



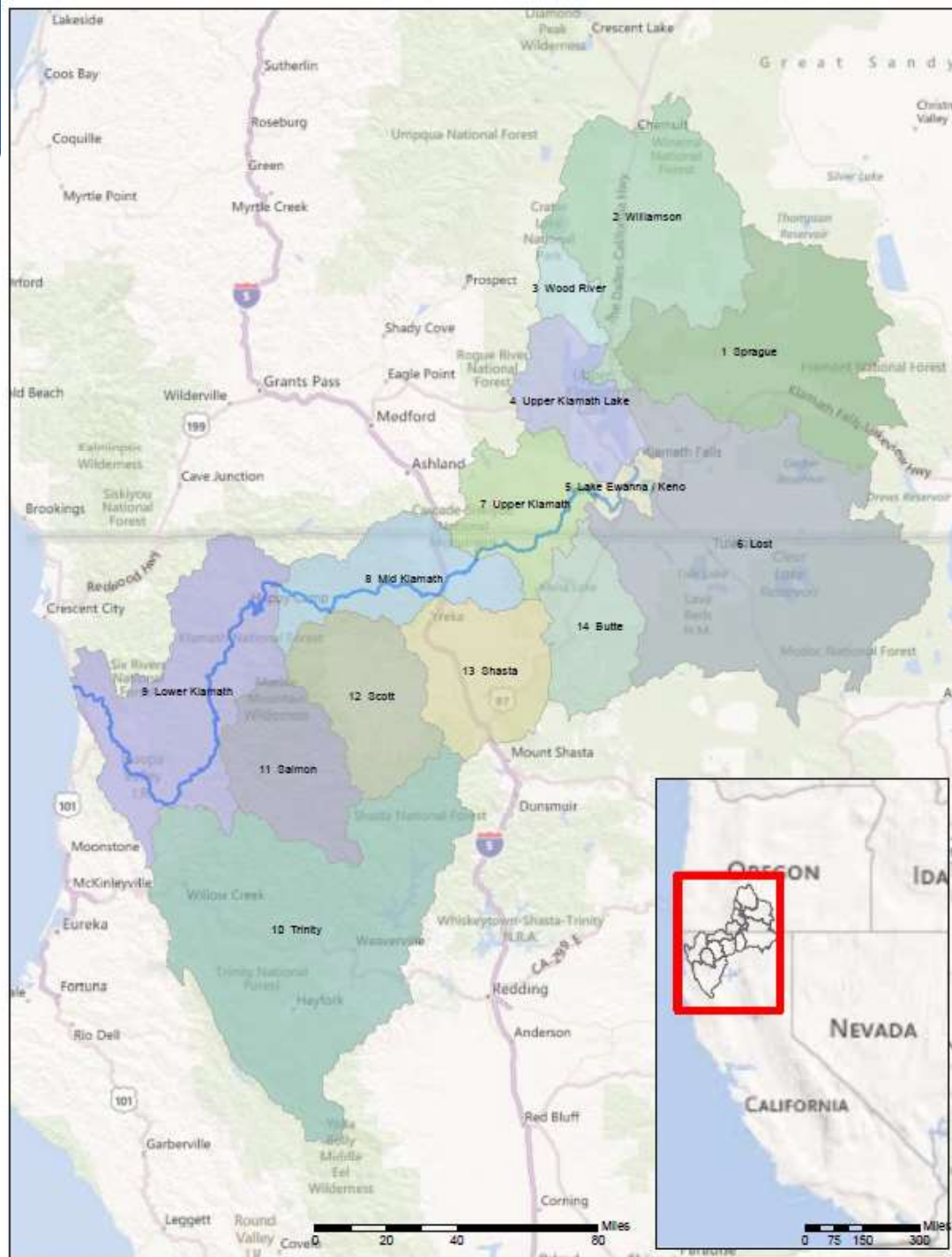
# Water Quality Improvement Activities in the Klamath Basin

NCRWQCB

October 9, 2014

Yreka, CA

Clayton Creager & Invited Speakers





# Presentation / Panel Outline

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- **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

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- **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

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- 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**

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- **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

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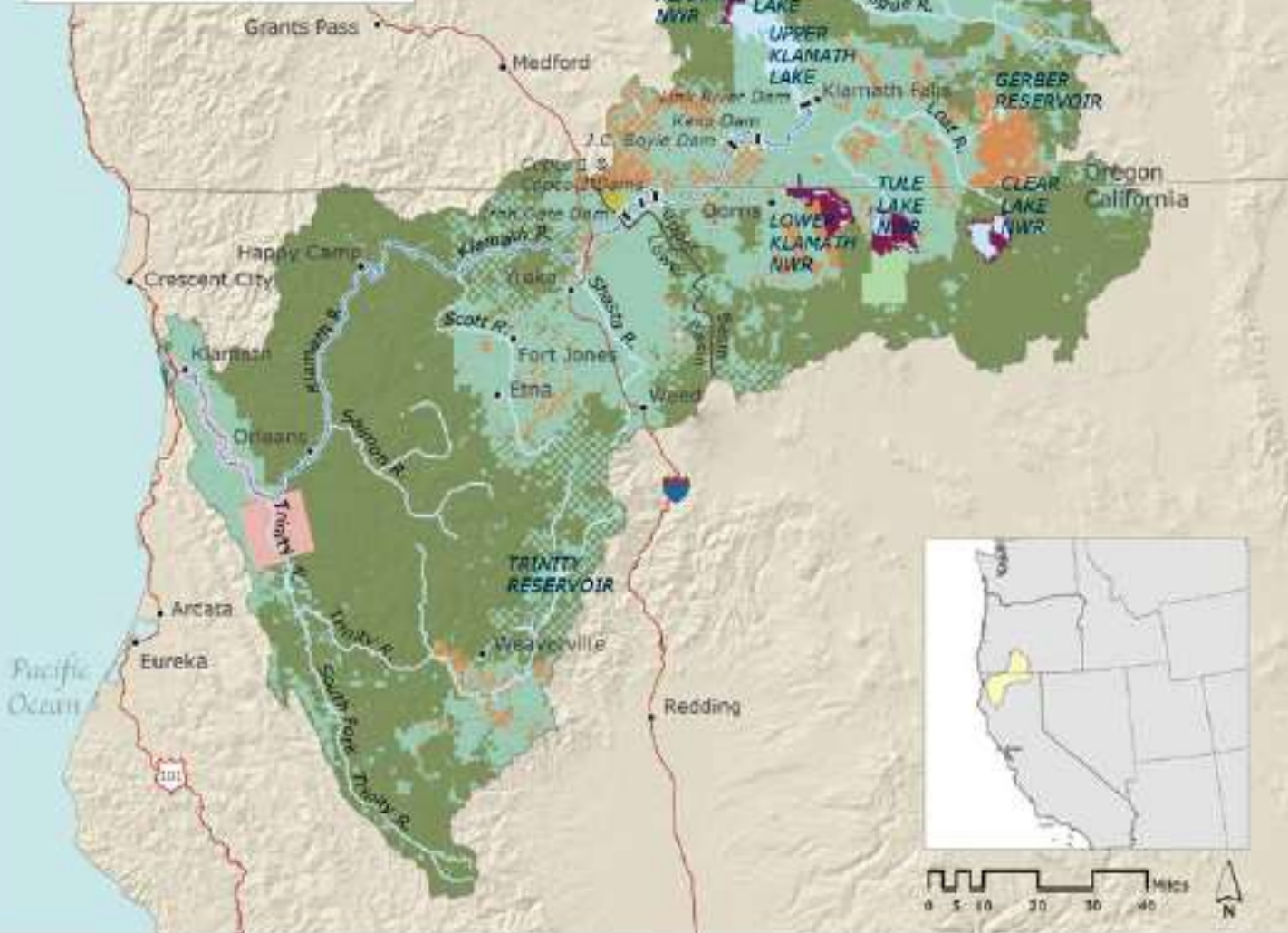


- **Comprehensive Basin Strategy**
- **Partnerships through Sub-basin Watershed Stewardship Groups**
- **Collaborate with KHSA / KBRA to address impacts of dams**



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

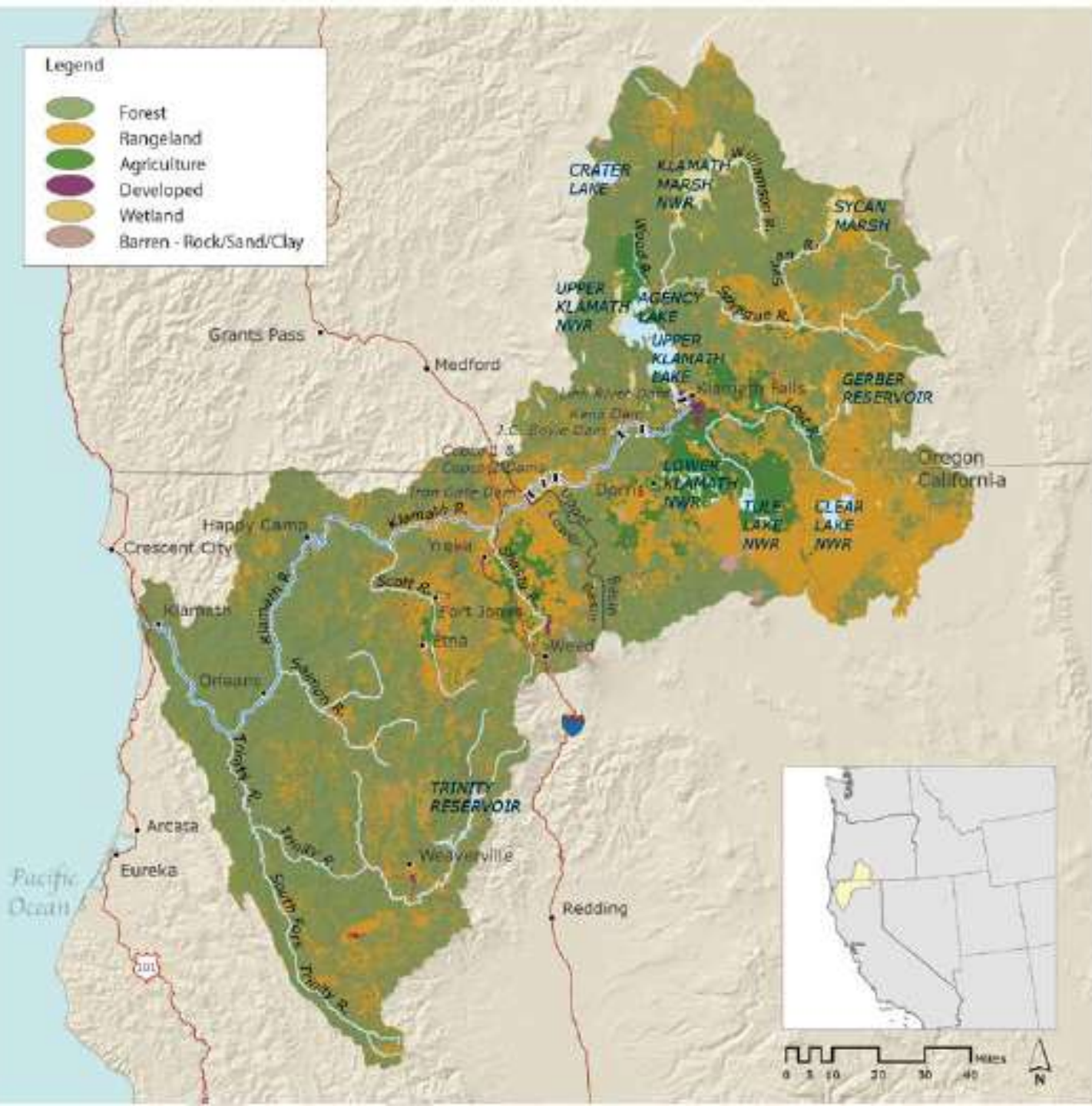






Legend

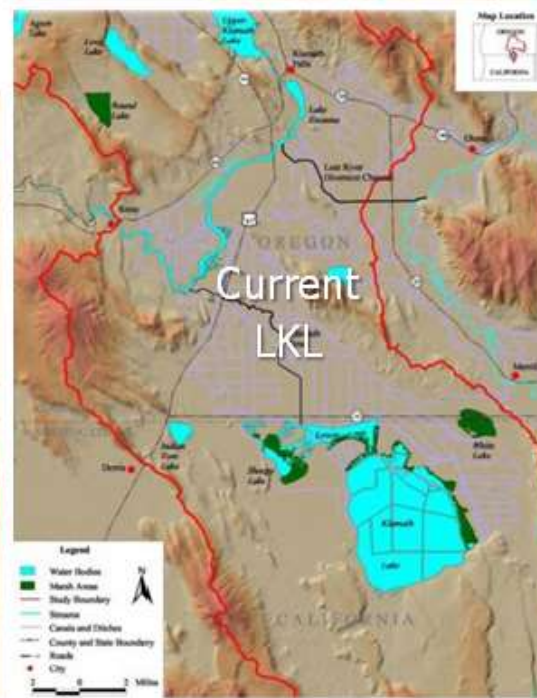
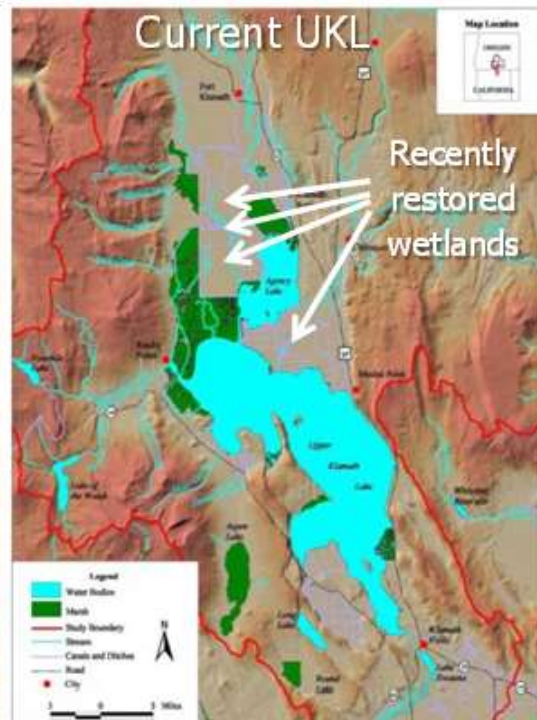
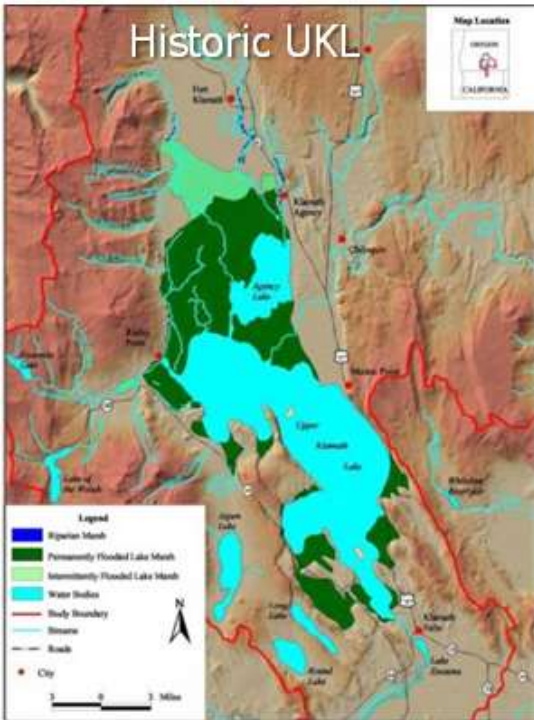
- Forest
- Rangeland
- Agriculture
- Developed
- Wetland
- Barren - Rock/Sand/Clay





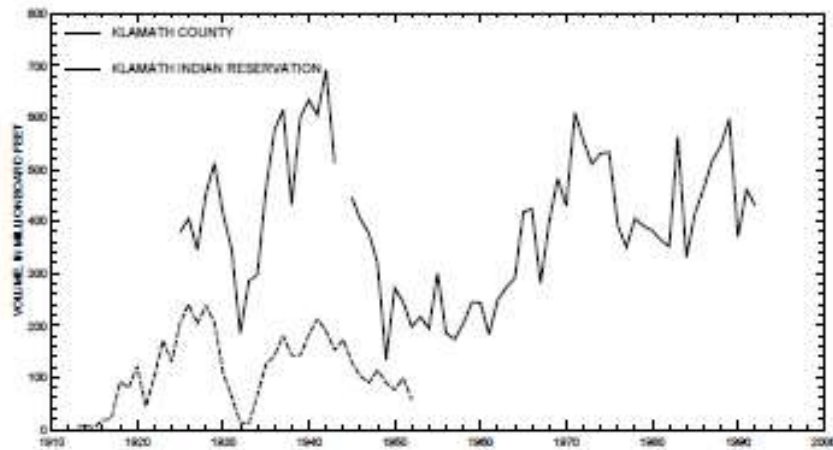
# Klamath Water Quality Improvement Strategy

- 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

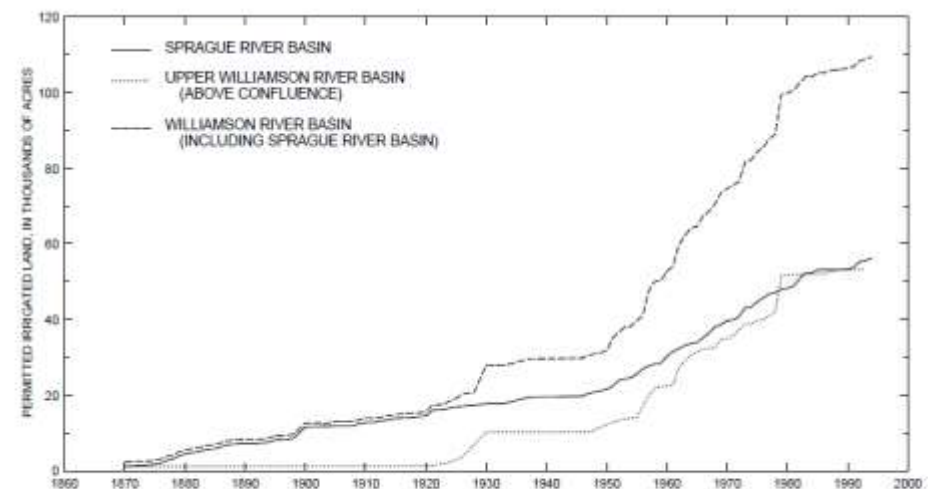


Era when logging not as well managed as it is today.

