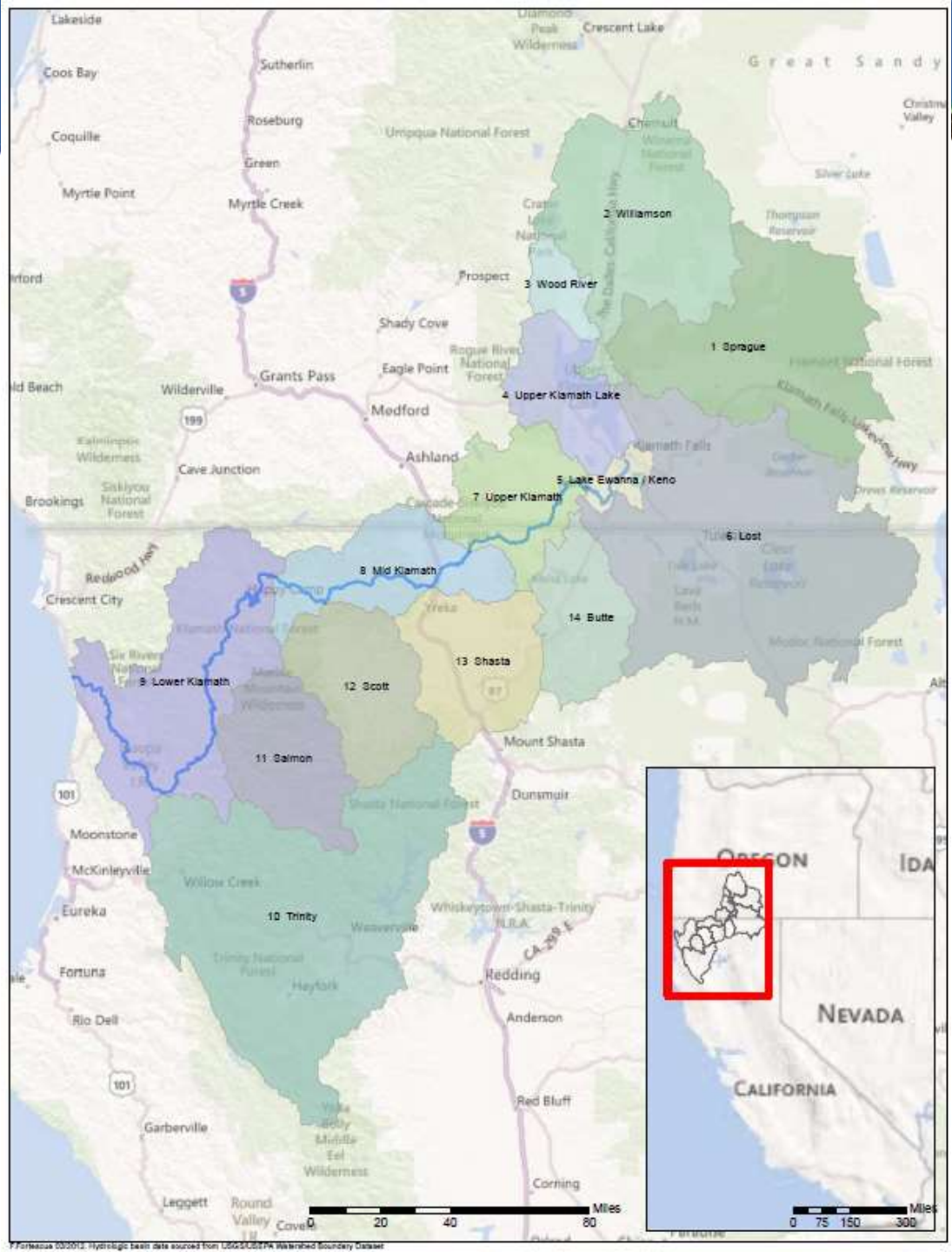


Water Quality Improvement Activities in the Klamath Basin

NCRWQCB

October 9, 2014

Yreka, CA

Clayton Creager & Invited Speakers

Presentation / Panel Outline

- Introduce Panel & Presentation Topics
- Topics / Projects Not Addressed
- General Stewardship Overview
- Panel Speaker Presentations
- Board Questions / Comments
- Concluding Comments
- Public Comment

Water Quality Update Panel

- Andy Baker – NCRWQCB
- Sarah Beesley – Yurok Tribal Fisheries Program
- Sara Borok – CDF&W
- Jared Bottcher – Klamath Basin Rangeland Trust
- Amy Campbell – The Nature Conservancy
- Rick Carlson – US Bureau of Reclamation
- Katharine Carter – NCRWQCB
- Ric Costales – County of Siskiyou
- Lyra Cressey – Salmon River Restoration Council
- Adriane Garayalde – Shasta Valley RCD
- Mike Hiatt – OR Department of Environmental Quality
- Amy Hoss – The Nature Conservancy
- Nell Kolden – Klamath Basin Rangeland Trust
- Greg Laurie – USFS Klamath National Forest
- Bryan McFadin – NCRWQCB
- Tom Menne – Scott Valley Groundwater Advisory Committee
- Sari Sommarstrom – Scott River Water Trust
- Gus Tolley – University of CA Davis
- Craig Tucker – The Karuk Tribe
- Randy Turner – Klamath Basin Monitoring Program

Presentation Topics

I. Klamath Overview

II. Klamath Fish Health Assessment Team

III. Klamath River Flow Augmentation Update

IV. Yurok Tribe Environmental Restoration Projects

V. Salmon River Habitat Restoration

VI. USFS Restoration Projects: Seiad and Sugar Creeks

VI. Scott & Shasta TMDL Waivers Update

VII. Shasta Watershed Stewardship Pilot Project

VIII. Flow Augmentation in Shasta & Scott Rivers

IX. Scott Valley Groundwater

X. Upper Klamath Basin Diffuse Source Treatment Wetlands

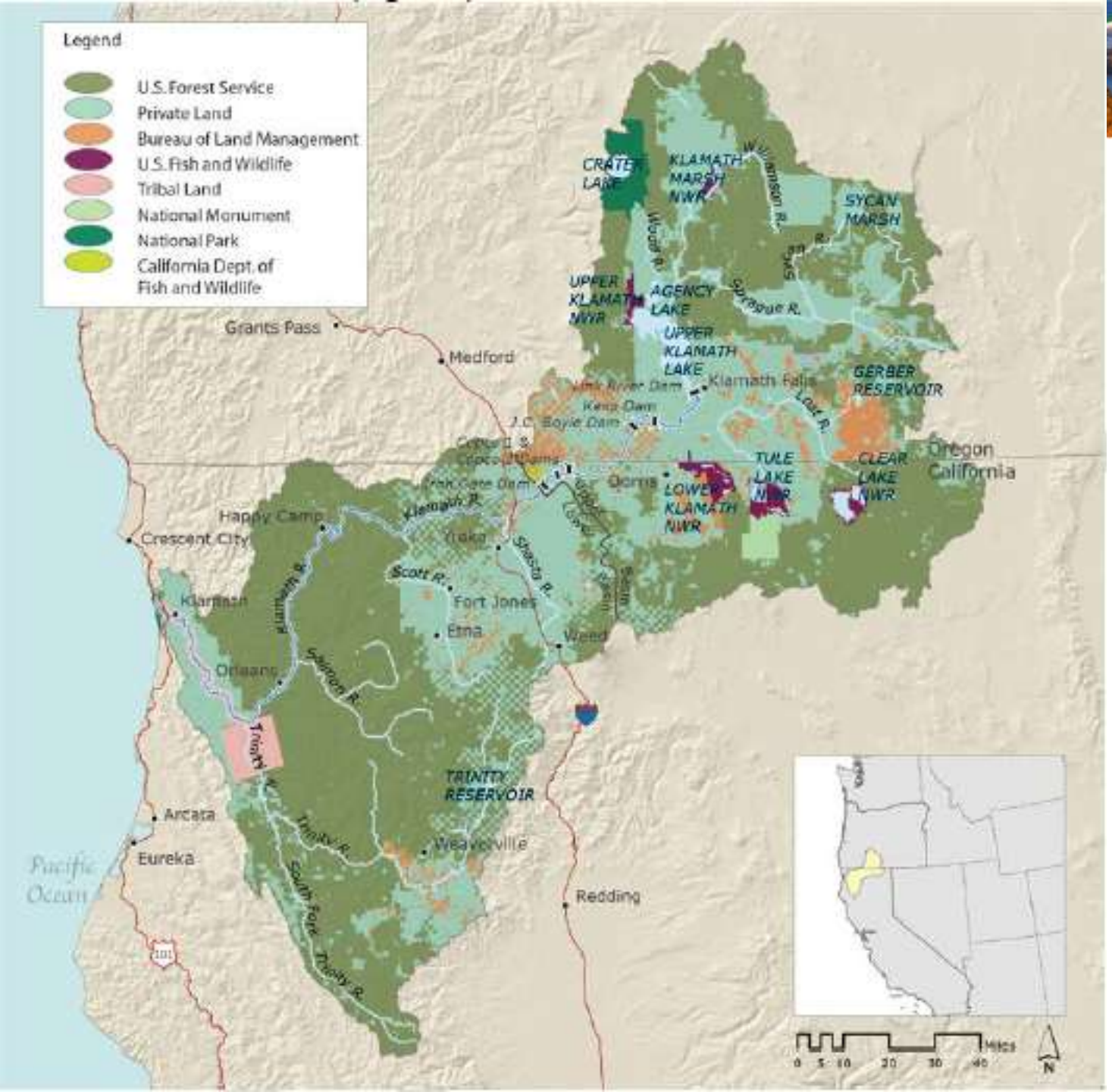
XI. Bureau of Reclamation Water Quality Improvement Activities

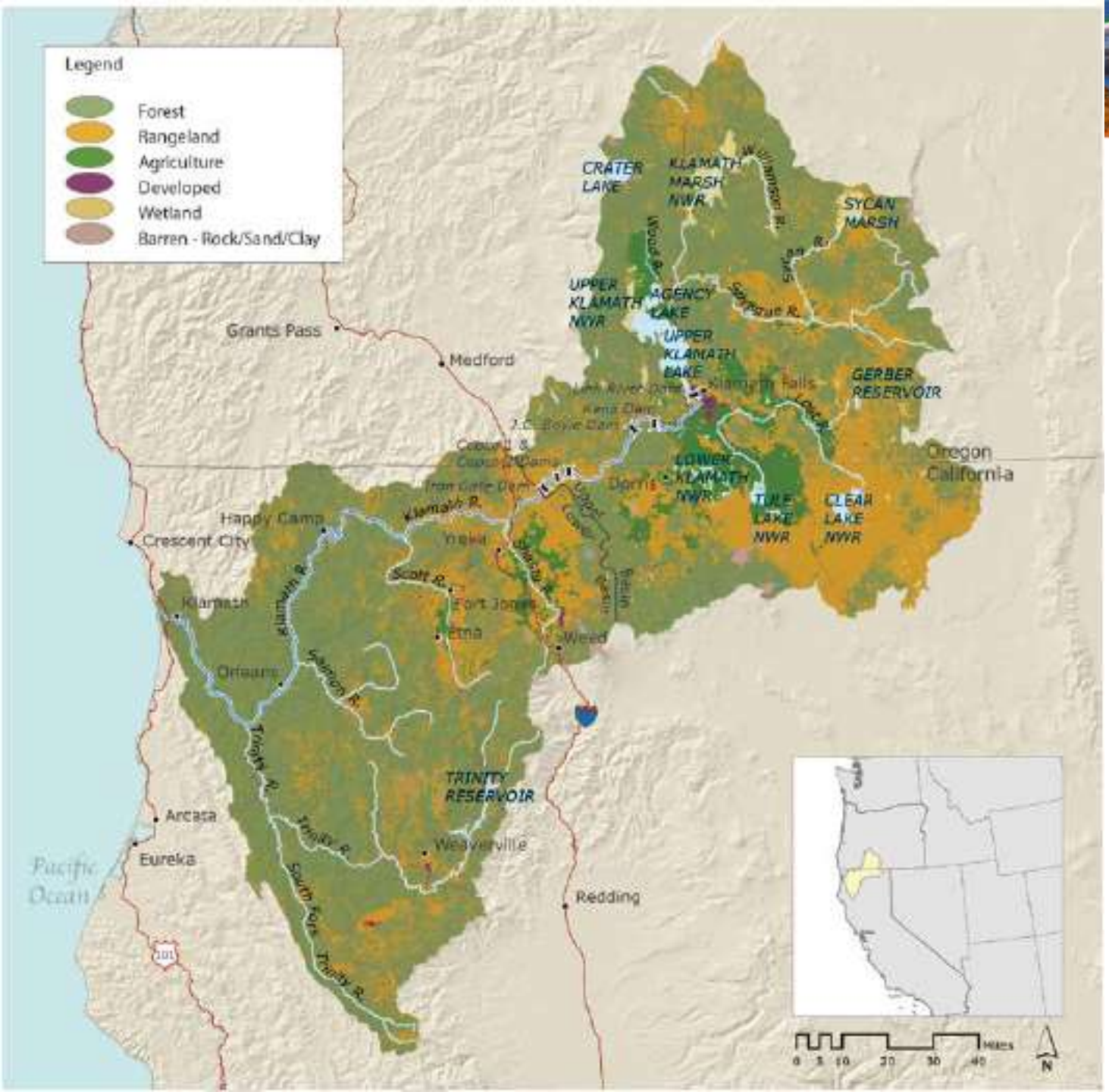
Acknowledge That Many Stewardship Activities Could Not Be Included

- Trinity River Restoration Program
- Hoopa Valley Tribe Water Quality Program
- US Forest Service Waiver & Management Activities
- Mid-Klamath Watershed Council
- USFWS Restoration Projects
- Klamath Tribes Environmental Program
- Many Others!!!!

Klamath TMDL Strategy

- Comprehensive Basin Strategy
- Partnerships through Sub-basin Watershed Stewardship Groups
- Collaborate with KHSA / KBRA to address impacts of dams


Legend
U.S. Forest Service
Private Land
Bureau of Land Management
U.S. Fish and Wildlife
Tribal Land
National Monument
National Park
California Dept. of Fish and Wildlife
CRATER LAKE
KLAMATH MARSH NWR
SYCAN MARSH
UPPER KLAMATH NWR
AGENCY LAKE
UPPER KLAMATH LAKE
GERBER RESERVOIR
CLEAR LAKE NWR
TULE LAKE NWR
LOWER KLAMATH NWR
TRINITY RESERVOIR
Grants Pass
Medford
Klamath Falls
Oregon
California
Happy Camp
Crescent City
Yreka
Scott R.
Fort Jones
Etna
Weed
Klamath
Orleans
Arcata
Eureka
Weaverville
Redding
Pacific Ocean
Miles
N


Legend
Forest
Rangeland
Agriculture
Developed
Wetland
Barren - Rock/Sand/Clay
CRATER LAKE
KLAMATH MARSH NWR
SYCAN MARSH
UPPER KLAMATH NWR
AGENCY LAKE
UPPER KLAMATH LAKE
GERBER RESERVOIR
Grants Pass
Medford
Klamath Falls
Oregon
California
LOWER KLAMATH NWR
TULE LAKE NWR
CLEAR LAKE NWR
Happy Camp
Crescent City
Klamath
Orleans
Weed
TRINITY RESERVOIR
Arcata
Eureka
Weaverville
Redding
Pacific Ocean
Miles
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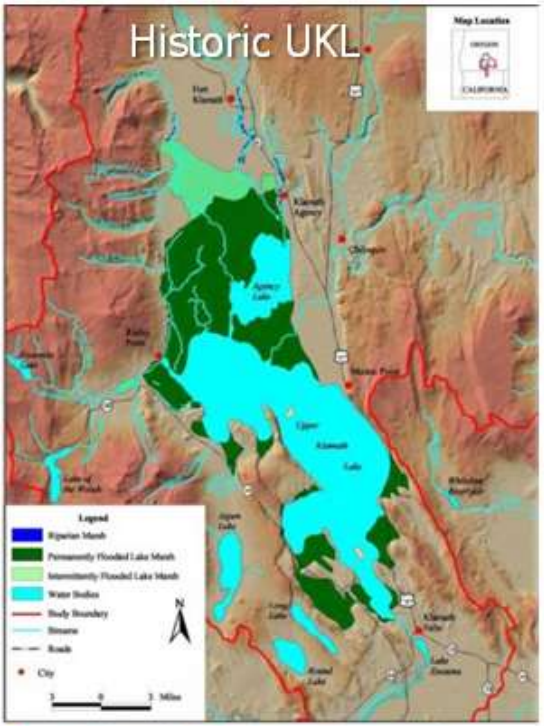
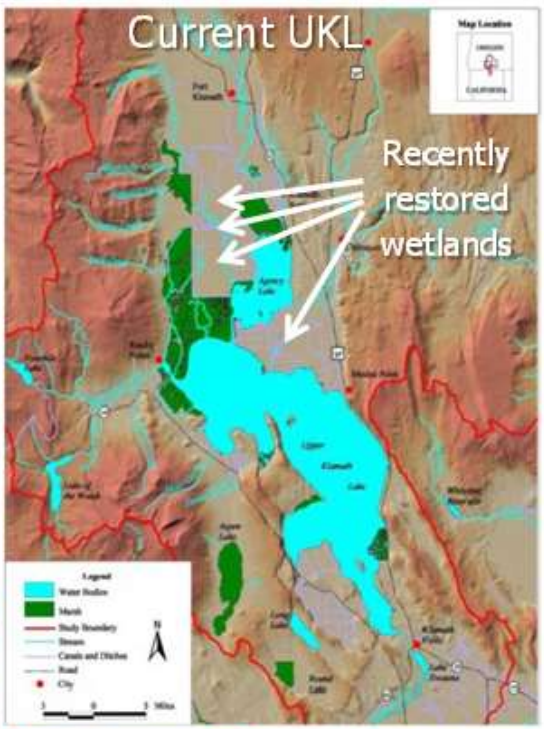
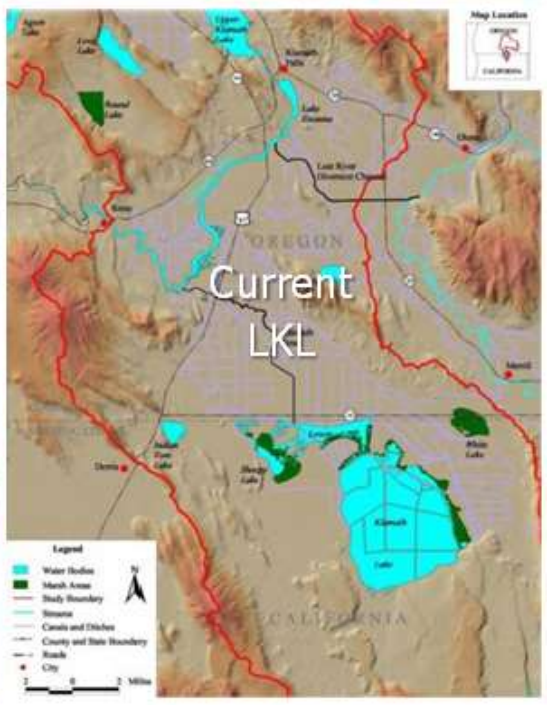






Klamath Water Quality Improvement Strategy

- Mitigate loss of wetlands
- Reduce mobilization of nutrients from Upper Klamath Lake sediments
- Work with agriculture and forestry through stewardship program

Legacy effects of large-scale land use disturbance activities

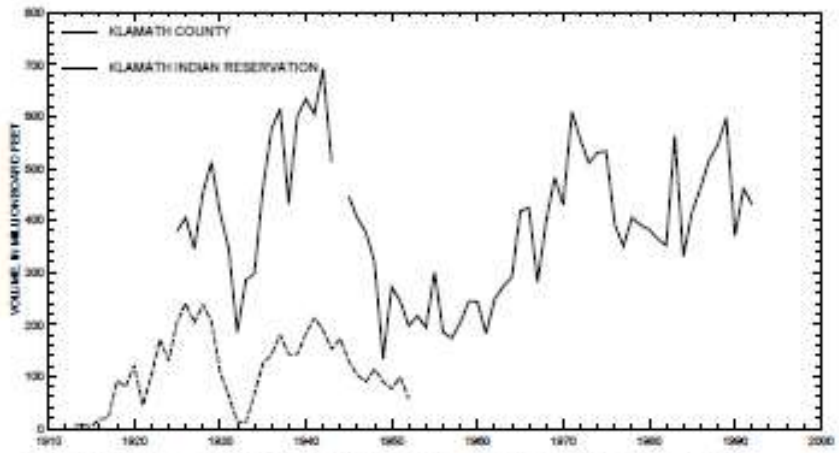


Figure 19. Annual timber harvest totals for Klamath County and Klamath Indian Reservation, Oregon, 1913–92.

Era when logging not as well managed as it is today.

Upper Klamath Lake Basin Nutrient-Loading Study—Assessment of Historic Flows in the Williamson and Sprague Rivers

USGS 1998 Risley & Laenen

Acreage of irrigated agriculture increased following WWII and Korean War when Homestead Act lands were granted to returning veterans

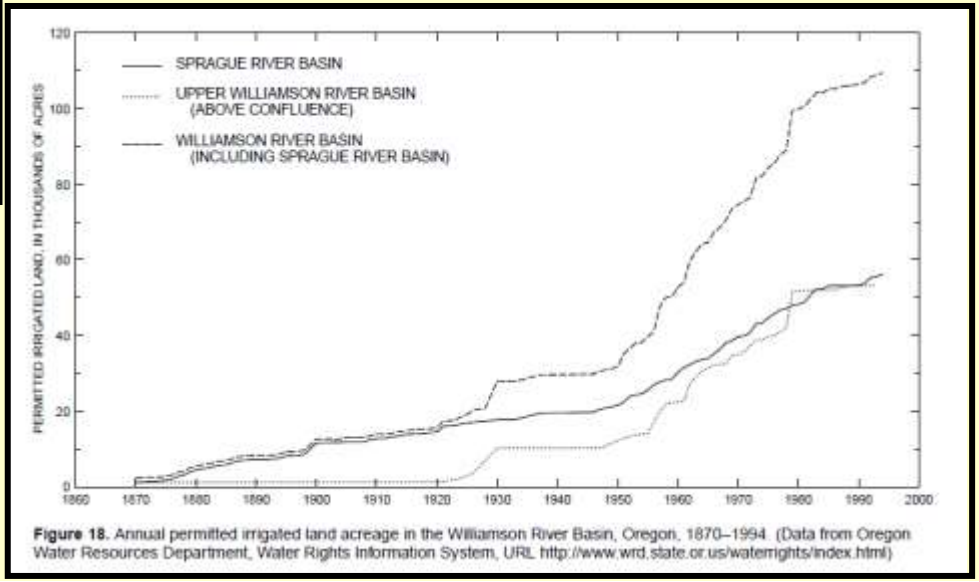
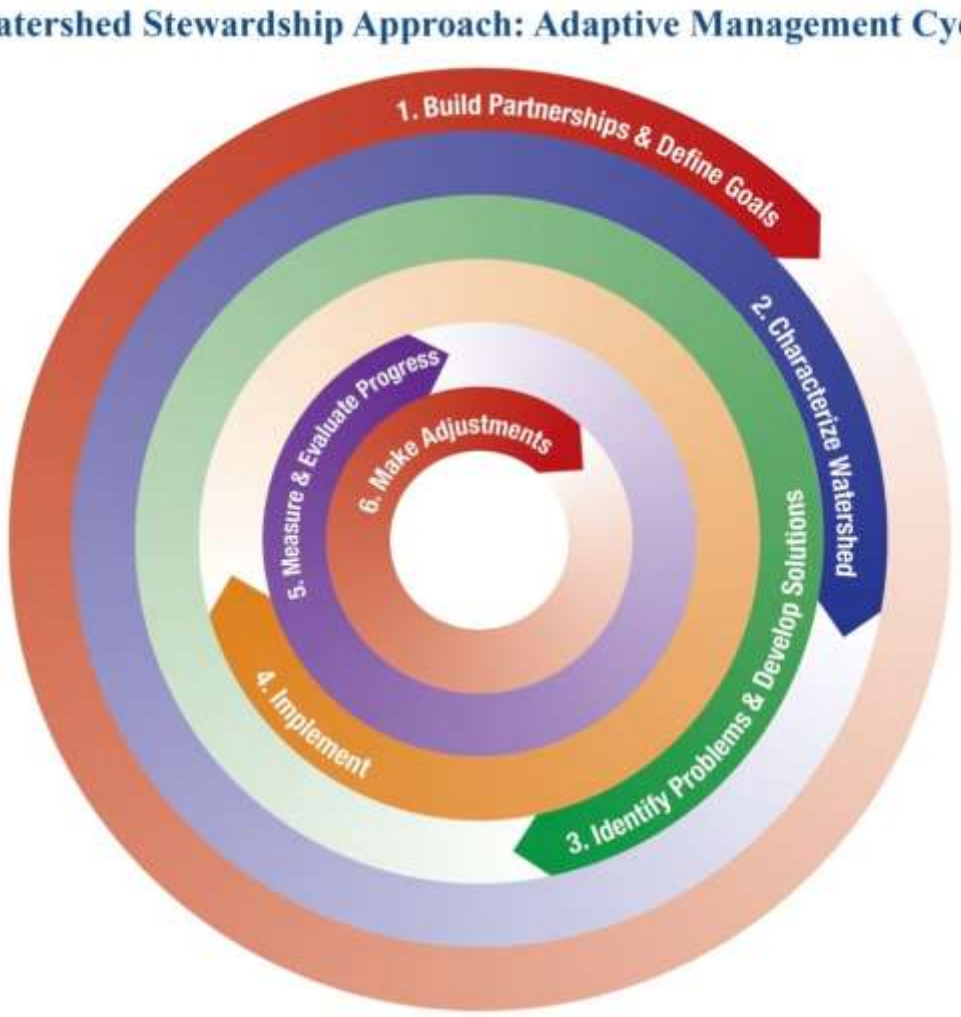


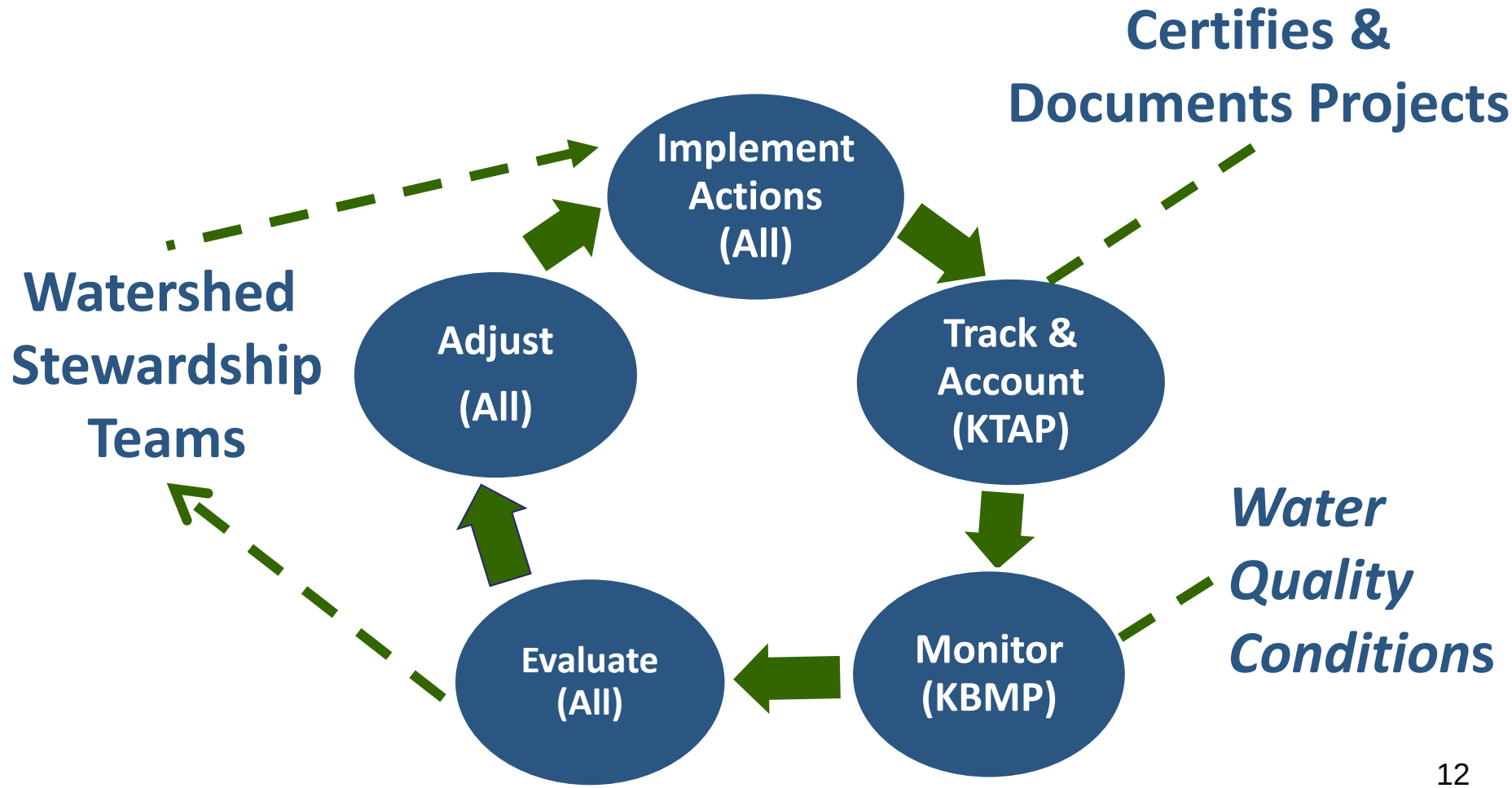
Figure 18. Annual permitted irrigated land acreage in the Williamson River Basin, Oregon, 1870–1994. (Data from Oregon Water Resources Department, Water Rights Information System, URL http://www.wrd.state.or.us/waterrights/index.html)

Watershed Stewardship Framework



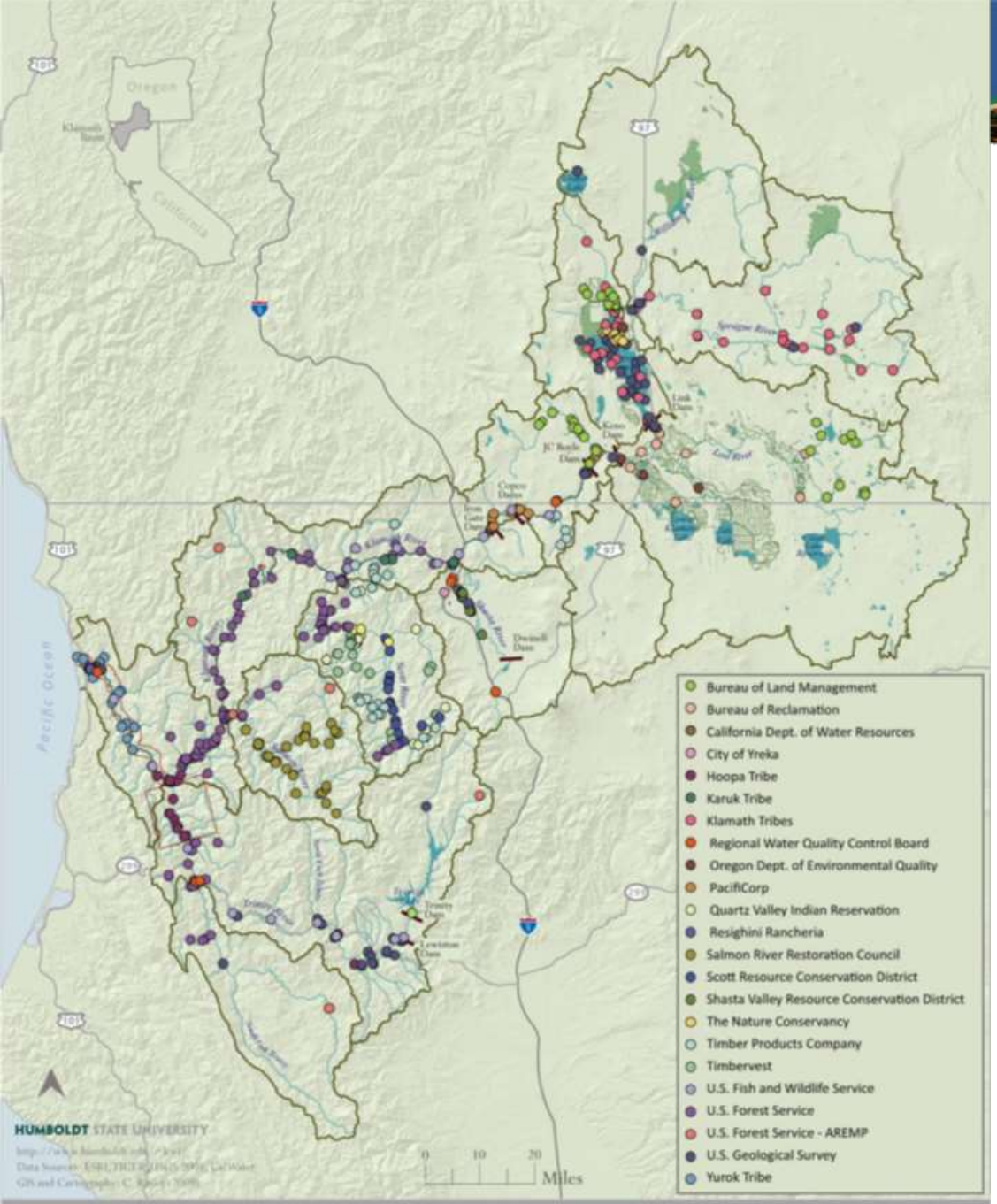
An approach that supports collaborative outcomes

