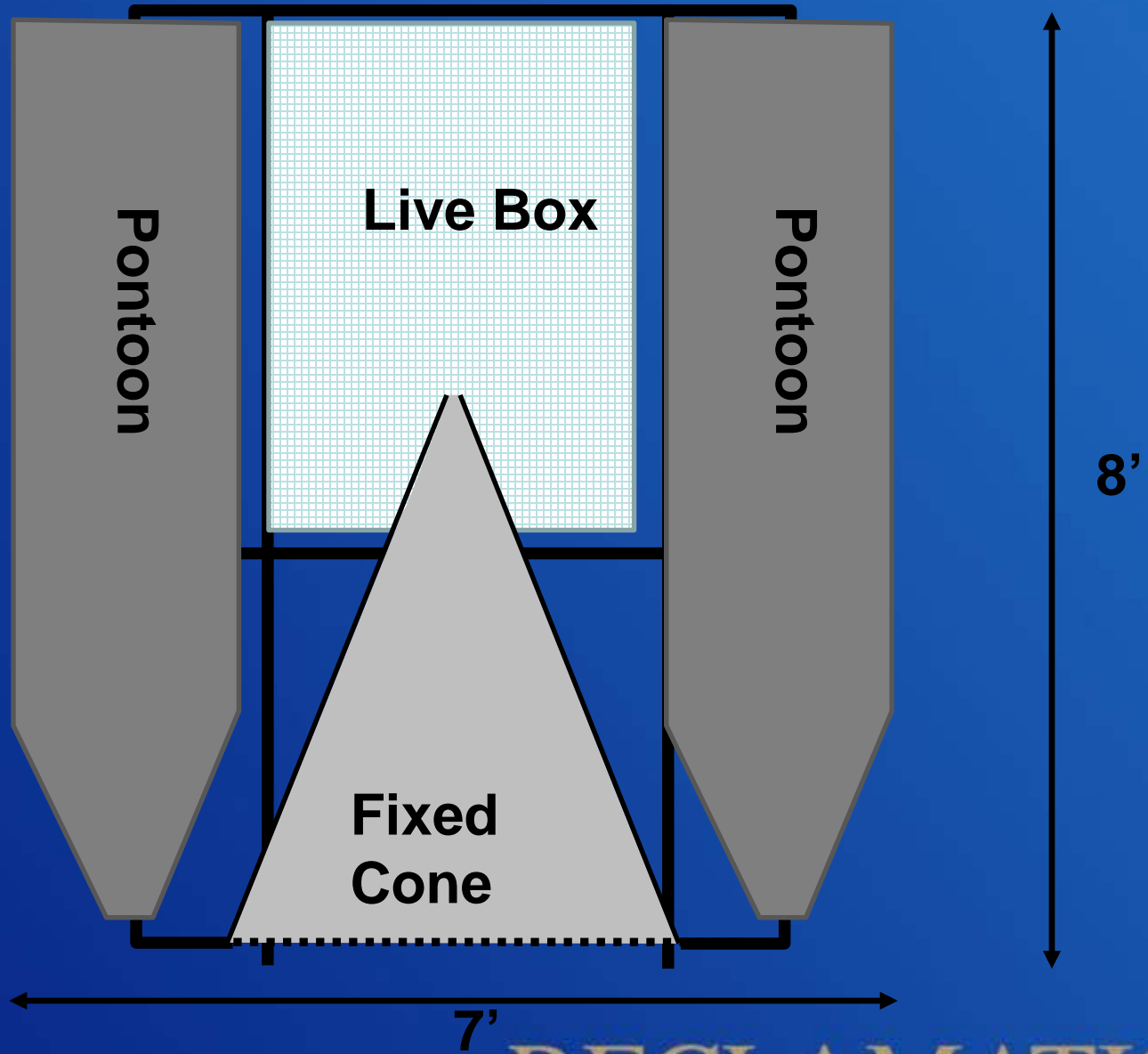
In-River Collector Concept (not to scale)