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

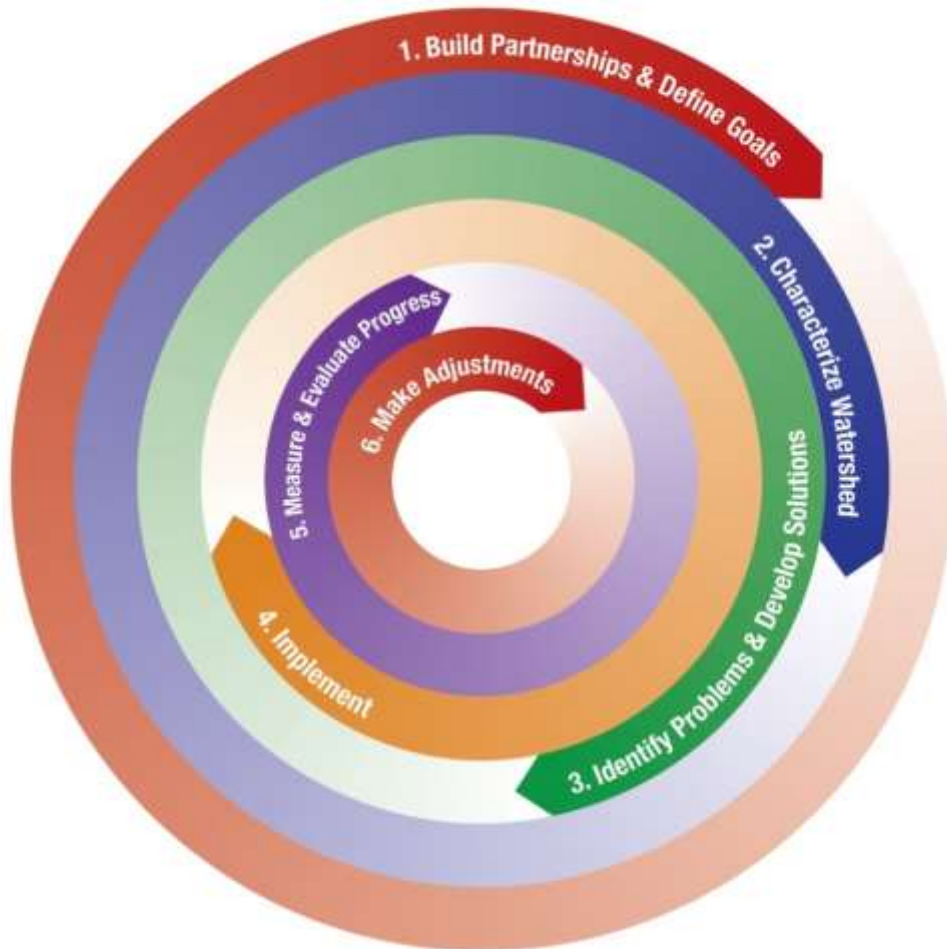
USGS 1998 Risley & Laenen

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



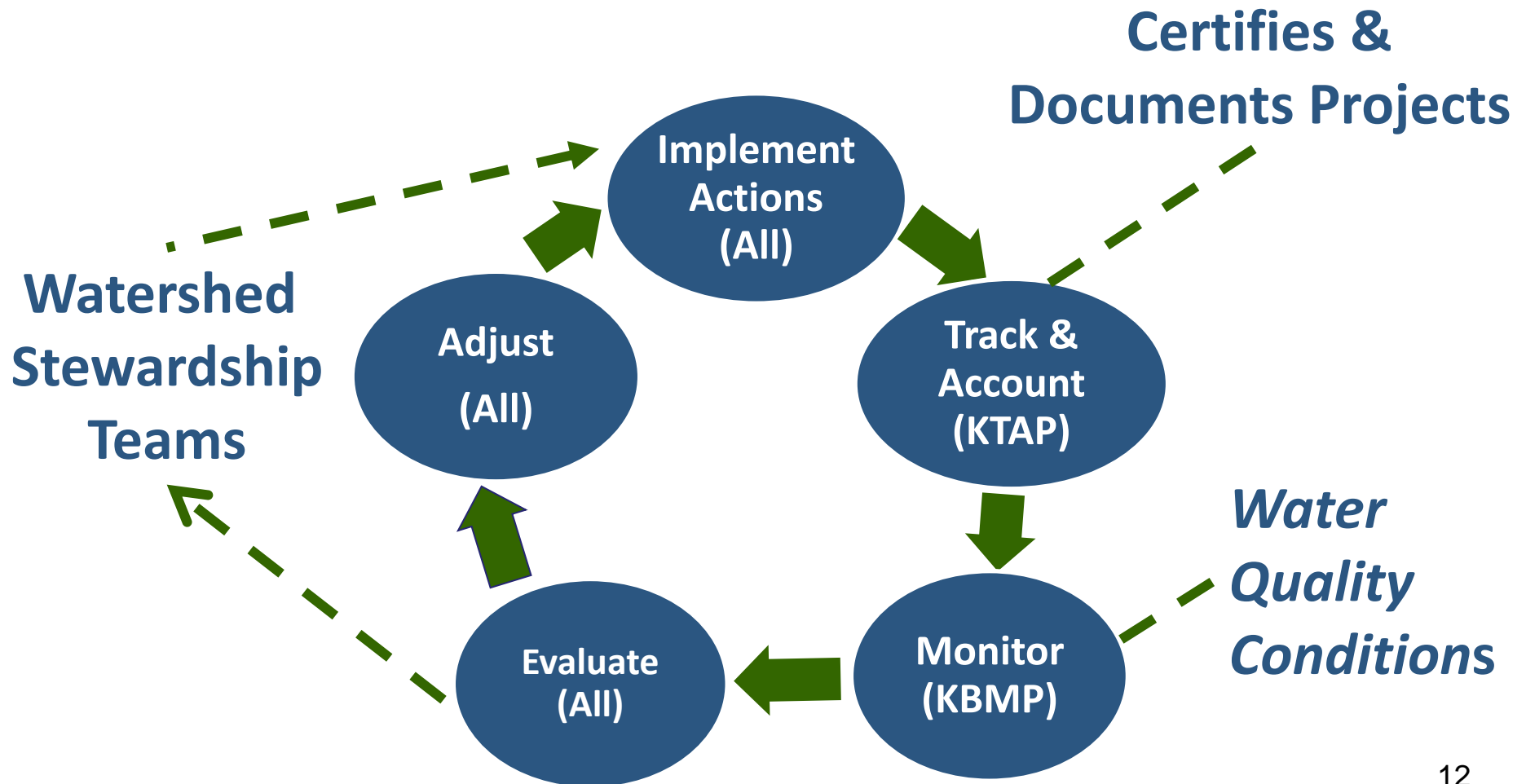
# Watershed Stewardship Framework

## Watershed Stewardship Approach: Adaptive Management Cycle



An approach that supports collaborative outcomes

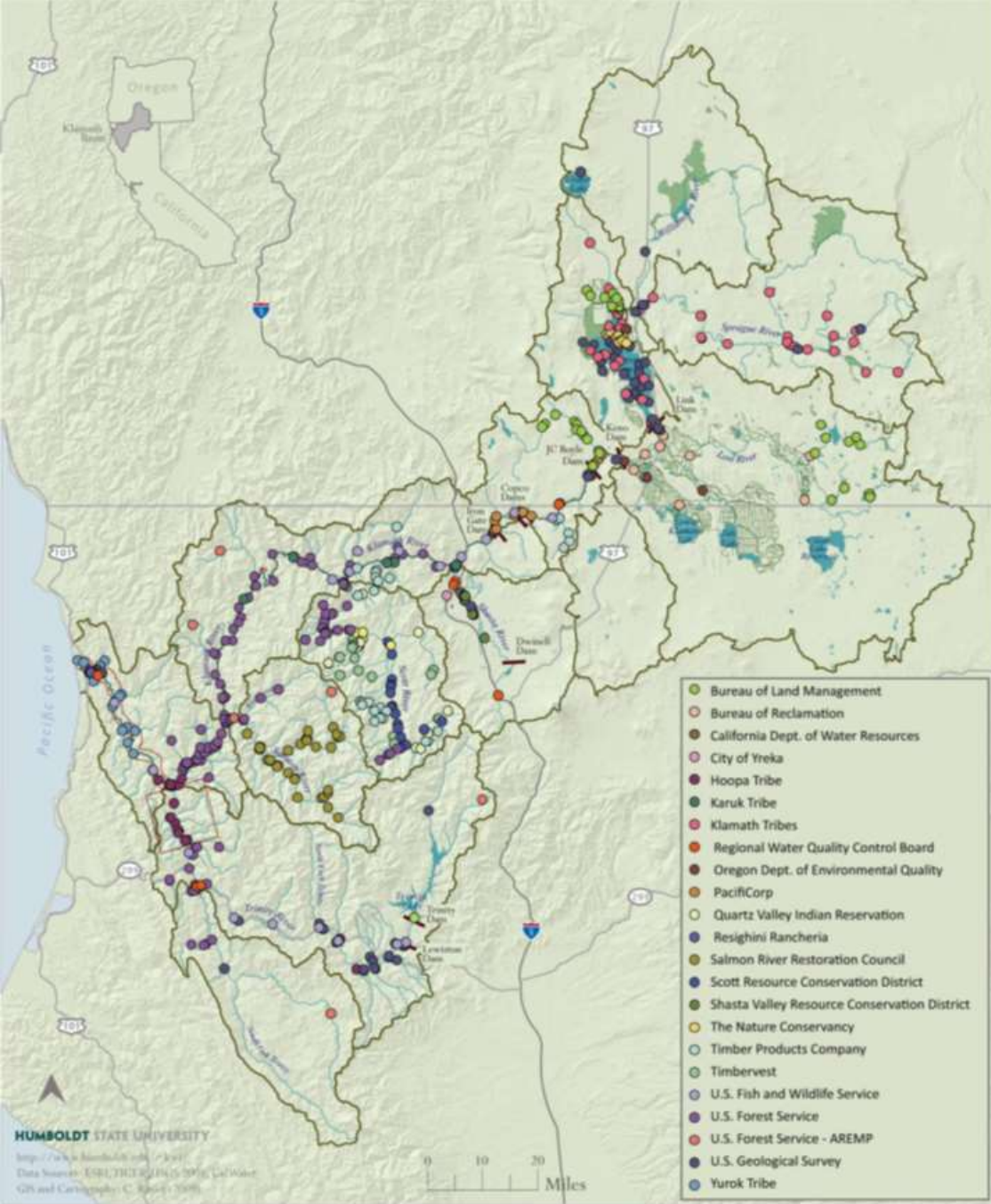
# Adaptive Management Framework





# 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](http://www.kbmp.net)



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



# Klamath Tracking & Accounting Program (KTAP)





# KTAP - Program Components

Quantification  
Methods

Consistent  
Protocols

Tracking/  
Registration



Propose  
Eligible  
Project

Quantify  
Benefits

Verify  
Conditions

Register &  
Issue

Track

Acquire  
Benefits

Investment  
Goals

October 2014

Klamath Tracking and Accounting Program

# Klamath Fish Health Assessment Team

## 2014 Update



**Sara Borok & Katharine Carter**



16

# Overview

## How does KFHAT do it?

### Fish Kill Response Plan

#### Klamath River Basin Fish Kill Response Plan



**Klamath Fish Health Assessment Team  
(KFHAT)**

August 2005  
Updated March 2011

### Training Manual

#### Klamath River Basin Training Manual




**Klamath Fish Health Assessment Team  
(KFHAT)**

May 2012

# 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**

### 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.




### Blue-Green Algae Map



### 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



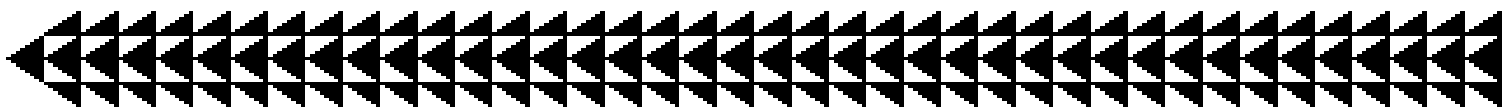
Data and information collected by KFHAT members are utilized to determine the likelihood of a fish kill and inform resource managers who make resource allocation decisions



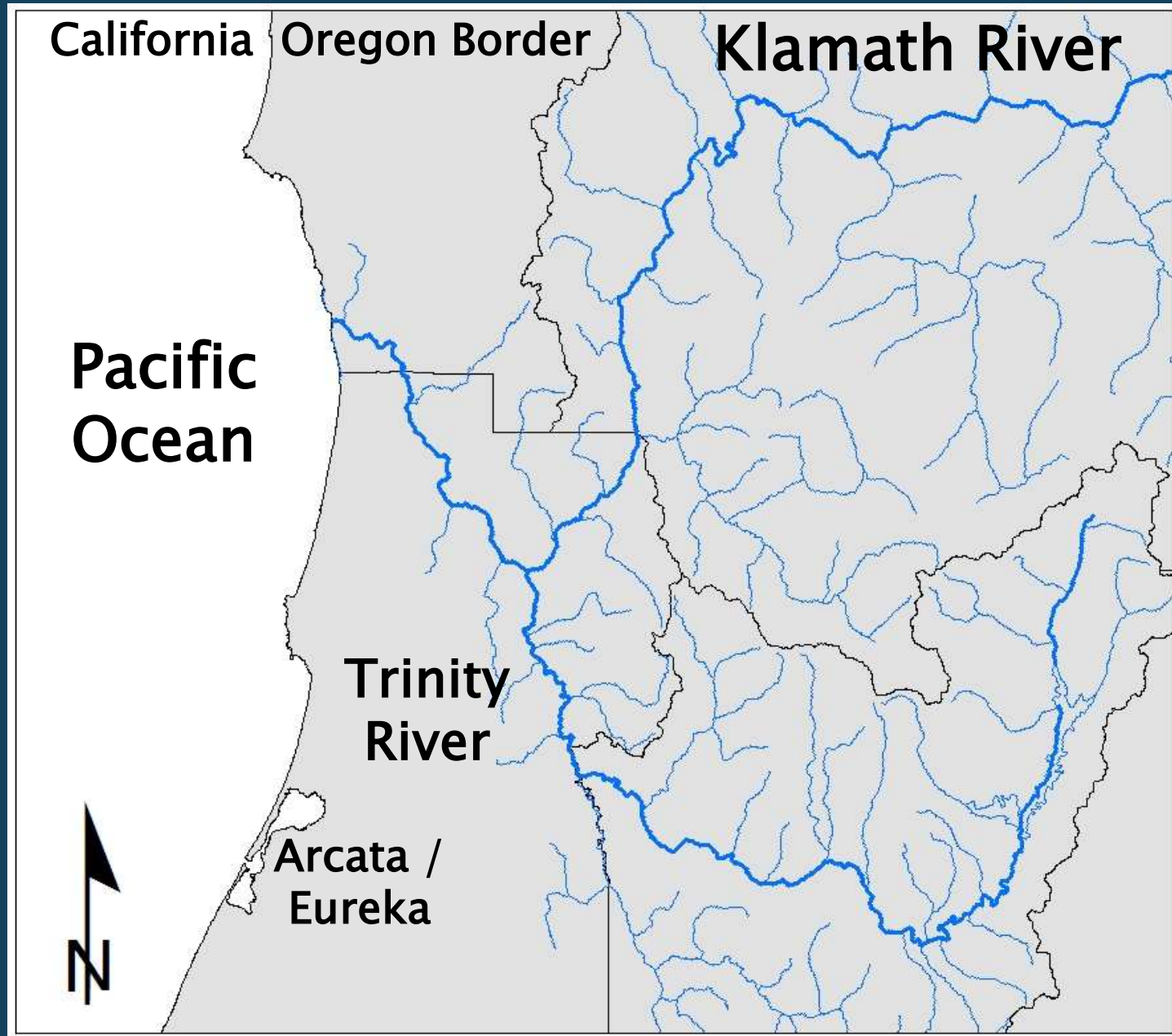
# Yurok Fisheries & Water Quality Restoration in the Lower Klamath



Sarah Beesley – Yurok Tribal Fisheries Program



# Lower Klamath River





# Historic Logging, Wetland Conversion Stream Clearing & Hydroelectric Operations



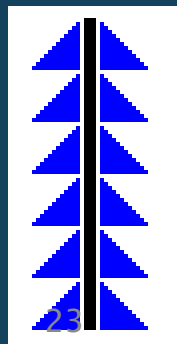
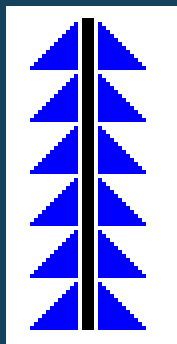