Adaptive Management Framework



Klamath Basin Monitoring Program

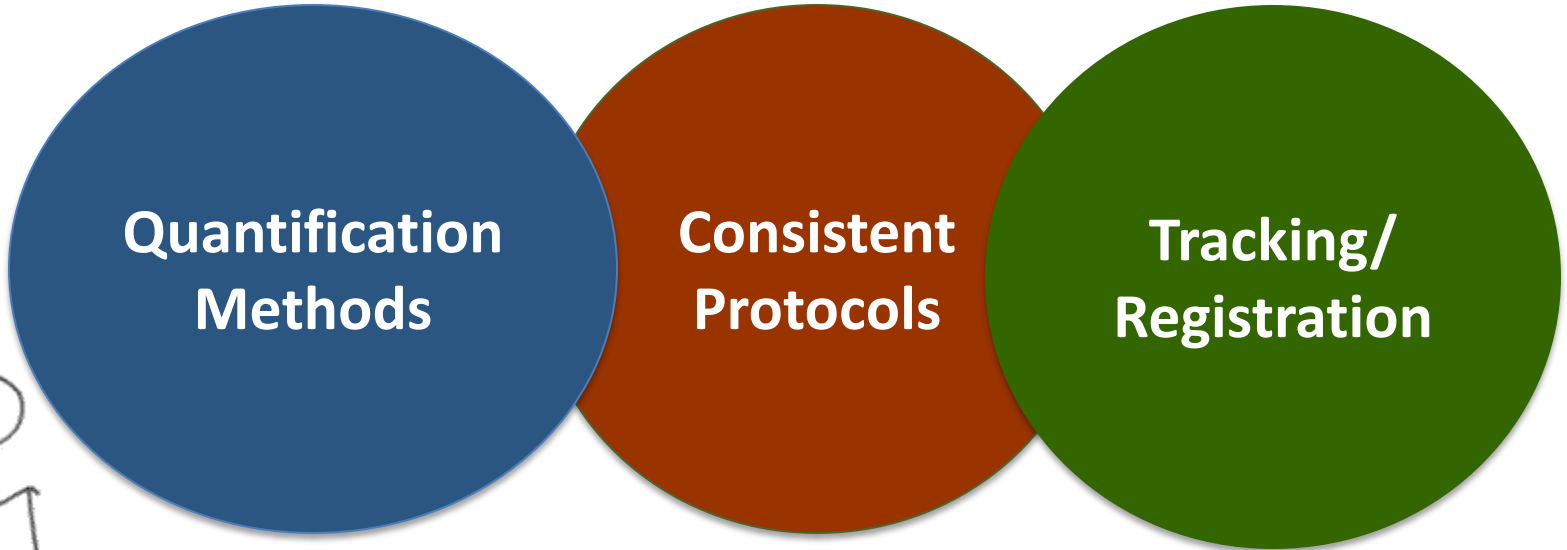
- Monitoring coordination
- Common analytical methods and sampling protocols
- Data management
- Membership organization
- Watershed stewardship assessment reports
- Web Information Portal (Blue-green Algae Tracker)
- www.kbmp.net



Klamath Basin Water Quality Monitoring Plan: 2009 Monitoring Locations by Organization

Klamath Tracking & Accounting Program (KTAP)

KTAP - *Program Components*



Klamath Fish Health Assessment Team

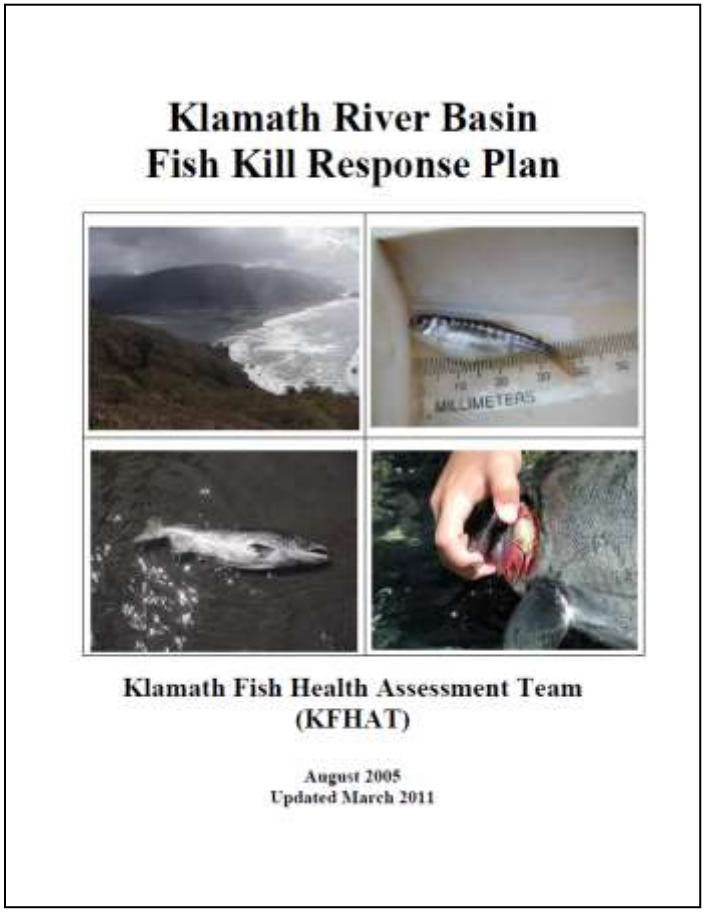
2014 Update


Sara Borok & Katharine Carter

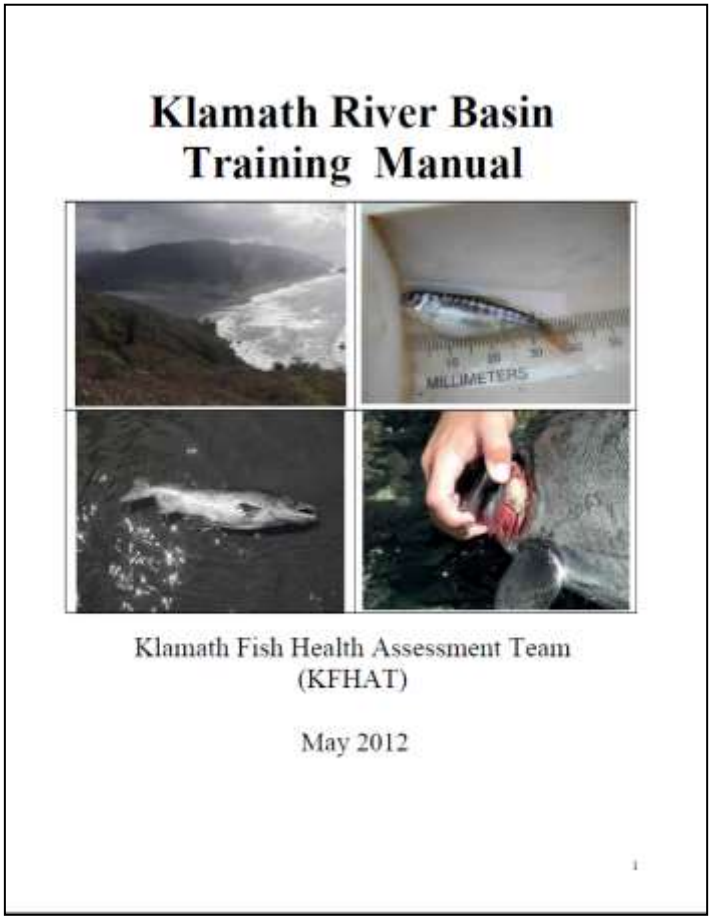
Overview

How does KFHAT do it?

Fish Kill Response Plan



Training Manual



Overview

KFHAT Website: http://www.kbmp.net/collaboration/kfhat

Klamath Basin
Monitoring Program

A- A+

Home | About Us | Maps & Monitoring Data | Meetings & Documents | Stewardship | Collaboration | News | Contact Us

UKCAN | KHSA Monitoring | Klamath Blue-green Algae Workgroup | Klamath TAP | Klamath Fish Health

Klamath Basin Monitoring Program

Blue-Green Algae Map

Klamath Fish Health Assessment Team

Mainstem Klamath below Iron Gate Reservoir- Current Readiness Level: **Orange**

-Critically dry water year, presence of ich parasite in salmonids

- A kill is likely to occur and management levels in agencies need to be alerted.
- Frequent data sharing among KFHAT and resource managers is vital.
- If possible, KFHAT will provide recommendations for resource management actions to management with basis for recommendations.

Shasta, Scott, Salmon, and Trinity Rivers- Current Readiness Level: **Yellow**

- Low flows and critically dry water year

- Conditions, such as unfavorable physical or chemical conditions, observation of increased incidence of pathogens, or increased fish morbidity and/or mortality suggest the need for heightened awareness.
- Frequent data sharing among KFHAT and resource managers becomes important.
- The Response Plan procedures should be reviewed and responders should be ready to take action if the situation worsens.

Read more about the Readiness Levels

Overview

KFHAT Data & Information Sharing

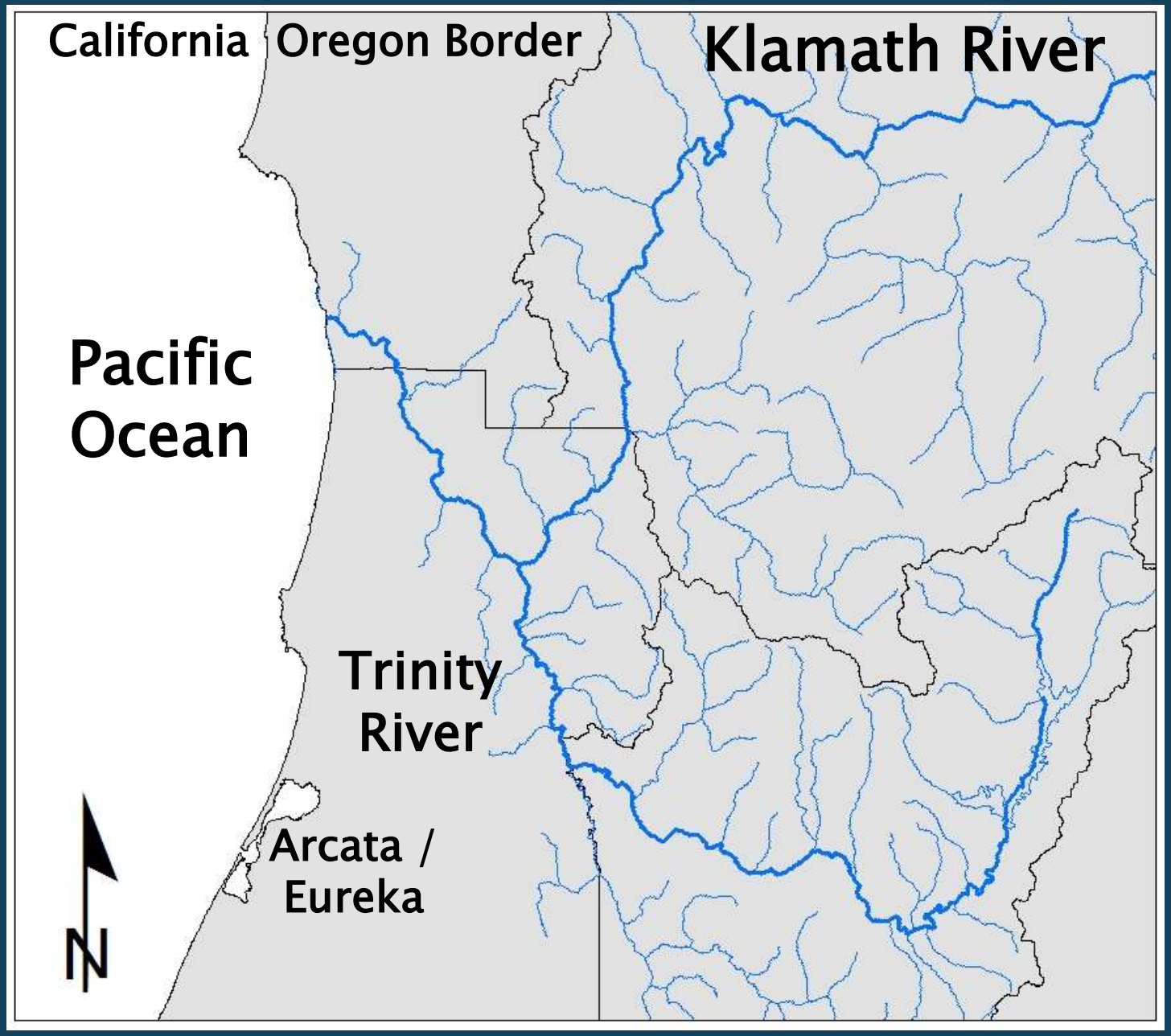
- Hydrologic conditions
- Fishery data and information
- Disease monitoring
- Water quality data
- Blue-green algae

Data and information collected by KFHAT members are utilized to determine the likelihood of a fish kill and inform resource managers who make resource allocation decisions

Yurok Fisheries & Water Quality Restoration in the Lower Klamath

Sarah Beesley – Yurok Tribal Fisheries Program

Lower Klamath River



Historic Logging, Wetland Conversion Stream Clearing & Hydroelectric Operations

Yurok Tribe Environmental Program

Water Division

Community & Ecosystem Division

Pollution Prevention Division







Yurok Tribe Watershed Restoration Program

Slope Stabilization

Trinity River Restoration Program






Yurok Tribal Fisheries Program

Instream & Riparian Habitat Enhancement

Lower Klamath YTFP Division

Essential Program Partners

Rocco Fiori ∞ Karuk Tribe
Yurok Tribe Watershed Restoration Program
Green Diamond Resource Company
Larry Lestelle ∞ USFWS ∞ USBOR

Riparian Restoration

Instream – Building Back Complexity

Constructed Wood Jams – Hunter Creek


Bar Apex Jam 4
As-Built 2012


Early November
2012


Late November 2012


March 2013


February 2014

Off-Channel Habitat Construction

McGarvey Alcove I

Before Construction

Winter 2013

Hunter Creek Alcove I


Thank You

Salmon River Habitat Restoration

Salmon River Restoration Council

Lyra Cressey
Associate Director

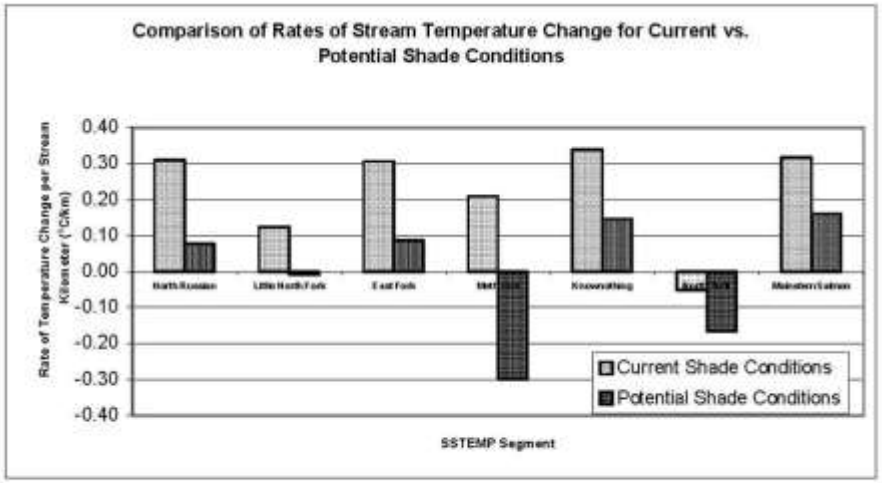
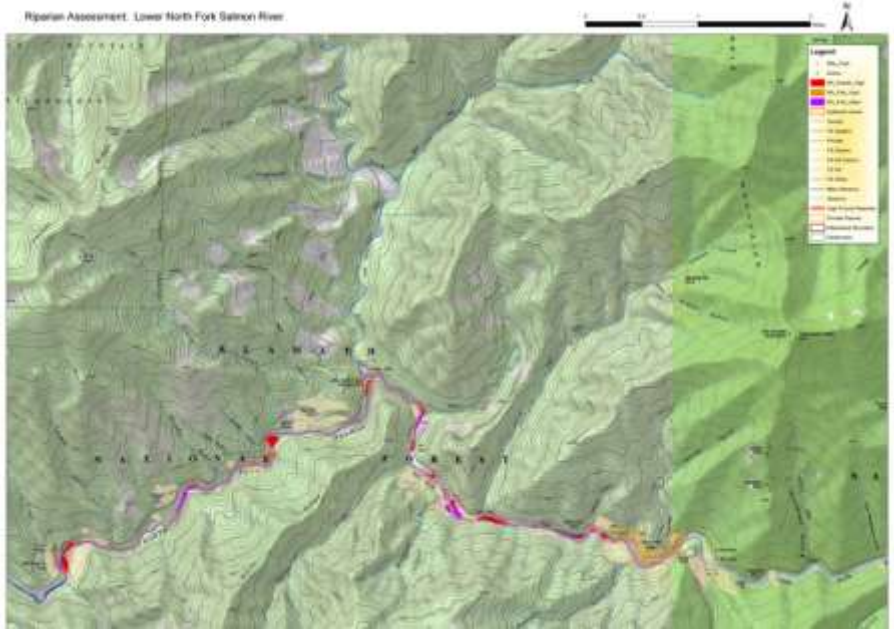


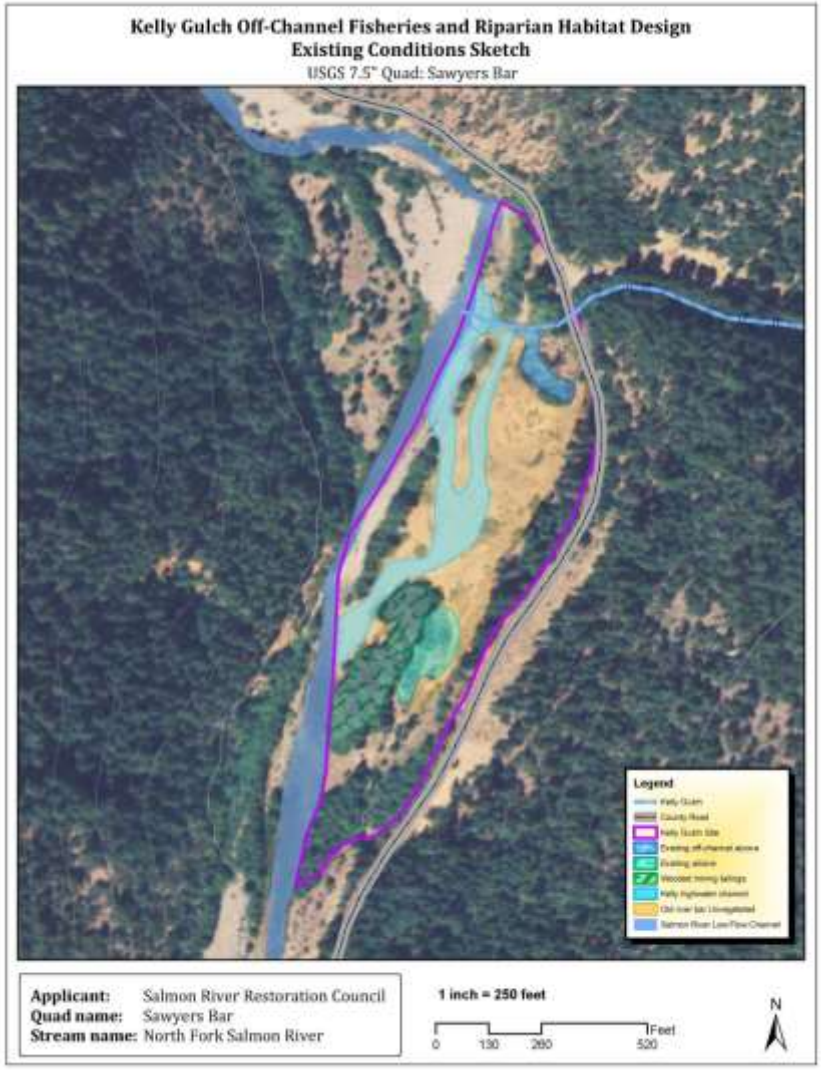
Figure B-9 Results show that increasing riparian trees to adjusted potential heights can produce a reduction in the rate of stream heating of 0.12°C/km to 0.51°C/km

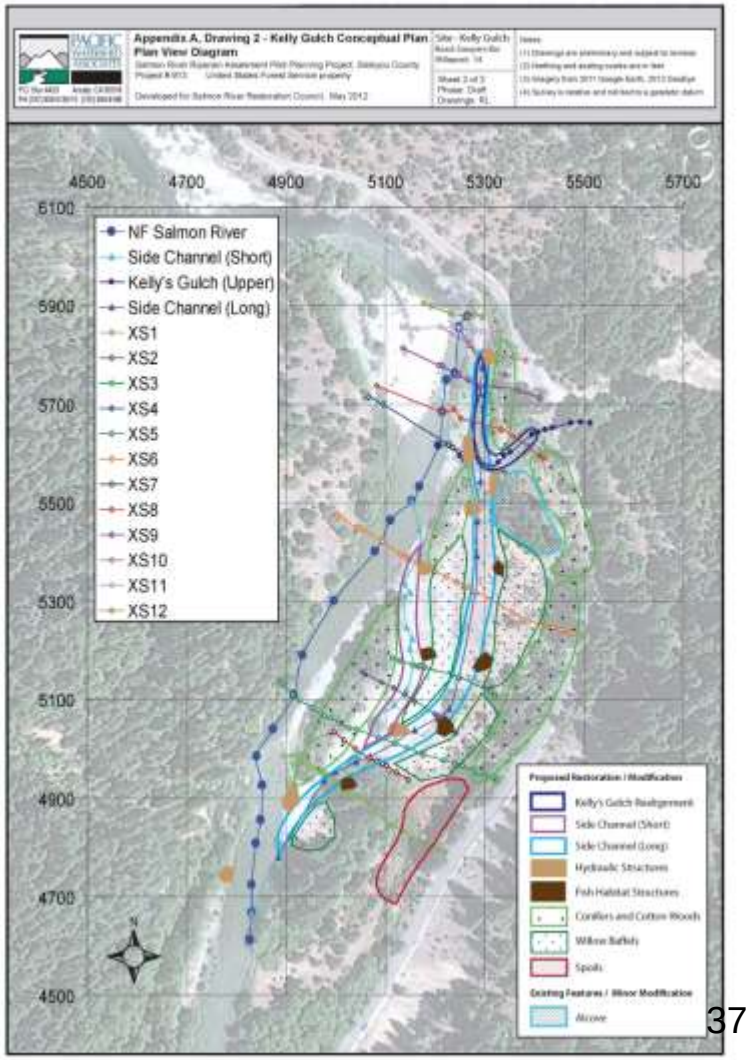


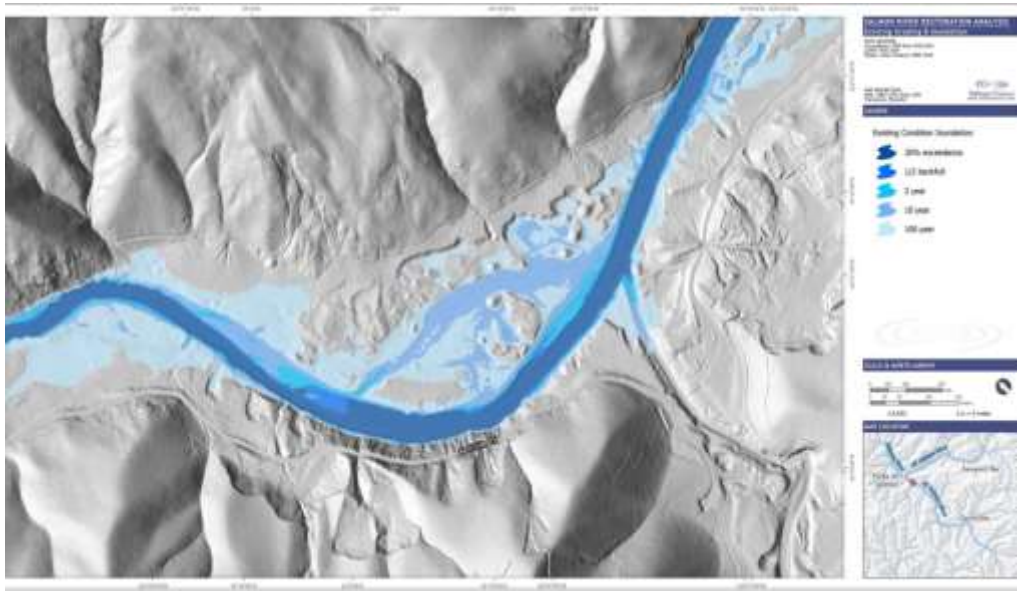
Riparian Assessment 2006-2008

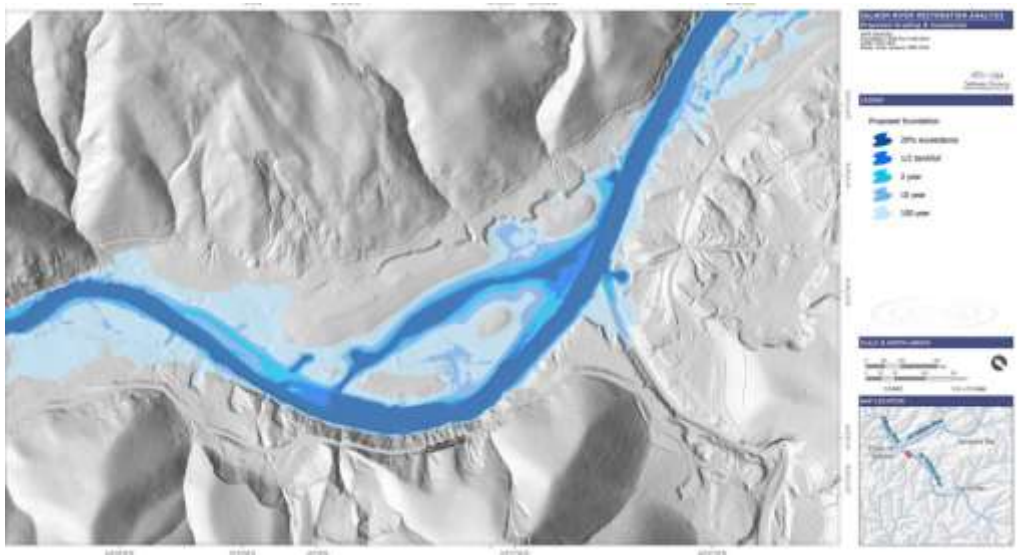
- SRRC completed a detailed assessment of riparian vegetation and shading potential for the entire Salmon River corridor
- Sites were prioritized based on a number of different factors, including vegetation deficiency, aspect, access, and fish habitat potential.

Riparian and Fish Habitat Restoration





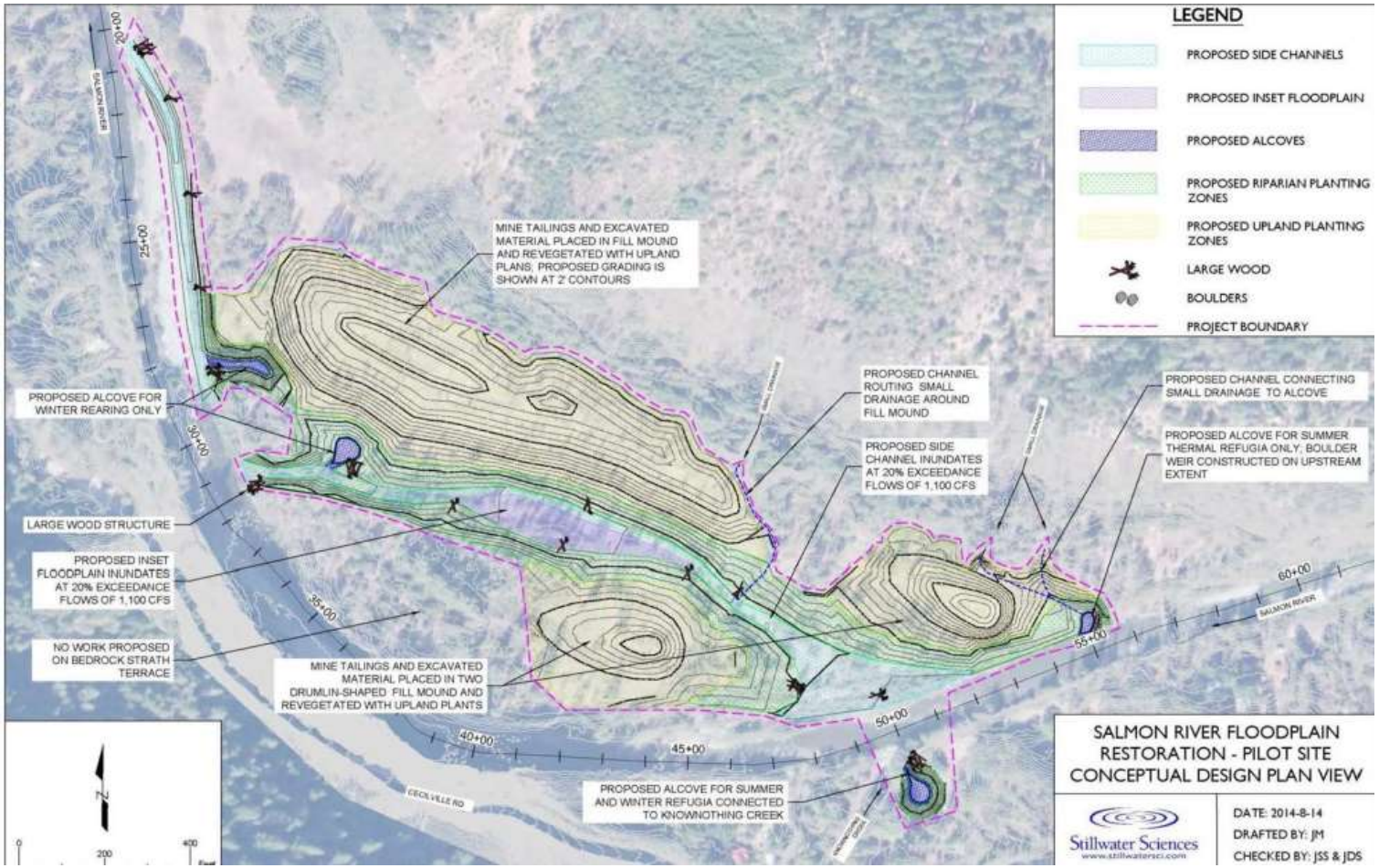




Floodplain Assessment 2013-2015

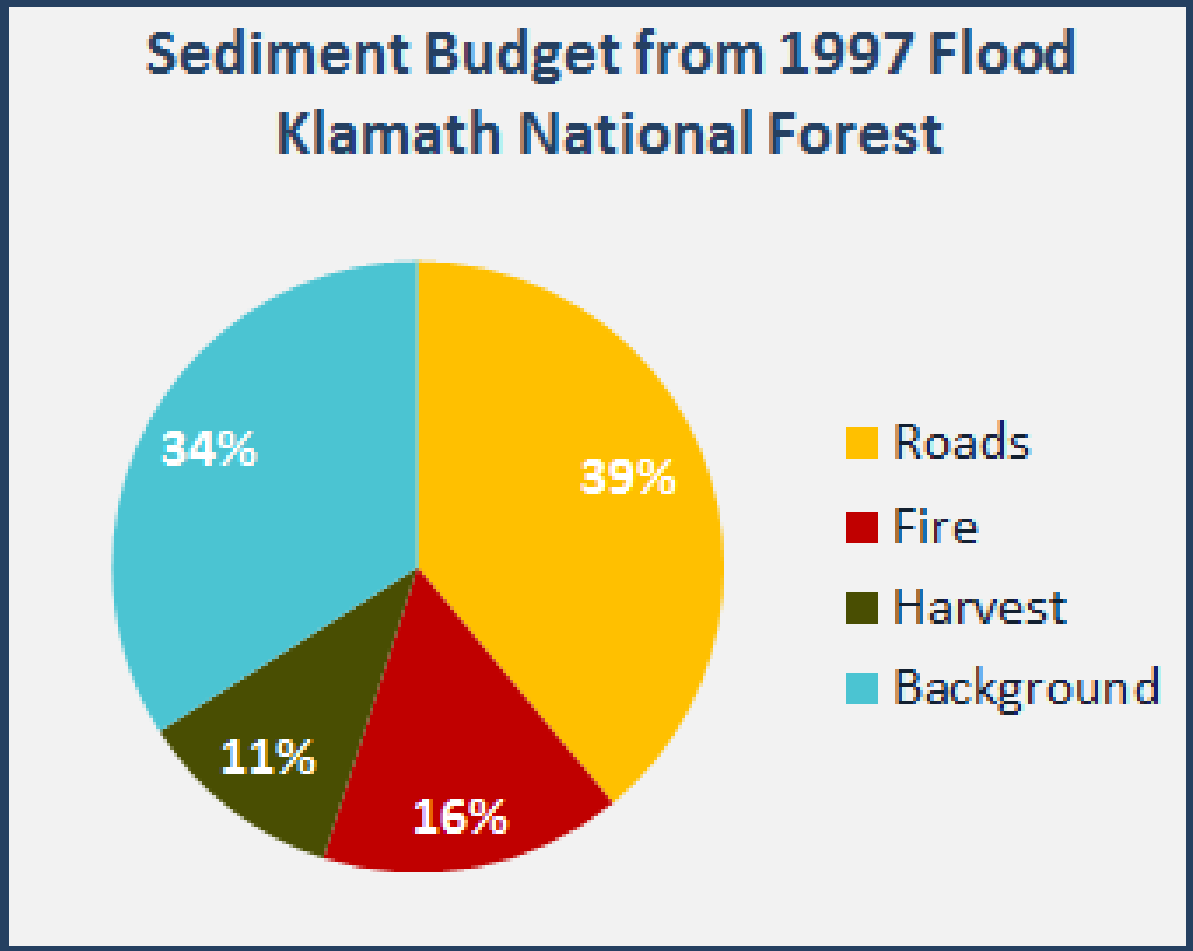
- Legacy mine tailings from extensive gold mining continue to degrade habitat within the floodplain and riparian corridor by preventing floodplain inundation and riparian plant succession.
- SRRC is currently assessing potential opportunities for restoring floodplain areas and associated mine tailing piles.