Randy Beckwith, CDWR

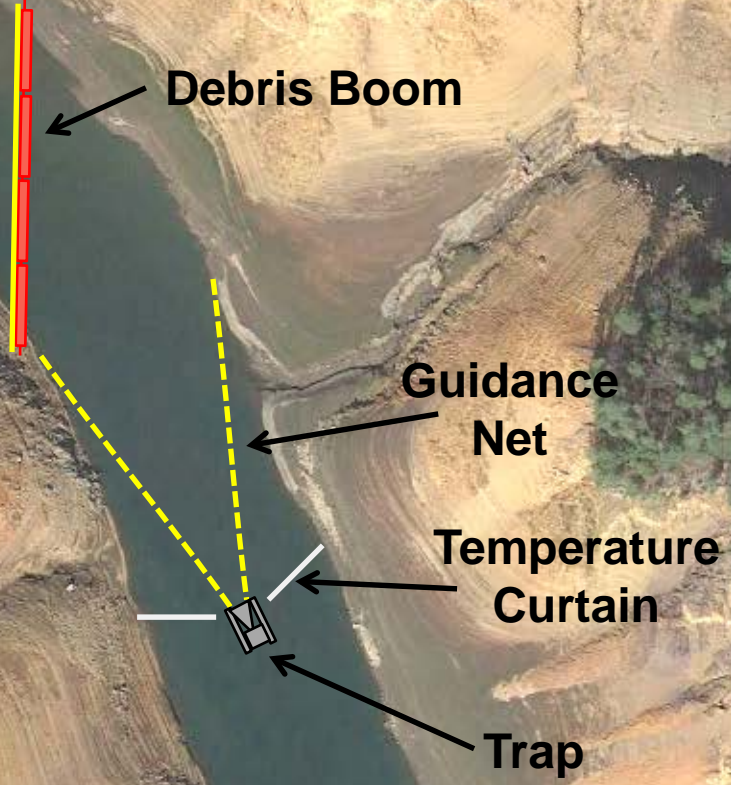
Google

In-River Trap Concept



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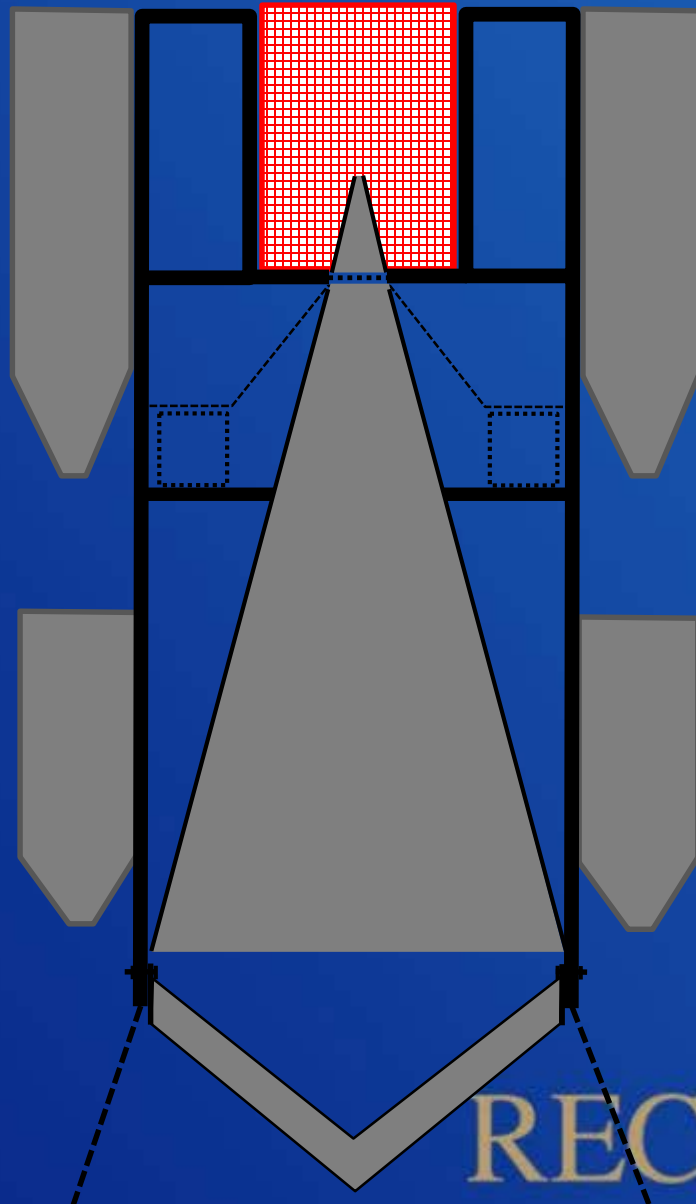
**Head-of-Reservoir
Collector Concept
(not to scale)**