# Yurok Tribe Environmental Program

## Water Division

## Community & Ecosystem Division

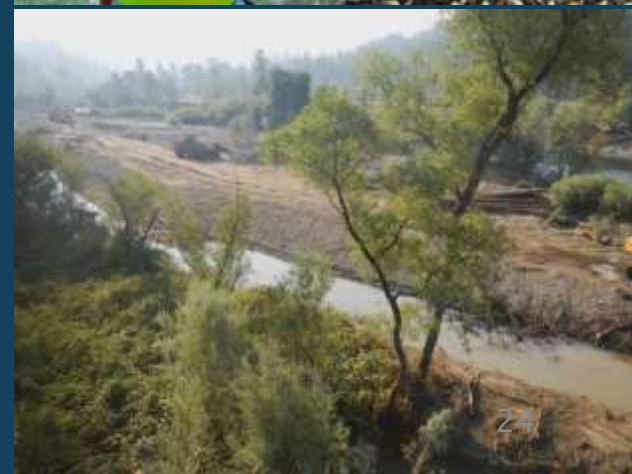
## Pollution Prevention Division



# 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

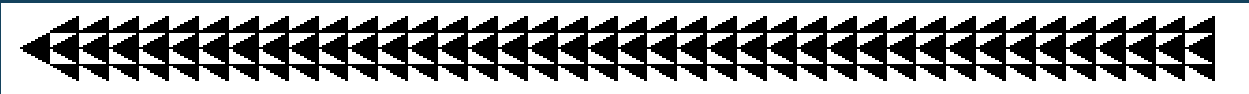
Green Diamond Resource Company

Larry Lestelle ∞ USFWS ∞ USBOR





# Riparian Restoration





# Instream – Building Back Complexity





# Constructed Wood Jams – Hunter Creek

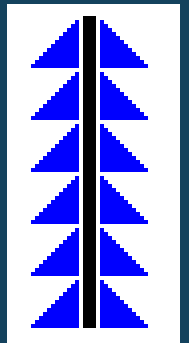
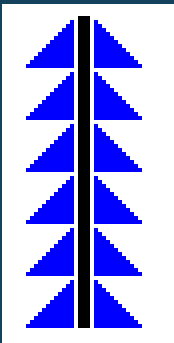




**Bar Apex Jam 4  
As-Built 2012**



**Early November  
2012**







Late November 2012



March 2013



February 2014



# Off-Channel Habitat Construction



McGarvey  
Alcove I

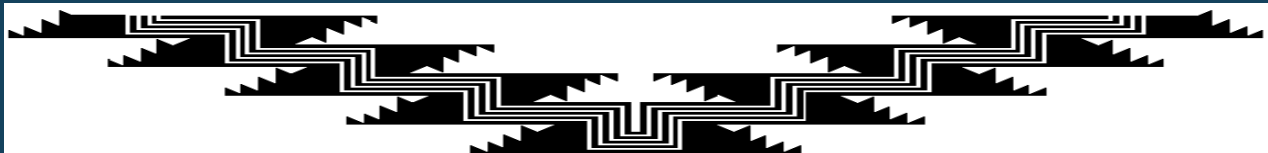
Before  
Construction



Winter  
2013



# Hunter Creek Alcove I





**Thank You**





# **Salmon River Habitat Restoration**

**Salmon River  
Restoration Council**

**Lyra Cressey  
Associate Director**



# Riparian Assessment 2006-2008

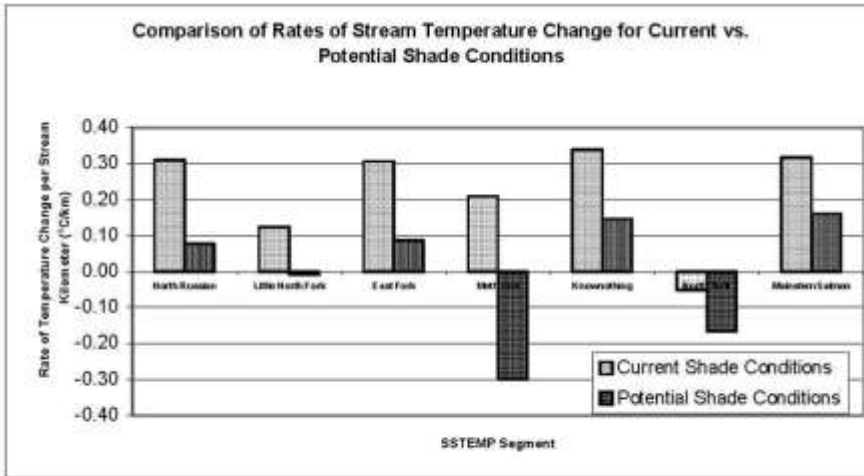
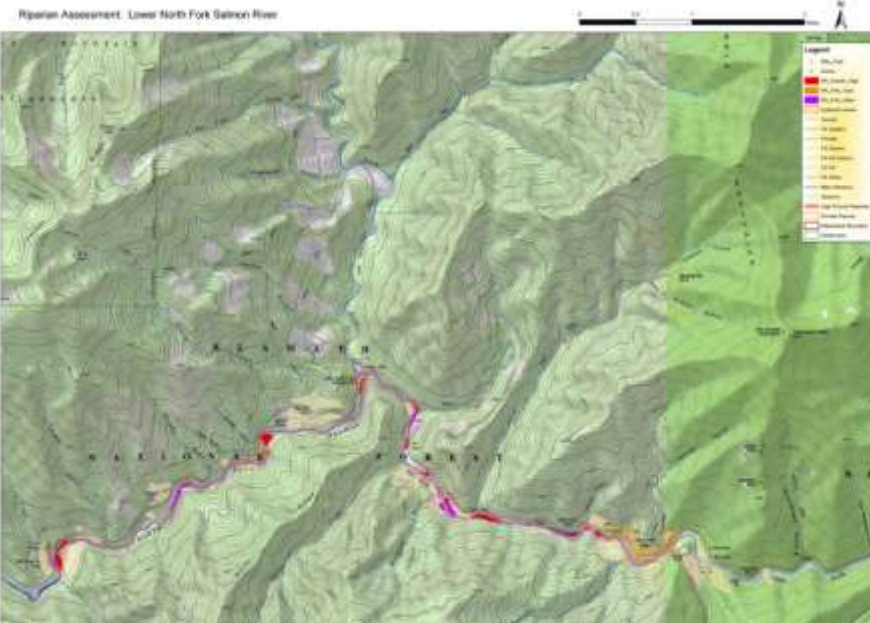
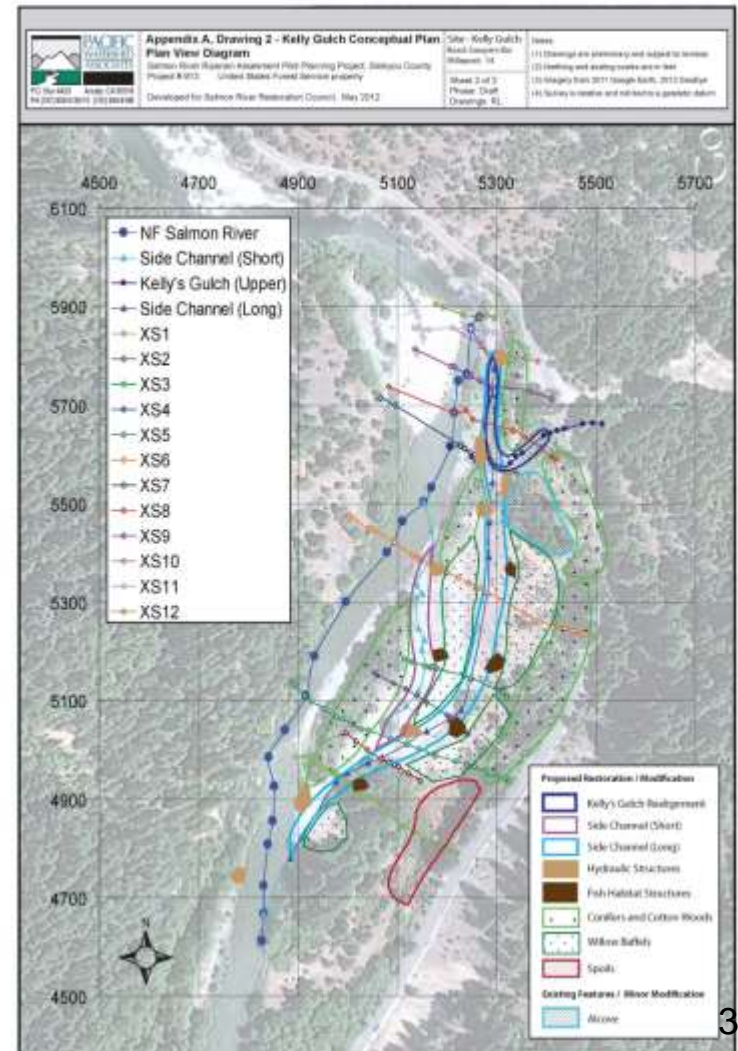
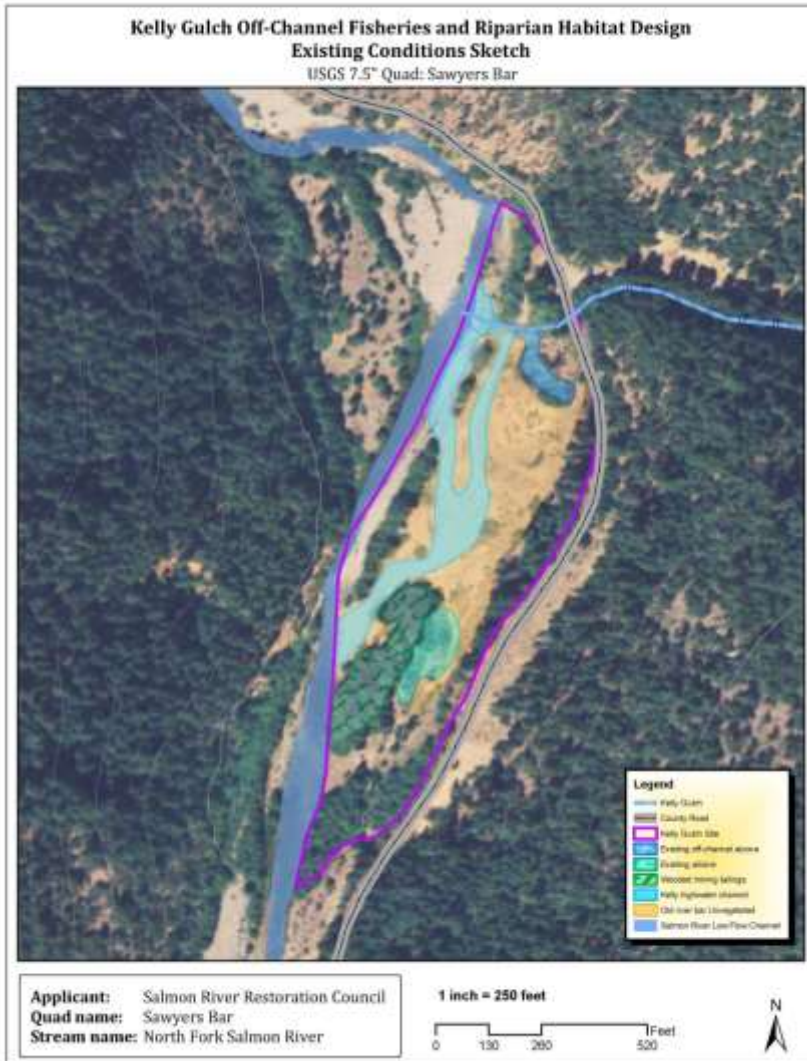


Figure B-9 Results show that increasing riparian trees to adjusted potential heights can produce a reduction in the rate of stream heating of 0.12°C/km to 0.51°C/km



- 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.

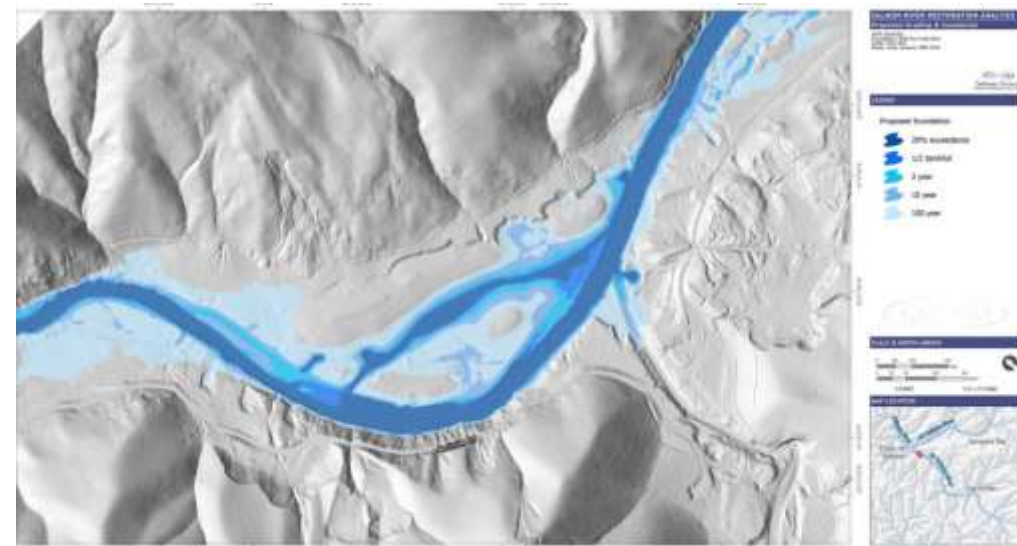
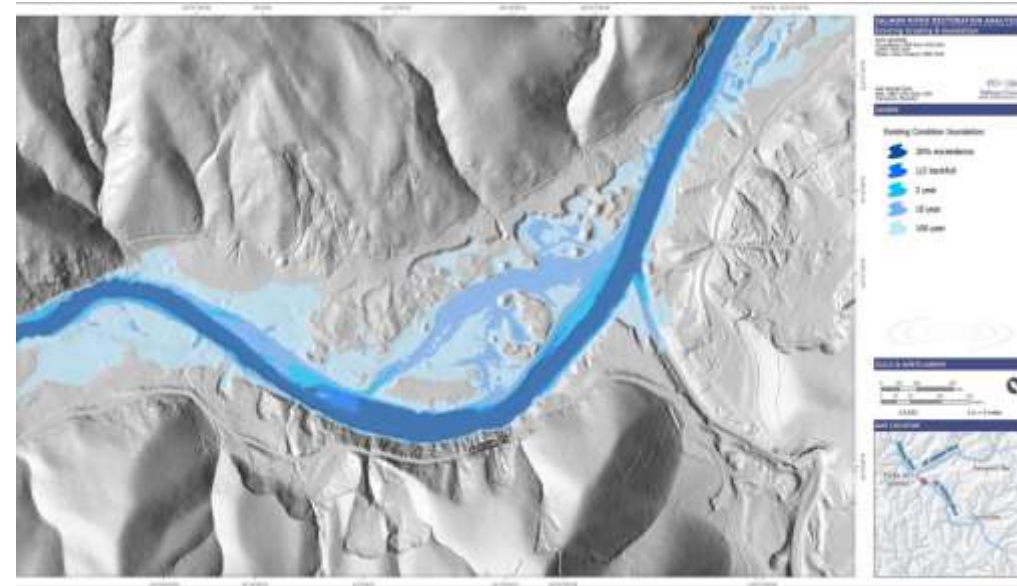
# Riparian and Fish Habitat Restoration