Floodplain Restoration

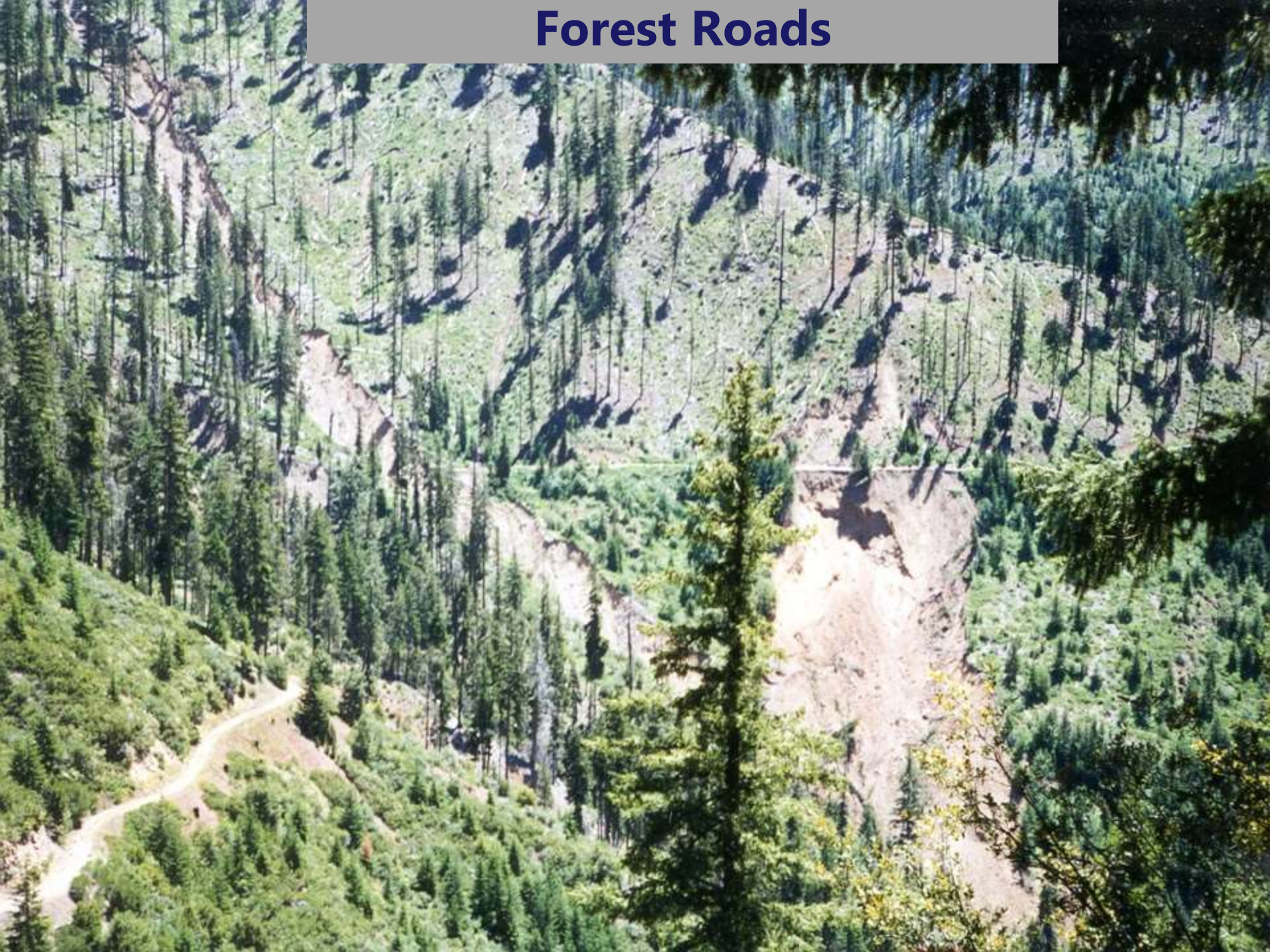


Klamath National Forest
Watershed Restoration Program

North Coast Regional Water Quality Control Board Meeting
Yreka, CA
October 9, 2014


Sediment Budget from 1997 Flood
Klamath National Forest
34%
39%
11%
16%
Roads
Fire
Harvest
Background

Forest Roads



Stream Crossing Failures

Typical Road Stormproofing

Before:
Diversion potential at culvert

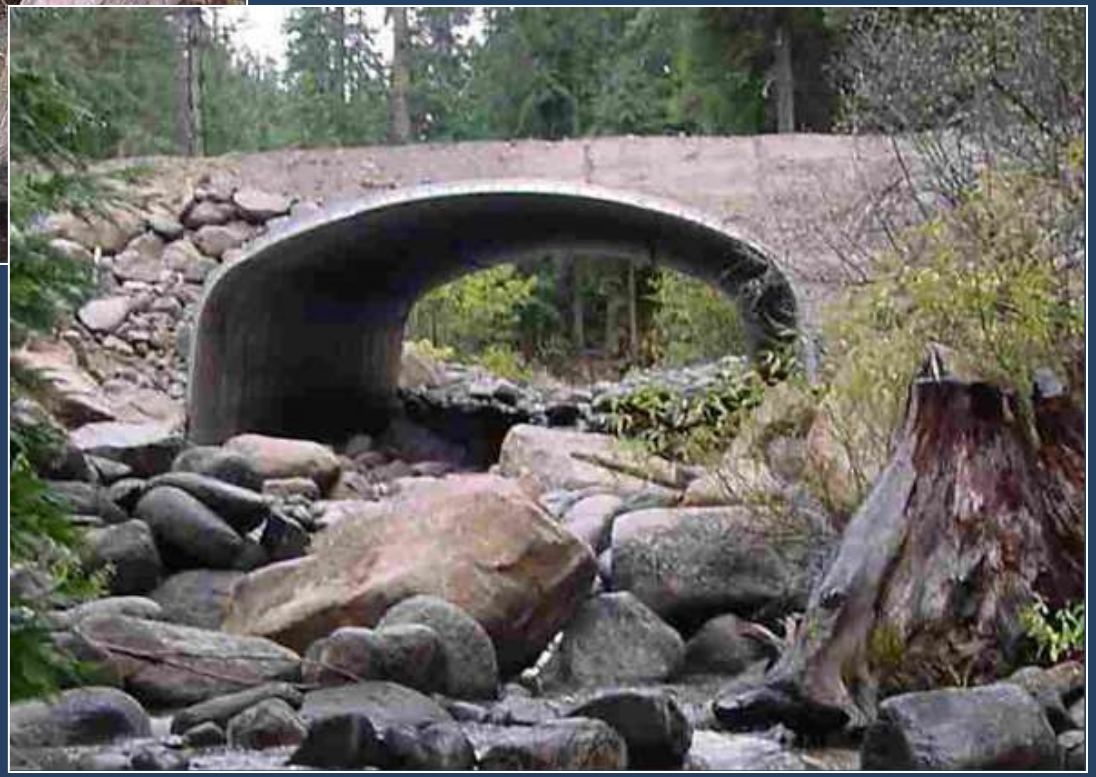
After:
Dip with armored outlet and surface aggregate

Stream Crossing Upgrade

- Increase pipe size
- Constructed a dip
- Rock fill

Stream Crossing Upgrade

Before



After

Fire Restoration

Before

After

Road Work Completed Since the 1997 Flood

Road upgrading (stormproofing):	248 miles
Road Decommissioning:	59 miles
Fish Passage Projects:	27 structures
Road Inventory:	4,000+ miles

Watershed Condition Framework (WCF)

National Forest Service process for restoring riparian and aquatic ecosystems

A. Classify Watershed Condition

B. Prioritize watersheds

C. Develop Watershed Restoration Action Plans

- Conduct field assessment to document specific problems
- Identify ‘essential projects’ that address specific problems
- Identify potential partners and funding sources
- Develop implementation schedule & monitoring plan

D. Implement Restoration Projects

E. Monitor and Track Accomplishments

Klamath National Forest Priority Watersheds

Projects	Seiad Creek	Sugar Creek
Road Upgrade	20.7 miles	24.9 miles
Road Decommissioning	3.9 miles	7.9 miles
Meadow Restoration	-	5 acres
Mine Waste Removal	-	15 acres
Fish Passage Barrier	-	1 crossing
Noxious Weed Removal	10 acres	10 acres
Dredge Tailings (BLM & private)	-	2.5 miles
Fuels Treatment	3,600 acres	5,000 acres

Meadow Restoration

Mine Restoration

Dredge Tailings

Next Steps

- Complete work in the Seiad and Sugar Creek restoration plans
- Select the next priority watersheds
- Develop watershed restoration plans for the next priority watersheds
- Incorporate TMDL requirements into Forest Service restoration plans.

Scott River TMDL Conditional Waiver Update

October 9, 2014

Yreka, CA

Bryan McFadin - NCRWQCB

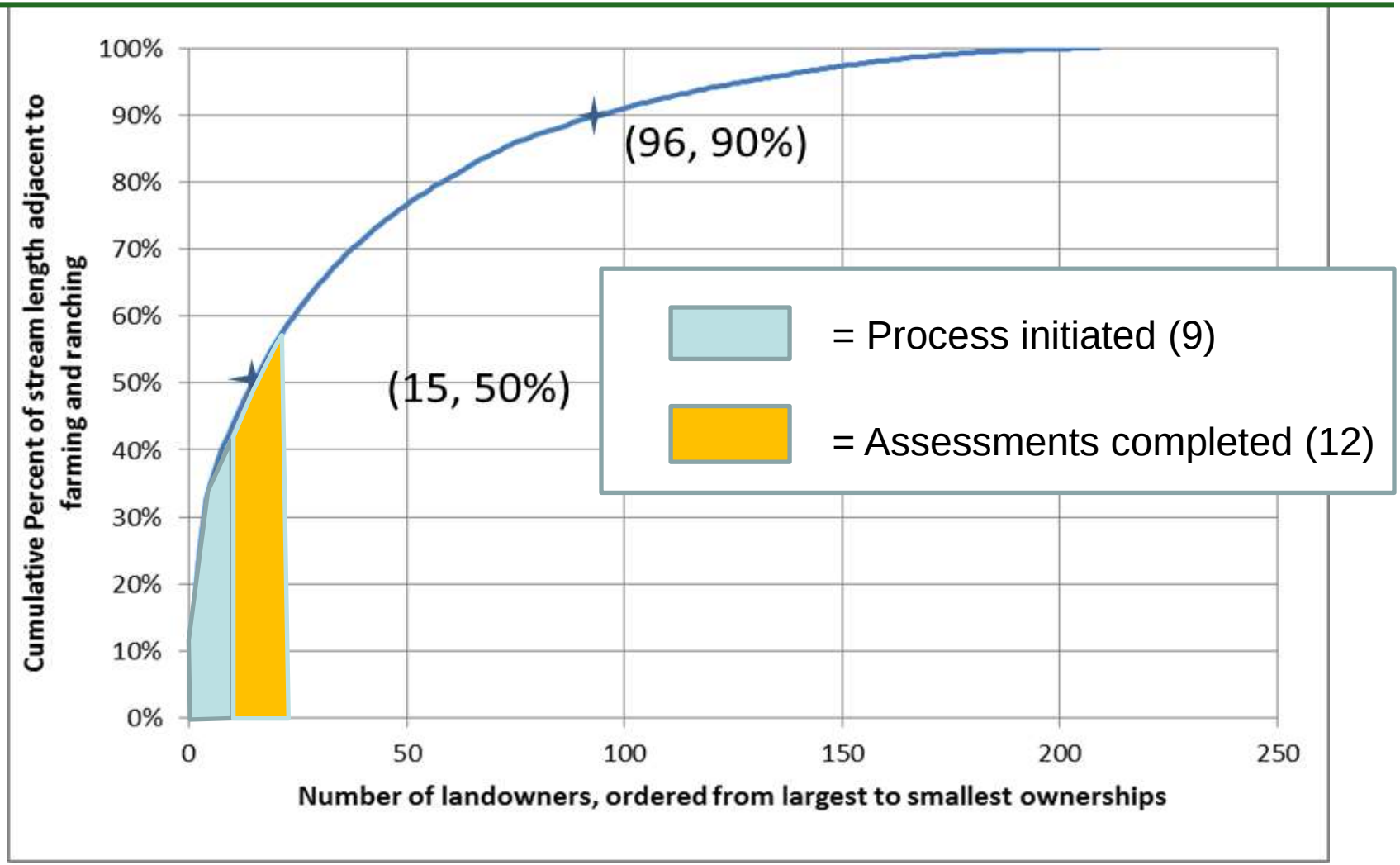
Scott River TMDL Conditional Waiver Update

- Scott TMDL was adopted in September 2006
- Current Conditional Waiver adopted October 2012
- Focus is on land management activities adjacent to streams
- Property-by-property assessment approach
- Assessments prioritized by length of ag lands adjacent to streams

Water Quality Assessment Status

- Water quality assessments completed on 12 ownerships
- Assessment process initiated in 9 additional ownerships

Scott River Conditional Waiver Implementation Progress



Scott TMDL Grants and Contracts

319(h) grants:

- Scott River riparian restoration
- Groundwater Study Plan implementation

Prop. 84 grant:

- Moffett Creek exclusionary fencing project

Contracts:

- Streamflow data collection
- Groundwater study plan
- Groundwater data collection and outreach
- Ranch Plan assistance

Next Steps

- Continue property-by-property water quality assessments
- Continue Ranch Plan development
- Continue working with timber companies on development and submittal of erosion control plans

Shasta River TMDL Conditional Waiver Update

October 9, 2014

Yreka, CA

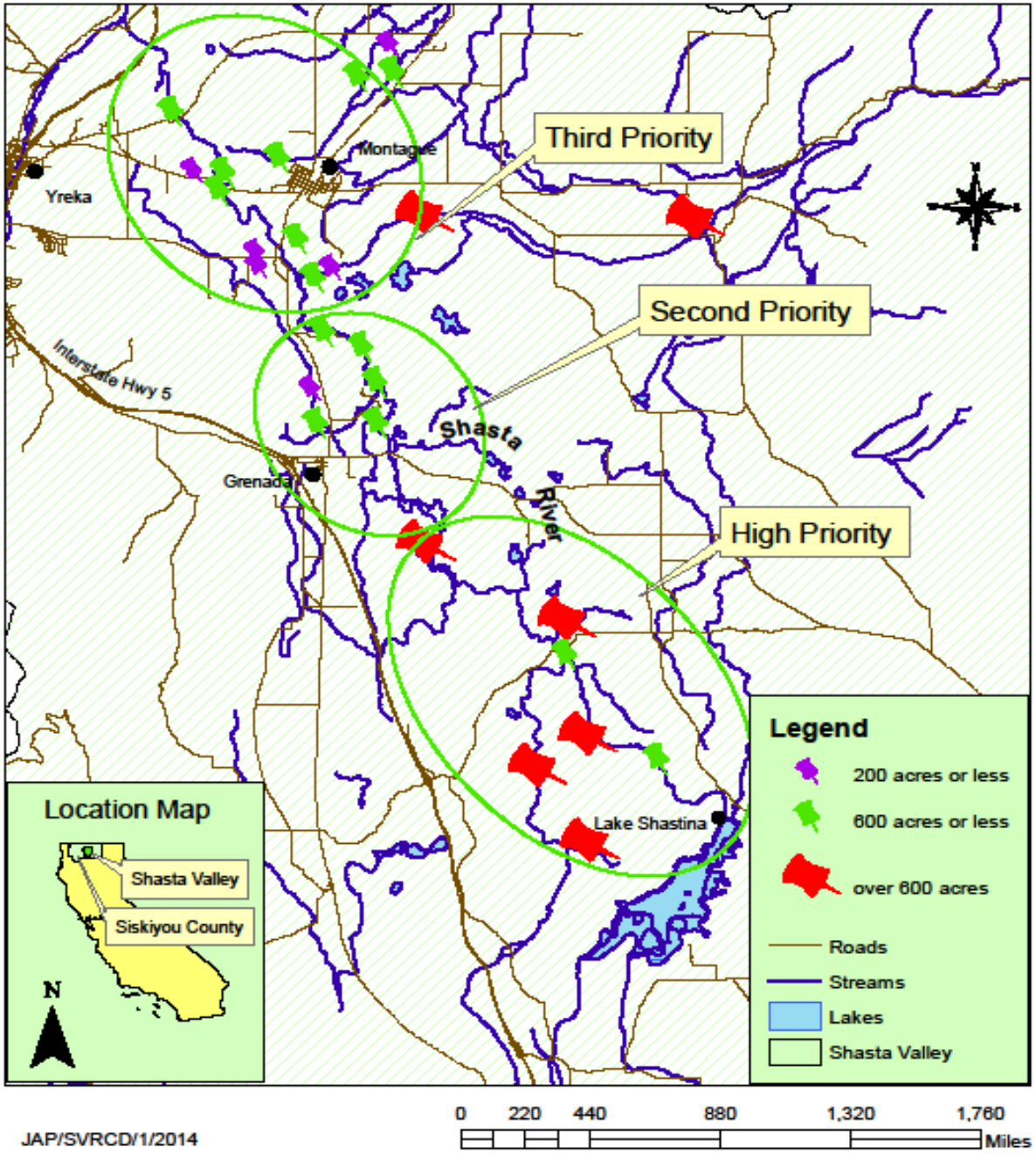
Andy Baker - NCRWQCB

Overview of Shasta TMDL Conditional Waiver

- The Shasta TMDL was adopted in January 2007
- Shasta River TMDL Conditional Waiver renewed by RWB October 2012
- Focus first on high priority area downstream of Dwinnell Dam, including Parks Creek, Big Springs Creek and tributary cold water springs
- Support development of additional water quality ranch plans
- Develop project tracking program (KTAP)

Water Quality Ranch Planning

- Important tool for landowners to protect water quality
- 34 ranch plans completed (some landowners already have ranch plans)
- 24 water quality ranch plans developed by SVRCD for TMDL purposes
- Continue to develop additional water quality ranch plans and work with landowners



Water Quality Ranch Plans Completed in Priority Areas

TMDL Waiver Highest Priority Area

- Staff has worked with all eight landowners within high priority area
- Landowners are participating in working group to improve fish habitat and reconnect cold water springs in high priority area
- Much work has been completed including scientific studies, monitoring, and restoration projects
- New 319 grants and TMDL contracts may provide additional assessment, analysis, and project implementation

TMDL Grants and Contracts

- Phase I: Three completed grants for tailwater reduction and minor impoundment removal (2006-2007)
- Phase II: Tailwater Reduction (2009)
- Riparian Protection and Restoration (2011)
- Assessment and Planning Analysis in High Priority Area (2013)
- Phase III: Irrigation Water Management and Watershed Stewardship Project (2013)
- Annual small contracts to SVRCD (2006 – 2013 for coordinating work supportive of the TMDL)
- Staff currently writing new TMDL contract for TNC

Shasta River Watershed Stewardship: Pilot Project Update

October 9, 2014

Yreka, CA

Adriane Garayalde
Shasta Valley Resource Conservation District

Shasta River Watershed Stewardship: Pilot Project Update

1) Draft Assessment of Water Temperature Data Completed
2) KTAP Inventory of Stewardship Projects Ongoing
3) Draft Monitoring Plan Completed
4) RCD Board Review
5) Partnership Review of Draft Report –
6) Final Report Preparation
7) Posting at KBMP Website – March 2015

Flow Augmentation in Shasta & Scott Rivers

- **Efforts to Increase Flows in the Shasta River: Amy Campbell & Amy Hoss, The Nature Conservancy**
- **Efforts to Increase Flows in the Scott River: Sari Sommarstrom, Scott River Water Trust**

The Nature Conservancy

Protecting nature. Preserving life.®

nature.org

Shasta River Water Transaction Program-

Improving Instream Flow Conditions in the Shasta River for Coho and Chinook Salmon

October 2014,

presented by Amy Campbell

California Water Code Section 1707

"Any person entitled to the use of water, whether based upon an appropriative, riparian, or other right, may petition the board for a change for purposes of preserving or enhancing wetlands habitat, fish and wildlife resources, or recreation in, or on, the water."

1707:
ONE TOOL IN THE TOOLBOX

1707 (Instream Flow Dedication) is one of the

Water Protection Tools

But it isn't the only one, and it is NOT a

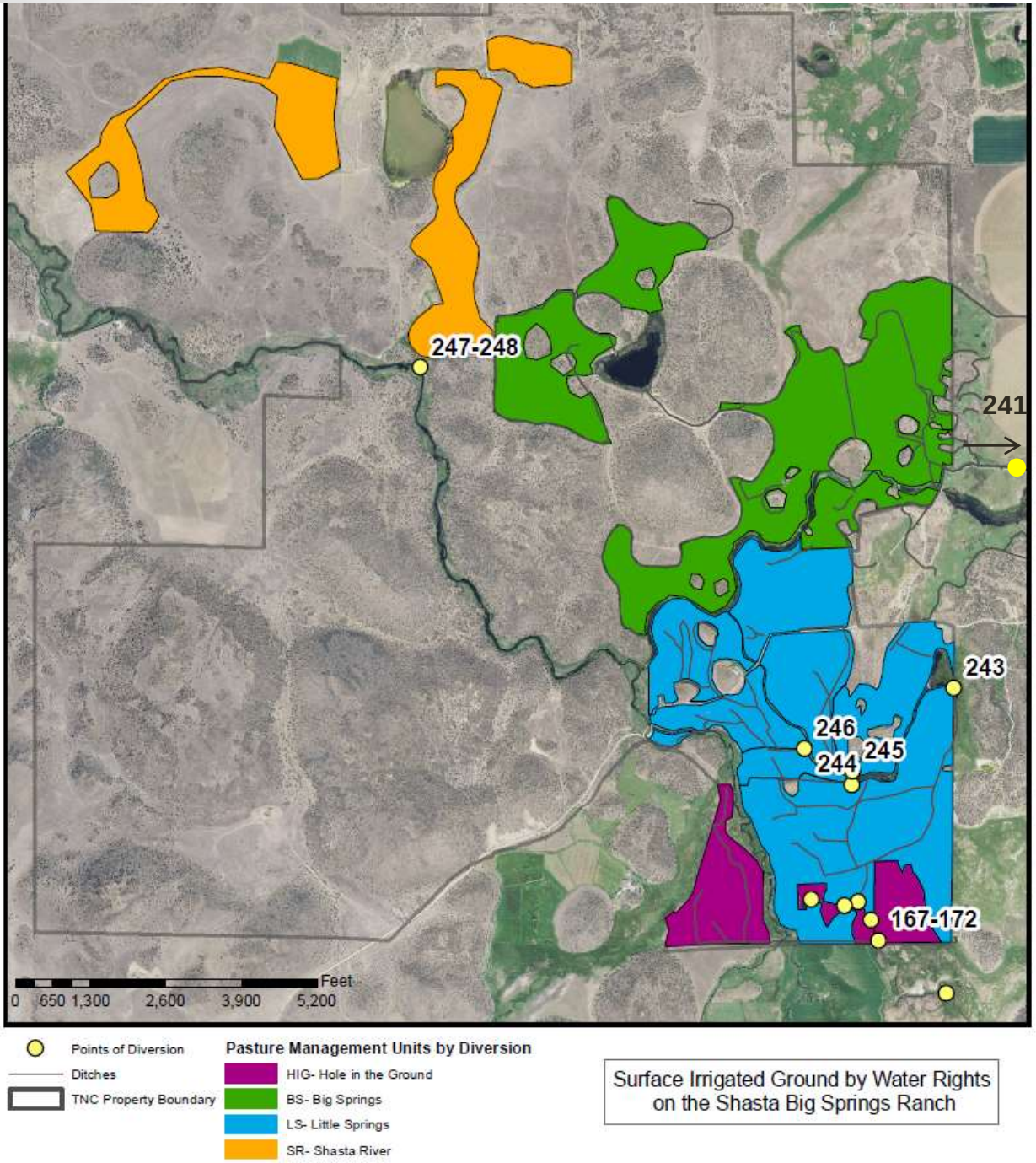
Water Restoration Tool

Water Protection Tools

- *1707 dedications*
- *Forbearance agreements*
- *Short or long term transfers*
- *Source substitution*
- *Water use efficiency (maybe)*

Water Restoration Tools

- *Riparian shading*
- *Channel restoration*
- *Maintain groundwater /surface water connectivity and integrity*
- *Streambank stabilization*



- Total Area—5,834 acres
- Irrigated Area—1,147 acres
- 18.11 cubic feet/second
- Approx. 650 cow/calf pair
- April – Nov grazing only
- Two grazing leases

The View From Above: What Are We Trying to Do With this Water?

GOAL:
IMPROVE IN-STREAM CONDITIONS
(temperature and dissolved oxygen)

- ✓ maximize anadromous fish production
- ✓ quality, location, and timing of water is key
- ✓ coho rearing in Big Springs Complex (April-September)
- ✓ Fall Chinook adult migration in canyon (August and September)

The View From Above: What Are We Trying to Do With this Water?

GOAL:
IMPROVE IN-STREAM CONDITIONS
(temperature and dissolved oxygen)

ADDITIONALLY…….
If possible, keep lands in agriculture—permissive, not restrictive dedication

- ✓Introduce the 1707 tool in the Shasta River
- ✓Test the 1707 dedication process for TNC
- ✓Help inform/change/revise the process
- ✓Understand what it takes to know if it is feasible/economic for other landowners

Where Do We Start?
Due Diligence: Not All Water is Created Equal

"Sure, we can spend all day nitpicking specifics but aren't sweeping generalities so much more satisfying?"

- ✓WATER RIGHT VALIDITY
- ✓WATER RIGHT PRIORITY
- ✓WATER RIGHT LANDSCAPE
- ✓WATER RIGHT QUANTITY
- ✓ECOLOGICAL GOALS
- ✓LOCATION AND TIMING
- ✓WATER RIGHT QUALITY

Local and reach-scale summary of results for water management alternatives that focus on instream dedications of TNC water rights in the Shasta River Watershed.

Body of Water	Quantity	Local effect*	Reach-scale effect
Hole in the Ground Creek	1.5 cfs	Yes** (↑)	No
Big Springs Creek	~6.7 cfs***	Yes (↓)	No
Little Springs Creek	7.9 cfs	Yes (↓)	Yes
BSC+LSC	14.6 cfs	Yes (↓)	Yes
Shasta River	2.3 cfs	No (-)	No

* Local effect can result in cooler (↓), warmer (↑), and no change (-) in downstream water temperatures.
** Examined empirically
*** Diversion shared with Busk Ranch. SBSR takes 10 cfs for 7 days of a 10-day rotation.

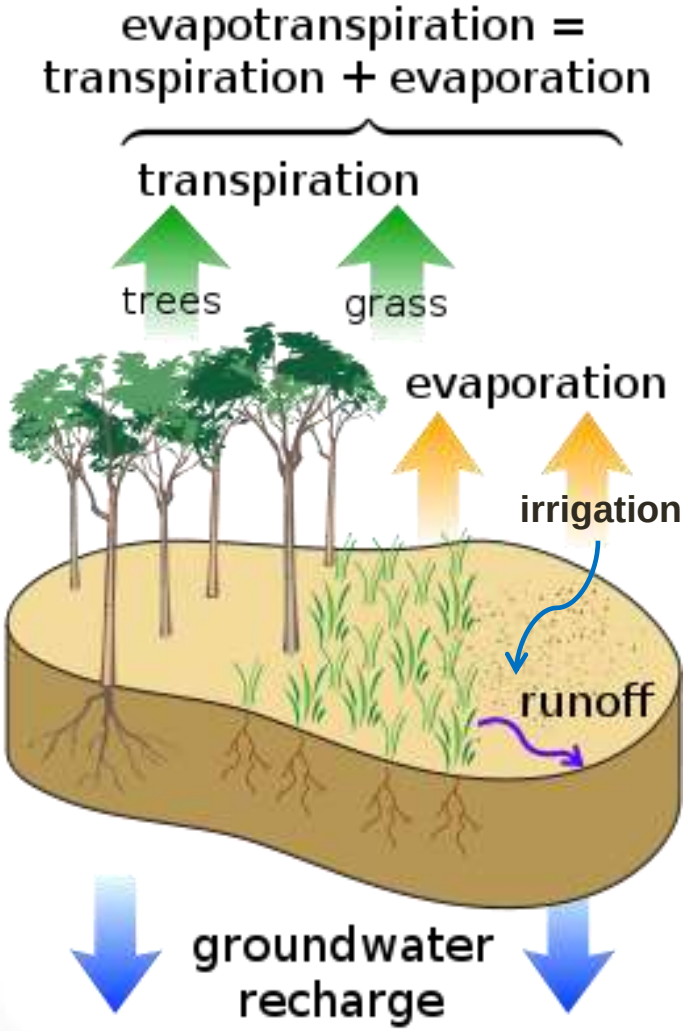
1707 Due Diligence: Water Quantity—Consumptive Use

to protect against the "no injury rule"

- While the entire water right can be dedicated to instream resources only the consumptively used water can be transferred downstream for beneficial use of instream resources.

- *Consumptive Use:* That part of water withdrawn that is evaporated, transpired by plants, consumed by crops or animals, or otherwise removed from the immediate water environment.

Consumptive Use



Consumed Water of TNC owned water rights in the Shasta River Watershed.

TNC Water Rights Total = 18 cfs

Calculation of Consumed Water (CFS)					
Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**
.67	**4.9**	**6.72**	**8.02**	**6.95**	**4.85**
4%	27%	37%	44%	38%	27%

Bring it home…. How do §1707 relate to the Shasta TMDL?

Draft Shasta TMDL Implementation Plan states: Within five years … water diverters shall provide a final report ... documenting dedicated cold water instream flow in the Shasta River in relation to the **45 cfs goal** or **alternative flow regime** that achieves the same temperature reductions from May 15 to October 15.

Months	April	May	June	July	Aug	Sept
estimated % consumptive use of applied water	4%	27%	37%	44%	38%	27%
~ Quantity of water secured via §1707 in order to achieve 45 cfs in the lower Shasta River Canyon	1125 cfs	167 cfs	121cfs	102 cfs	118 cfs	167 cfs
Estimated water diversion volumes per month						

Summary: Solely relying on §1707 to achieve this goal is not realistic. Need to be more specific on what flows are needed, where and during what times of the year.

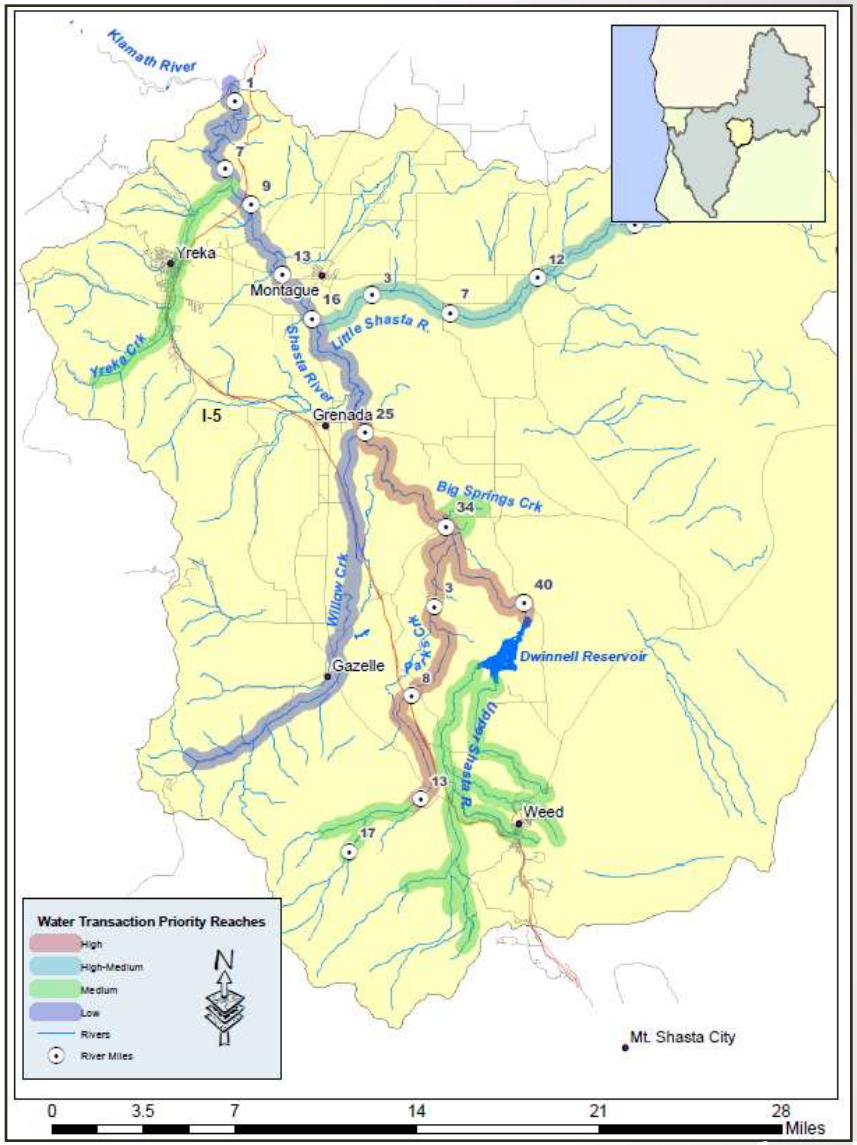
When do we need the water?