Gilman-Rd

© 2015 Google

Google earth



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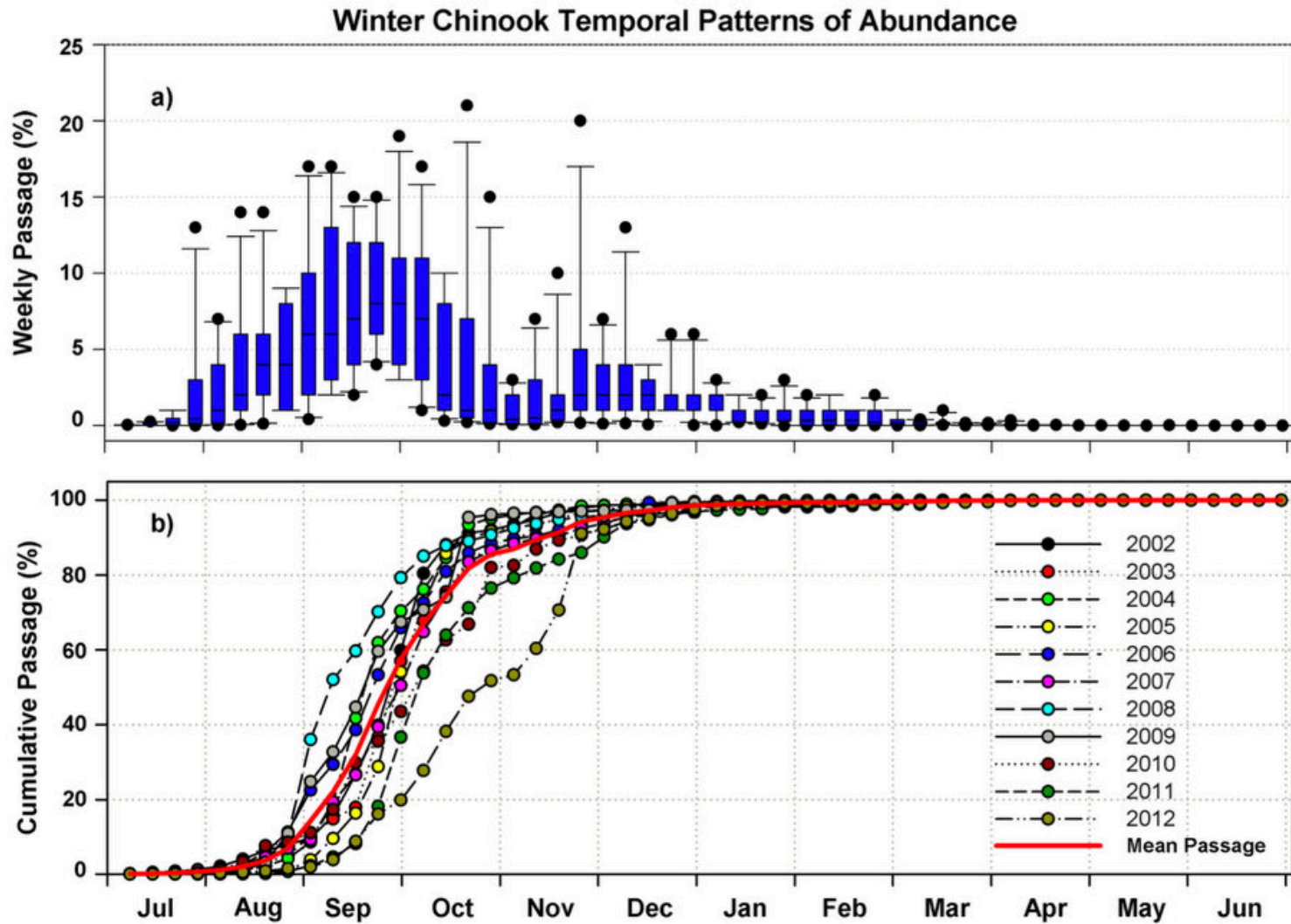


Figure 15. RBDD rotary trap winter Chinook (a) boxplots of weekly passage estimates relative to annual total passage estimates and (b) cumulative weekly passage with 11-year mean passage trend line for the period July 2002 through June 2013.