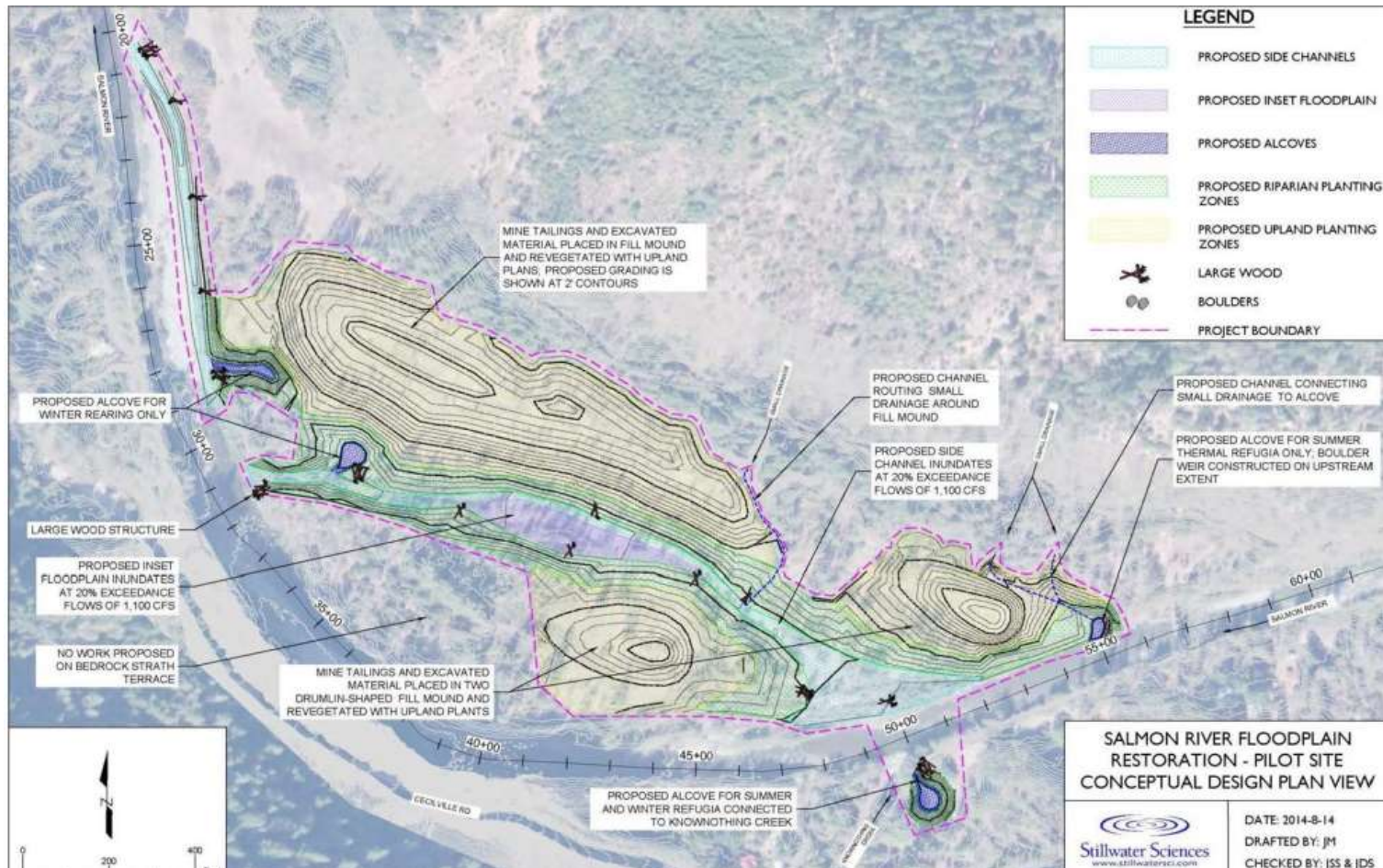


# Floodplain Assessment 2013-2015

- 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



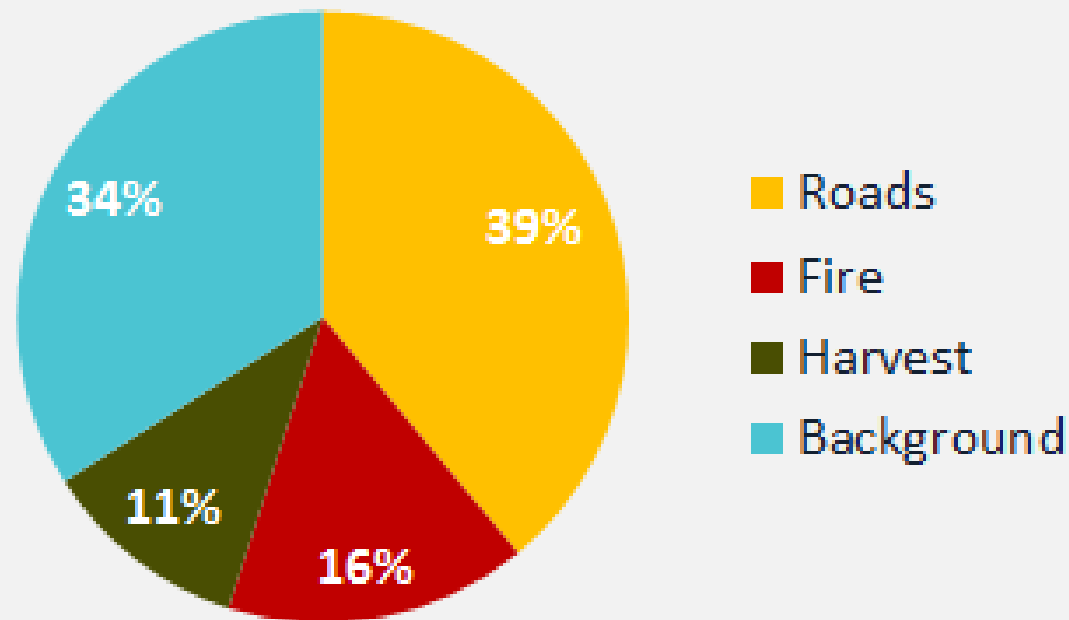


# Klamath National Forest Watershed Restoration Program

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

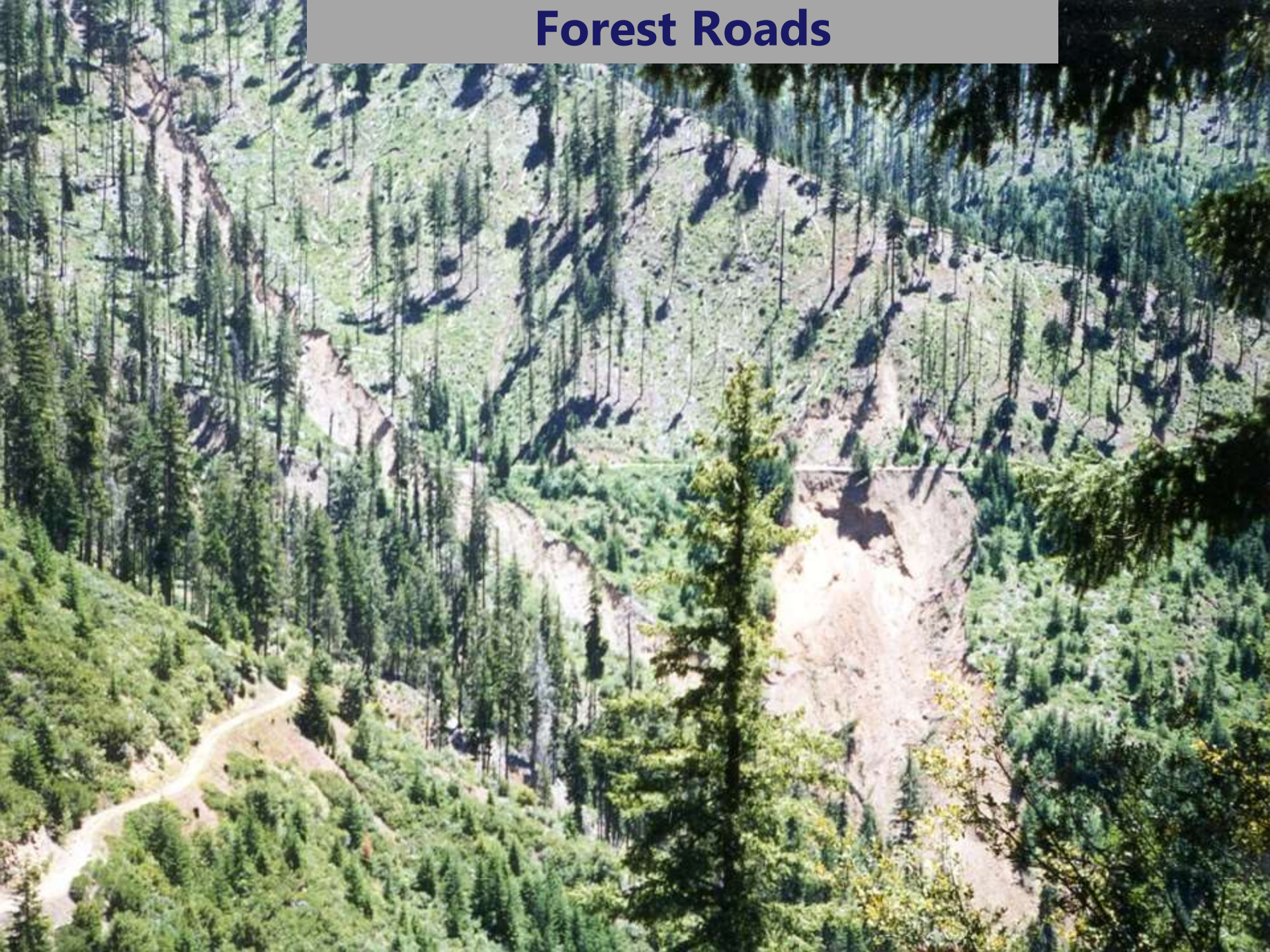


## Sediment Budget from 1997 Flood Klamath National Forest





# 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

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

# 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

<b>Projects</b>	<b>Seiad Creek</b>	<b>Sugar Creek</b>
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**

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**October 9, 2014**

**Yreka, CA**

**Bryan McFadin - NCRWQCB**





# **Scott River TMDL Conditional Waiver Update**

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- **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**

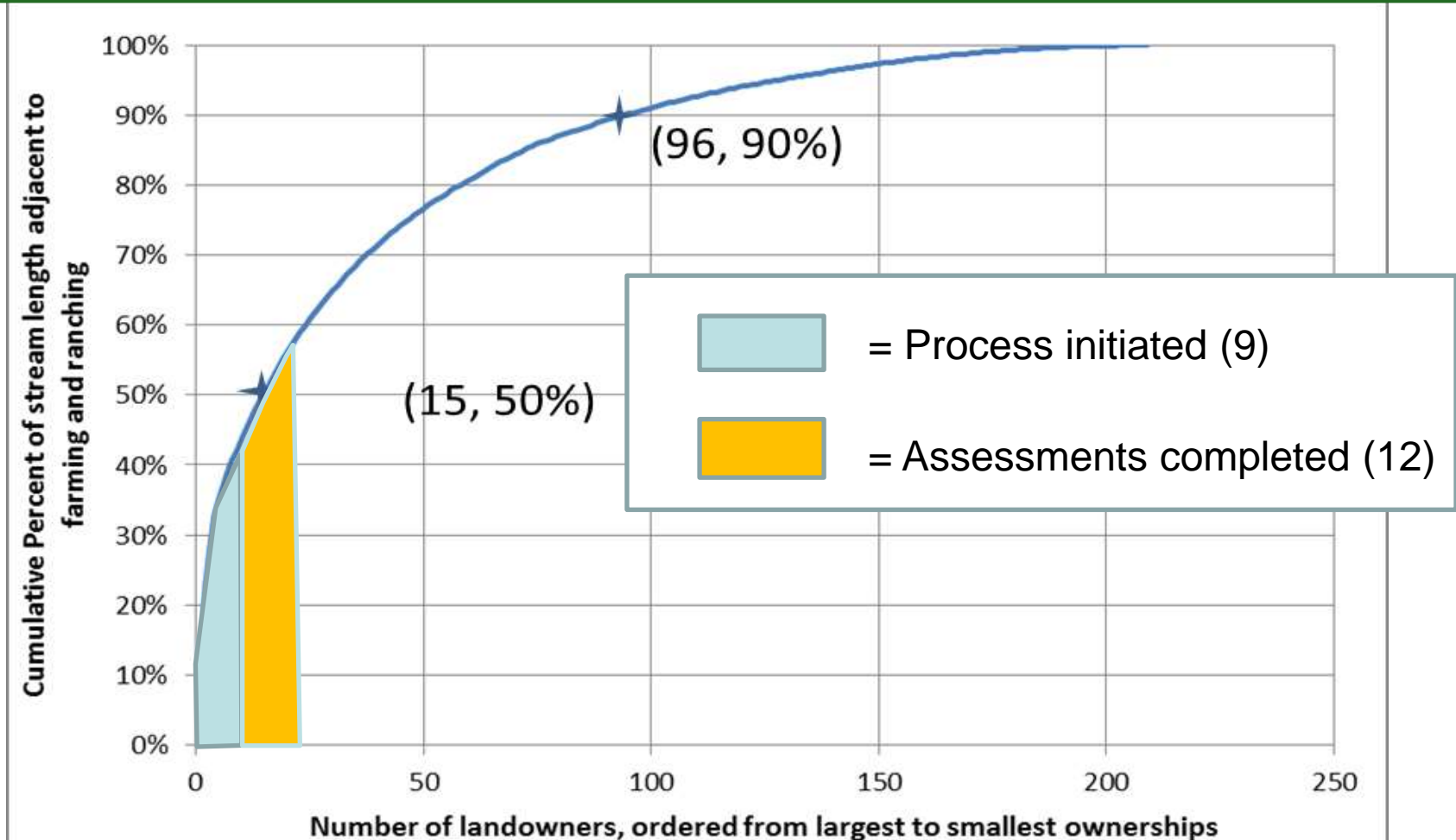
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- **Water quality assessments completed on 12 ownerships**
- **Assessment process initiated in 9 additional ownerships**



# Scott River Conditional Waiver Implementation Progress





# Scott TMDL Grants and Contracts

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## 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

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- **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**

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**October 9, 2014**

**Yreka, CA**

**Andy Baker - NCRWQCB**





# **Overview of Shasta TMDL Conditional Waiver**

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- **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

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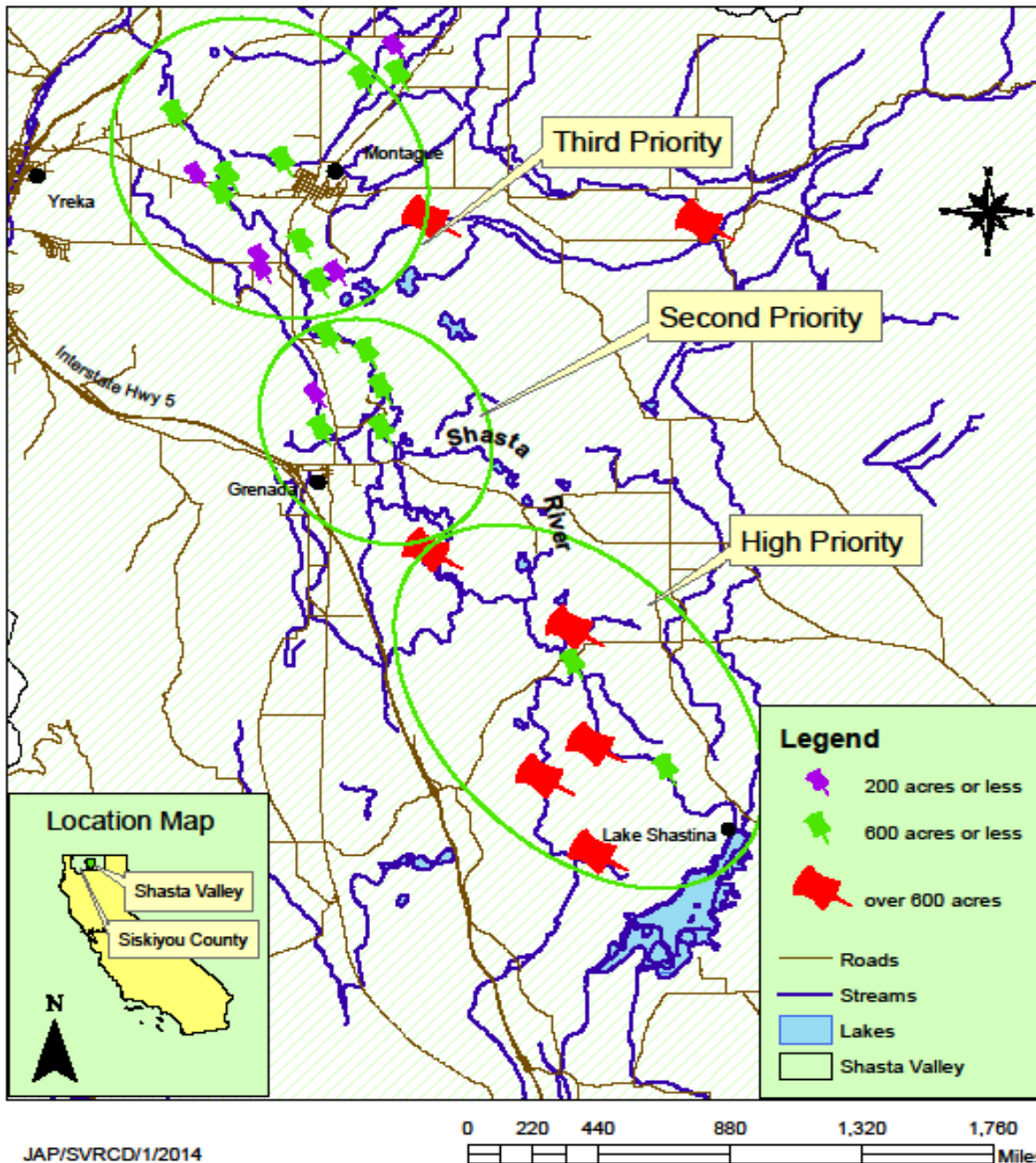
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- Important tool for landowners to protect water quality
- 34 ranch plans completed (some landowners already have ranch plans)
- 24 water quality ranch plans developed by SVRCD for TMDL purposes
- Continue to develop additional water quality ranch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





# Water Quality Ranch Plans Completed in Priority Areas





# **TMDL Waiver Highest Priority Area**

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- **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**

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- **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**

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**October 9, 2014**

**Yreka, CA**

**Adriane Garayalde  
Shasta Valley Resource Conservation District**



# **Shasta River Watershed Stewardship: Pilot Project Update**

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- 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

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- **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**