Where do we need the water?

How much water do we need?

What quality of water are we looking for?

Is there water potentially available?



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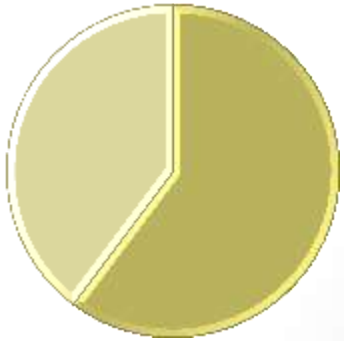
Shasta Water Transaction Program

Instream Flows Coordinated by the Shasta River Water Transaction Program

Water Transaction Species Targeted



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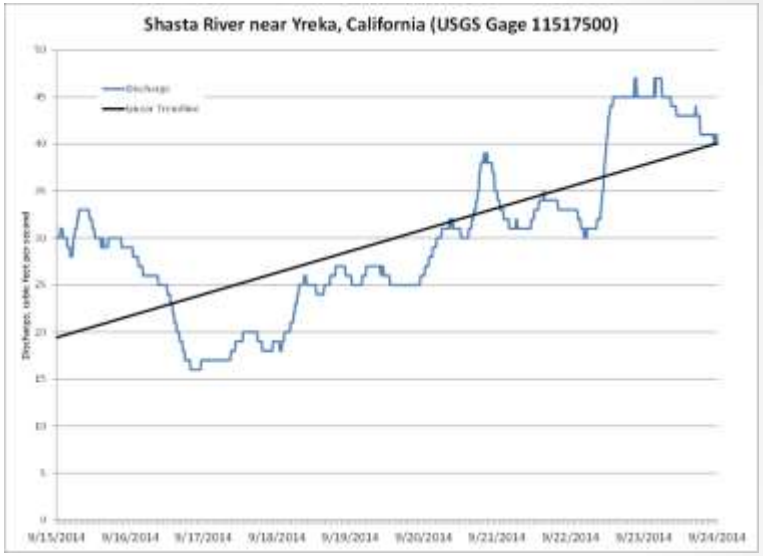
Shasta Valley Community-wide Fall Flow Program, 2009-2014

2014 Water Contributions:

- **When? September 15-Oct 1**
- **Where? Shasta River Canyon (RM0-7)**
- **How much? Minimum of 70 cfs**
- **What are we trying to achieve? Volume**
- **Results:**
  - **63 cfs (cubic feet per second) added combination of forbearance agrmts and voluntary contributions**



Print Page

By David Smith
@SDNDavidSmith

September 29, 2014 8:43AM

Shasta River Chinook numbers spike

Valley groups and agricultural community work to ensure sufficient flows

Chinook salmon are still pouring into Siskiyou County rivers, and one group is working to ensure that adequate water is available for the fish to spawn in the Shasta River.

California Department of Fish and Wildlife video counts on the Shasta River reveal that as of Sept. 24, 2,429 adult fall-run Chinook salmon had returned to spawn. Last year, by the same date, only 988 had been counted.

On Bogus Creek, CDFW data show that 85 Chinook had returned as of Sept. 21, nearly four times as many as were counted last year by the same date.

The Shasta Valley Resource Conservation District stated in a recent press release that numerous individuals have come together to ensure that the salmon returning to the Shasta River have enough water this year – an annual effort facilitated by the group.

According to the release, members of the agricultural community – through an incentive-based water exchange – contributed surface water and preserved groundwater resources, effectively doubling the flow of water in the river.

"These fish needed all the water we could get them this year," The Nature Conservancy Project Associate Amy Campbell said in the release. TNC partners with the SVRCD to administer its water exchange program.

"We know the ranchers have had a tough year with the drought and so have the fish. It is great to see ranchers willing to sacrifice, to get these fish the water they need, especially during this dry, hot year," Campbell added.

The release also notes the recent discovery of salmon in the lower Klamath River infested with the parasite ich, which was a major factor in a large-scale fish kill in the Klamath in 2002.

Thus far, the release notes, no ich has been found in the salmon that have returned this year to the Shasta River.

"With over 2,000 fish already in the Shasta River, the outlook is good that the run will remain healthy and spawn successfully," the release states.

Our Partners:

Shasta Valley Ag Community
Shasta Valley RCD
CDFW
NOAA
Scott/Shasta Watermaster District
NFWF
BOR

Priorities and actions driven by science.

- Sustainable and long-term funding to support gages;
- Capacity to support monitoring of transactions;
- Mechanism to quickly adapt and adjust plans accordingly.

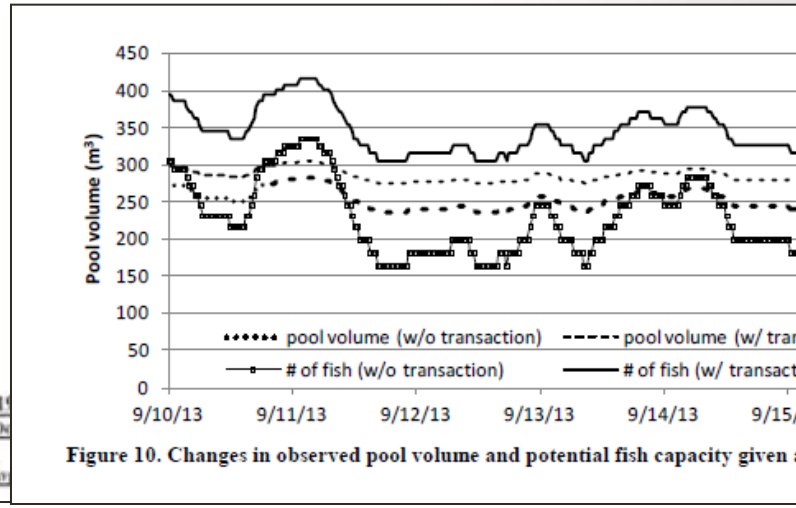


Figure 10. Changes in observed pool volume and potential fish capacity given

Table 8. Monthly Evapotranspiration of Applied Water for Actual Irrigated Areas Associated with Water Rights (19

Diversion Number	Adjudicated Area, Acres[2]	Water Right Flow, cfs	Mar			Apr			May			Jun			Jul			Aug			Sep			Oc
			Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min
167-172	67.2	1.5				0.00	0.06	0.25	0.18	0.48	0.68	0.42	0.64	0.76	0.62	0.76	0.87	0.40	0.66	0.76	0.34	0.46	0.56	
167-172	67.2	1.5				0.00	0.05	0.23	0.10	0.39	0.58	0.33	0.54	0.65	0.52	0.65	0.75	0.32	0.56	0.6				
167-172	67.2	1.5				0.00	0.05	0.21	0.04	0.31	0.48	0.24	0.44	0.54	0.41	0.54	0.62	0.24	0.47	0.5				
241	303.2	6.7				0.00	0.31	1.15	0.87	2.18	3.06	1.91	2.87	3.42	2.78	3.44	3.94	1.79	2.98	3.4				
241	303.2	6.7				0.00	0.27	1.05	0.53	1.80	2.61	1.49	2.43	2.92	2.32	2.94	3.37	1.44	2.54	2.9				
241	303.2	6.7				0.00	0.23	0.96	0.22	1.42	2.16	1.07	2.00	2.43	1.87	2.43	2.81	1.09	2.10	2.4				
																			1.95	2.2				
																			1.66	1.9				
																			1.38	1.5				
																			0.17	0.1				
																			0.14	0.1				
																			0.12	0.1				
																			0.49	0.5				
																			0.41	0.4				
																			0.34	0.4				
																			0.26	0.3				

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Memorandum

Date: 08/06/2013

Monitoring of pulse flows contributed to the Shasta River- April 2013
Prepared by: Amy Campbell, Chris Babcock, Ada Fowler

Introduction

In April 2013, The Nature Conservancy (TNC) partnered with the Montague Water Conservation District (MWCD) ("District") to release approximately 100 ac-ft of stored water from Dwinnell Reservoir. The purpose of this release was to assist with out-migrating juvenile salmonids past low flow and potential natural fish barriers in the Upper Shasta River. Specific salmonids targeted for this release include coho, Fall Chinook and steelhead. This release of stored water was coordinated with the California Department of Fish and Wildlife (CDFW), National Oceanic Atmospheric (NOAA)

Instream flows: new tools to quantify water quality conditions for returning adult Chinook salmon *(in submission)*

Ann D. Willis,[1] Amy M. Campbell,[2] Ada C. Fowler,[3] Christopher A. Babcock,[4] Jeanette K. Howard,[5] Michael L. Deas (P.E., M. ASCE),[6] Andrew L. Nichols[7]

Key words: Instream flow, fish management, migration, aquatic habitats, water quality, dissolved oxygen

ABSTRACT

This paper examines the effect of implementing a water transaction program to address potential water quality limitations for returning adult fall-run Chinook salmon in a stream system where the agriculture is the dominant land and water use. Water transactions are becoming an increasingly used approach to provide instream flows during periods when there are competing water uses. Water transactions are often used to achieve ecological objectives, but their water quality or biological effects are rarely quantified. The effects of a water transaction implemented in the Shasta River were evaluated using a spreadsheet model to quantify changes in dissolved oxygen conditions as they relate to discharge, pool volumes, holding habitat capacity, and potential dissolved oxygen demand by holding fish. The results indicate that water transactions may mitigate potential water quality impairments by decreasing the residence time in holding habitat, and are particularly effective during periods when flows are low, holding habitats are near carrying capacity, and dissolved oxygen demand by fish is elevated.

INTRODUCTION

Other ways to get more water instream?

- ✓ Continue to streamline the 1707 petition process
- ✓ Invest in flow monitoring and science to drive priorities
- ✓ Invest in the community of water rights owners
- ✓ Programmatic 1707s in areas with similar water rights
- ✓ Continue to encourage and fund water markets
- ✓ Urgent, but patience….paradigm shift needed

SHASTA BIG SPRINGS RANCH
OPEN HOUSE

Friday & Saturday, October 17 & 18, 2014

The Nature Conservancy

Invites you to join us for our annual Open House at spectacular Shasta Big Springs Ranch

Friday, October 17, 2014

10 am–4 pm

Streamside presentations at 11 am, 1 pm, and 3 pm

Saturday, October 18, 2014

10 am–4 pm

Streamside presentations at 11 am, 1 pm, and 3 pm

Shasta Big Springs Ranch

North of Mt. Shasta and Weed,
4 miles east of I-5 on Louie Road
Parking near Louie Road Bridge over the Shasta River

Join us to watch this year's spectacular run of fall Chinook in the Shasta River. See female salmon guard and build nests, while males compete with each other for spawning opportunities. Experts will be on hand to answer questions and point you to the best spots to catch all the action. It's the perfect outing for families, photographers, and all wildlife enthusiasts.

If you are bringing a group of 10 or more or if you are brining school kids on Friday during school hours, RSVP to Ally Sherlock:
(530) 436-5056 • allysherlock@gmail.com

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CALIFORNIA TROUT

RCD

NOAA

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Ally Sherlock

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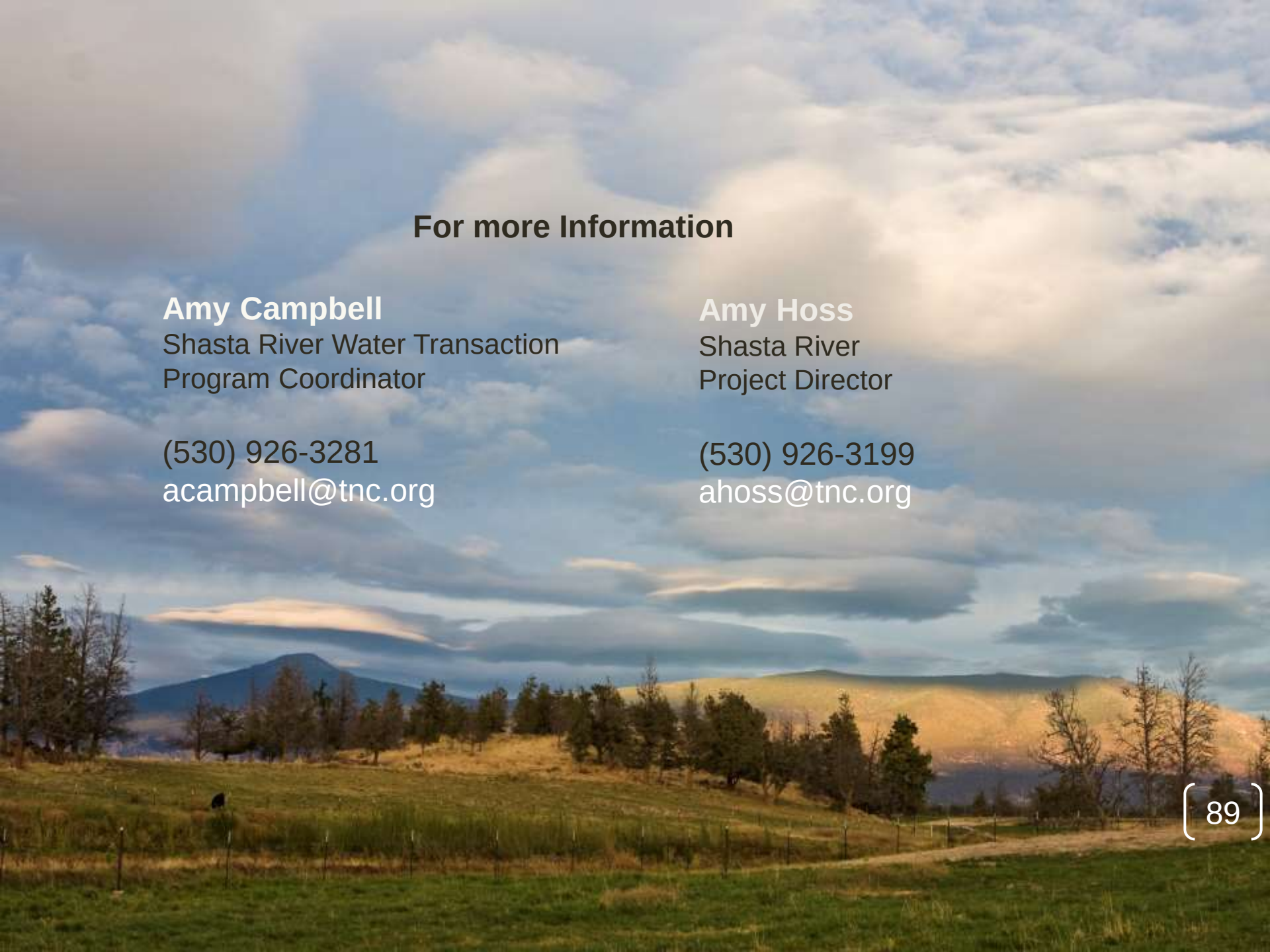
Acknowledgments/Partners

American Rivers
Aquaterra
California DFW
California Trout
Conservation Farms and Ranches
Davids Engineering
Farm Bureau
NOAA Restoration Center
North Coast RWB
NFWF
NRCS
River Right
SWRCB
Scott River Water Trust
Shasta and Scott River Watermaster District
Shasta Valley Ag Community
Shasta Valley RCD
Siskiyou County
Trout Unlimited
UCD Watershed Center
US Fish and Wildlife Service
Watercourse Engineering



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Project Director

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Board Questions & Comments

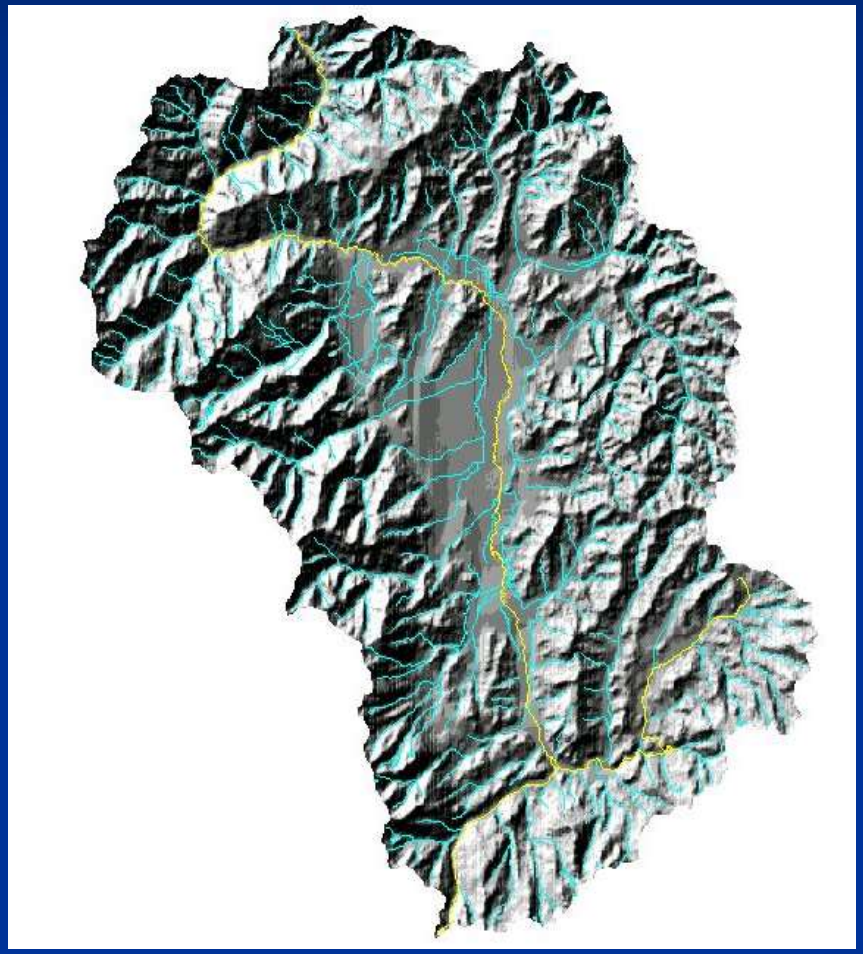
2014 Scott River Story: So Far

By Sari Sommarstrom

& Preston Harris

Scott River Water Trust

Scott River Watershed
814 square miles

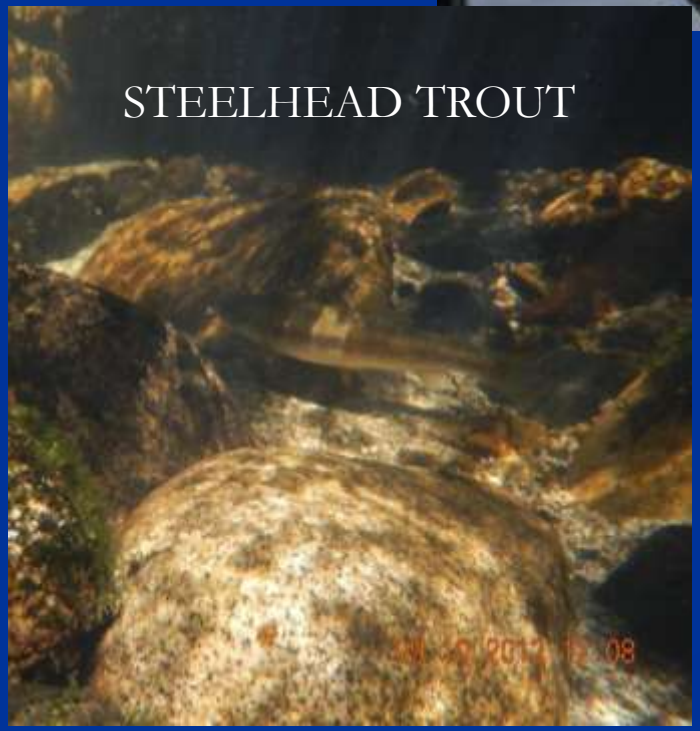


- Elev. 1,600 to 8,500 ft.
- 58 river miles mainstem
- Alluvial valley 33,000 ac.
- Groundwater basin
- Snow-melt fed runoff
- Rain shadow effect
- Semi-arid – 21” rain ave.

Scott Valley Fish

COHO SALMON

CHINOOK SALMON



STEELHEAD TROUT

Scott River Watershed Restoration Checklist

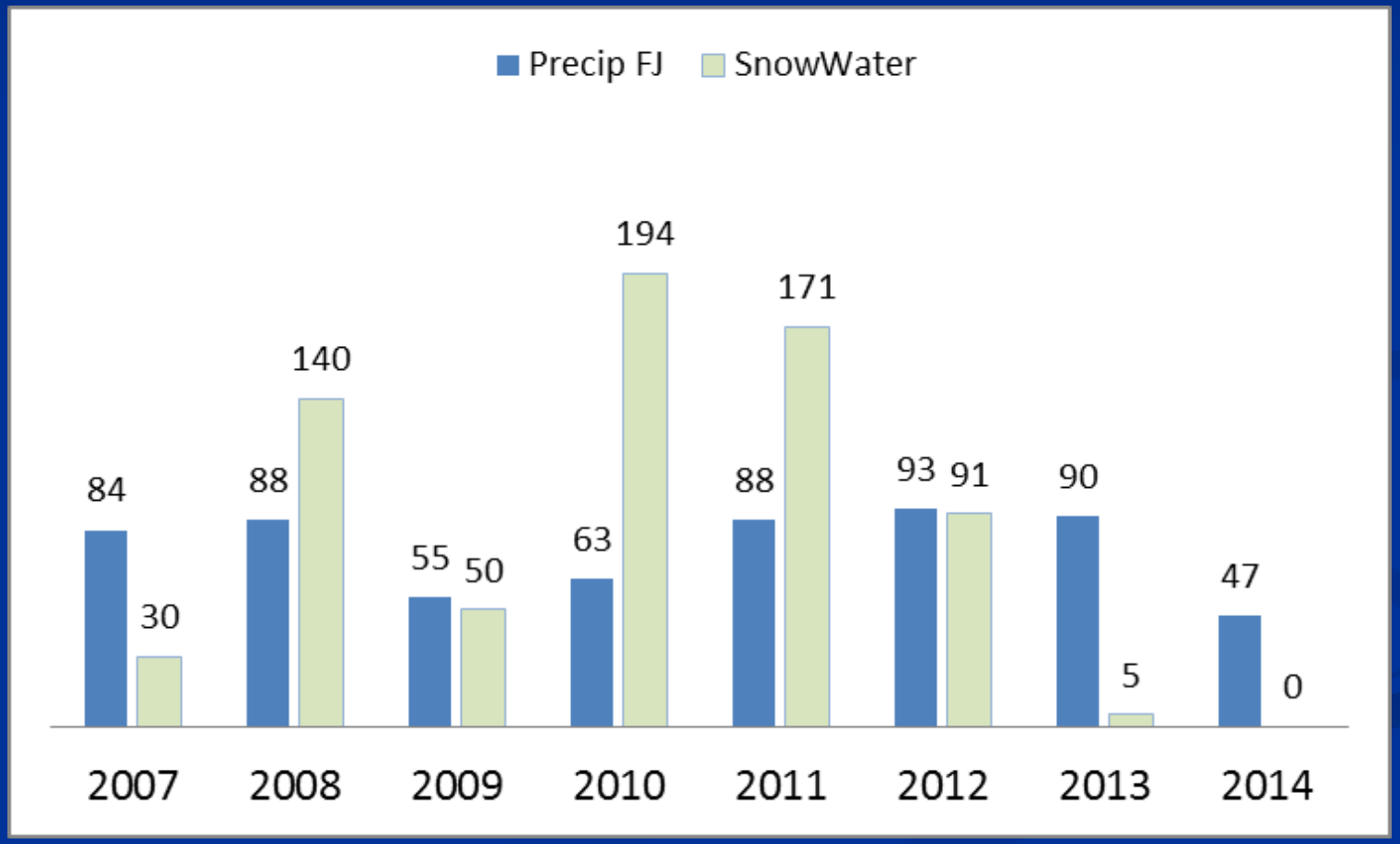
- Fish Screens = 100%
- Livestock fencing =80%
- Stockwater systems=60%
- Water Conservation = ++
- Water Rights Decrees =100%
- Watermaster Service =~10%
- Water Leasing = ++
- Instream rights = 7
- Beaver population = +

Scott Valley Family Farming & Ranching: Water Needs

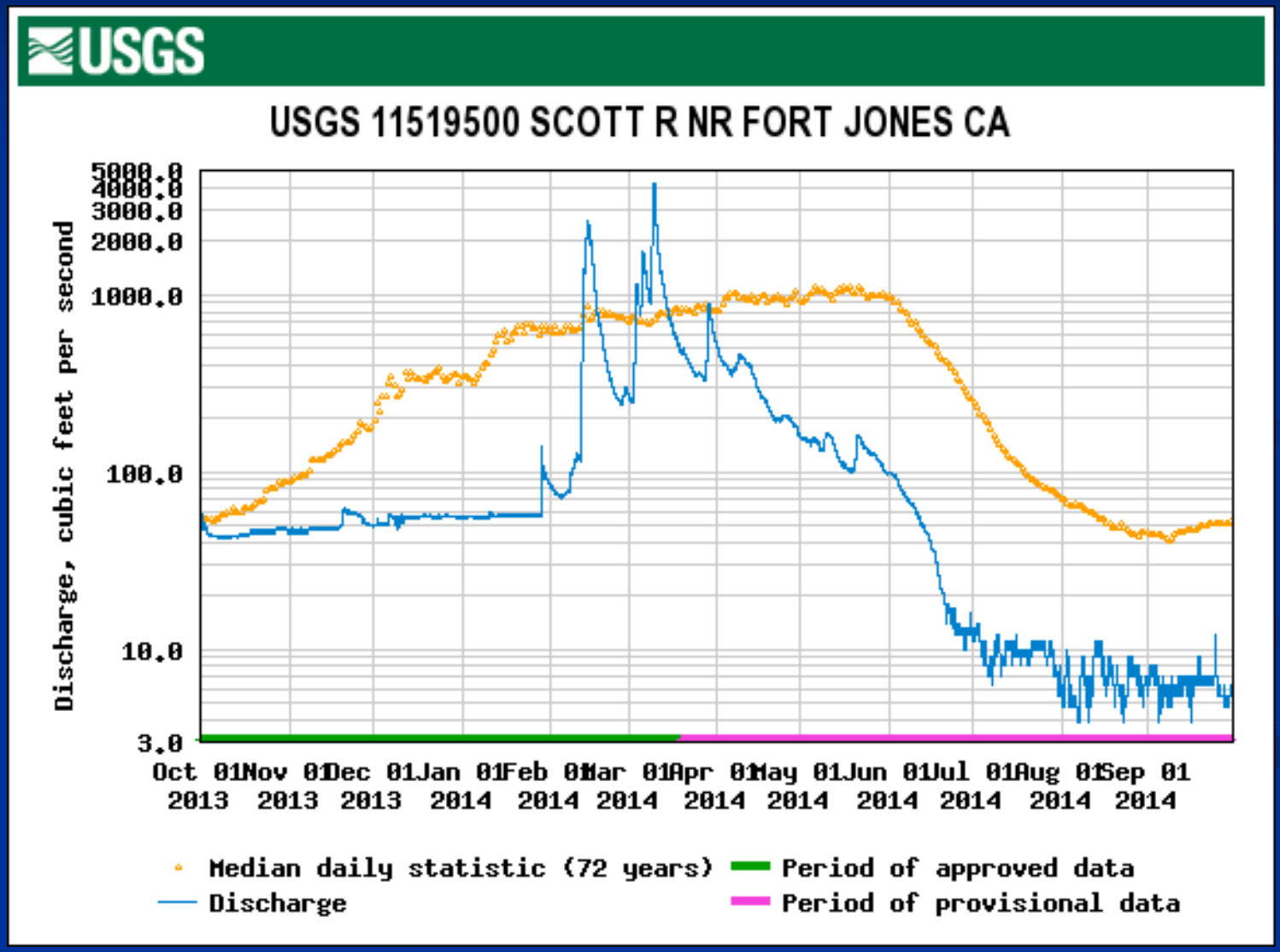
Irrigation
for Alfalfa, Pasture, Grain crops
32,000 acres
~ April to September ~

Stockwater
for Cattle and Horses
~ Year-round ~

Scott Watershed Rain & Snow: % of Average, 2007-2014 (May 1)



2014 Water Year – Extremely Dry



Scott River Water Trust: A Win-Win for Fish & Ag

We reimburse active water users for leaving water instream:

- to benefit salmon and steelhead
- during their critical life stages
- in priority reaches of the Scott River and its tributaries
- while protecting family farms.

First water trust in California!

WHO is the Water Trust?
~ Program since 2007~

NONPROFIT 501(c)(3)

- Water Trust Staff:
  - **Preston Harris**
    Executive Director
- Monitoring
  - Contractor - Peter Thamer
  - Partner - Siskiyou RCD

- Board Members: 5
  - Brad Erickson
  - Dave Krell
  - Sari Sommarstrom
  - Peter Yolles
  - vacancy
- Advisory Committee: 7
  - Local ranchers
  - Siskiyou RCD
  - Watershed Council
  - UC Cooperative Extension
  - Calif. Dept. Fish & Wildlife
  - NOAA-Fisheries (NMFS)

Water Leases: Forbearance Agreements

- Informal contract of ~4 pages between Trust & Water Rights holder
- Specifies:
  - Water right
  - Leased flow amount,
  - Dates of lease: Begin & End
  - Location of diversion & instream benefit,
  - Price per acre-foot, plus any Bonus payment
  - Total estimated volume
  - Estimated total cost

Pricing Matrix – 2014 Very Dry Water Year

	Water Year Type			
# Adjacent Lessors	Very Dry	Dry	Normal	Above Normal /Wet
1	$ 65	$ 60	$ 55	$ 50
2	$ 70	$ 65	$ 60	$ 55
3	$ 75	$ 70	$ 65	$ 60
4	$ 80	$ 75	$ 70	$ 65
5	$ 85	$ 80	$ 75	$ 70
6	$ 90	$ 85	$ 80	$ 75

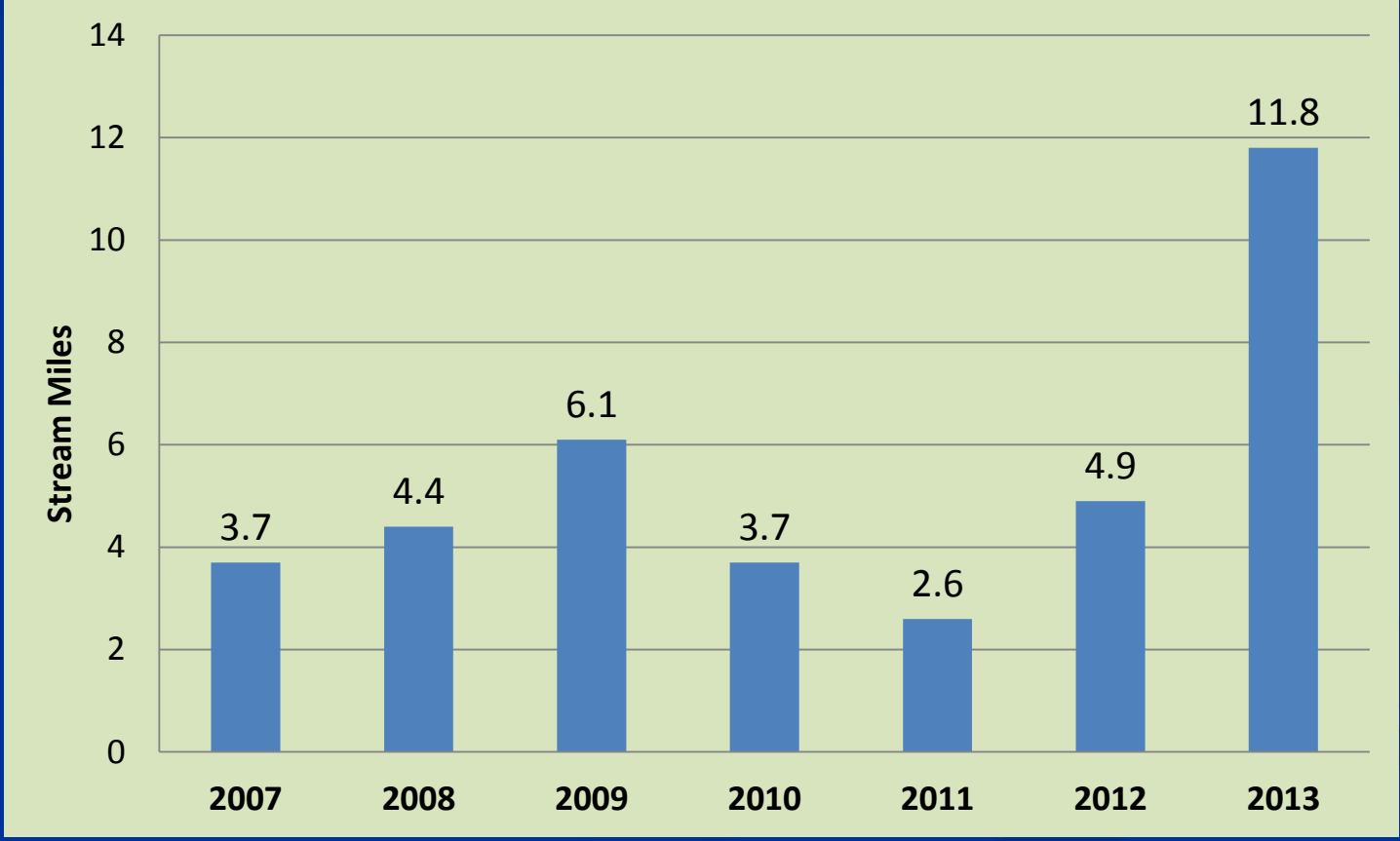
EXTREME YEAR BONUS: $1,000 to commit to starting by July 1st