Temperature Curtain Evaluation

Katherine Clancy, UNR

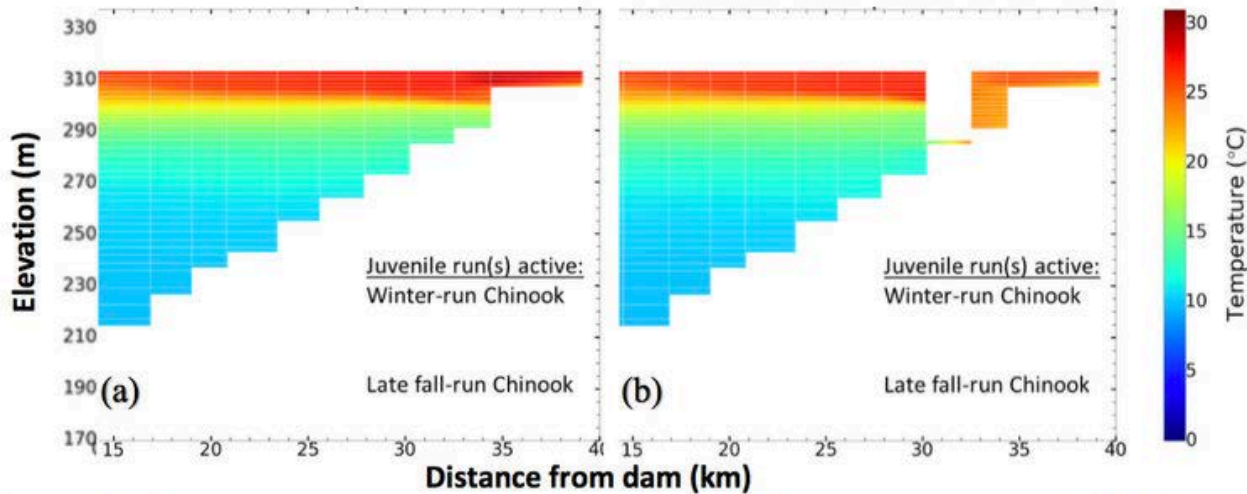


Figure 47: Temperature conditions of the McCloud River on August 5, 2001 (dry year simulation) a) without a temperature curtain and b) with a LF curtain at Segment 34. Temperature curtain is illustrated with a white box.