**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*



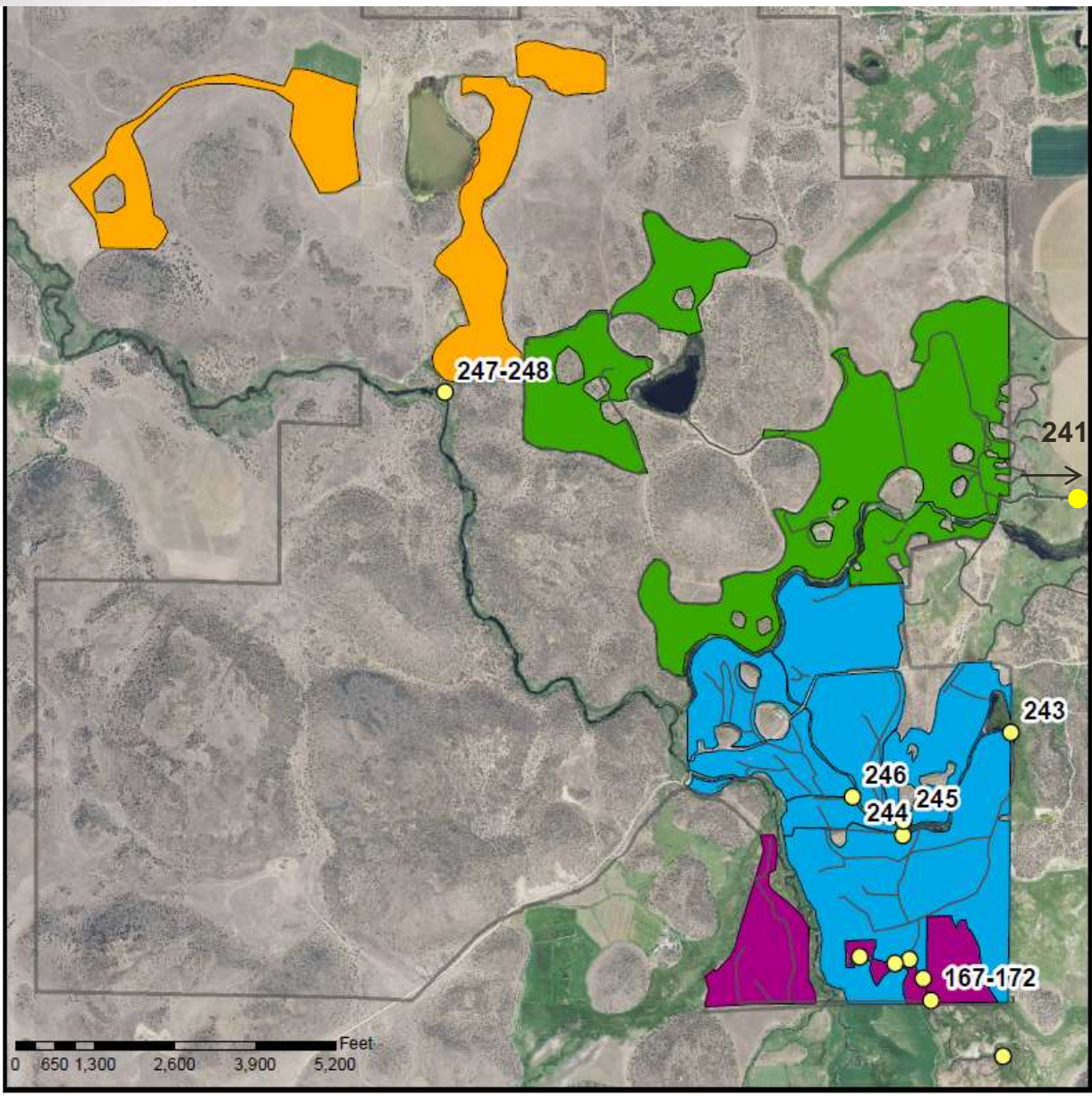


## Water *Protection* Tools

- *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

● Points of Diversion  
 Ditches  
 TNC Property Boundary

**Pasture Management Units by Diversion**  
 HIG- Hole in the Ground  
 BS- Big Springs  
 LS- Little Springs  
 SR- Shasta River

Surface Irrigated Ground by Water Rights on the Shasta Big Springs Ranch



## 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



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

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

**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.



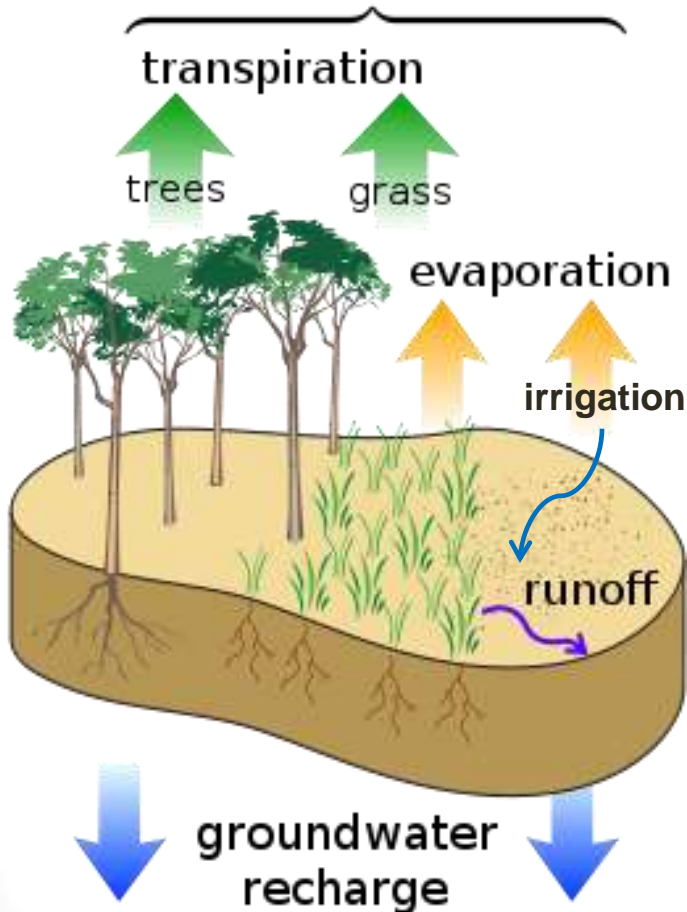
# 1707 Due Diligence: Water Quantity—Consumptive Use

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

evapotranspiration =  
transpiration + evaporation



**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
<b>estimated % consumptive use of applied water</b>	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.



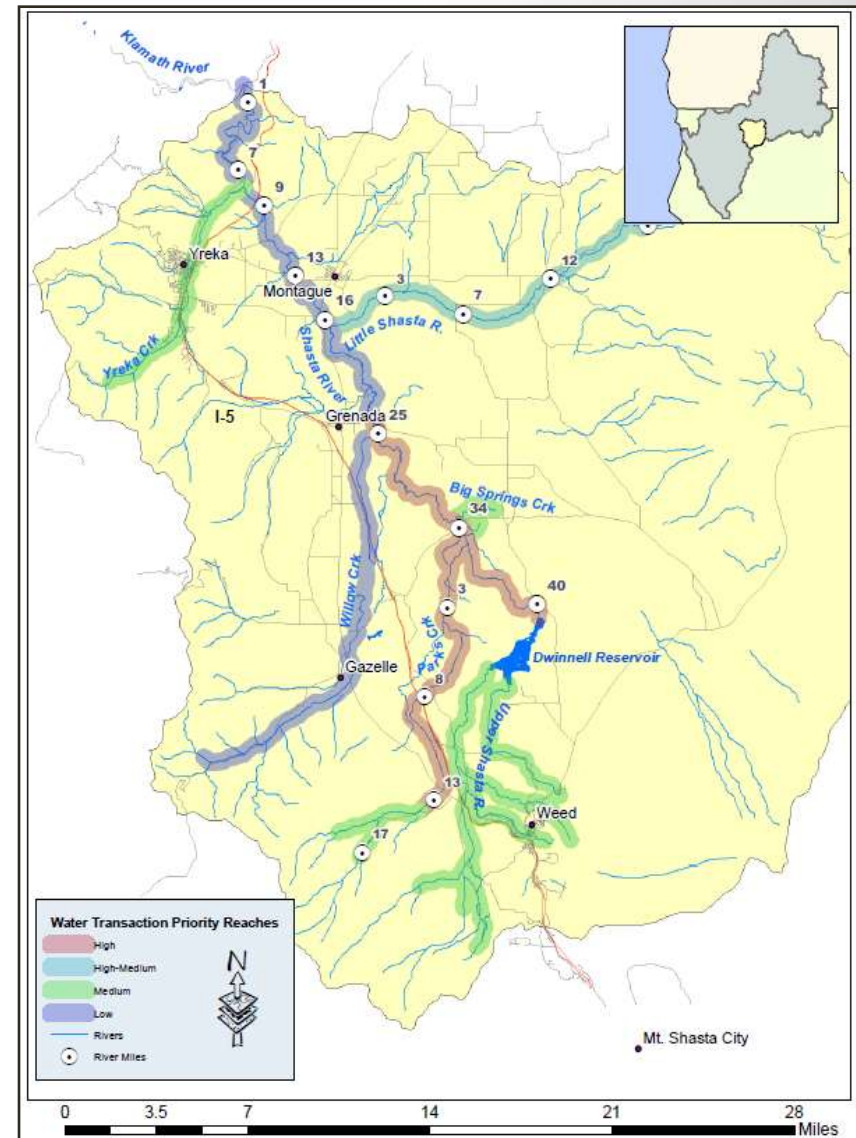
**When do we need the water?**

**Where do we need the water?**

**How much water do we need?**

**What quality of water are we looking for?**

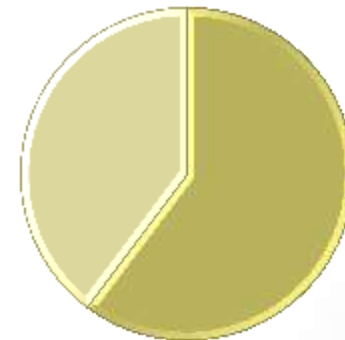
**Is there water potentially available?**



## Instream Flows Coordinated by the Shasta River Water Transaction Program



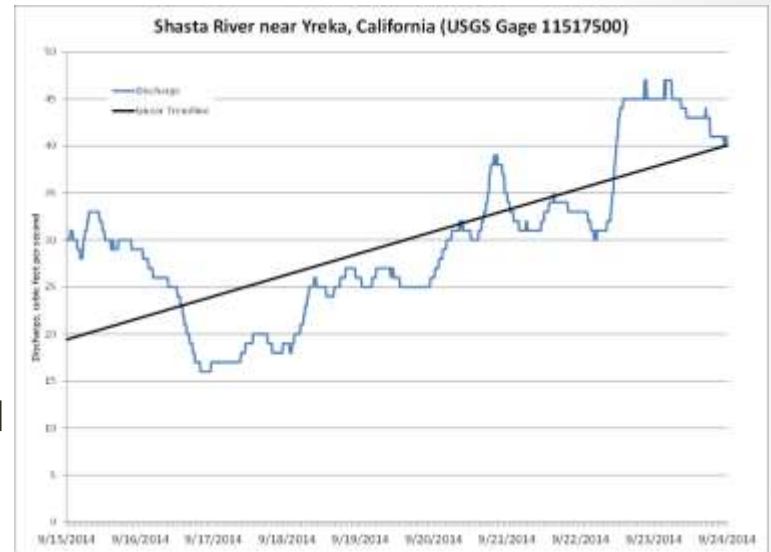
## Water Transaction Species Targeted



# 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



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, 2,419 adult fall-run Chinook salmon had returned to spawn. Last year, by the same date, only 988 had been counted.

On Boggs Creek, CDFW data show that 83 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 infected 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.

PHOTO: PHOTO COURTESY RESOURCEVALLEY.ORG

## 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.

Table 8. Monthly Evapotranspiration of Applied Water for Actual Irrigated Areas Associated with Water Rights (1)

Diversion Number	Adjudicated Area, Acres <sup>2</sup>	Water Right Flow, cfs	Mar		Apr			May			Jun			Jul			Aug			Sep			Oct			
			Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
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	0.74	0.46	0.56			
167-172	67.2	1.5				0.00	0.05	0.23	0.10	0.89	0.50	0.33	0.54	0.65	0.52	0.65	0.75	0.32	0.56	0.64	0.54	0.47	0.51			
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	0.51	0.54	0.47	0.51			
241	803.2	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	2.96	3.4	2.96	3.4				
241	803.2	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	2.94	2.54	2.94				
241	803.2	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	2.10	2.4				

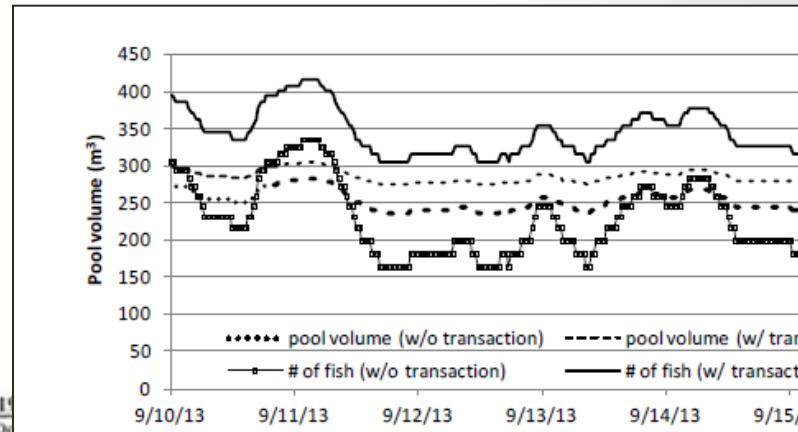


Figure 10. Changes in observed pool volume and potential fish capacity given



**The Nature Conservancy**  
Protecting nature. Preserving life.

## 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 Dwinell 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*)

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

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 bringing school kids on Friday during school hours, RSVP to Ally Sherlock:

(530) 436-5056 • allysherlock@gmail.com

## HOSTED BY:



Contact  
Ally Sherlock

(530) 436-5056  
allysherlock@gmail.com



# 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



## For more Information

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**Amy Hoss**

Shasta River  
Project Director

(530) 926-3199

[ahoss@tnc.org](mailto:ahoss@tnc.org)



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# Board Questions & Comments

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# 2014 Scott River Story: So Far