Summer Habitat Priorities

Juvenile Coho Salmon & Steelhead:

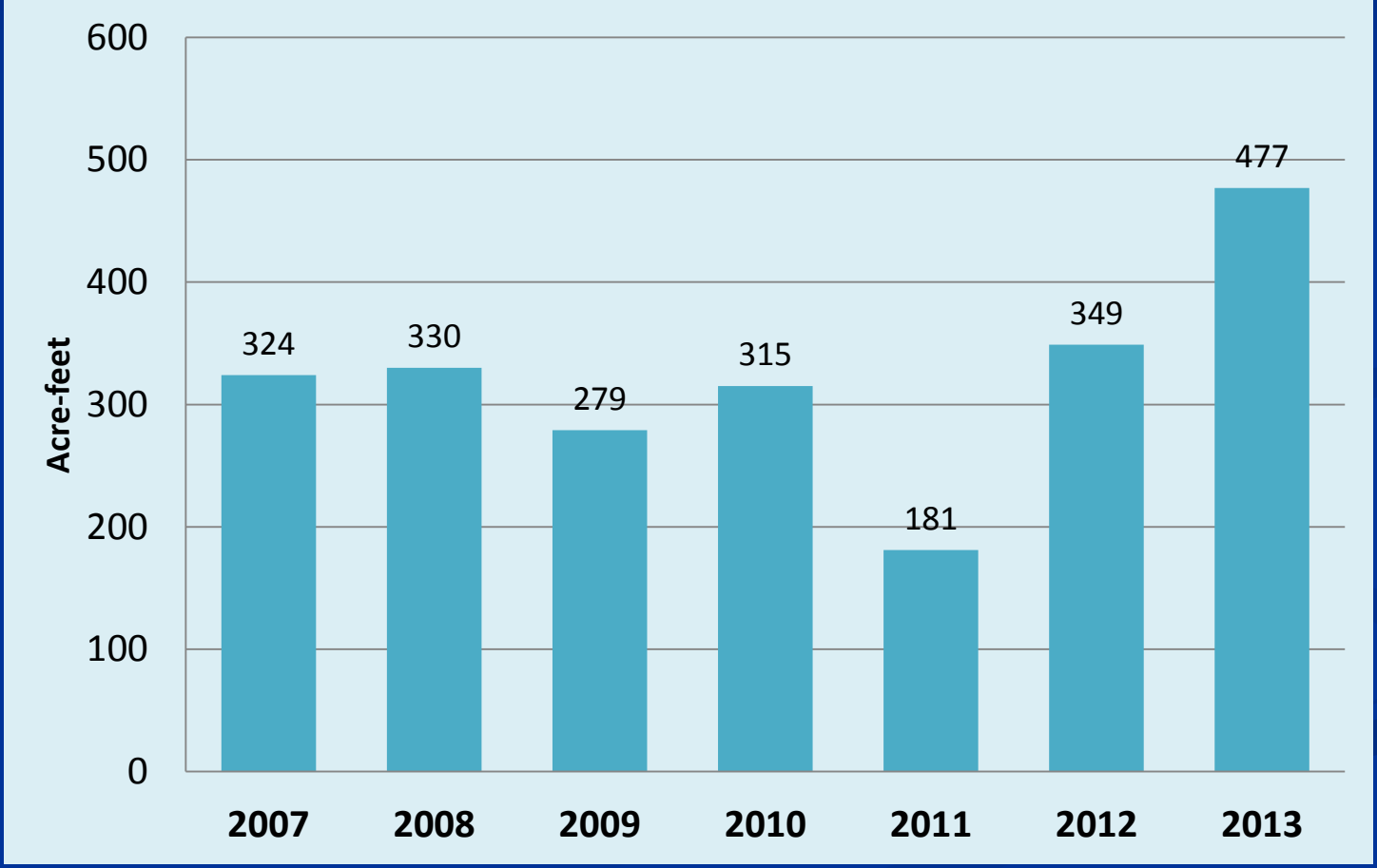
- Where: Tribs - French, Shackleford, Patterson, Sugar
- When: Early July – Oct 1st - depends upon water year type
- How Much: 0.2 – 5.0 cfs more in specific stream reaches

Summer Leases 2007-2013: Habitat Benefitted - miles




Fish-eye's view of lower
French Creek below beaver dam
09.06.2012 11:28

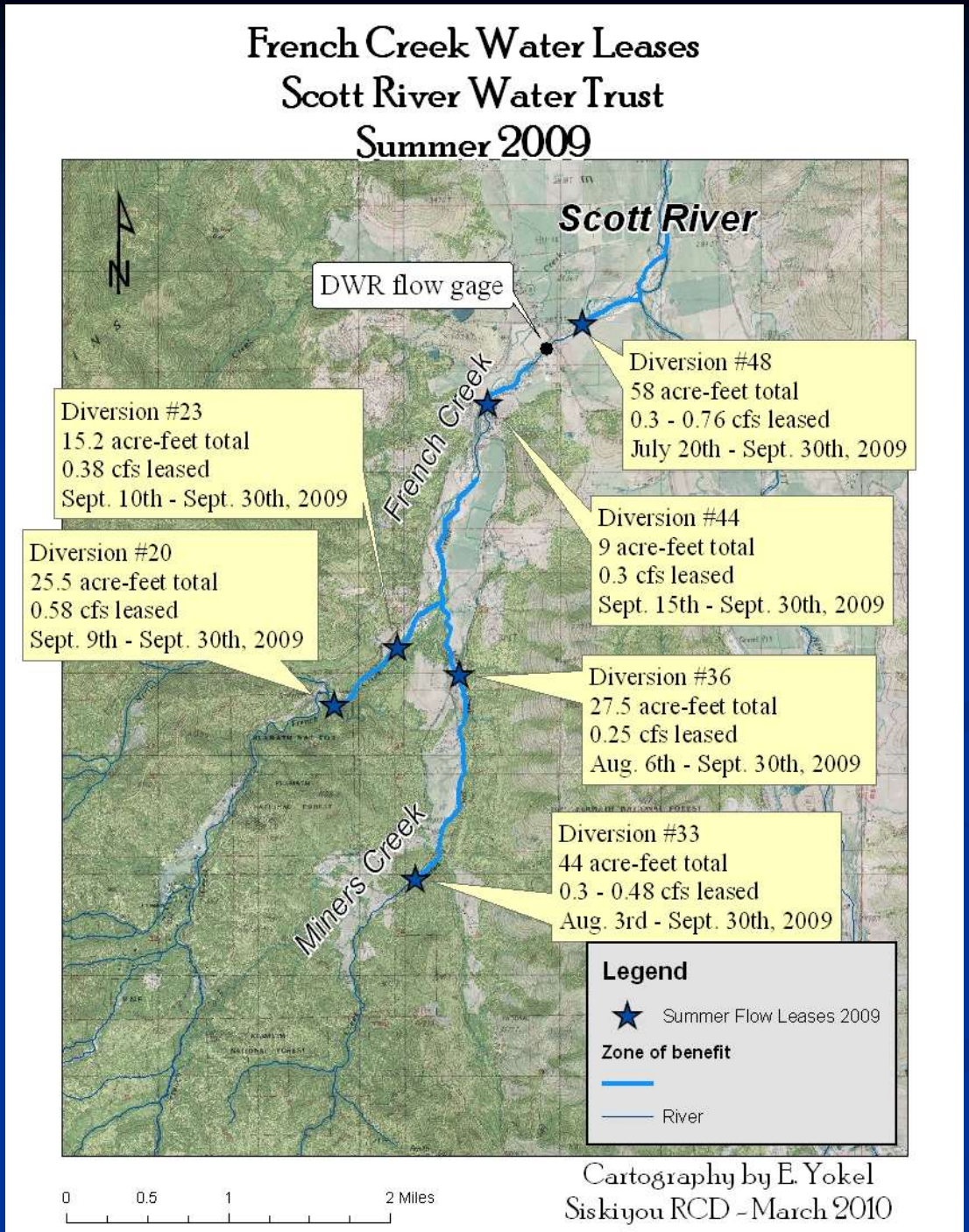
Summer Leases 2007-2013: Water Volume – acre-feet added



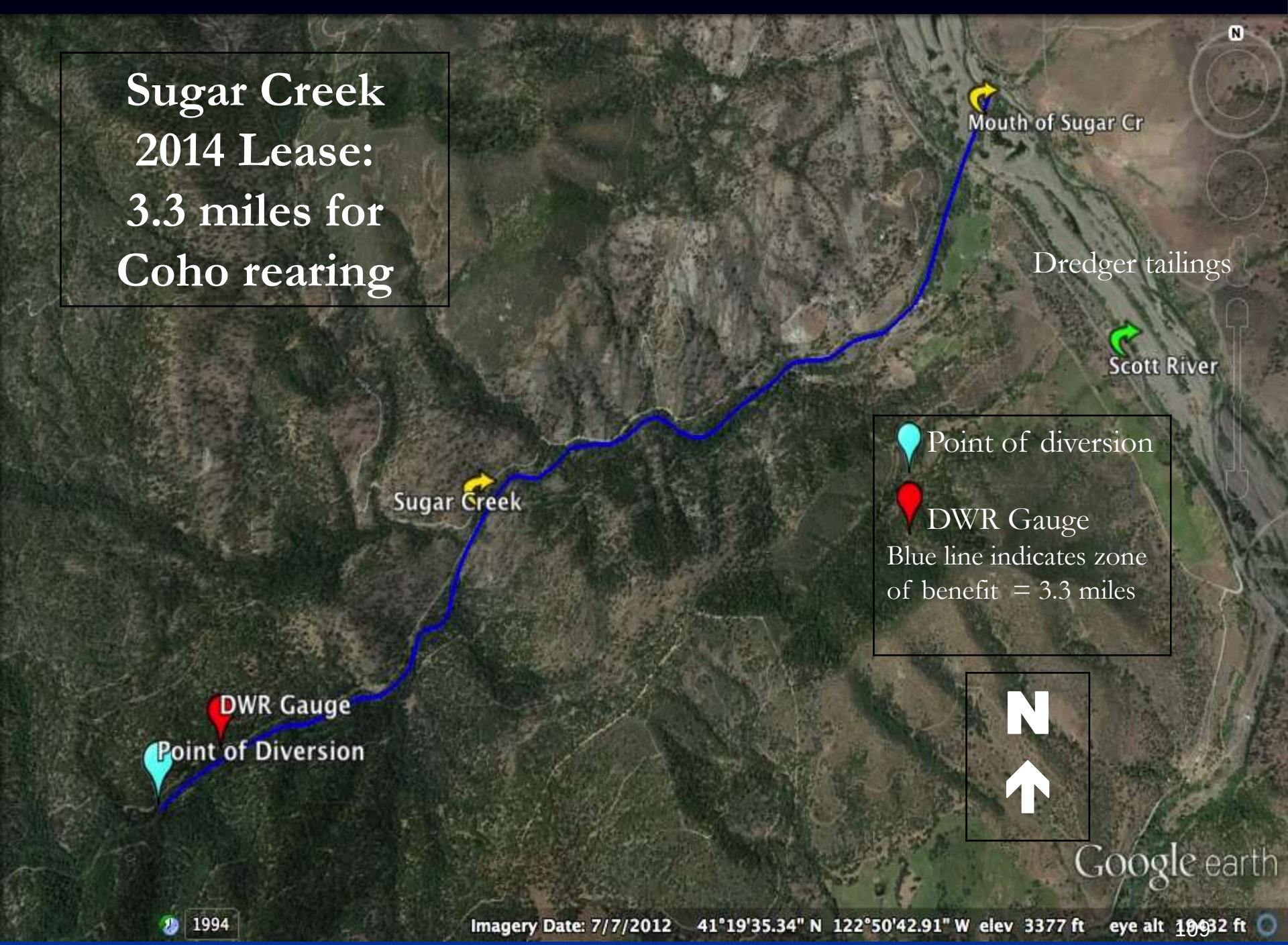
Summer Leases 2014: Preliminary Results

- French Creek – 7 leases
  - Sugar Ck – 1 lease
  - Scott River – 2 leases
  - 0.2 to 2.0 cfs per lease
  - ~800 acre-feet of volume
  - ~15 miles of habitat benefit
  - 20-106 days in length
  - 5 began by July 1st

French Ck & Trib: 7 leases in 2014 adding flow to 6.6 miles of habitat

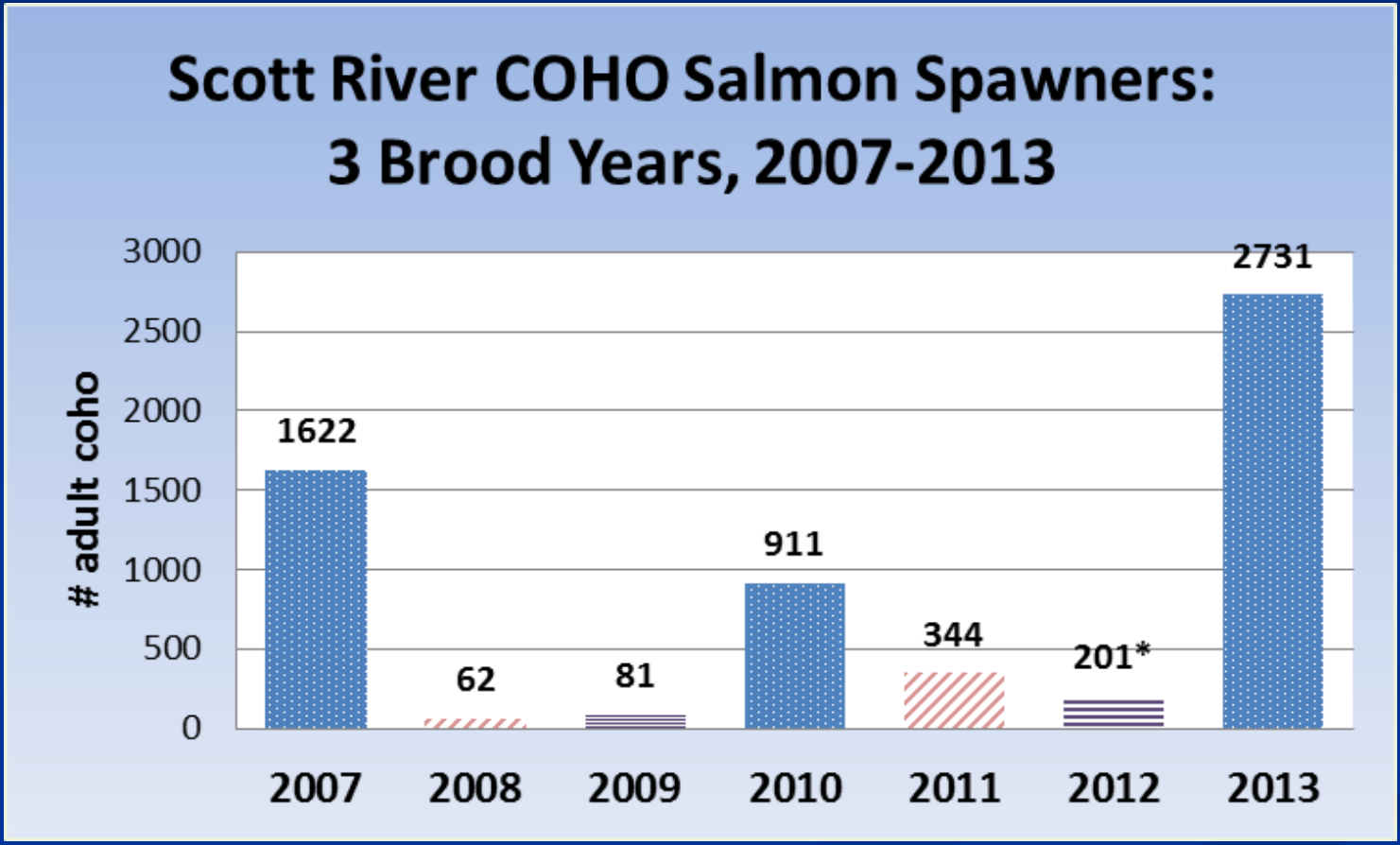


No new map yet:
2014 Lease Sites were at similar locations as in 2009 (also Critically Dry)

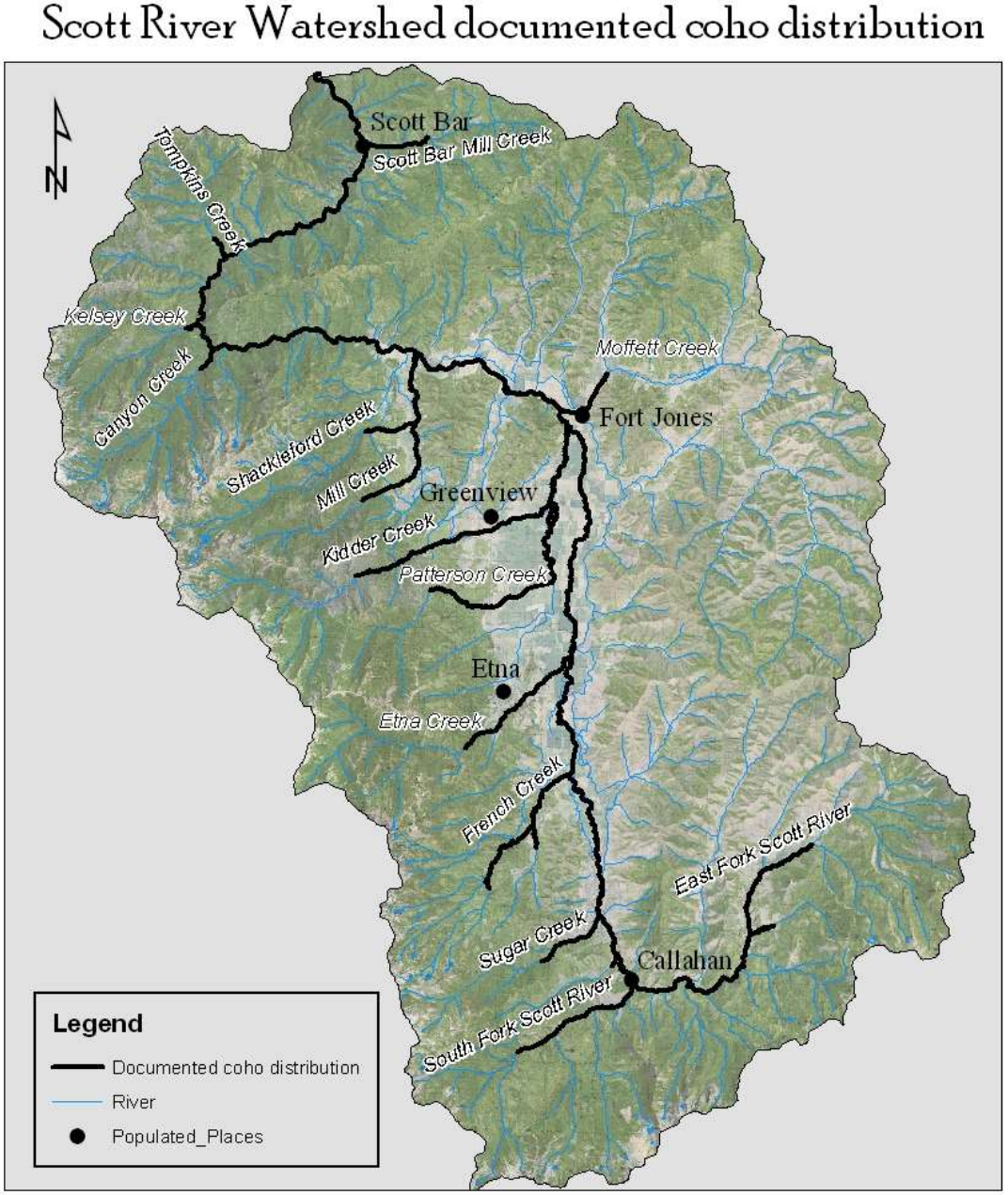

Sugar Creek
2014 Lease:
3.3 miles for
Coho rearing
Mouth of Sugar Cr
Dredger tailings
Scott River
Sugar Creek
Point of diversion
DWR Gauge
Blue line indicates zone
of benefit = 3.3 miles
DWR Gauge
Point of Diversion
N
Google earth
1994
Imagery Date: 7/7/2012 41°19'35.34" N 122°50'42.91" W elev 3377 ft eye alt 19932 ft

Coho Returns to Scott River

3 Brood Years are growing



CDFW data from Scott River video weir @ RM 18; * incomplete data



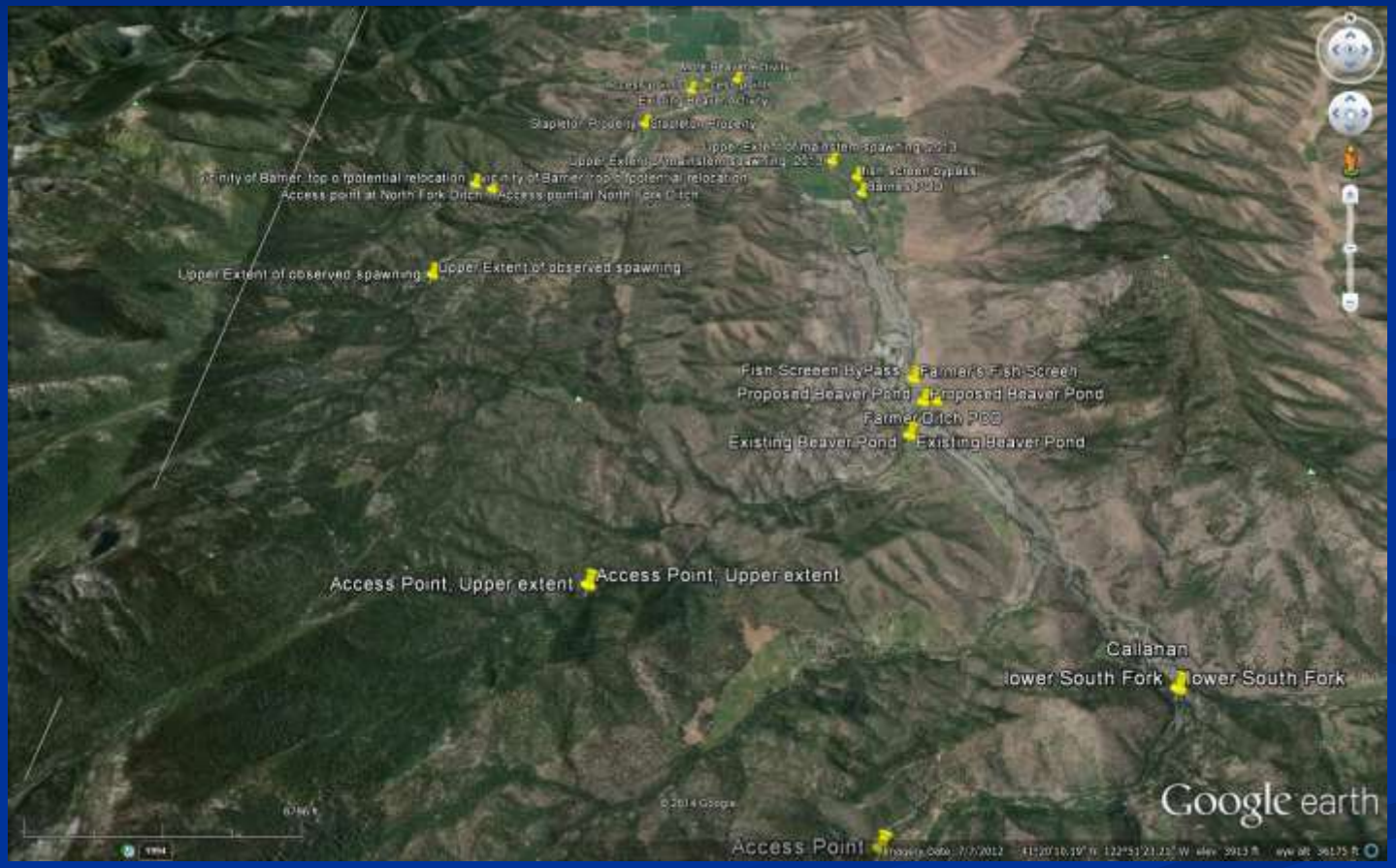
Scott River mainstem primarily <u>migratory</u> corridor for coho spawners and smolts.

Tributaries are main coho spawning and rearing areas, but EXTREME low flows in 2014 Fall & Winter blocked spawner access.

E EMERGENCY

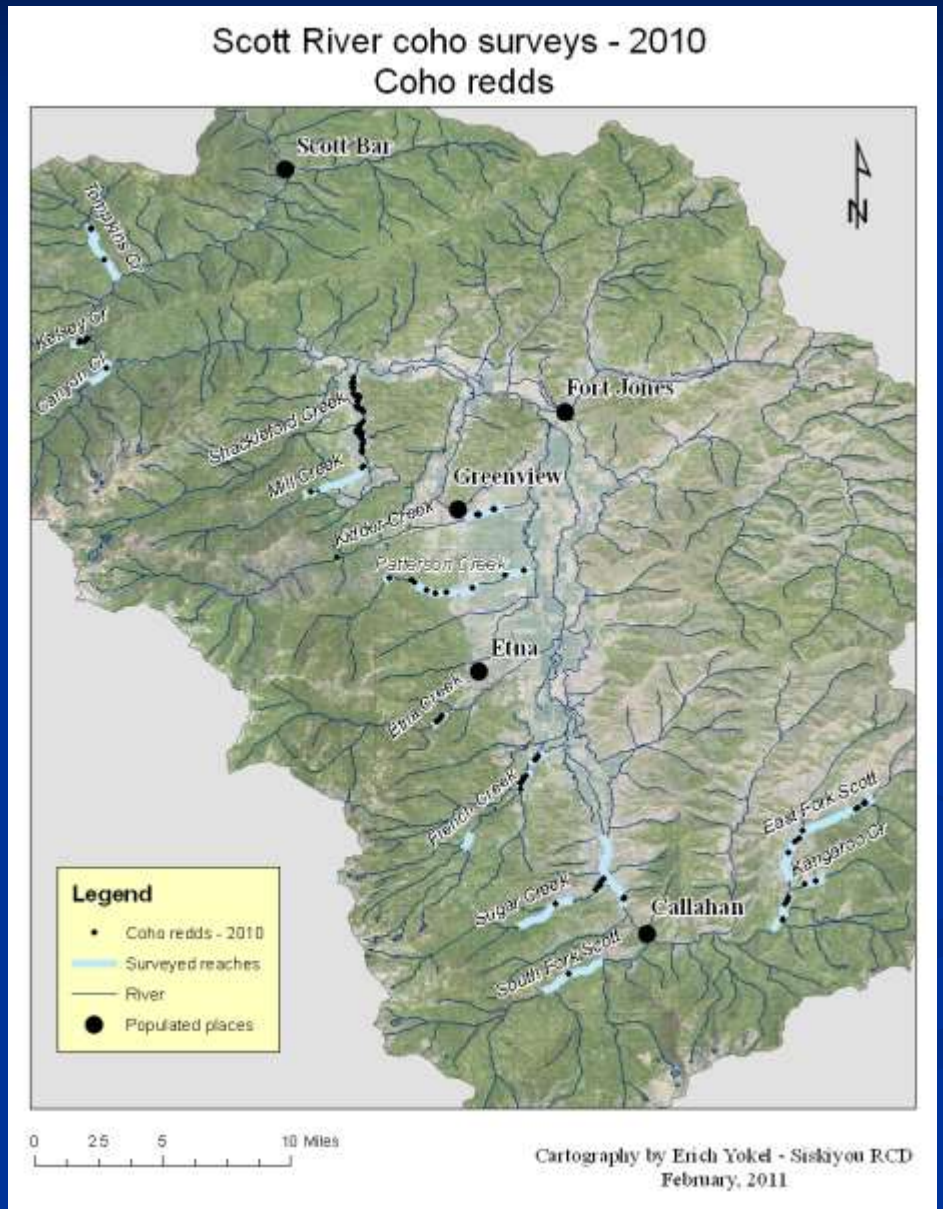
Coho male spawner, Dec. 2001, East Fork Scott

2014 Coho Emergency: Collaborative Juvenile Coho Rescue & Relocation



Siskiyou RCD initial strategy map by Danielle Yokel

2010 Coho Redd Sites: Destination



Rescue Site Seining & Sorting

All photos courtesy of CDFW

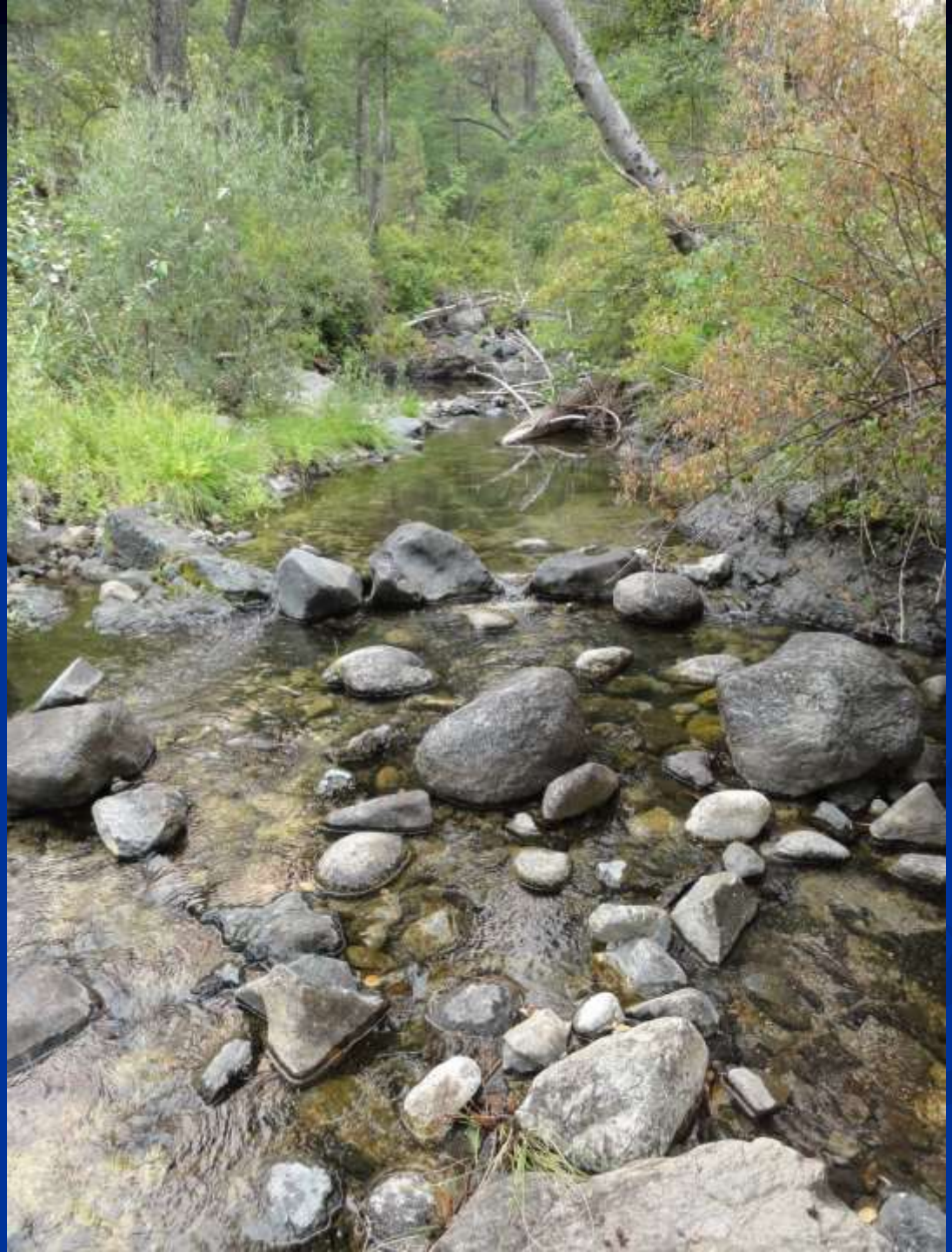
Sites located with ~10 miles of Scott River below Tailings.