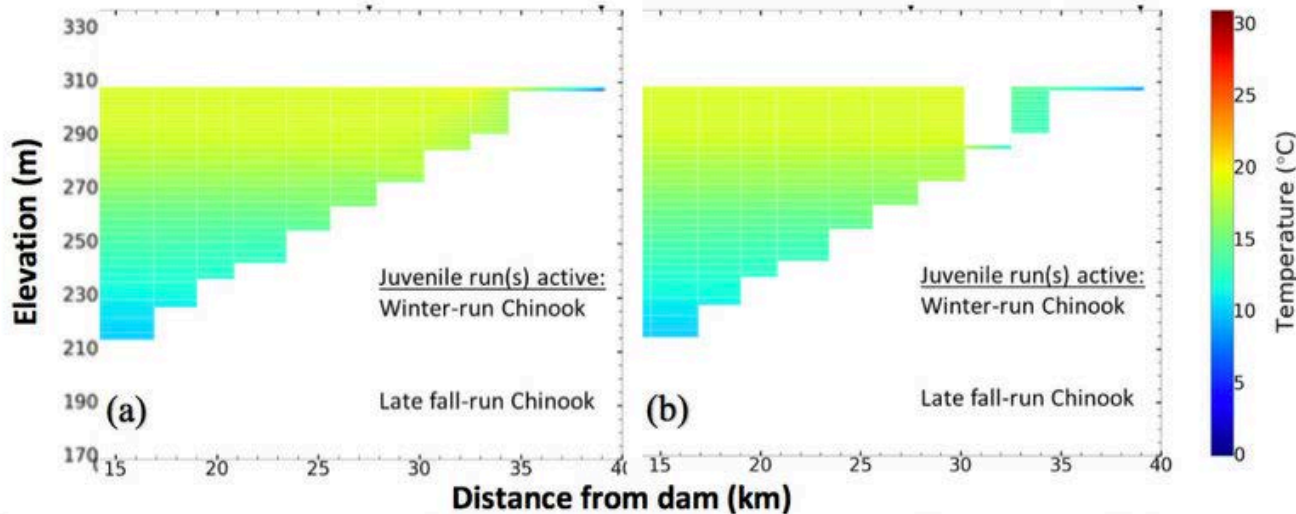
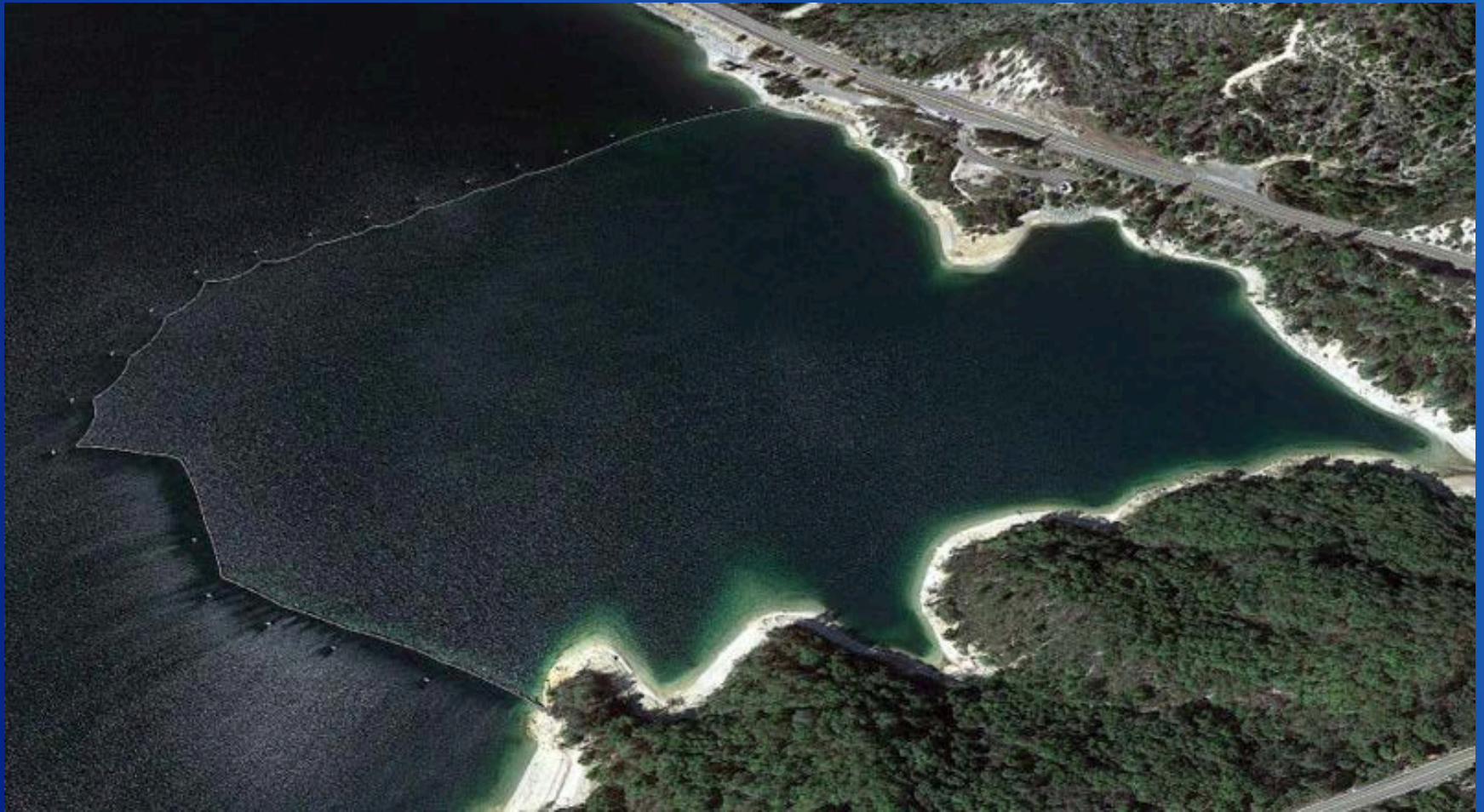


Figure 48: Temperature conditions of the McCloud River on October 15, 2001 (dry year simulation) a) without a temperature curtain and b) with a LF curtain at Segment 34. Temperature curtain is illustrated with a white box.

Temperature Curtain at Whiskeytown Lake



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Key Environmental Assessment Topics

- Resident fishery
- Recreation
- Water quality
- Cultural resources



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Shasta Dam Fish Passage Evaluation Schedule

2013-2014

- Habitat assessment of Sacramento and McCloud completed
- Agency draft Pilot Implementation Plan and Environmental Assessment
- Initiation of 10(j) experimental population designation process

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Pilot Program Timeline

- Pilot Plan and EA to public – 2015
- Complete fish health study – 2015
- Captive Broodstock HGMP – 2015
- Juvenile collection designs – early 2016
- Experimental Population and EA – 2016
- Install juvenile collection device(s) – 2017
- First fish release – 2017
- Annual reports of findings - 2018, 2019, 2020...

Thank You

Jhannon@usbr.gov

<http://www.usbr.gov/mp/BayDeltaOffice/shasta-dam-fish-pass.html>



2:20pm

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