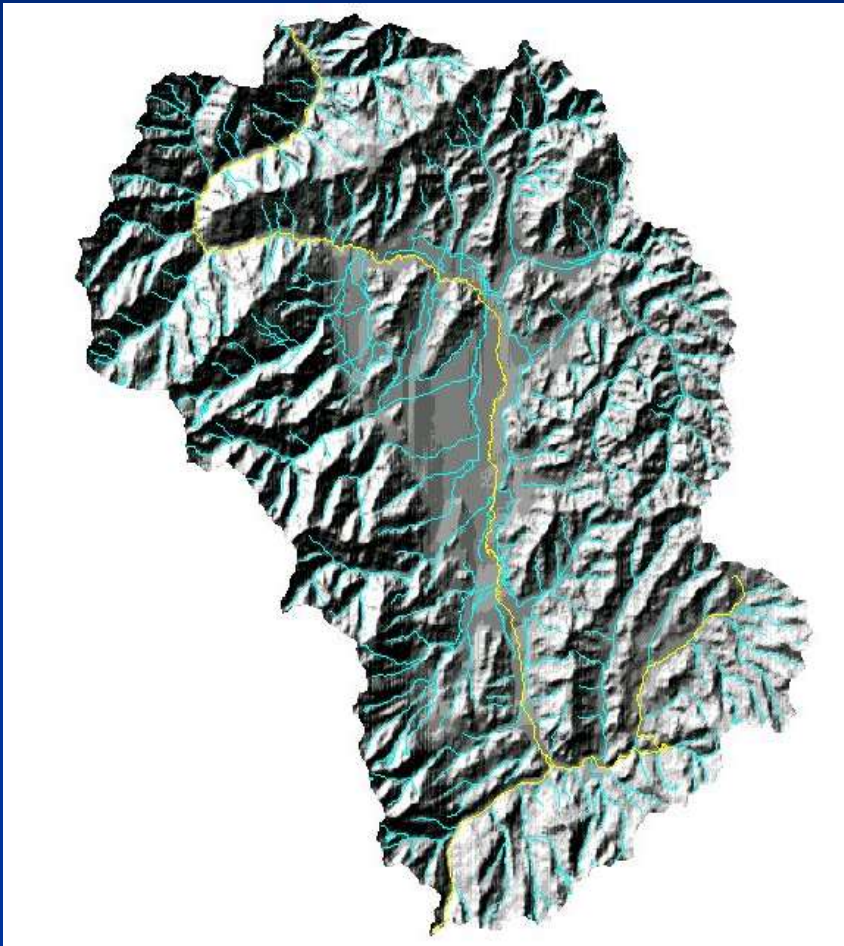


By Sari Sommarstrom  
& Preston Harris

**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.

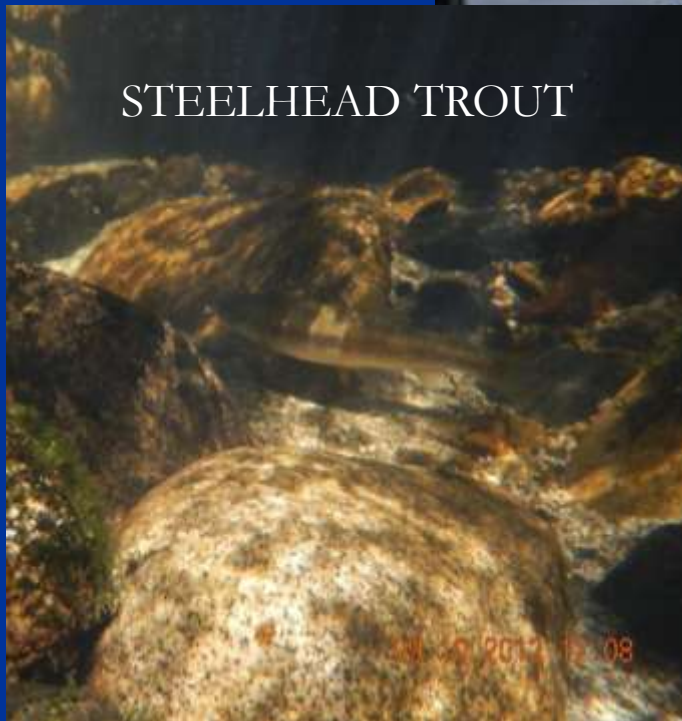


# Scott Valley Fish



COHO SALMON

CHINOOK SALMON



STEELHEAD TROUT





# Scott River Watershed Restoration Checklist



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

# Scott Valley Family Farming & Ranching: Water Needs

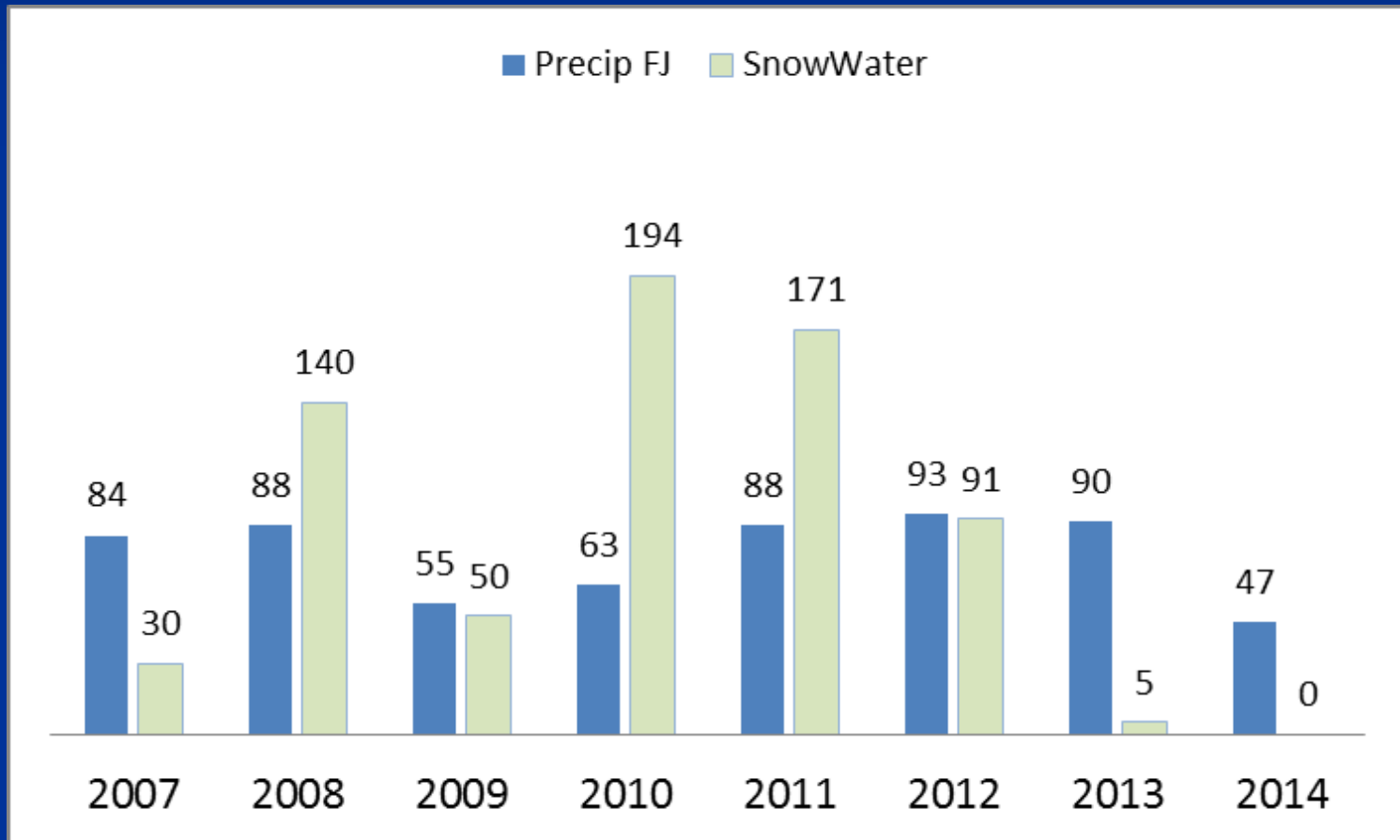


**Irrigation**  
for Alfalfa, Pasture, Grain crops  
32,000 acres  
~ April to September ~



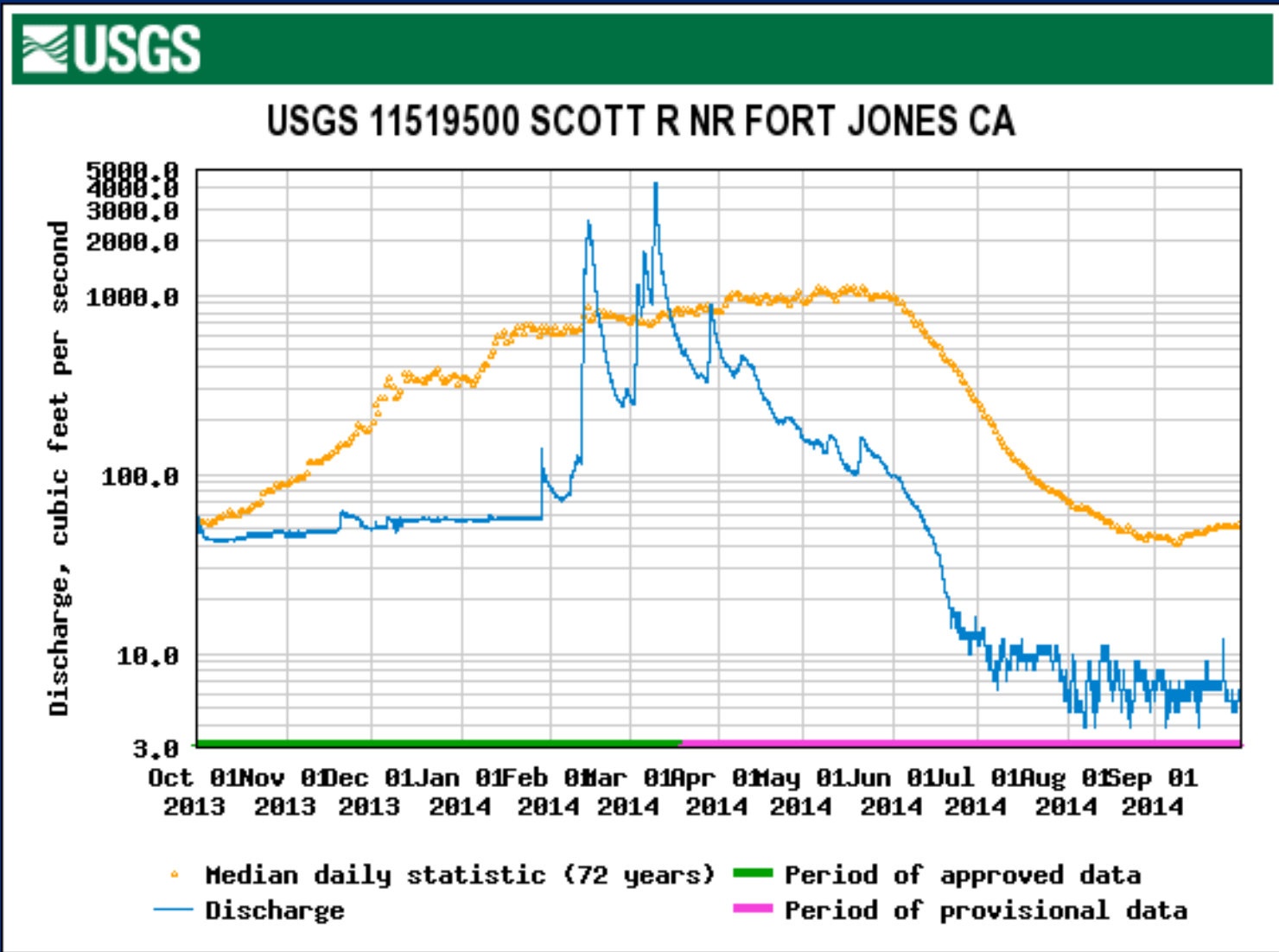
**Stockwater**  
for Cattle and Horses  
~ Year-round ~

# 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

# Adjacent Lessors	Water Year Type			
	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 1<sup>st</sup>

# Summer Habitat Priorities

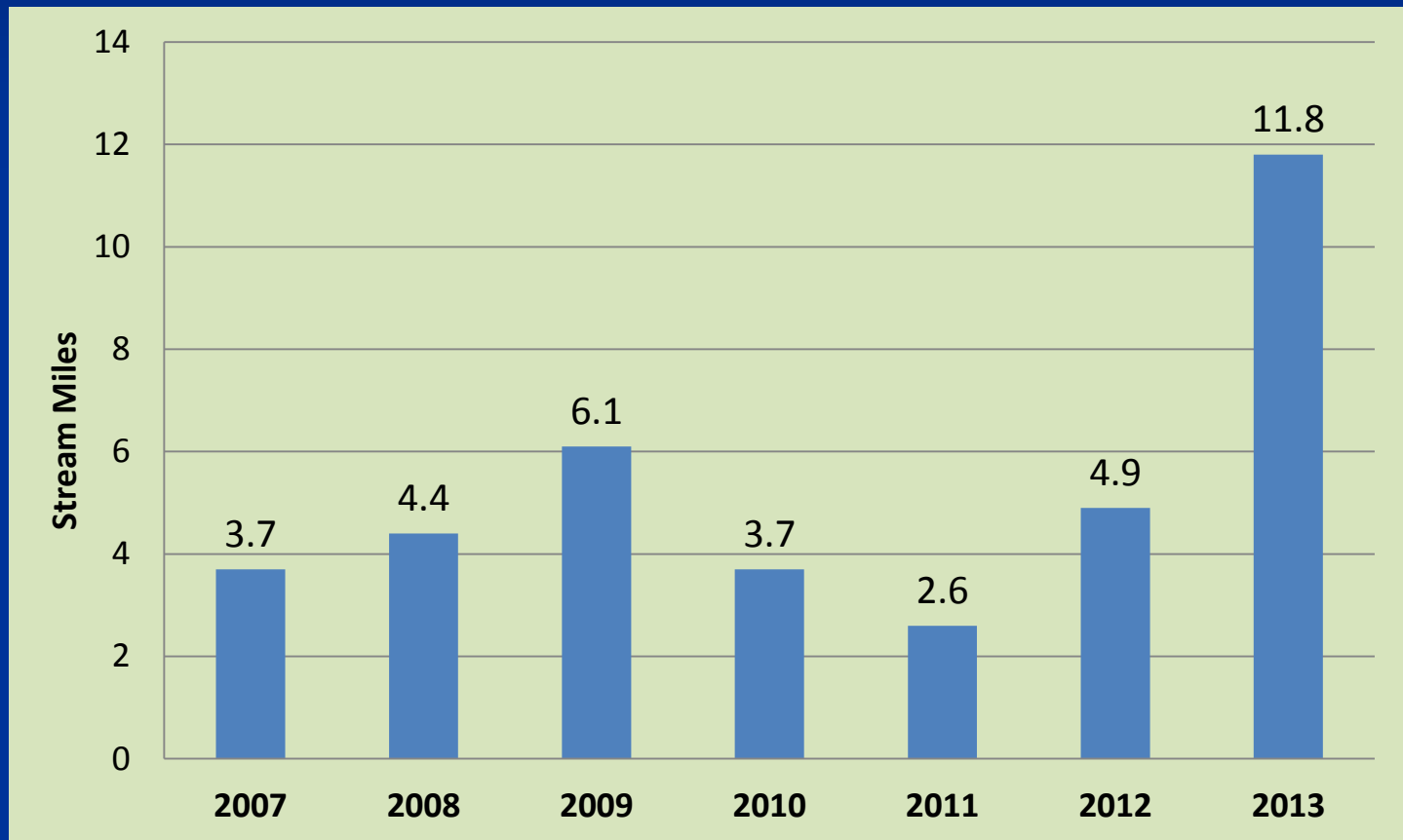


## Juvenile Coho Salmon & Steelhead:

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



# Summer Leases 2007-2013: Habitat Benefitted - miles

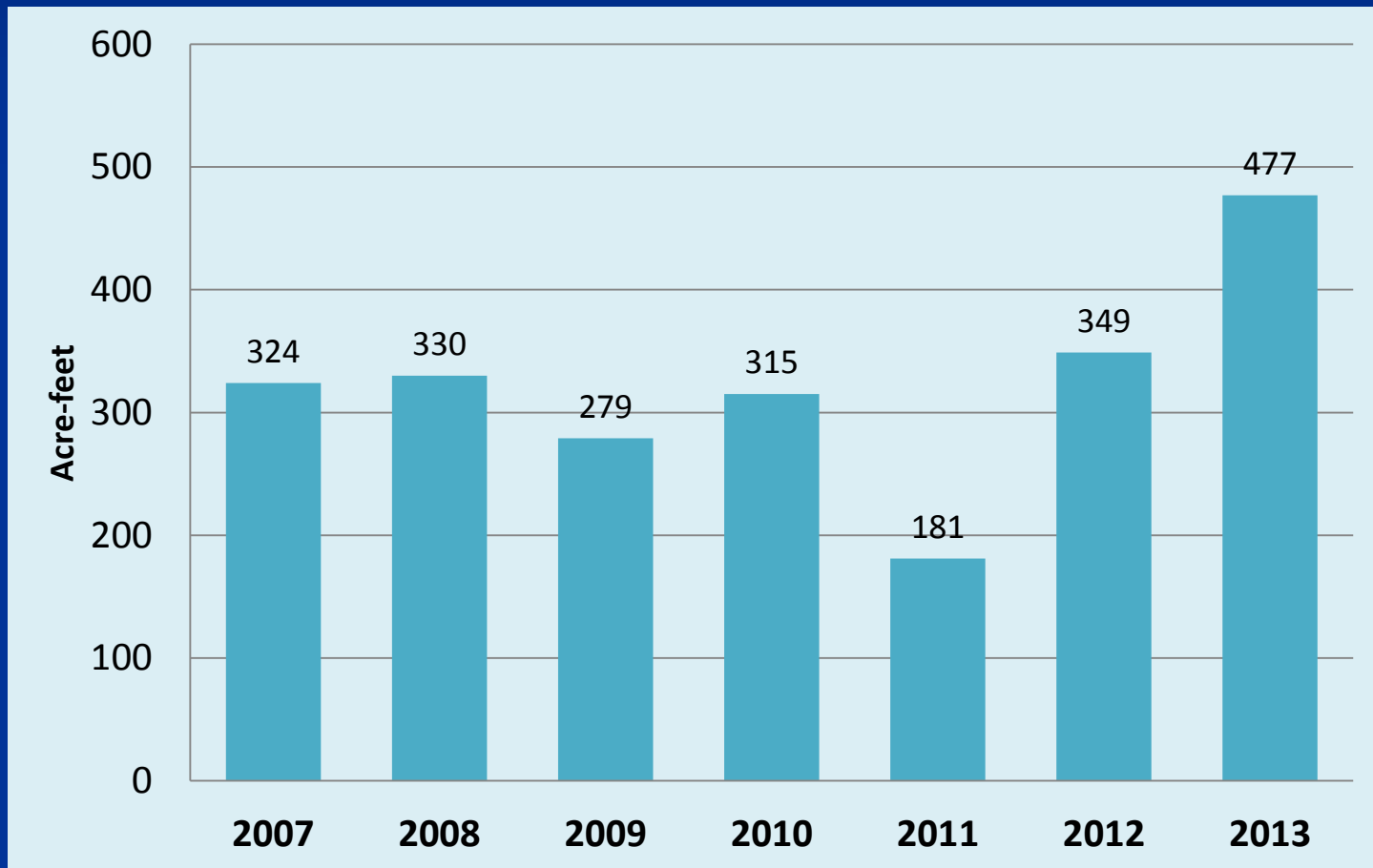


Fish-eye's view of lower  
French Creek below beaver dam



09.06.2012 11:28

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





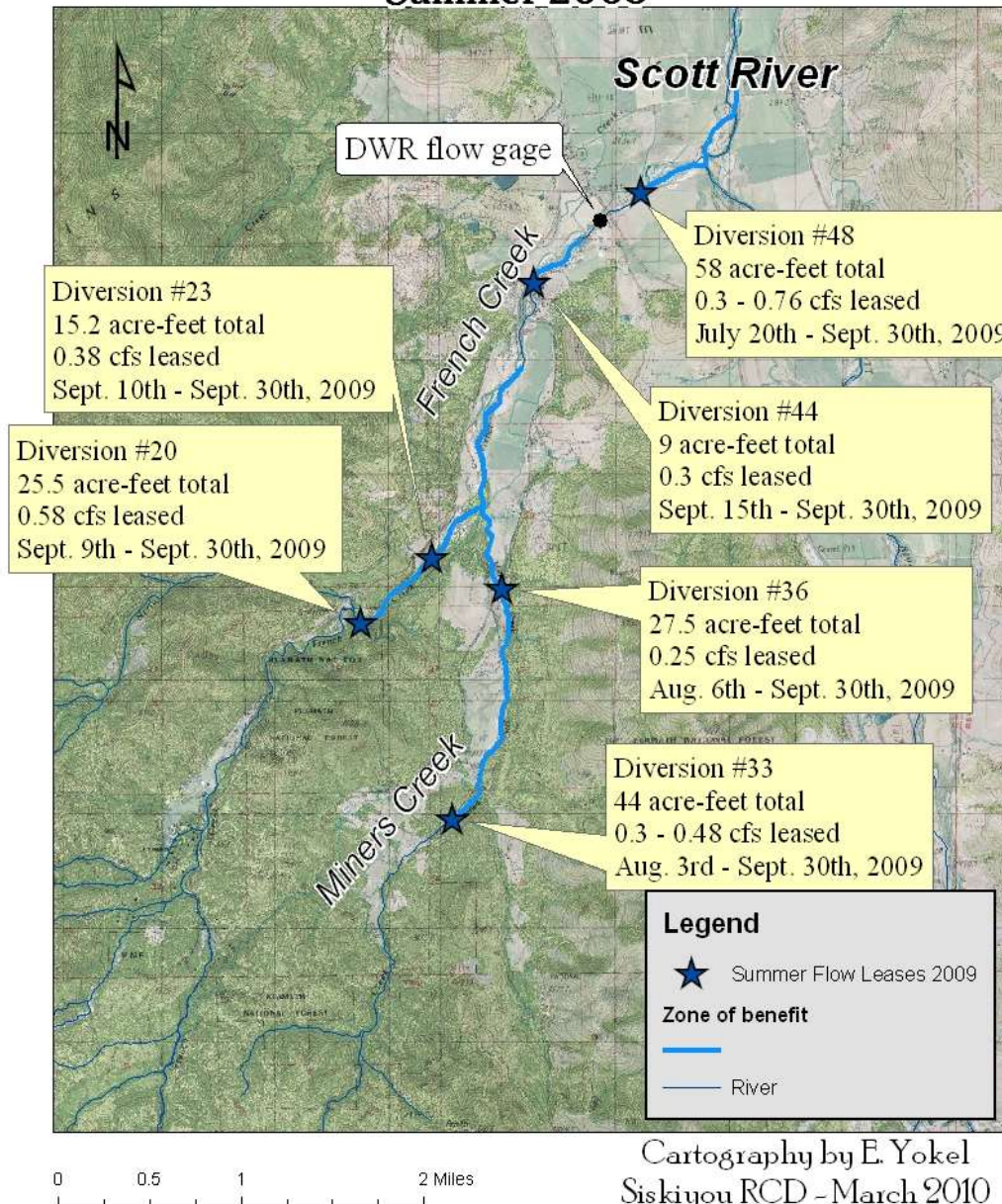
# Summer Leases 2014: Preliminary Results