Moved June 3 thru August 19th

Moving 116,000 coho to new homes

TO: South Fork, East Fork (Grouse Ck), Sugar Ck, French Ck & tribs, Etna Ck, Canyon Ck, Kelsey Ck

Iron Gate Hatchery received 4,447 coho as back-up



SUGAR CREEK Relocation site

8/19/14

Photo by Water Trust

PIT Tagging & Tracking

1,827 juvenile coho tagged:

- 20% released at rescue site
- 80% released at relocation sites

One of several PIT tag arrays in Scott River and several tribs

1st Water Lease in Spring: Helping migrating 0+ and 1+ coho

Farmers Ditch Diversion

Photo by Peter Thamer

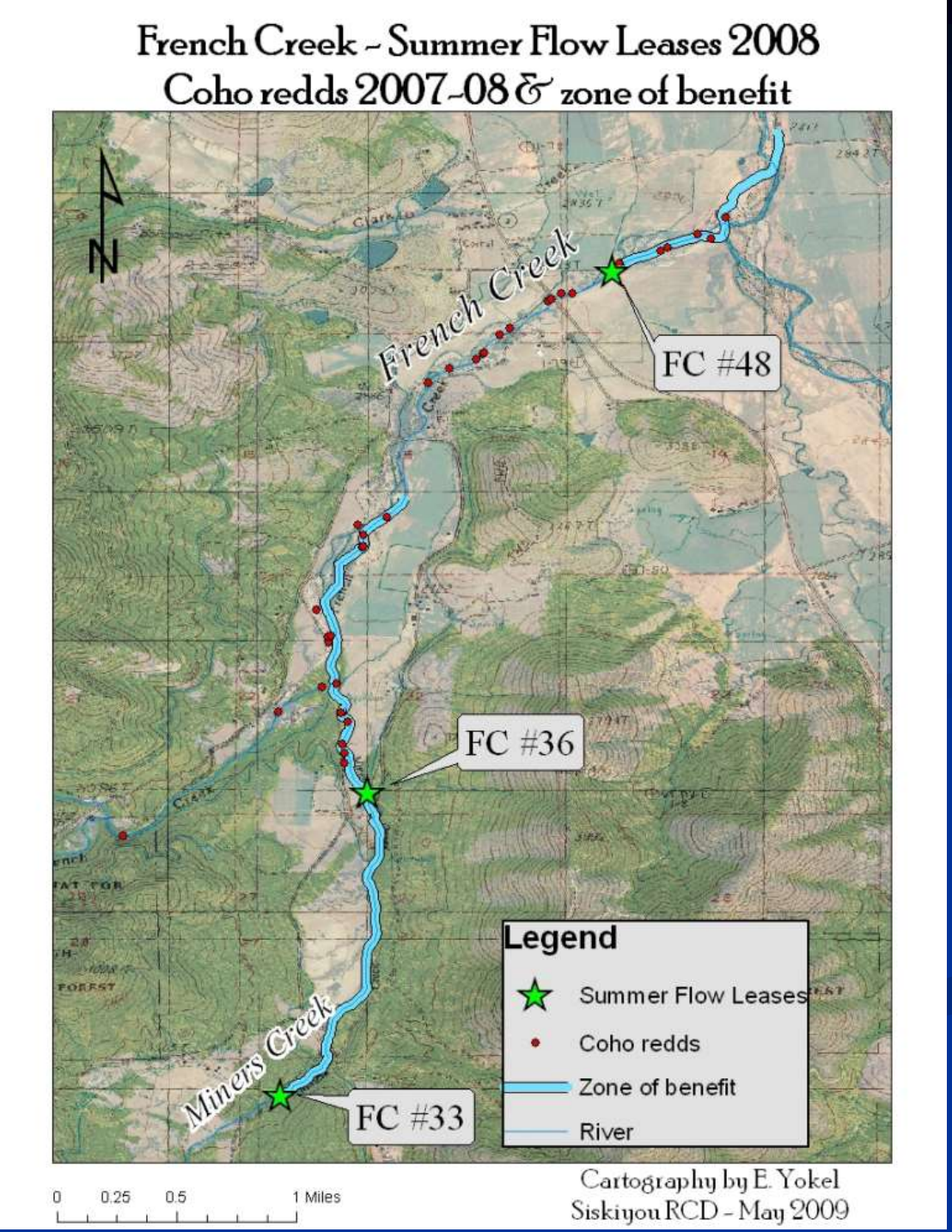
20 cfs added through upper Scott River Tailings Reach – RM 52-55

Lease Dates: April 30 to June 6

SUMMER LEASES:

Water Trust targeted leases to benefit coho relocation sites, based on <u>known</u> coho habitat and water availability

2007 same brood year as 2013

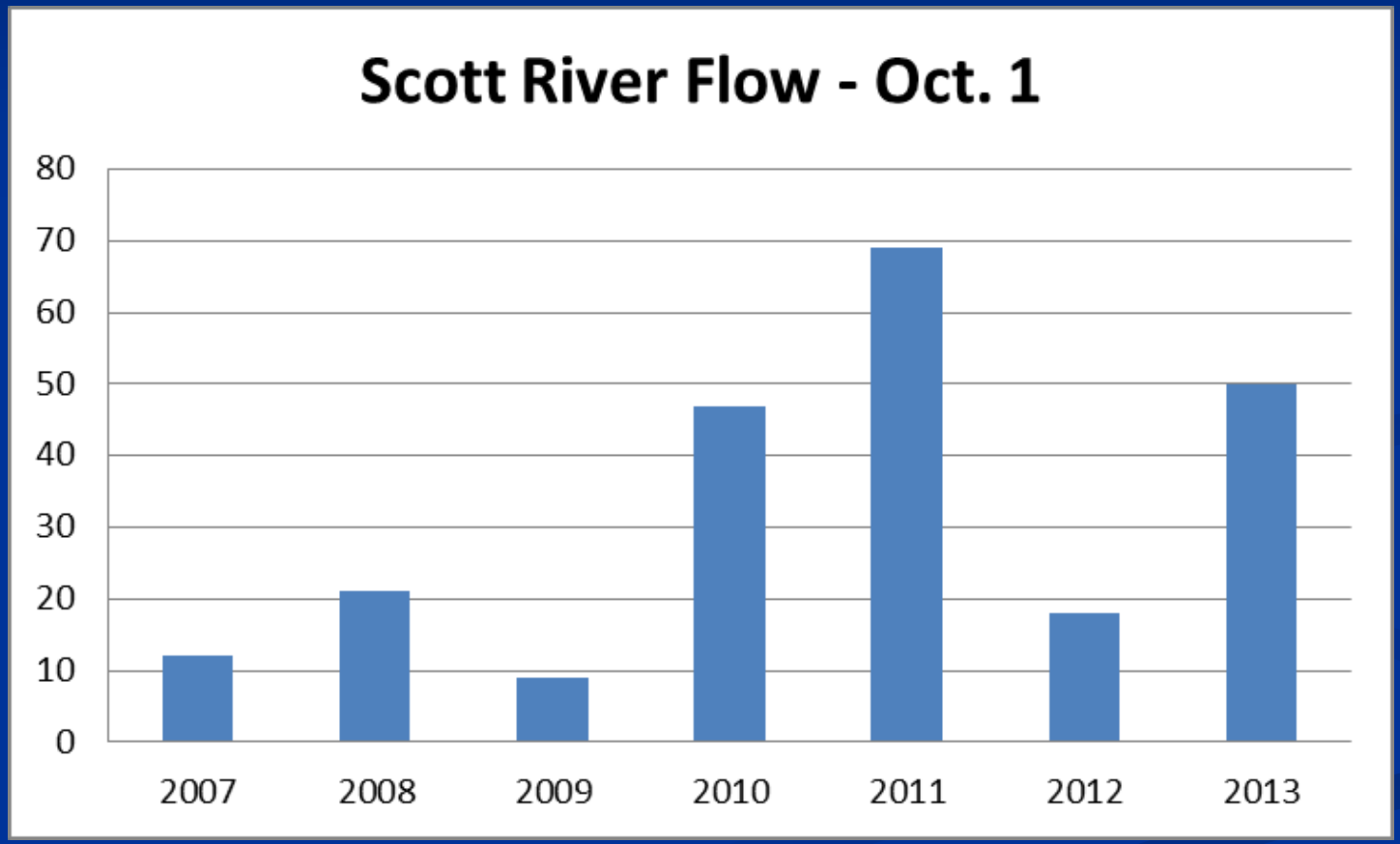


Fall Flow Needs & Sites

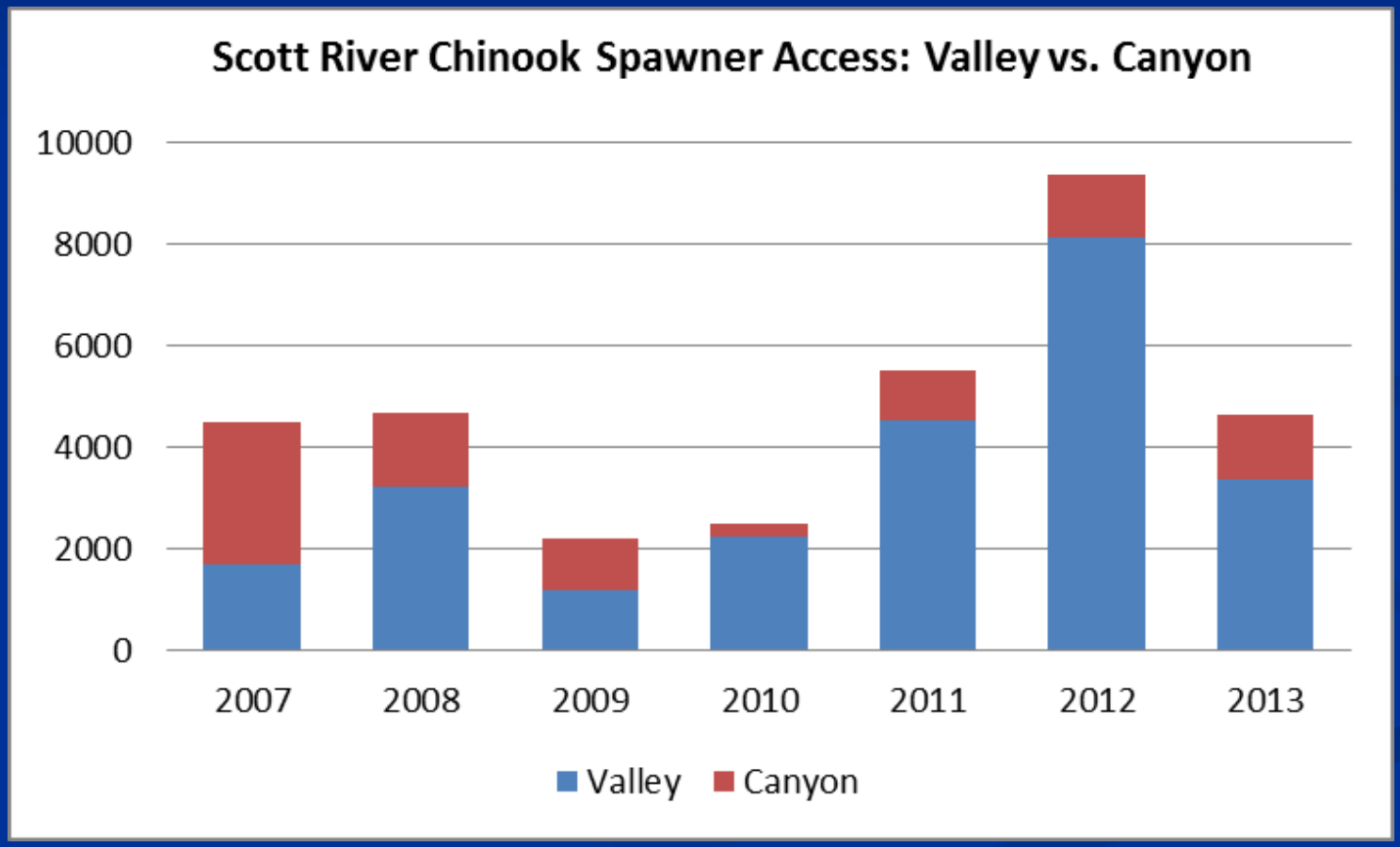
Adult Chinook & Coho Salmon : Migration & spawning

- Where: Scott River, Shackleford Ck, French Ck, & others
- When: Chinook – Early October / Coho: November to January
- How much: Assume 25 cfs at USGS gage at RM 21 for spawners to get into Scott Valley; 50 cfs to get up to Tailings reach.

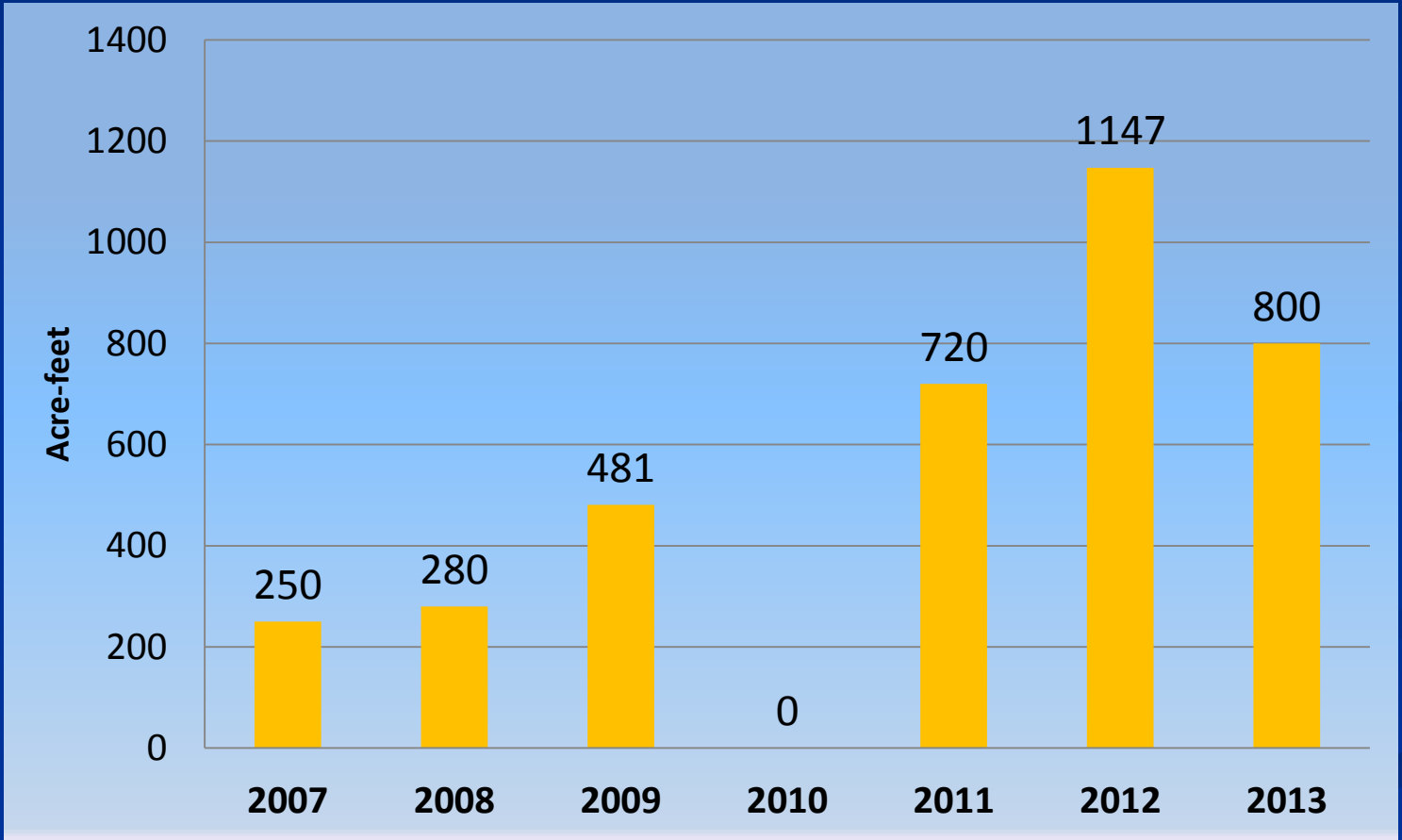
Recent Fall Flows on Oct. 1st : Barrier, or not, to spawners?



Recent Chinook spawner access to Scott Valley above canyon reach



Fall Lease Volumes, 2007-2013



Fall 2014 Connecting the Reaches

River Mile 56

RM 45

RM 35

Only 800 acre-feet made connection in 2009

2014 In Review

- Expanded the SRWT water leasing program:
  - Earlier Start Dates to help fish
    - Incentive bonus if lease could begin by July 1
  - Spring lease to help juvenile migration at tailings
  - Greater volume and habitat mileage benefit
- Assisted with Emergency Coho Rescue & Relocation Strategy, in collaboration with CDFW, Siskiyou RCD, USFS, and others.
- Landowner cooperation was key to letting this all happen.

Current Funding Sources

- Bella Vista Foundation
- Dean Witter Foundation
- National Fish & Wildlife Foundation
- PacifiCorp
- U.S. Bureau of Reclamation
- U.S. Fish & Wildlife Service

Scott River Water Trust

www.scottwatertrust.org

Contact:
Preston Harris, Exec. Director
(530) 643-2395
preston@scottwatertrust.org

Scott Valley Groundwater Study

North Coast RWQCB Meeting – October 9th 2014

Gus Tolley, Jakob Neumann, Laura Foglia, and Thomas Harter

ThHarter@ucdavis.edu

http://groundwater.ucdavis.edu

OUTLINE

- Introduction
- Model Overview
- Current Status of Model
- Ongoing and Future Modeling Efforts
- Water Management Challenges

SCOTT VALLEY

- Agricultural groundwater basin
  - Primarily alfalfa/grain hay and pasture
- Scott River drains 813 square miles, is undammed, and is tributary to the Klamath River
- Average late summer streamflow has decreased approximately 50% since the 1950's
  - Likely due to combination of climate change and development of groundwater resources in the basin
  - Detrimental to anadromous fish species including the threatened coho salmon

SCOTT VALLEY INTEGRATED HYDROLOGIC MODEL (SVIHM)

- SVIHM Version 1
  - Originally developed by Harter research group in 2010

- SVIHM Version 2 (SVIHM report 2013, WRR 2013, Meeting 12/2013)
  - Adjusted model boundaries, topography, and extension to Callahan
  - 2-layer high resolution model, 50 m (~166 ft) horizontal discretization
  - Added soil-water budget (for groundwater model input)
  - Added recharge to valley from surrounding mountains

- SVIHM Version 3 (current)
  - added adjusted water budget model to reflect measured values of irrigation application rates
  - Fixed ET values
  - Better representation of streams and tail-water sloughs
  - Included gain/loss observations for Scott River in calibration
  - Updated monitoring well observations
  - Mountain front recharge made seasonal

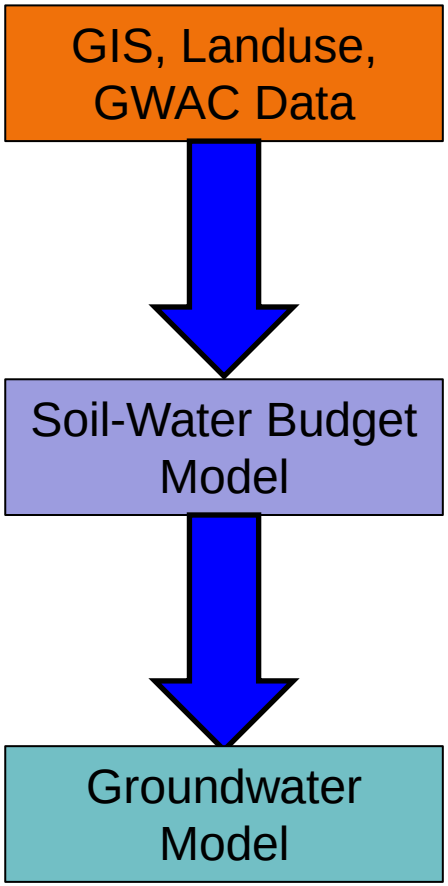
SVIHM

- Two Parts
  - Soil-water budget model → groundwater model

- One-directional coupling of the two models
  - -Output from the water budget model is used as input to the groundwater model

  - -Depth to groundwater is deep enough in most of the Scott Valley that groundwater doesn't have a significant impact on the soil zone

  - -Groundwater is affected by recharge from the soil zone.



SVIHM
WATER BUDGET MODEL

- Water Budget Model

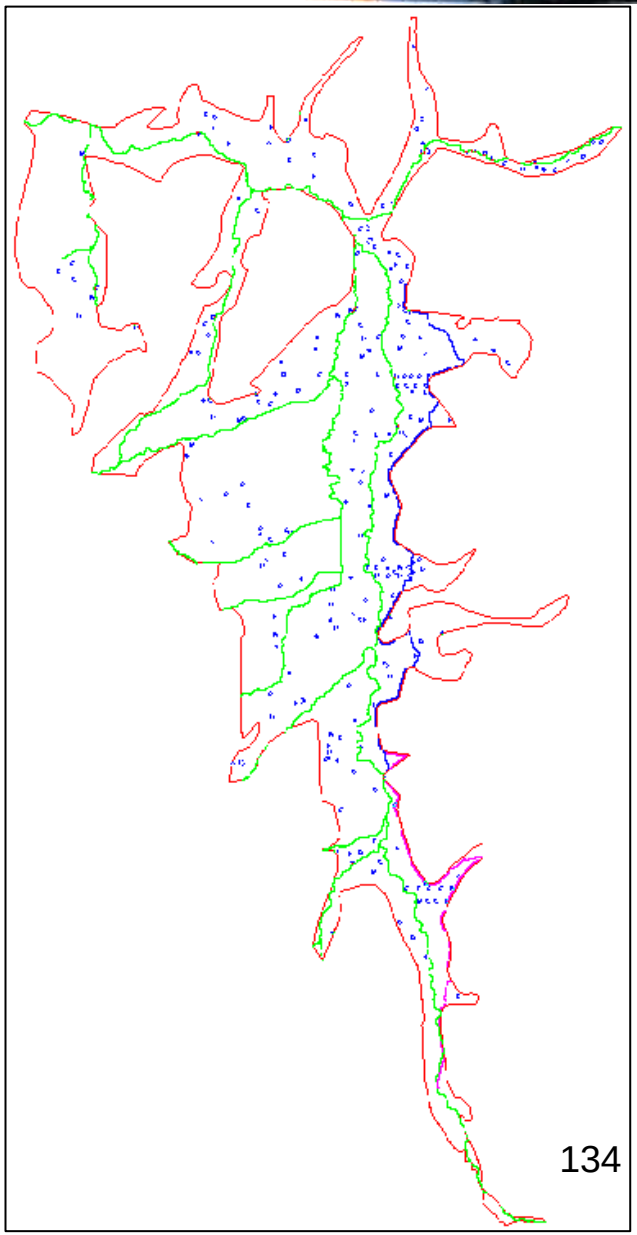
  -Uses a root zone “bucket” style approach for each agricultural field defined by the DWR land use survey

  -Output is a daily timeseries of fluxes for each field during the 21 year simulation period (WY1991 – WY2011)

  -Daily time-step allows us to account for quickly changing soil moisture and for carry-over of water storage in the soil zone to the next time step

SVIHM GROUNDWATER MODEL

- Groundwater Model
  - -50m x 50m grid size (44 x 21 km)
  - -880 rows
  - -420 columns
  - -2 layers
    - *Layer 1 = 50 ft thick
    - *Layer 2 = up to 200 ft thick
  - -Daily timestep
  - -Monthly stress periods
  - -21 year simulation period
  - -164 irrigation wells
  - -50 Observation Wells



SVIHM GROUNDWATER MODEL

- Boundary Conditions

  -Scott River and 10 tributaries (RIV Package)

  -Farmers and SVID ditches

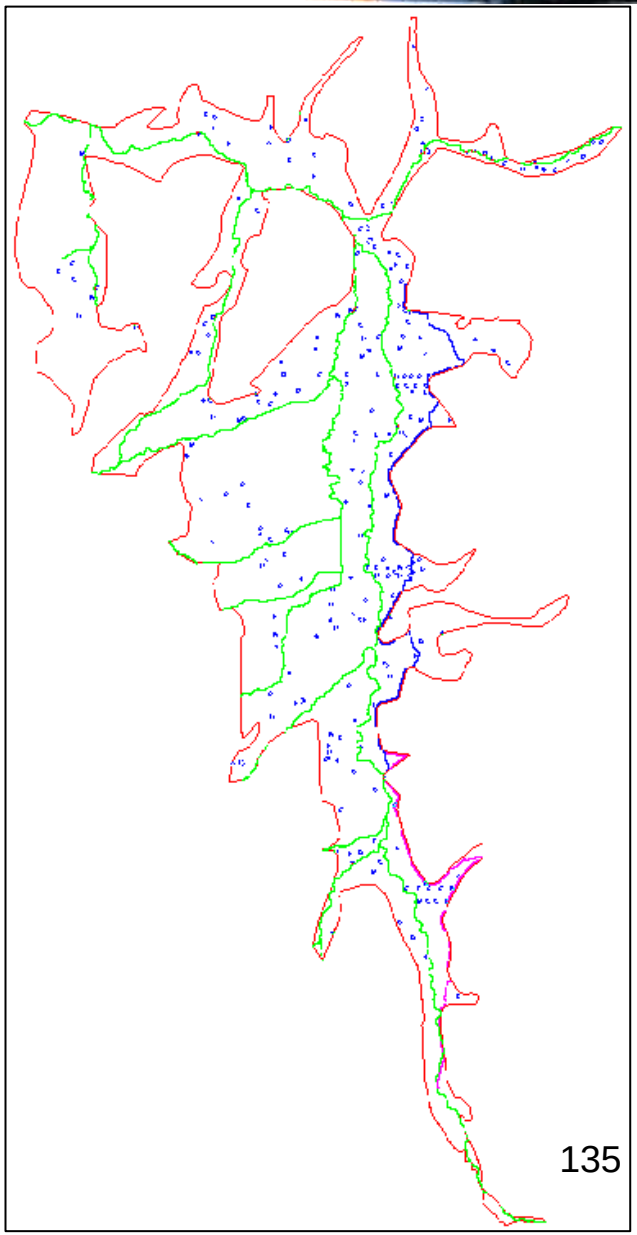
  (Well Package)

  -Mountain front recharge

  (Well Package)

  -Inputs from water budget model

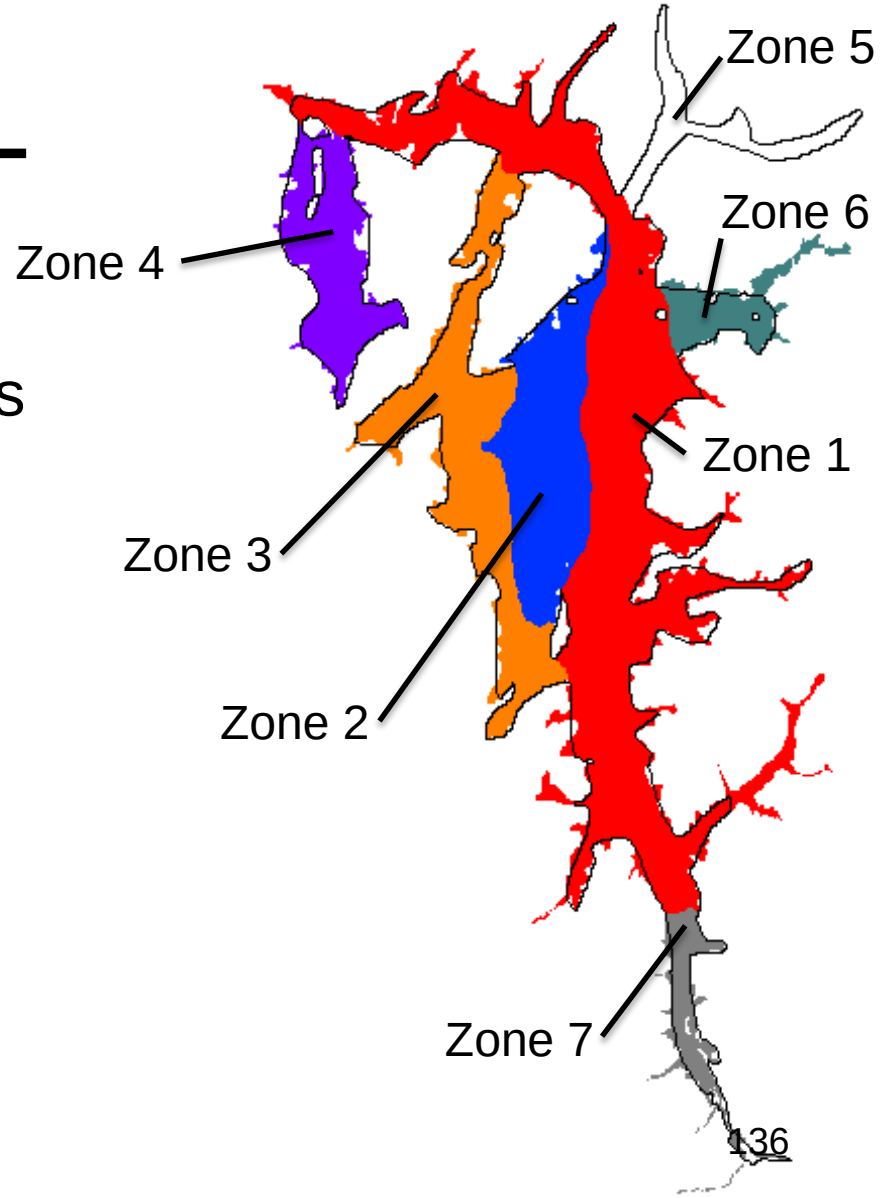
  (Recharge, ET, Pumping, etc.)



SVIHM GROUNDWATER MODEL

- Aquifer Properties
  - -7 hydraulic conductivity zones

Zone	Kx/Ky (ft/day)	Kz (ft/day)
1	152	15.2
2	118	11.8
3	167	16.7
4	66	6.6
5	41	4.1
6	92	9.2
7	3280	328



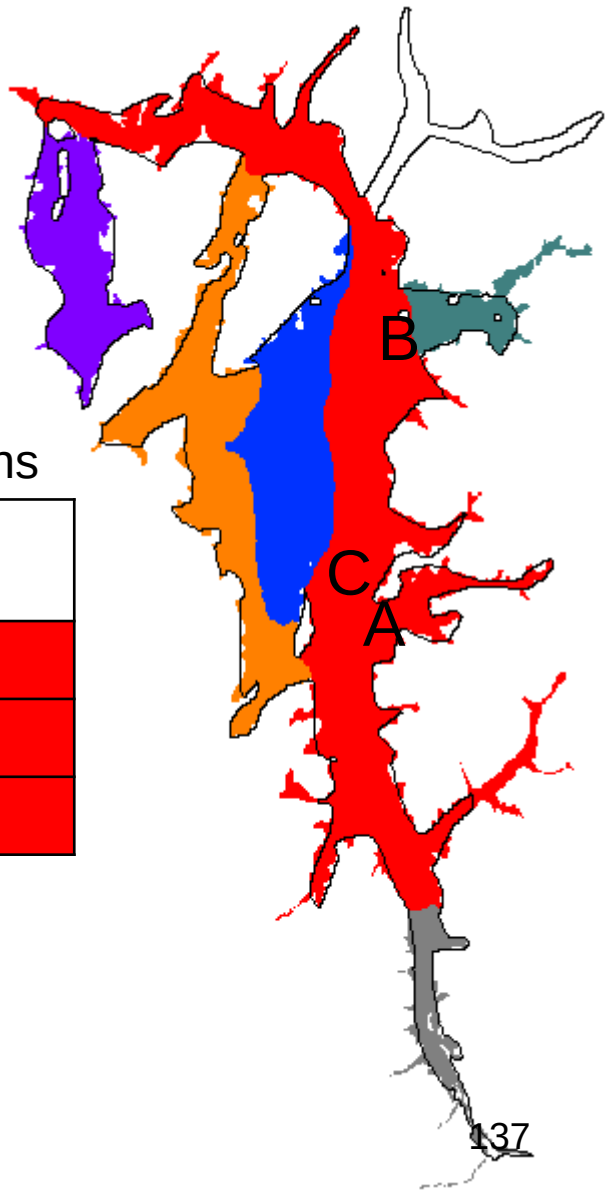
SVIHM GROUNDWATER MODEL

Calibrated Model Parameters

Zone	Kx/Ky (ft/day)	Kz (ft/day)
1	152	15.2
2	118	11.8
3	167	16.7
4	66	6.6
5	41	4.1
6	92	9.2
7	3280	328

Pumping Test Estimations

Location	Kx/Ky (ft/day)
A	70-110
B	90-630
C	110-460



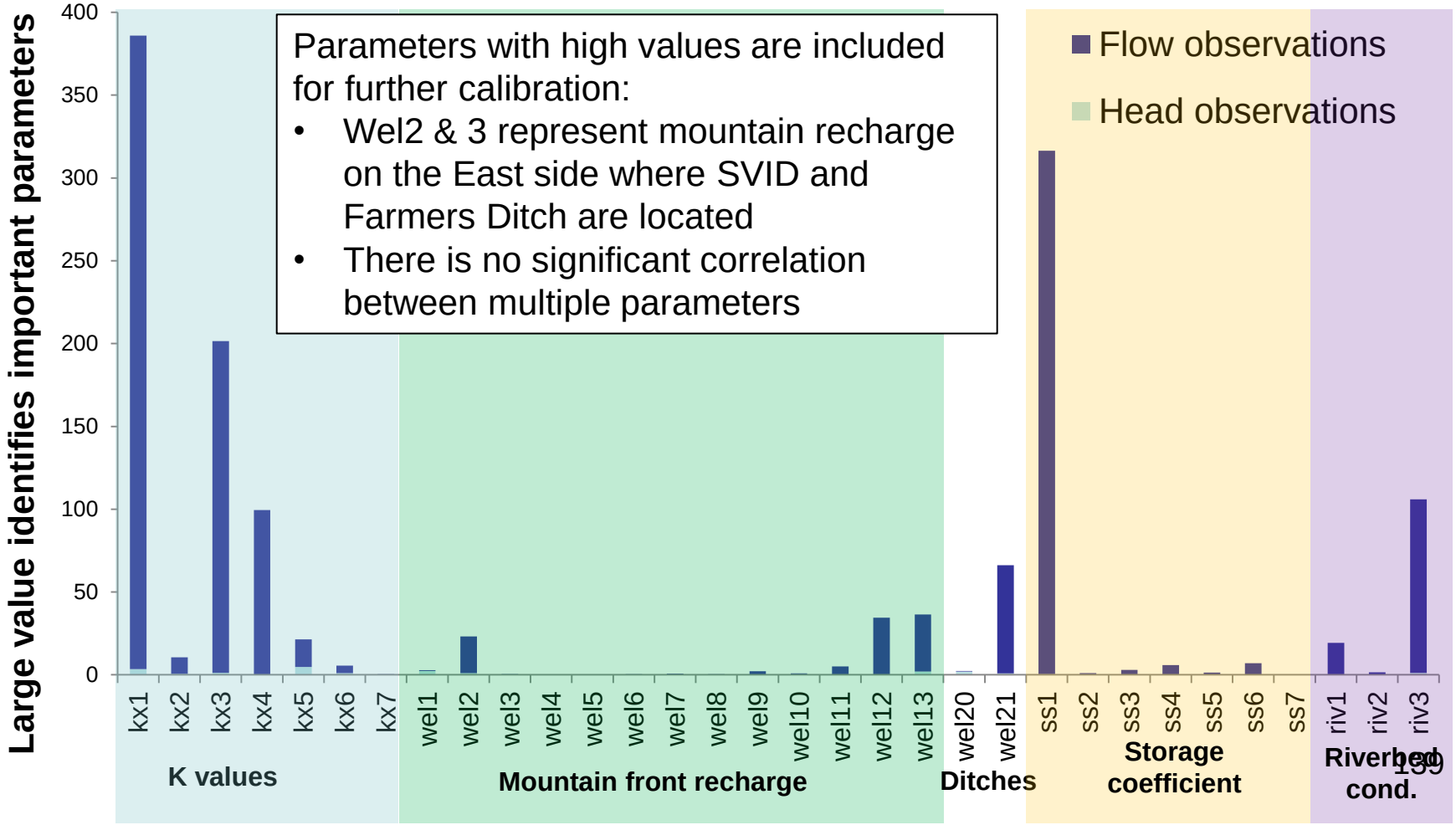
SVIHM
SENSITIVITY ANALYSIS

- Determines which parameters in the model are most important to know accurately

- **Sensitive parameters** → relatively small changes in the value result in a big change in the model output (e.g., water levels, river fluxes, etc.)