- 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 1<sup>st</sup>

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



# French Creek Water Leases Scott River Water Trust Summer 2009



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



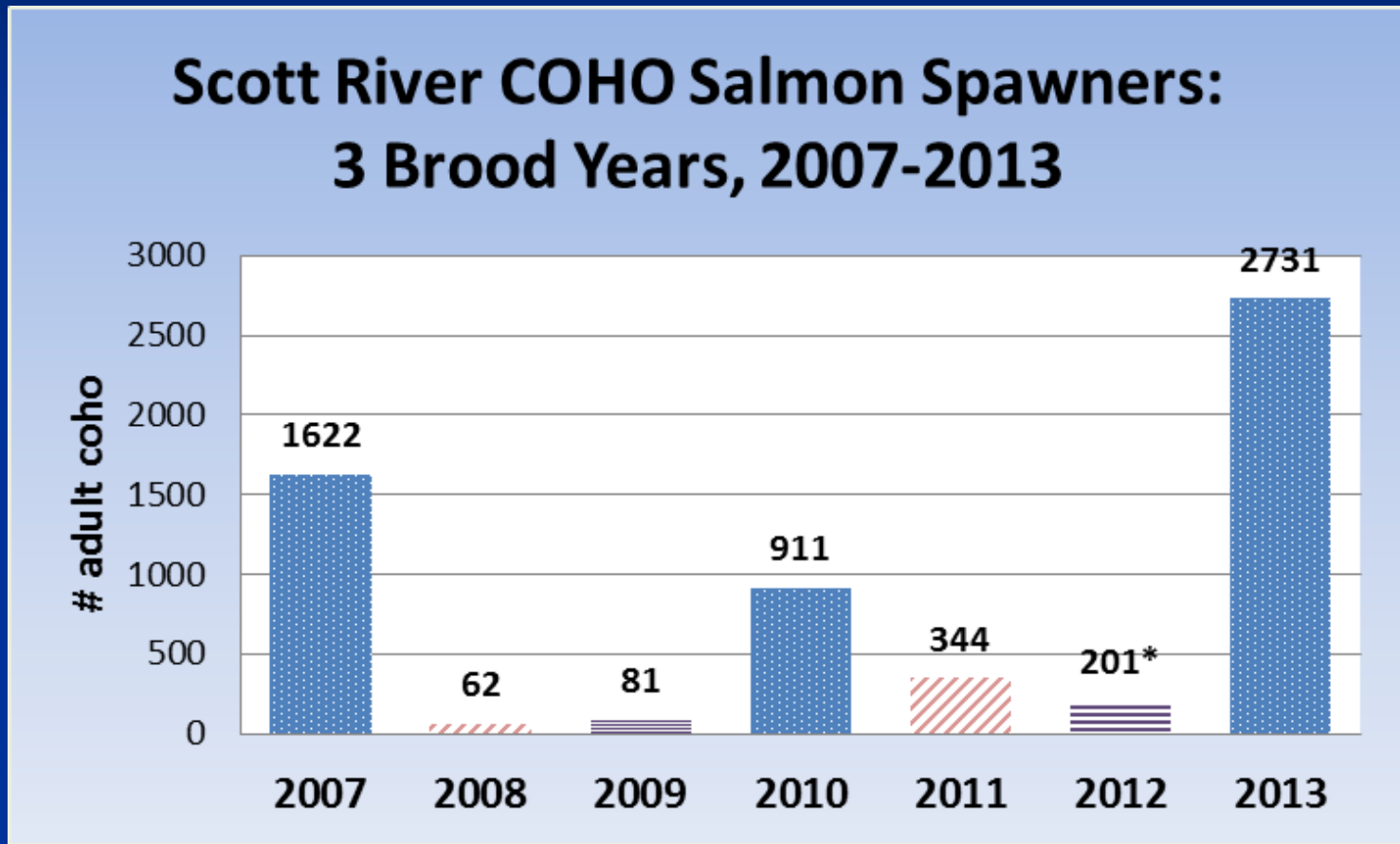
Google earth

1994

Imagery Date: 7/7/2012 41°19'35.34" N 122°50'42.91" W elev 3377 ft eye alt 10032 ft

# Coho Returns to Scott River

## 3 Brood Years are growing

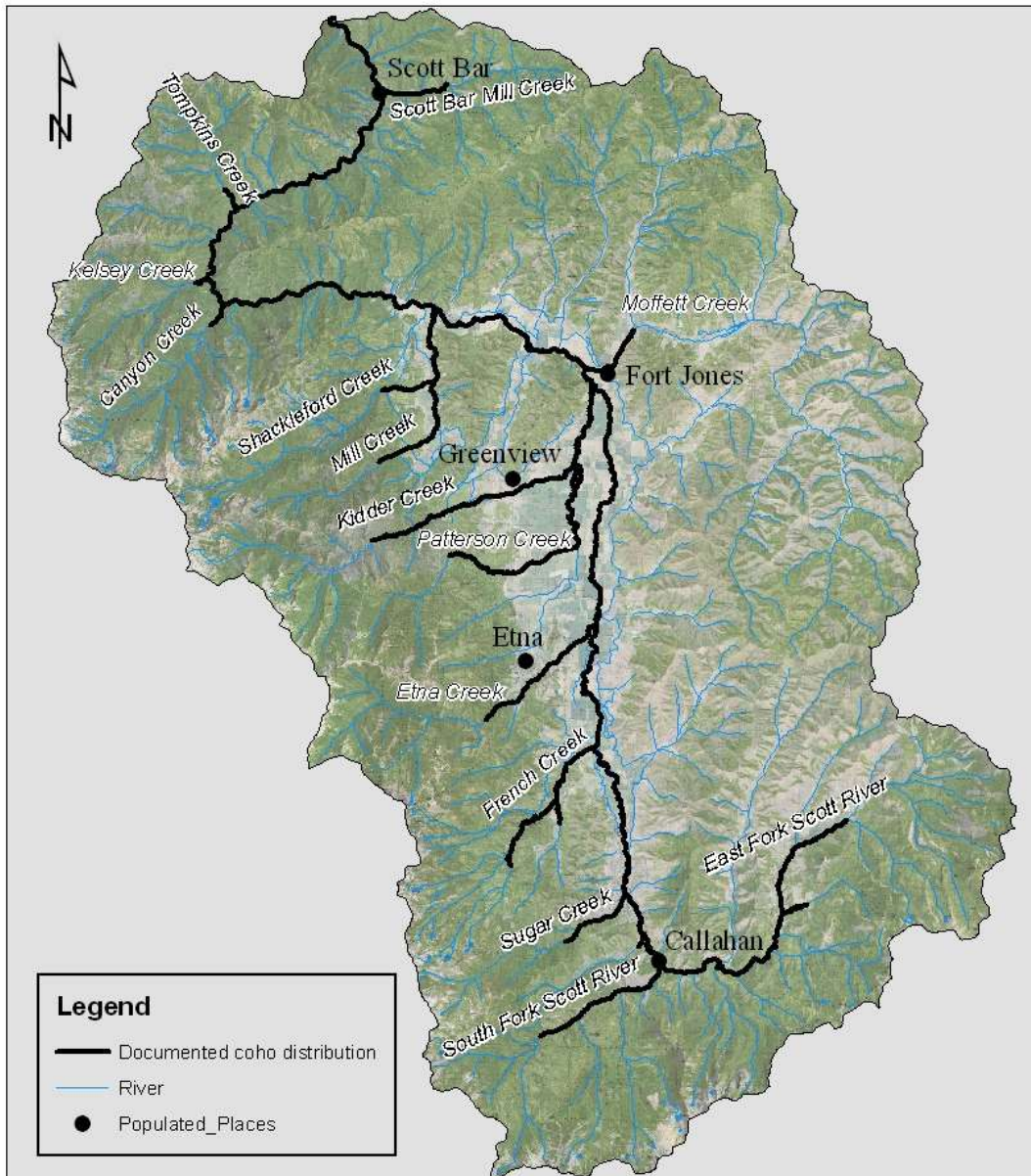


CDFW data from Scott River video weir @ RM 18;

\* incomplete data



# Scott River Watershed documented coho distribution



Cartography by Erich Yokel  
Siskiyou RCD - April 22, 2010

Scott River mainstem primarily migratory 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.

**EMERGENCY**

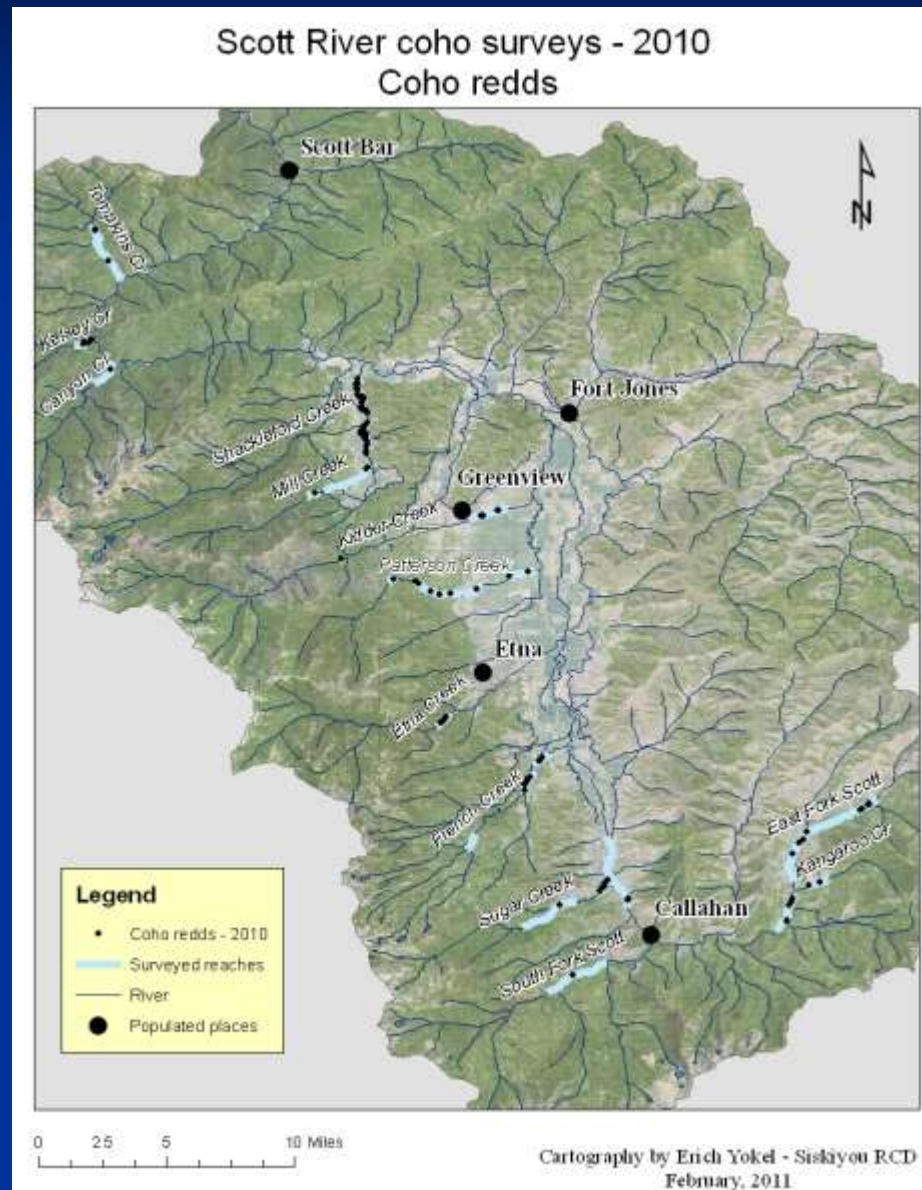


Coho male spawner, Dec. 2001, East Fork Scott





# 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 19<sup>th</sup>





# Moving 116,000 coho to new homes



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

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





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



20 cfs added through upper Scott  
River Tailings Reach – RM 52-55  
Lease Dates: April 30 to June 6