- **Insensitive parameters** → large changes in the value result in little or no change in the model output

SVIHM SENSITIVITY ANALYSIS



SVIHM
MODEL CALIBRATION

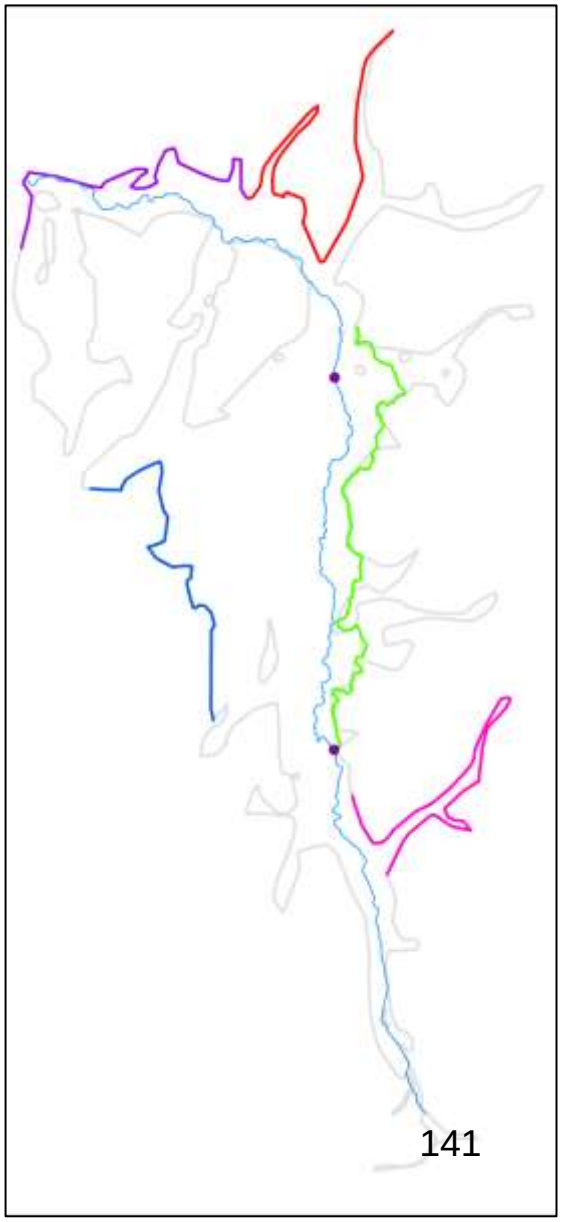
- Systematic adjustment of model parameters to minimize the difference between simulated and observed values

- Example calibration targets
  - Well hydrographs (water levels)
  - Stream hydrographs (flow in the river)
  - Flux of water to/from the river (gain/loss observations)

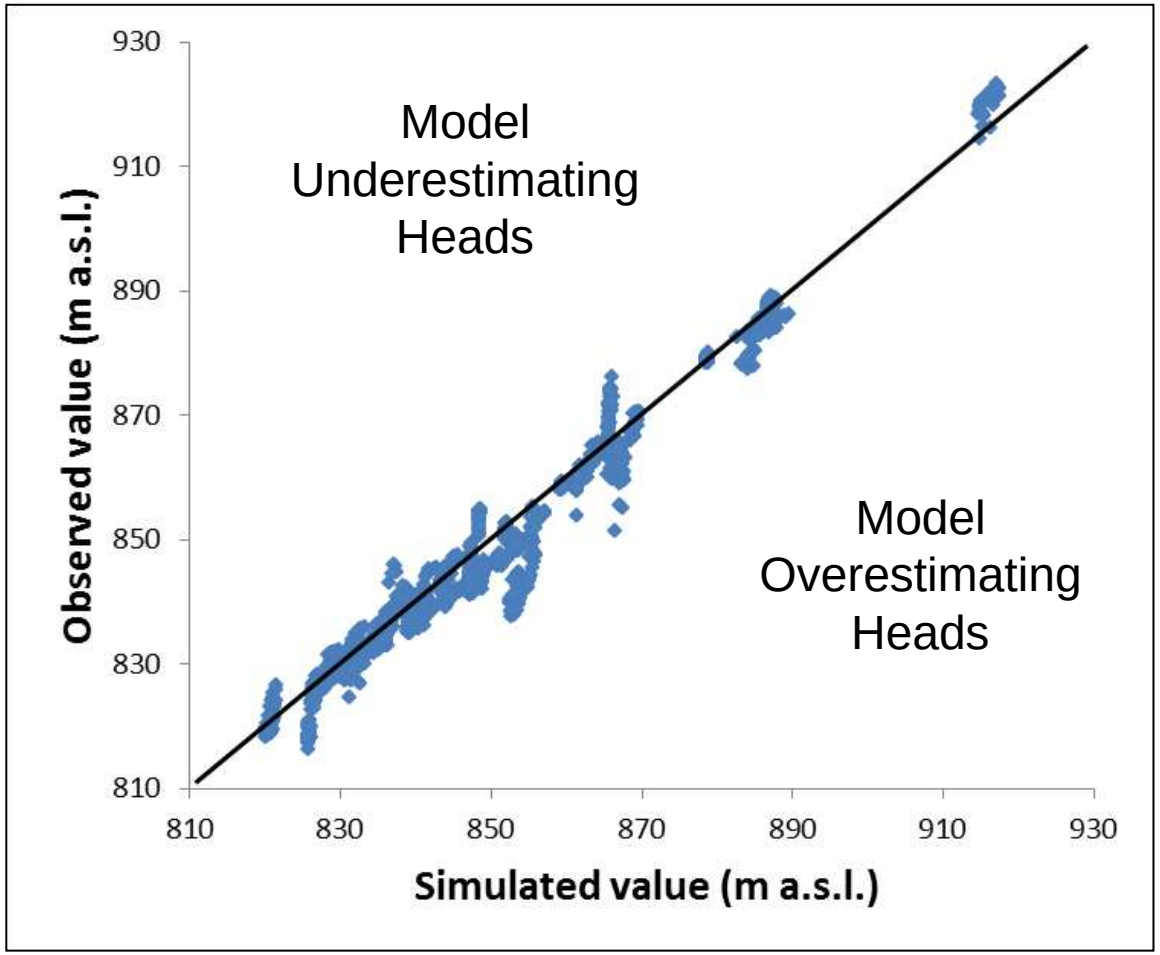
- Crucial step in model development

SVIHM MODEL CALIBRATION

	PARAMETER	Value DEC 2013	Calibrated Value
Hydraulic Conductivity Zones	kx1	148 (ft/day)	152 (ft/day)
	kx2	39 (ft/day)	118 (ft/day)
	kx5	33 (ft/day)	41 (ft/day)
Mountain Front Recharge	wel3	3 (gpm)	4 (gpm)
	wel8	15 (gpm)	0.002 (gpm)
	wel12	3 (gpm)	0.000002 (gpm)
	wel13	3 (gpm)	1 (gpm)
SVID Ditch	wel21	12 (gpm)	4 (gpm)
Specific Yield	ss1	0.120	0.135
Riverbed Hydraulic Conductivites	riv0	38750 (ft^2/day)	
	riv1		57 (ft^2/day)
	riv2		605 (ft^2/day)
	riv3		449931 (ft^2/day)

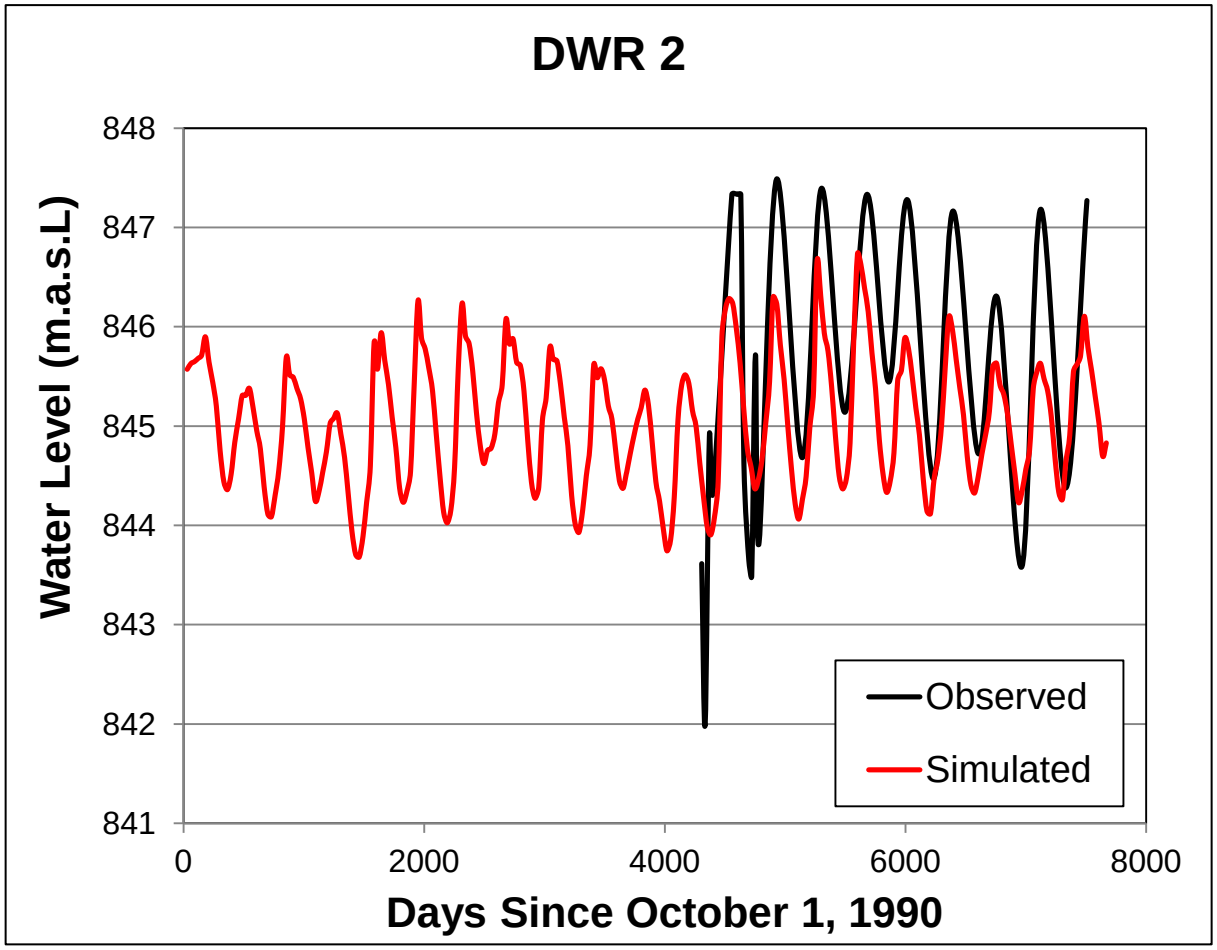


SVIHM
MODEL CALIBRATION



- Highest and lowest residuals are generally located near the model boundaries

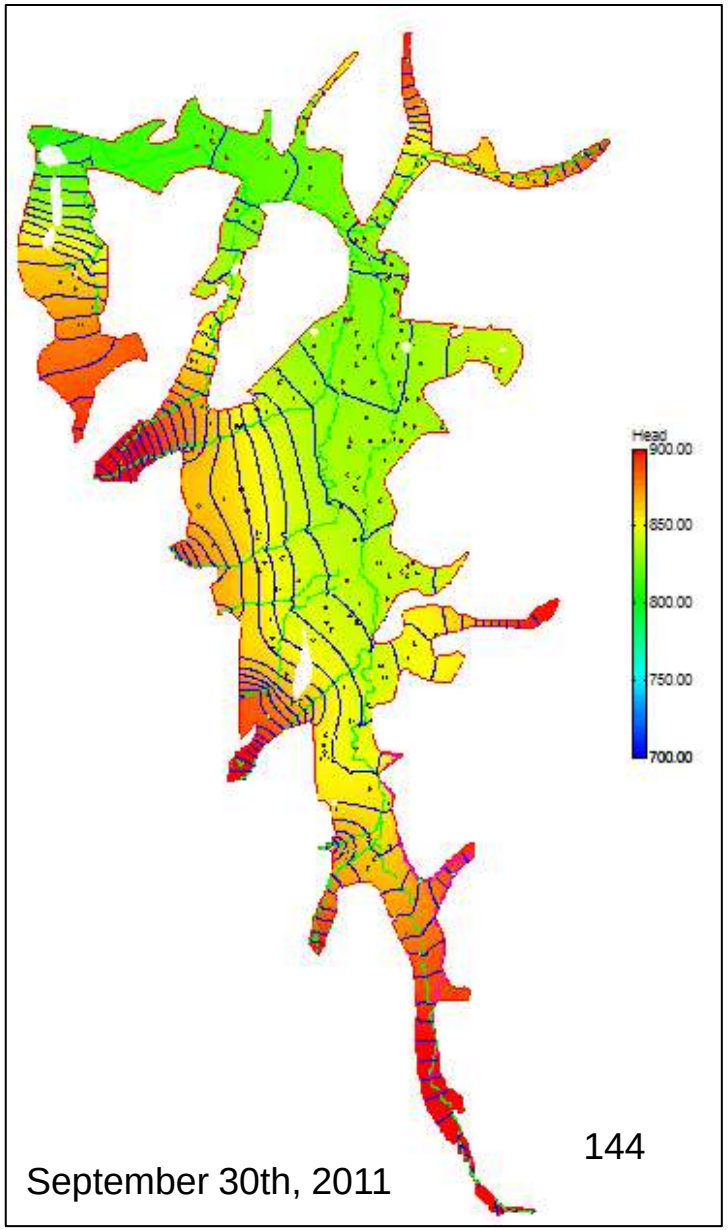
SVIHM
MODEL CALIBRATION



SVIHM
MODEL OUTPUT

- Currently set up to output results at the end of every stress period (same as last day of each month)
  - Model inputs are constant for a given month, therefore the maximum effect would be realized at the end of each month
  - Snapshot of what is happening in the model on that specific day

- Also able to calculate certain average monthly flux values



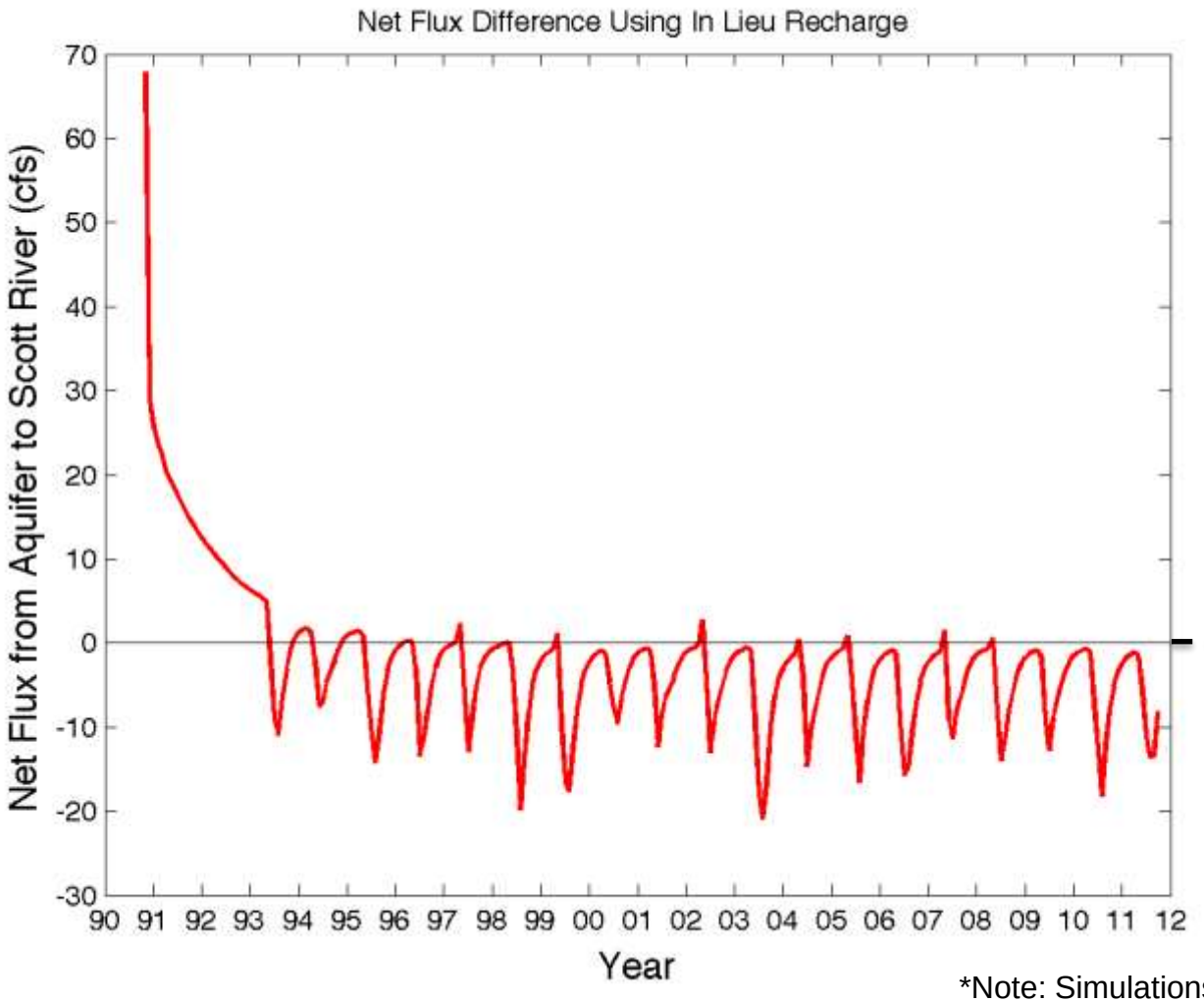
SVIHM
WATER MANAGEMENT SCENARIOS

- Two different water management scenarios are currently being modeled:

- In-Lieu Recharge
  - Surface-water instead of groundwater is used to irrigate fields near the river while streamflow is sufficiently high
  - Also apply one extra irrigation before first cutting of alfafa

- Managed Aquifer Recharge
  - Use existing agricultural infrastructure to apply water during high streamflow periods (Jan-Mar) to fields
  - Increased likelihood of refilling soil-moisture profile
  - Bank water during the wet months that can be extracted during the dry months

SVIHM
IN-LIEU RECHARGE SCENARIO



- Model indicates the in-lieu recharge scenario would increase late season streamflow

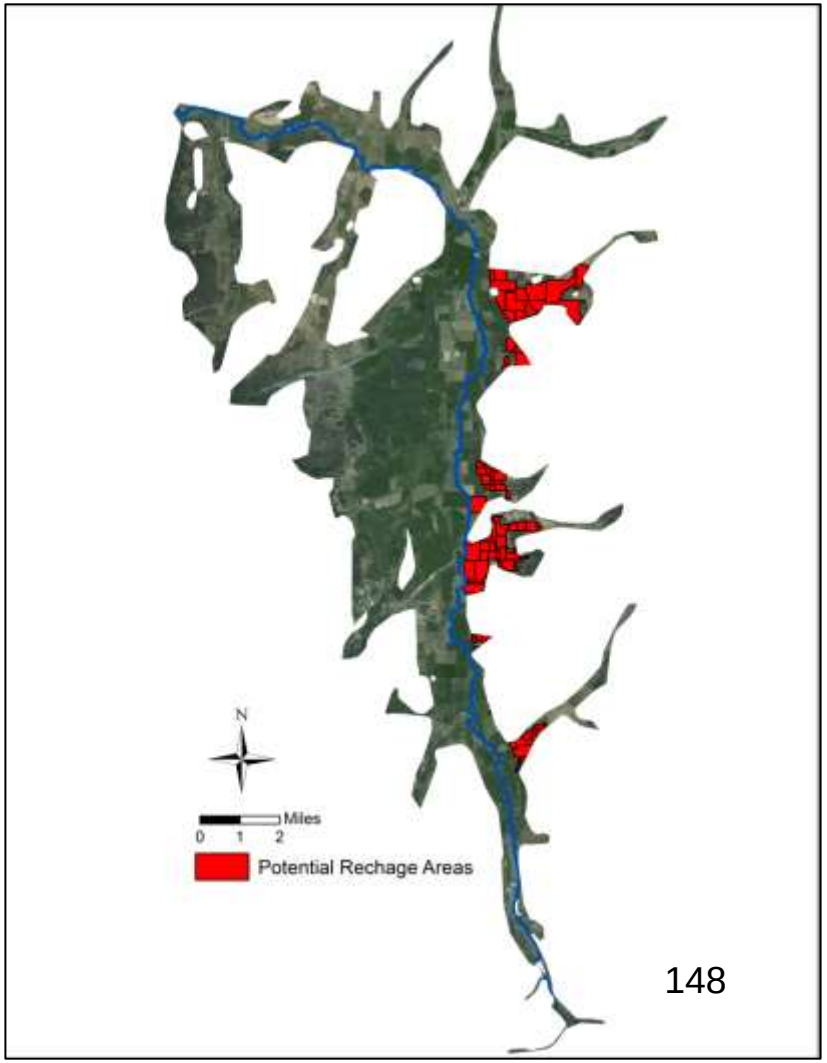
Decreased Streamflow

Increased Streamflow

*Note: Simulations run without new calibration values

SVIHM
MANAGED AQUIFER RECHARGE

- Potential recharge fields on the east side of Scott Valley
- 3,300 acres
  - 2,800 acres of alfalfa/grain hay
  - 500 acres of pasture
- Calculated available storage ranges from 3,300 acre-ft to 15,000 acre-ft
- 3,300 acre-ft could sustain 25 cfs of flow for over two months



SVIHM
MANAGED AQUIFER RECHARGE

- Pilot project for water banking study currently being developed in the Scott Valley (15 acre alfalfa field)
- Goal of study is to determine if agricultural lands can be used for opportunistic water banking during the wet winter months
- SVIHMv3 is being used to help determine type and location of measurements that can be used to determine project success
- Model will also be used show impact to Scott River, since streamflow measurements are not likely to increase significantly for such a small study area

SVIHM
FUTURE WORK

- Beaver dams
  - Artificial beaver dams are being erected on some of the tributaries
  - Groundwater recharge vs temperature effects
- Explore managed aquifer recharge scenario further
  - What are the travel times predicted by the model?
  - Does using one large field have the same effect as using several small fields?
  - How much added benefit is there from pumping water above irrigation ditches?
- Detailed sub-model that explores groundwater and surface-water interactions within the valley at a much finer scale
- Better understanding of coupling between upper watershed and Scott Valley
  - Snowpack
  - Frost
  - Fires
  - Tributary flows

SCOTT VALLEY CHALLENGES

- Water rights issues
  - Recharge projects aim to divert water during the wet winter months when demand is low and supply is high
    - Average winter streamflow in the Scott River is 1,000 cfs
    - SVID ditch can divert approximately 43 cfs
  - Recharge projects require a valid water right
  - Physically and scientifically the recharge projects are feasible, but require establishing a new right or change of an existing right
    - Not a quick, simple process
    - Fees required
  - The water right permitting process is prohibitively expensive for research projects

Scott Valley
Groundwater Advisory Committee

Tom Menne
President

NCRWQCB Presentation

October 9, 2014

Jared Bottcher and Nell Kolden

KBRT
Klamath Basin Rangeland Trust

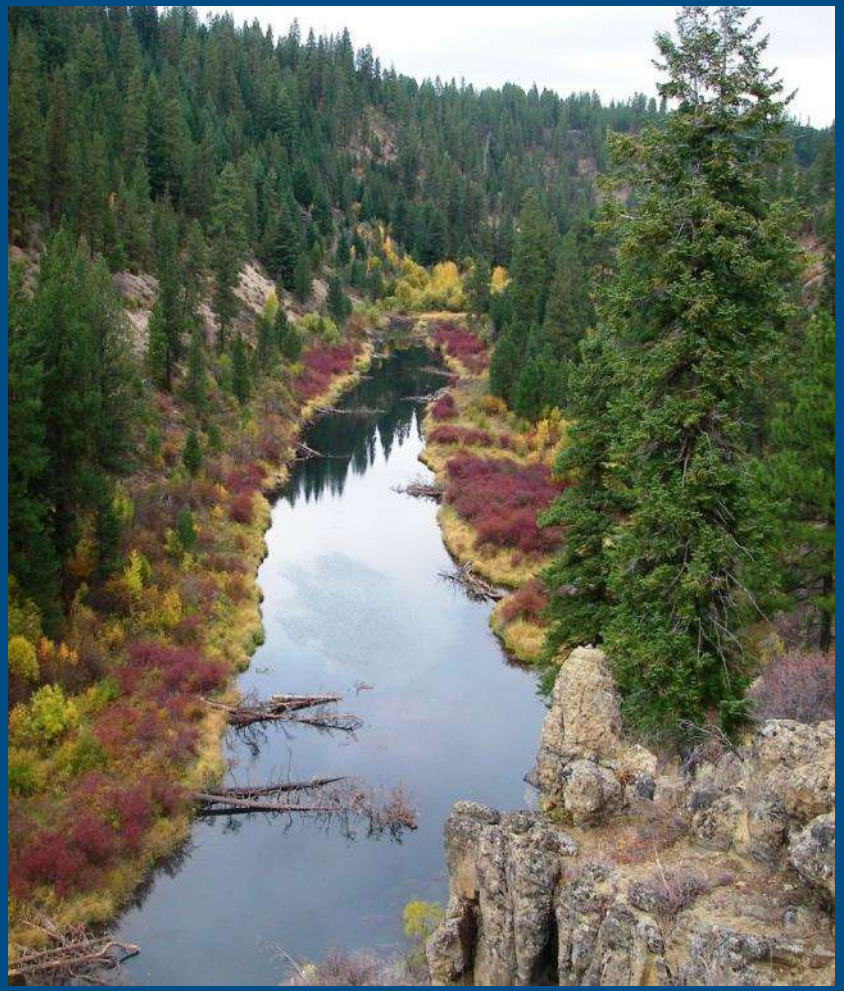
Klamath Basin Rangeland Trust: MISSION

- To restore and conserve the quality and quantity of water flowing in the Upper Klamath Basin
- To enhance the natural ecosystem, restore ecosystem processes, and supply needed water for downstream agriculture, ranching, and native fish and wildlife populations.

KBRT Klamath Basin Rangeland Trust

Klamath Basin Rangeland Trust: ACTIVITIES

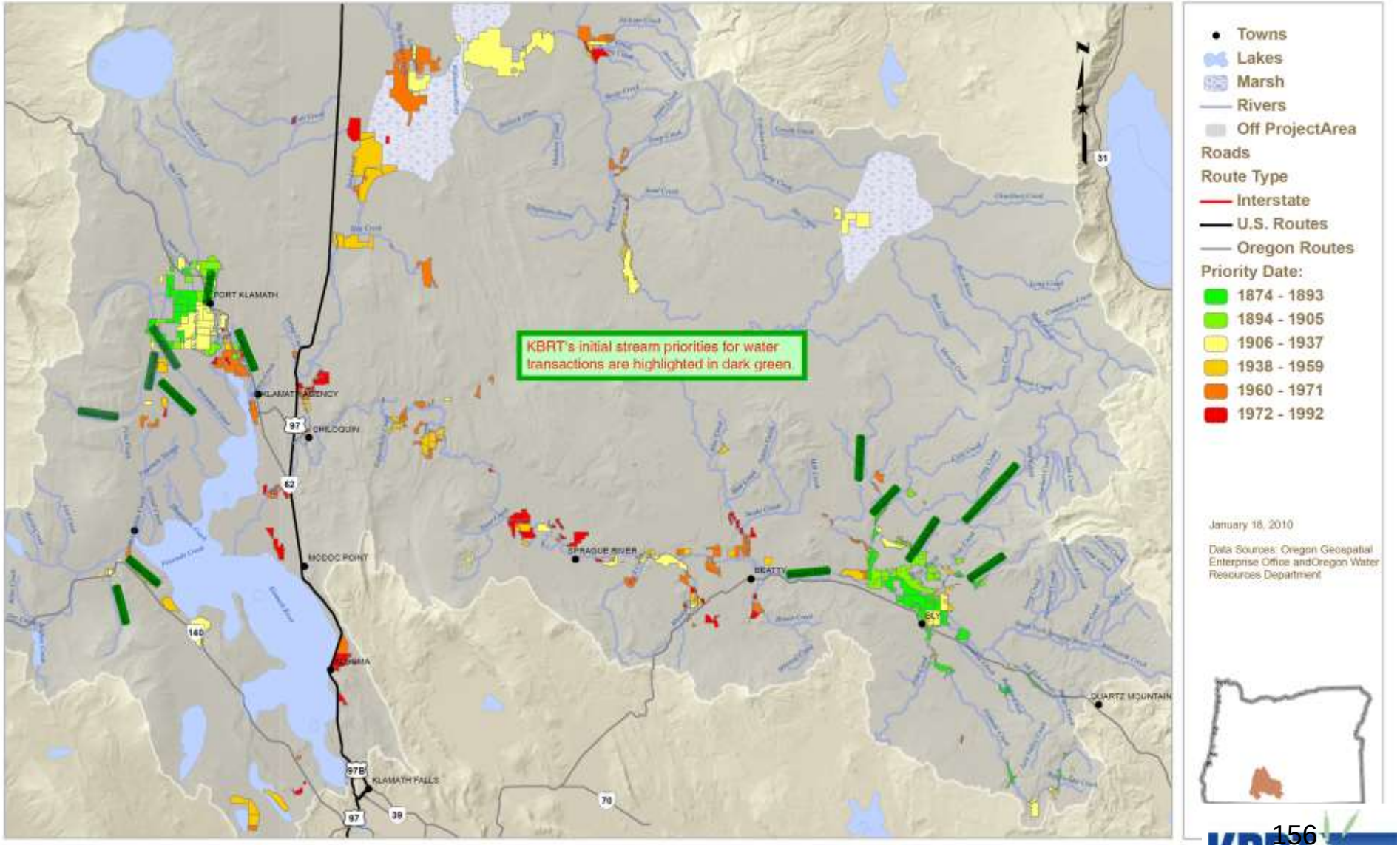
- Activities/Departments
  - Monitoring and Research
  - Landowner Assistance
  - Instream Flow Protection
  - Ecological Restoration



KBRT Klamath Basin Rangeland Trust

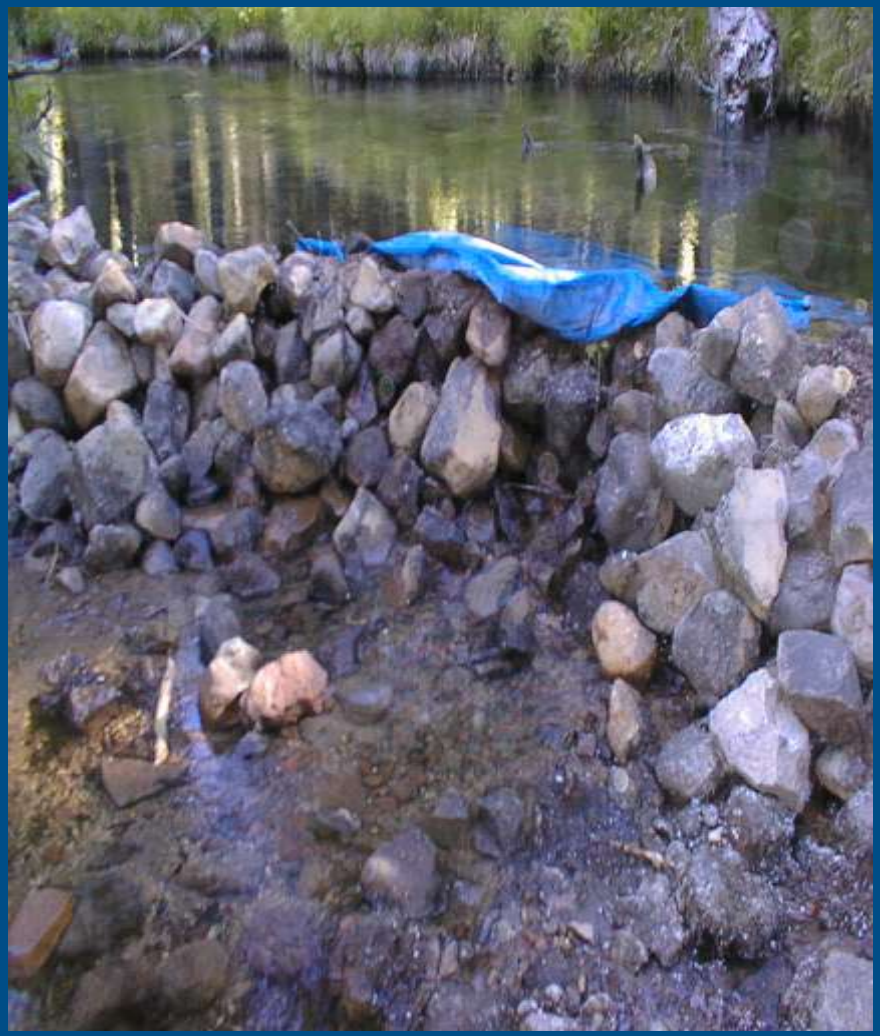
Instream Flow Restoration & Protection

WTP Initial Stream Reach Priorities

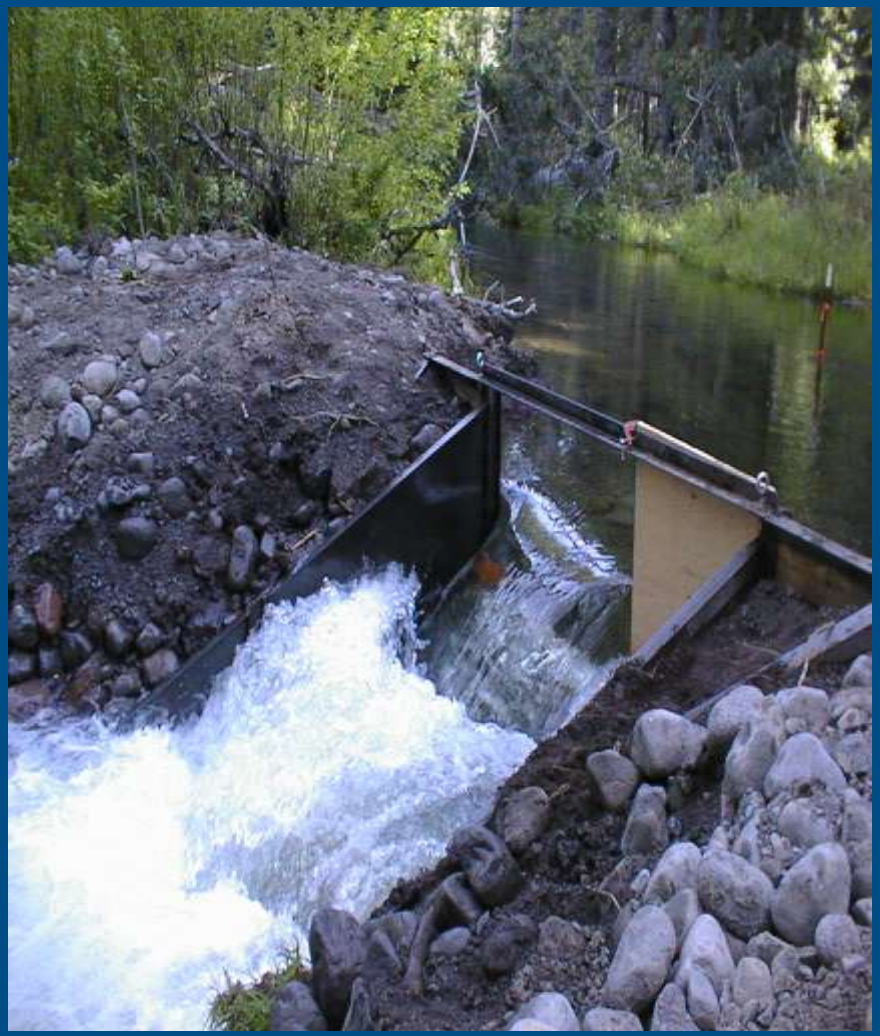


KBRT Klamath Basin Rangeland Trust

Instream Flow Restoration & Protection



Before Leasing



After Leasing

KBRT
Klamath Basin Rangeland Trust

Instream Flow Restoration & Protection

- Pricing
  - $1,700-2,300/ac Sprague
  - $1,500-2,800/ac Wood
- Locations/Priorities
  - Senior water right holders
  - High up in the watershed
  - Spring-fed systems
  - Endangered species considerations

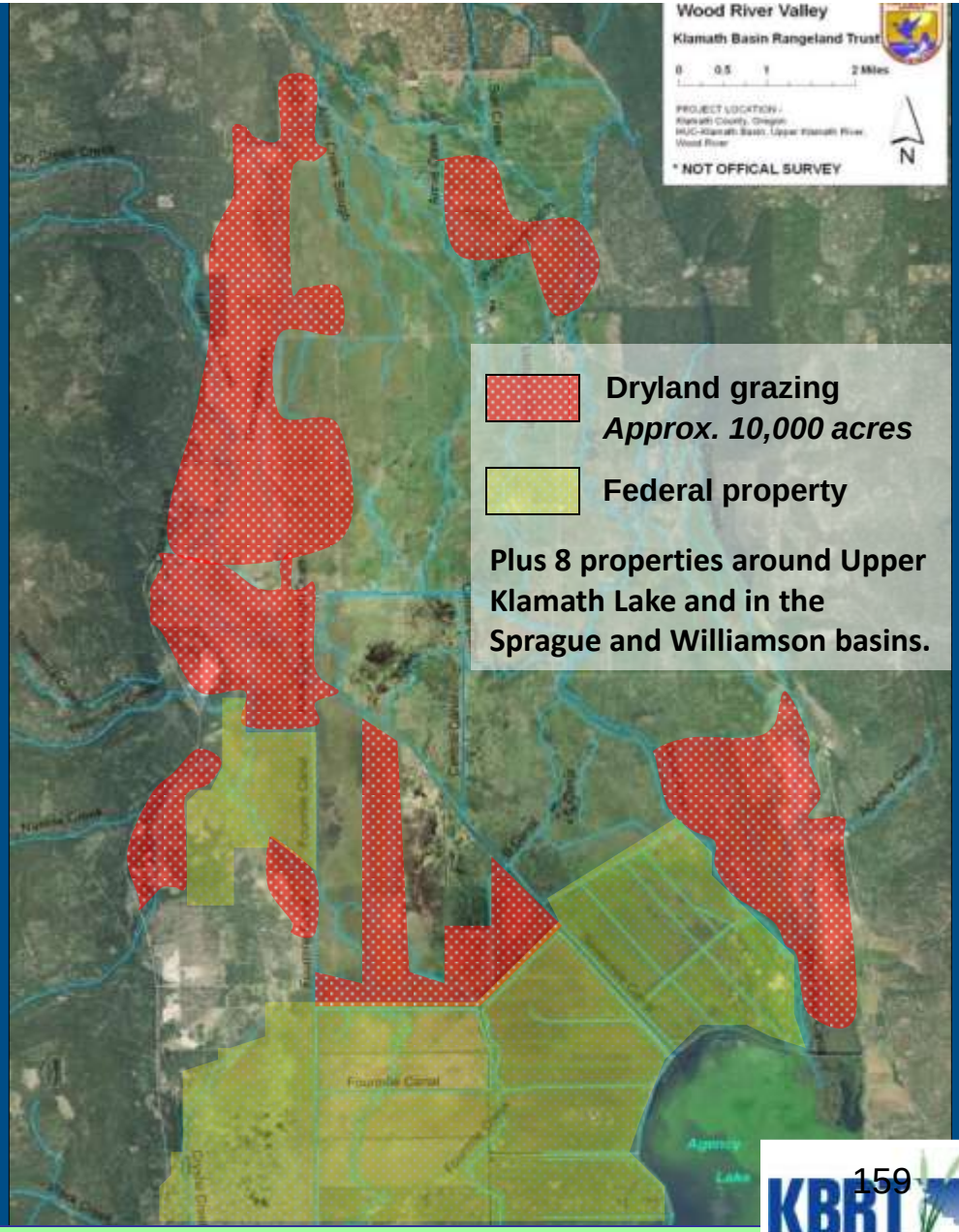
KBRT
Klamath Basin Rangeland Trust

Instream Flow Restoration & Protection

RESULTS THUS FAR:

18 landowners on just under 12,000 acres.

- Productivity is higher than expected
- Weight gains better than expected
- Initially began with complete dryland grazing, but monitoring and research suggested that one mid-season irrigation could bring fields close to full productivity.



KBRT Klamath Basin Rangeland Trust

Diffuse Source Treatment Wetland Program

KBRT Klamath Basin Rangeland Trust

Background

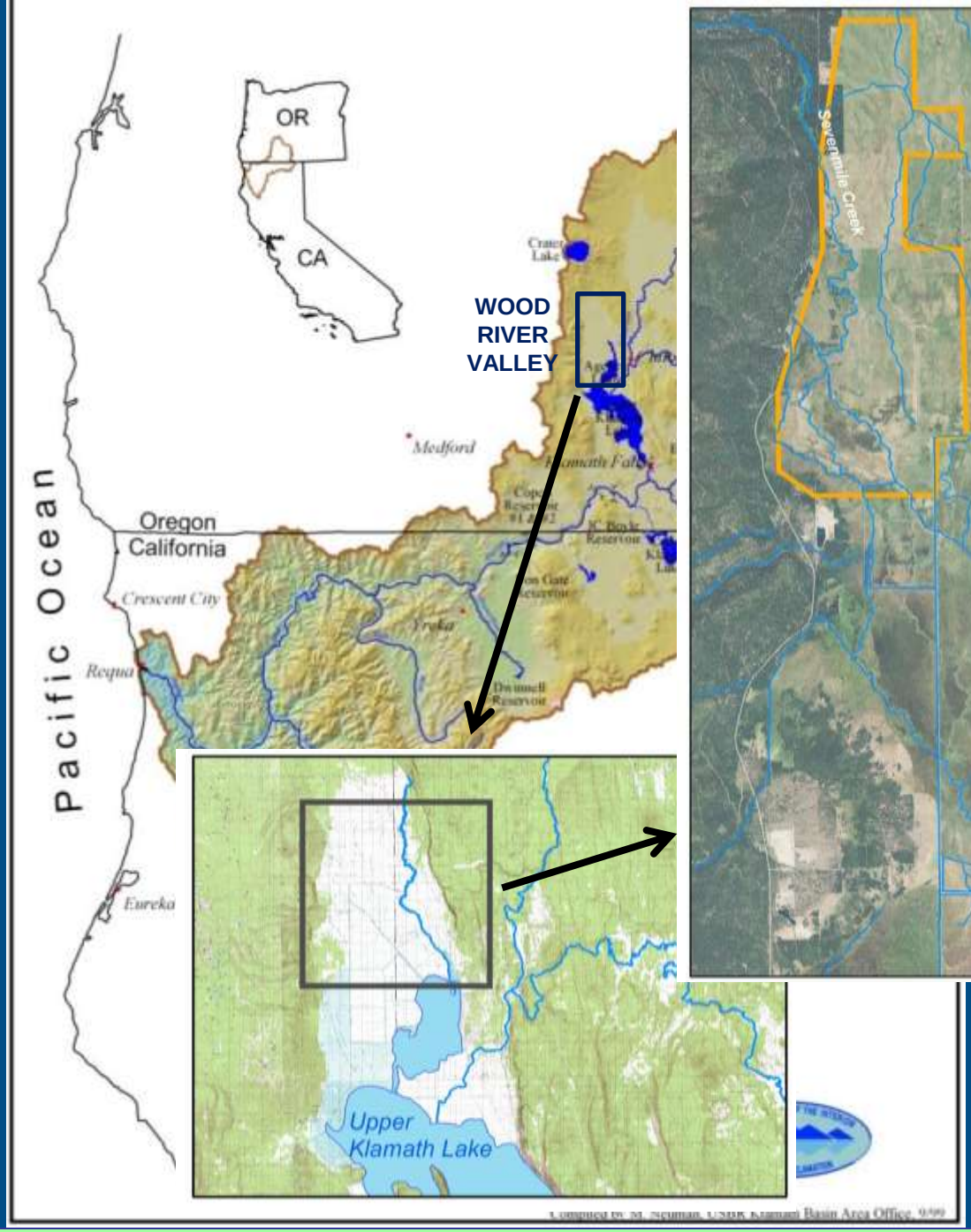
- Upper Klamath Lake is a major source of nitrogen and phosphorus to downstream reaches
- Nutrients contribute to algal blooms and decline of fisheries in both the upper and lower basins
- KBRT wants to focus on the causes, not the symptoms

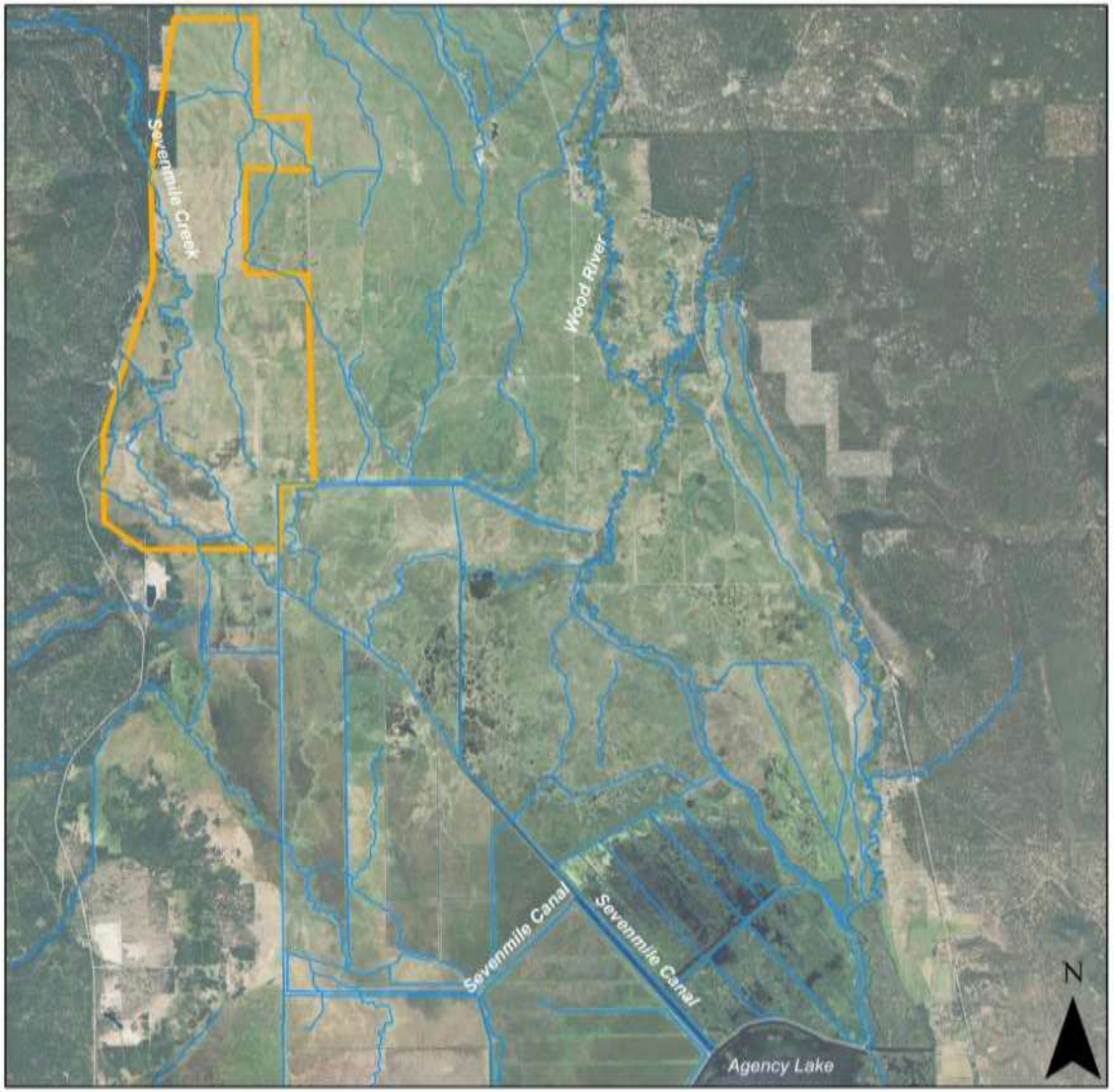
Restoration Tool: DSTWs

- Identified at the Klamath River Water Quality Workshop as an appropriate tool for addressing causes of impaired water quality
- Ranked high by workshop participants because of relatively low cost and high effectiveness

DSTW Design Components

- Small footprint (0.5-10 acres), so they rely on replication for effectiveness
- Increase hydraulic residence time and remove nutrients by two mechanisms: physical settling and uptake by plants
- Can range from simple impoundments to more engineered systems
- Compatible with existing grazing operations


OR
CA
WOOD
RIVER
VALLEY
Pacific Ocean
Oregon
California
Medford
Crescent City
Eureka
Upper
Klamath Lake


Sevenmile Creek
Wood River
Sevenmile Canal
Sevenmile Canal
Agency Lake
N
0 0.5 1 2 3 4
Miles

Wood River Valley Pilot Projects

- 2 wetlands will be constructed Oct 2014
- 4-6 more will be constructed in 2015

Partners:

The Klamath Tribes, US Fish and Wildlife Service, Stillwater Sciences, NCRWQCB, California Coastal Conservancy, Oregon Watershed Enhancement Board, National Fish and Wildlife Foundation, Natural Resource Conservation Service

Pilot Projects (cont'd)

- KBRT has at least two willing landowners (combined acreage ~4,500 acres)
- Cost for siting, planning, design, permitting:
  ~$11k per DSTW
- Cost for construction:
  ~$25k per DSTW
- Cost for monitoring:
  ~$15k per DSTW per year

Pilot Project Monitoring

- Flow, in situ water quality parameters, and SSC and nutrients will be measured pre-construction and post-construction at inlet and outlet of each DSTW
- Flow path tracer study in each DSTW to verify hydraulic residence time
- Seasonal ET measurements and estimations for each DSTW

Pilot Project Deliverables

- Annual reporting of monitoring results
- Design recommendations for future projects
- Water quality improvements!

Thank You!


THE KLAMATH TRIBES
KLAMATH . MODOC . YAHOOSKIN


OREGON WATERSHED
ENHANCEMENT BOARD
OWEB


U.S.
FISH & WILDLIFE
SERVICE
DEPARTMENT OF THE INTERIOR

Reclamation Water Quality Activities Upper Klamath Basin

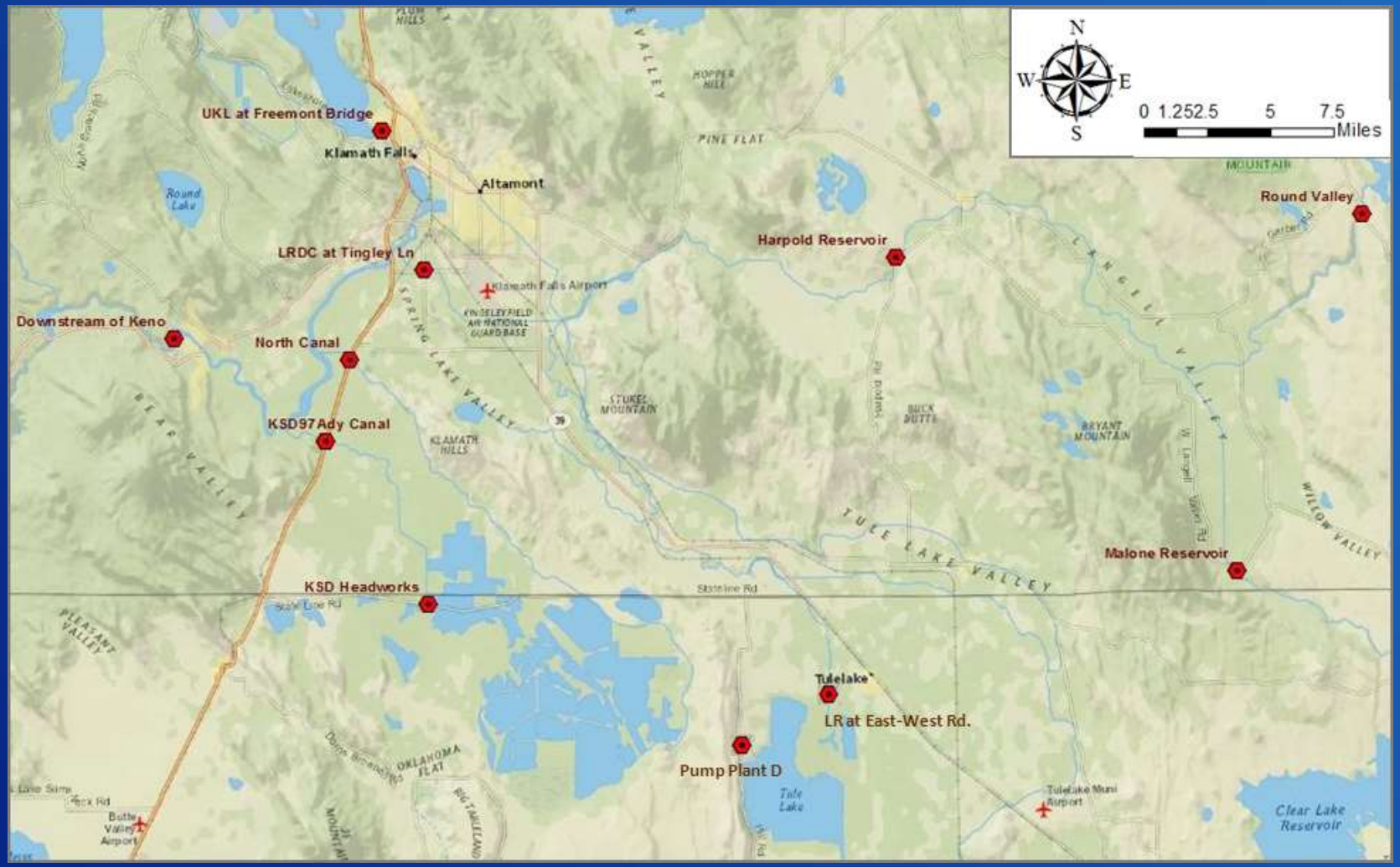
Presenter: Rick Carlson
KBAO Physical Scientist

RECLAMATION

Active Water Quality Monitoring Projects

- Klamath Project Quarterly Monitoring (1991 ->)
- Klamath Project Nutrient Budget Study (3/12 to 3/15)
- U. Klamath River Continuous Parameter Monitors (2001 ->)
- Upper Klamath Lake and Tributary Monitoring
  - USGS (2002->)
  - Klamath Tribes (1990s ->)
- KHSA Baseline Monitoring Assistance (2009 ->)
- Seasonal Zebra Mussel Monitoring (2009 ->)

Klamath Project Nutrient Budget Study (3/12 to 3/15)



RECLAMATION

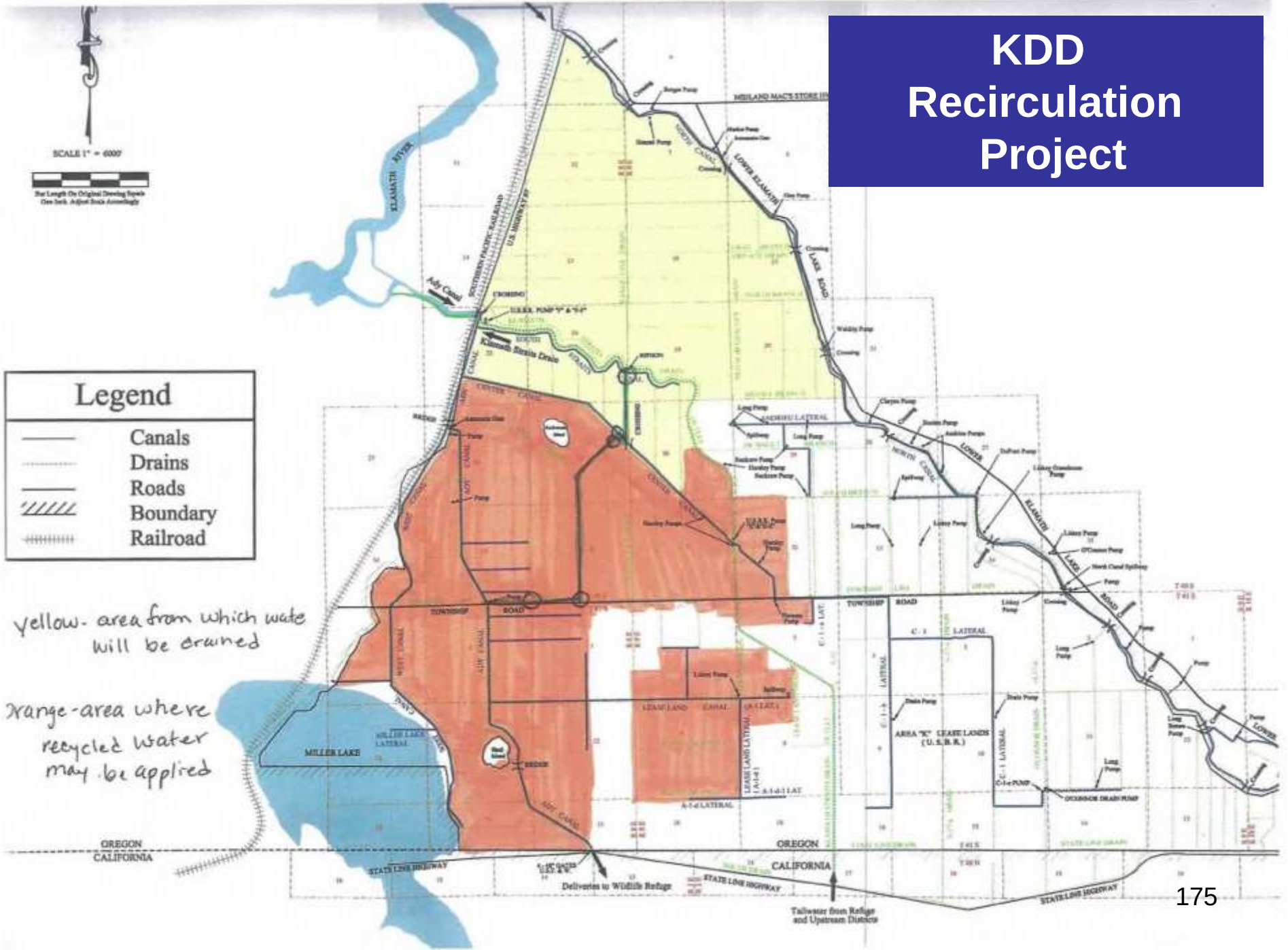
Klamath Project Nutrient Budget Study (March ‘12 to March ‘15)

- **12 Sites Located to Monitor Inflows and Outflows**
- **Sampled Bi-Weekly Year-Round**
- **Constituents Include**
  - Full Nutrient Suite (TN,NH3,NO3, TP, OP)
  - Corresponding Flow Measurements
  - Field Parameters
  - BOD5, CBOD5, Pheophytin, Chlorophyll *a*,
  - Every 8 Weeks - DOC, POC

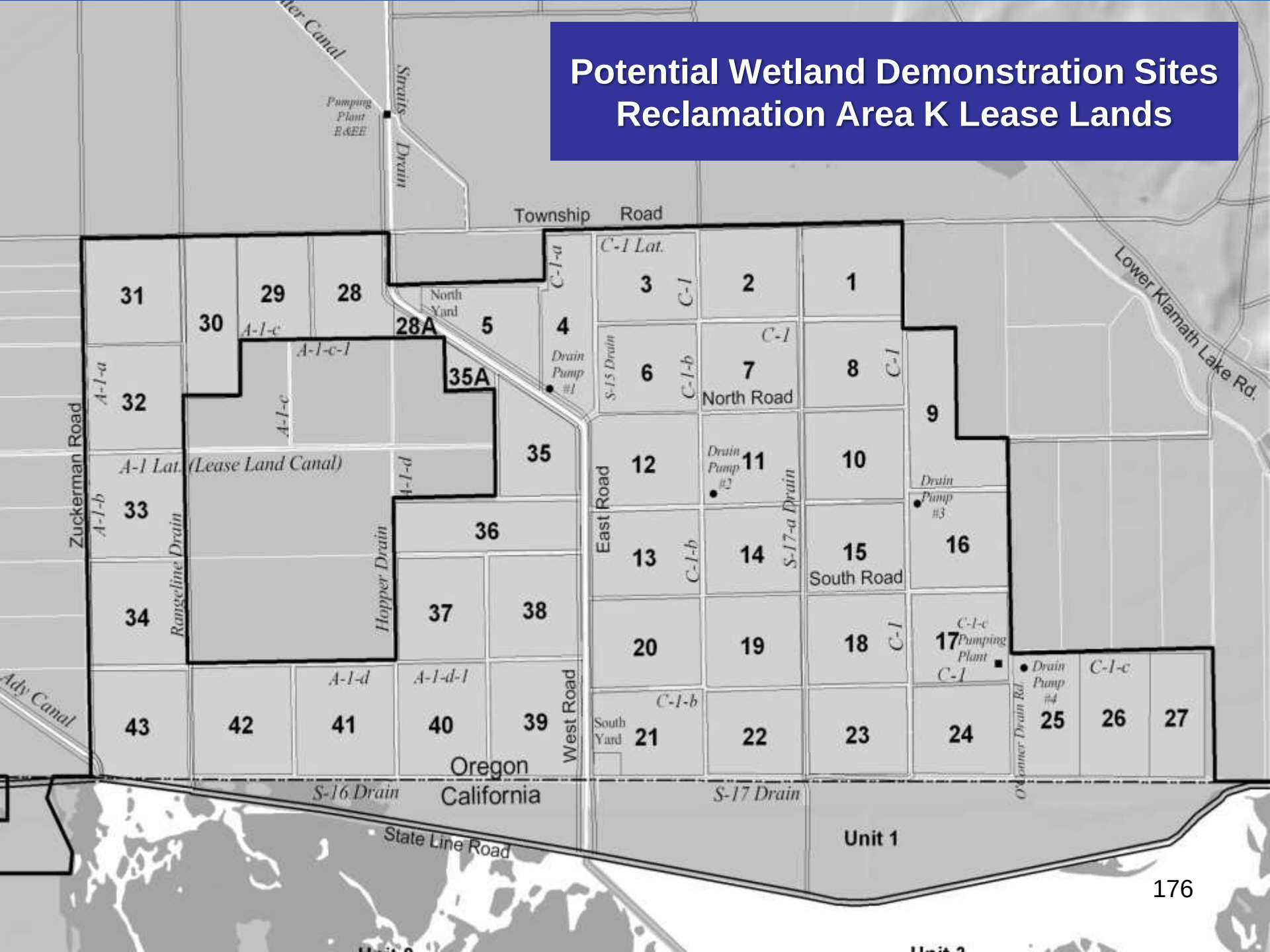
Recent and Ongoing Studies/Work

- UKL TMDL Model Review
- UKL Monitoring Optimization
- UKL Benthic Flux
- KSD Recirculation Investigations
  - KDD Recirculation Project
- Klamath Project Water Quality Demonstration Project Identification
- Transfer of Reclamation Klamath Basin Area Office Water Quality Data to USGS National Water Information System (NWIS)
- Stewardship Framework-Water Quality Database (KBMP)

KDD Recirculation Project



Potential Wetland Demonstration Sites
Reclamation Area K Lease Lands



Link to Keno Reach Hydrodynamic Model

- CE-QUAL-W2 Model (2006 to Present)
- Models Flow, Temperature, and Water Quality
- Reclamation, USGS, and Watercourse Engineering
- Currently Conducting Scenario Modeling

Link to Keno Reach Hydrodynamic Model

Report - Modeling the Water Quality Effects of Changes to the Klamath River Upstream of Keno Dam, Oregon (Sullivan et al., 2013)

- Scenarios 1 and 2. Water Quality Before and After TMDL Implementation
- Scenario 3. Compliance with Dissolved Oxygen, pH, and Ammonia Toxicity
- Scenario 4. Comparison to TMDL Model
- Scenario 5. Particulate Matter Shunting
- Scenario 6. Decrease Particulate Organic Matter and Algae in Link River
- Scenario 7. Route Klamath River Water Through Treatment Wetland
- Scenario 8. Altered Flow Import/Export to/from the Klamath Project
- Scenario 9. Augment Dissolved Oxygen or Add Riparian Shade
- Scenario 10. Climate Change Effects on Water Quality

Link to Keno Reach Hydrodynamic Model

Report Soon to Be Released

- Scenario 11. Klamath Straits Drain Recirculation
- Scenario 12. Wetlands Model Extension

Present and Future Work

- Study and Model Algal Health
- Expand Model to Include One-mile Link River
- Assess Link River to Keno Dam Nitrogen Cycling.
- Improve Predictions from Lost River Basin
- Evaluate Arsenic Levels

Upper Klamath Basin TMDL Water Quality Compliance and Monitoring Plan

- Project Management Plans – Reclamation Directive (1/25/14)
- Goal – Implement Compliance and Monitoring Actions to Meet Designated TMDL Requirements
- Nutrient Budget Study, Modeling, TSC Demonstration Project Assessments, Benthic Flux Study, TSC KSD WQ Project Scoping
- PMG – Tom Perry, Merlynn Bender, Kathy Fenton,Tammy Woods, Stewart Rounds, Mike Deas, James Kuwabara, James Carter, Rick Carlson (PM)
- Stakeholder Group
- Cost - $5,000,000 from FY 2013 to FY 2017

Legacy Conditions Create Need for Long-Term Ecosystem Rehabilitation Funding