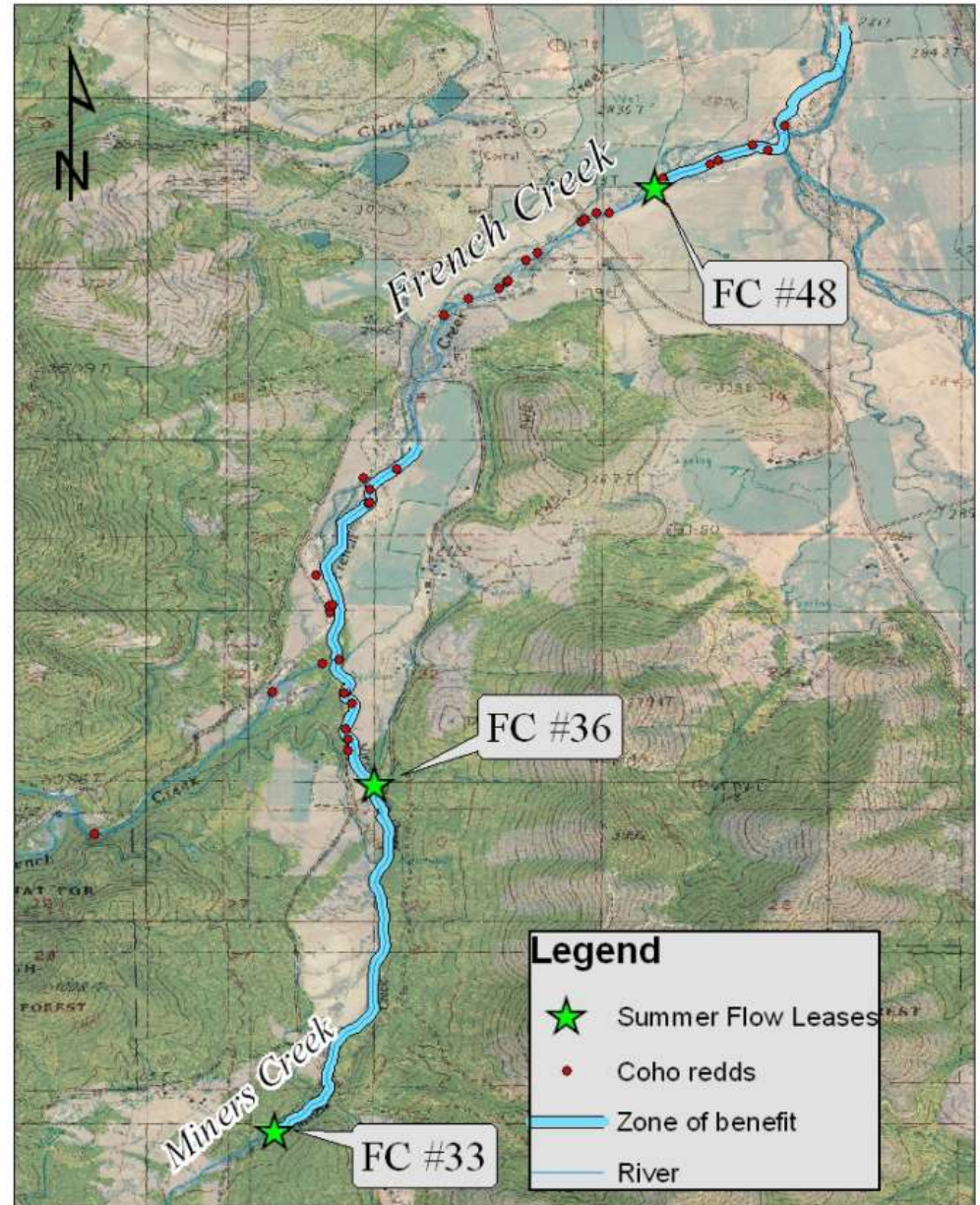


# French Creek ~ Summer Flow Leases 2008 Coho redds 2007-08 & zone of benefit

## SUMMER LEASES:

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

2007 same brood year  
as 2013



Cartography by E. Yokel  
Siskiyou RCD - May 2009

# Fall Flow Needs & Sites

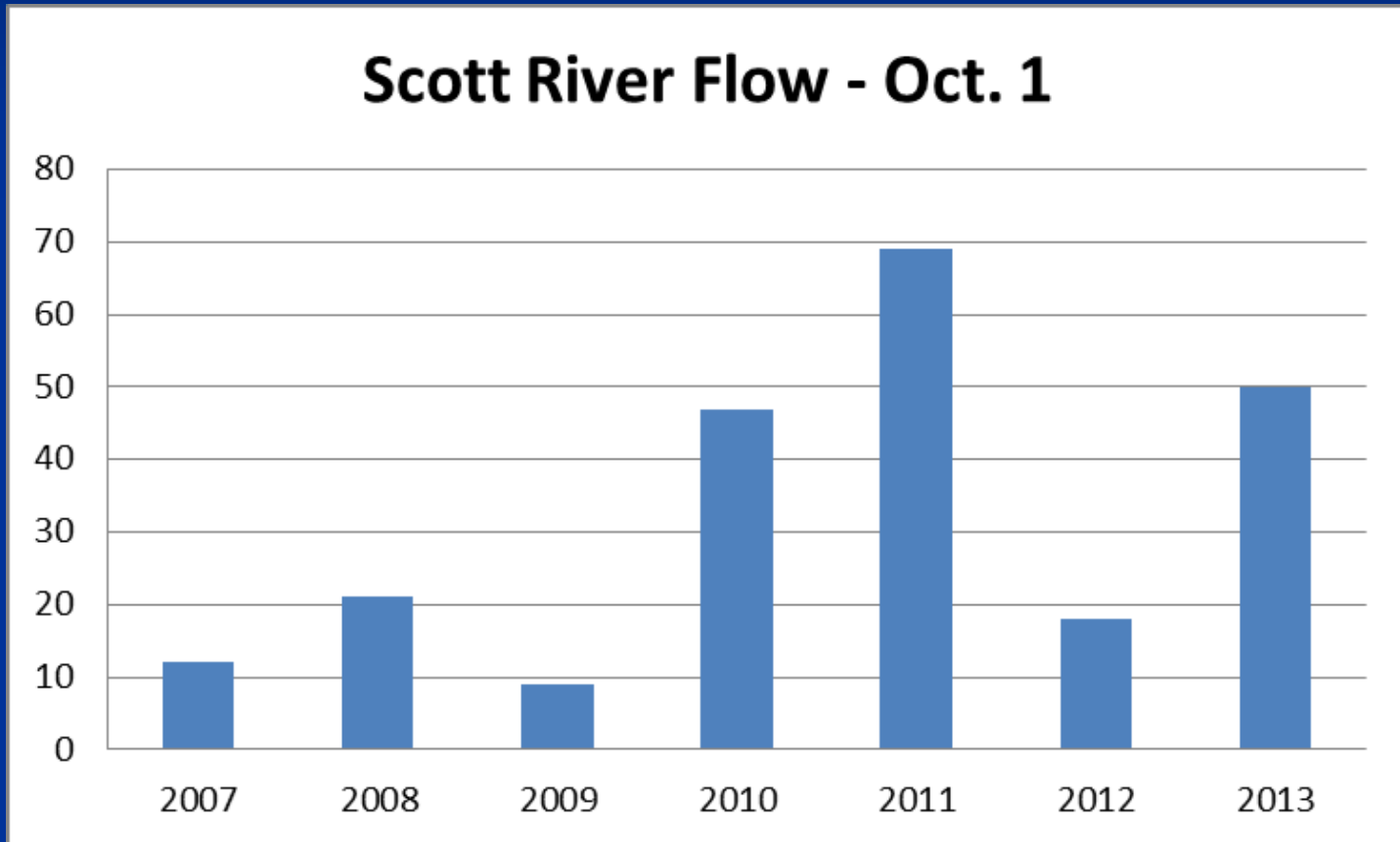
## Adult Chinook & Coho Salmon : Migration & spawning

- Where: Scott River, Shackelford 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.

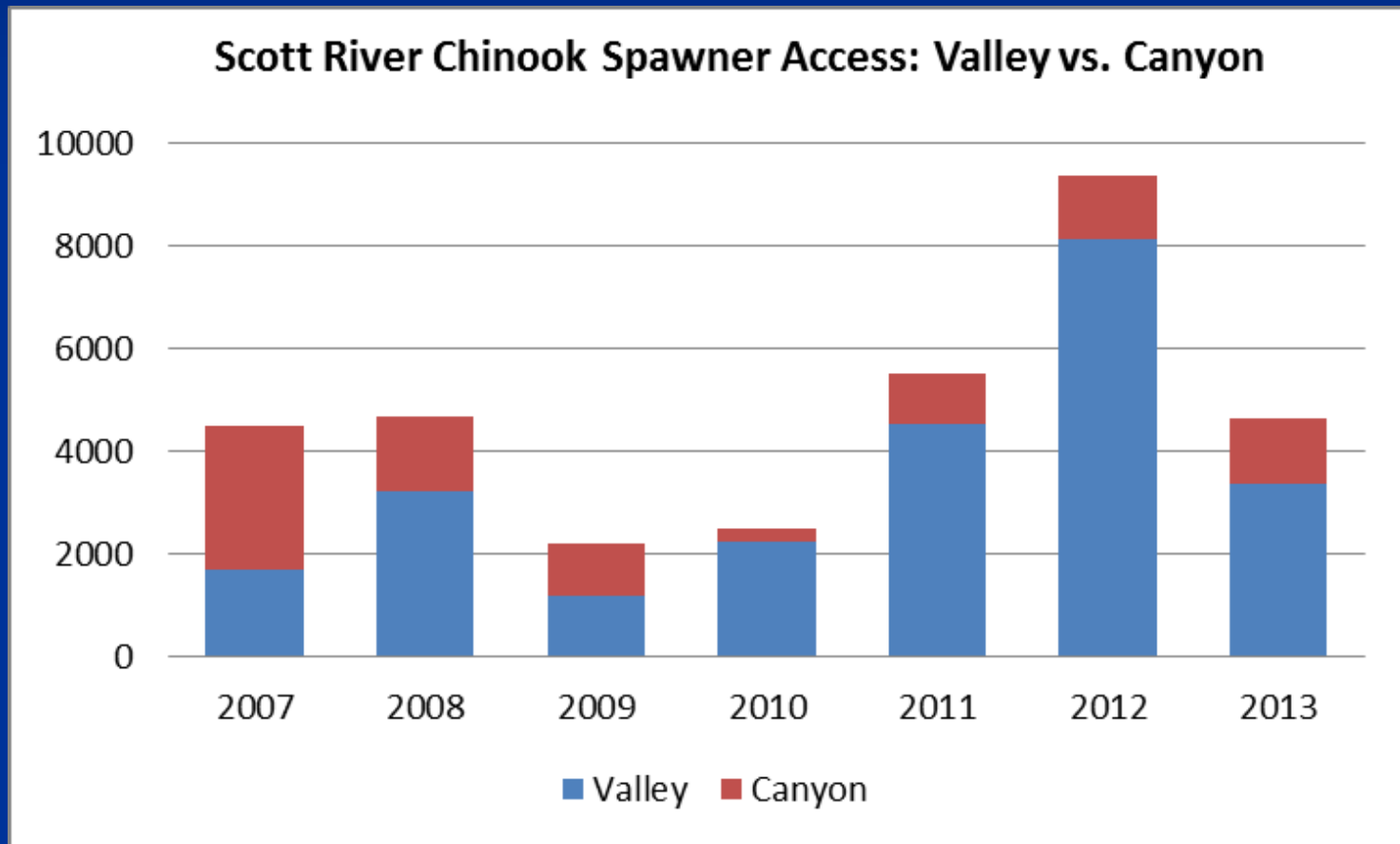




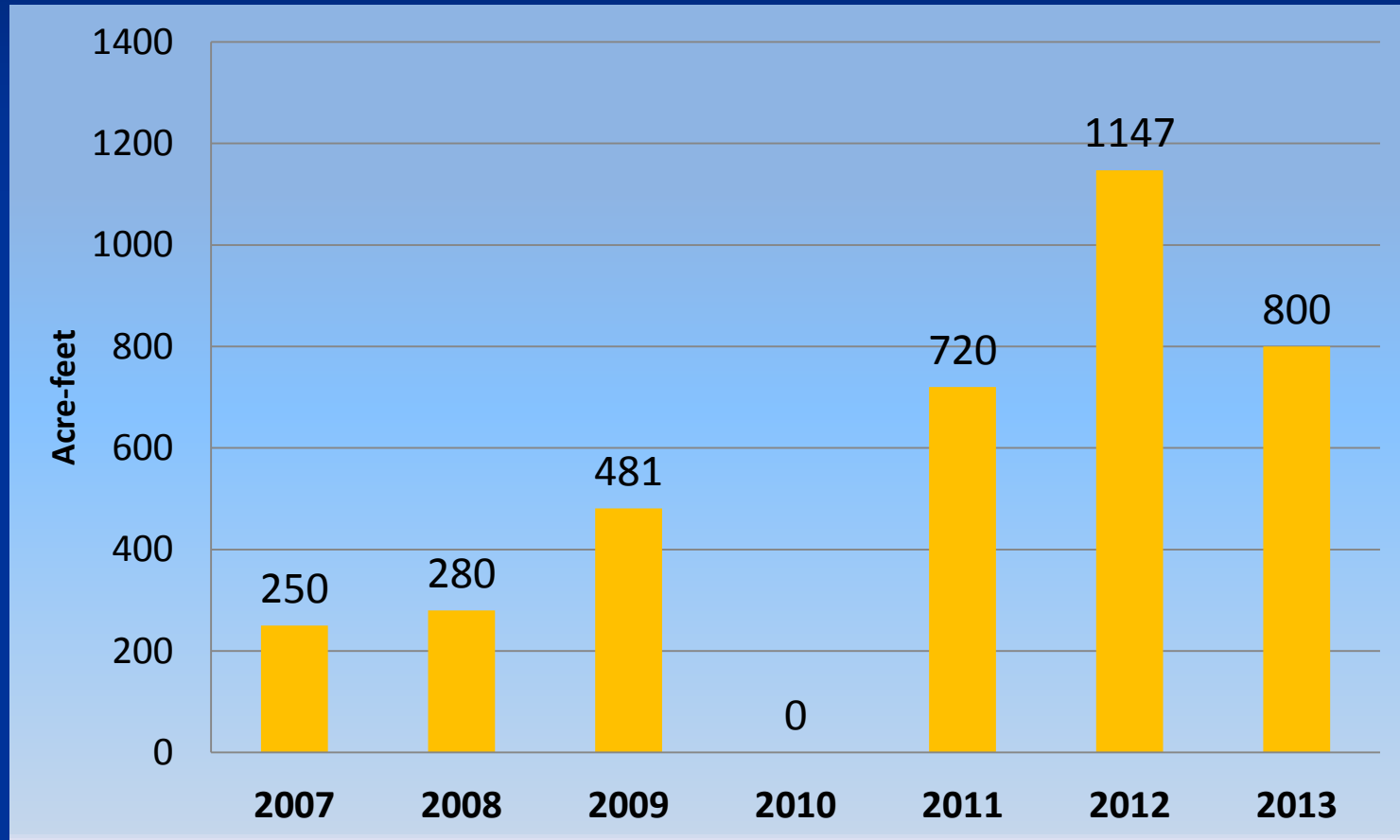
# Recent Fall Flows on Oct. 1st : Barrier, or not, to spawners?



# 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

**Only 800 acre-feet made  
connection in 2009**



RM 35

# 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](http://www.scottwatertrust.org)

Contact:

Preston Harris, Exec. Director  
(530) 643-2395

[preston@scottwatertrust.org](mailto:preston@scottwatertrust.org)



# Scott Valley Groundwater Study

North Coast RWQCB Meeting – October 9<sup>th</sup> 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



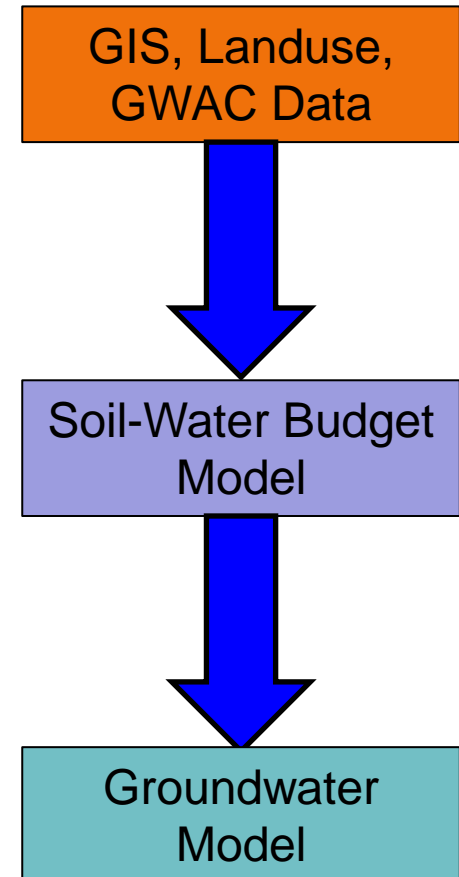


# SCOTT VALLEY INTEGRATED HYDROLOGIC MODEL (SVIHM)

- 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.







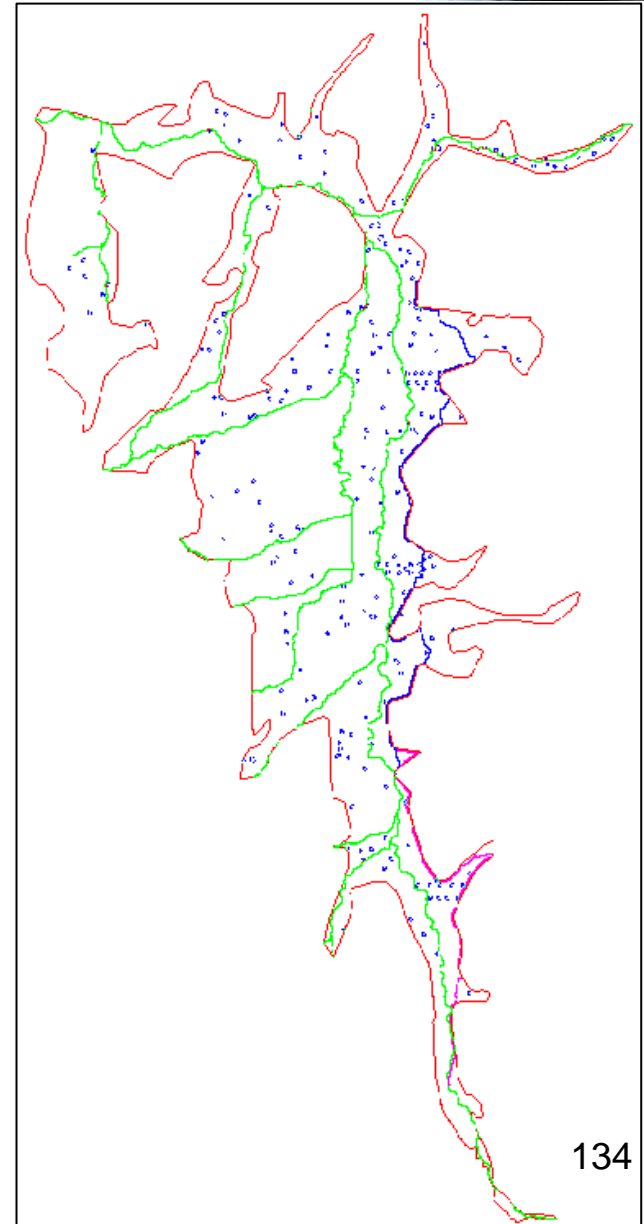
# **SVIHM**

## **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

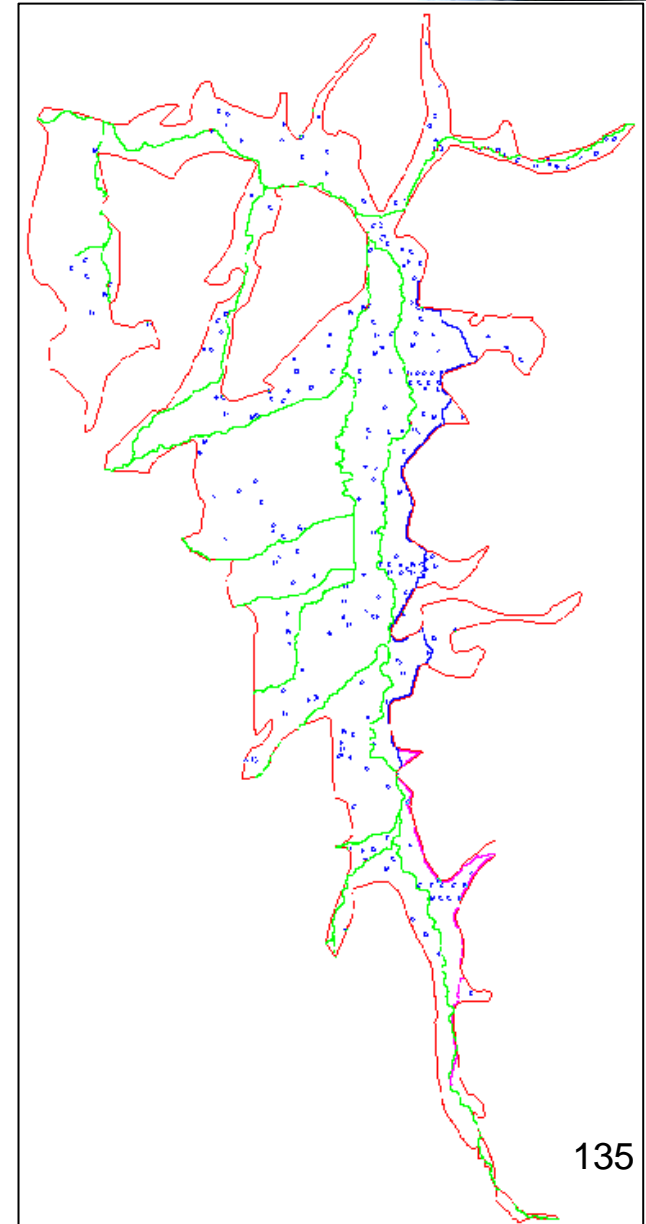
# SVIHM GROUNDWATER MODEL

- 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.)

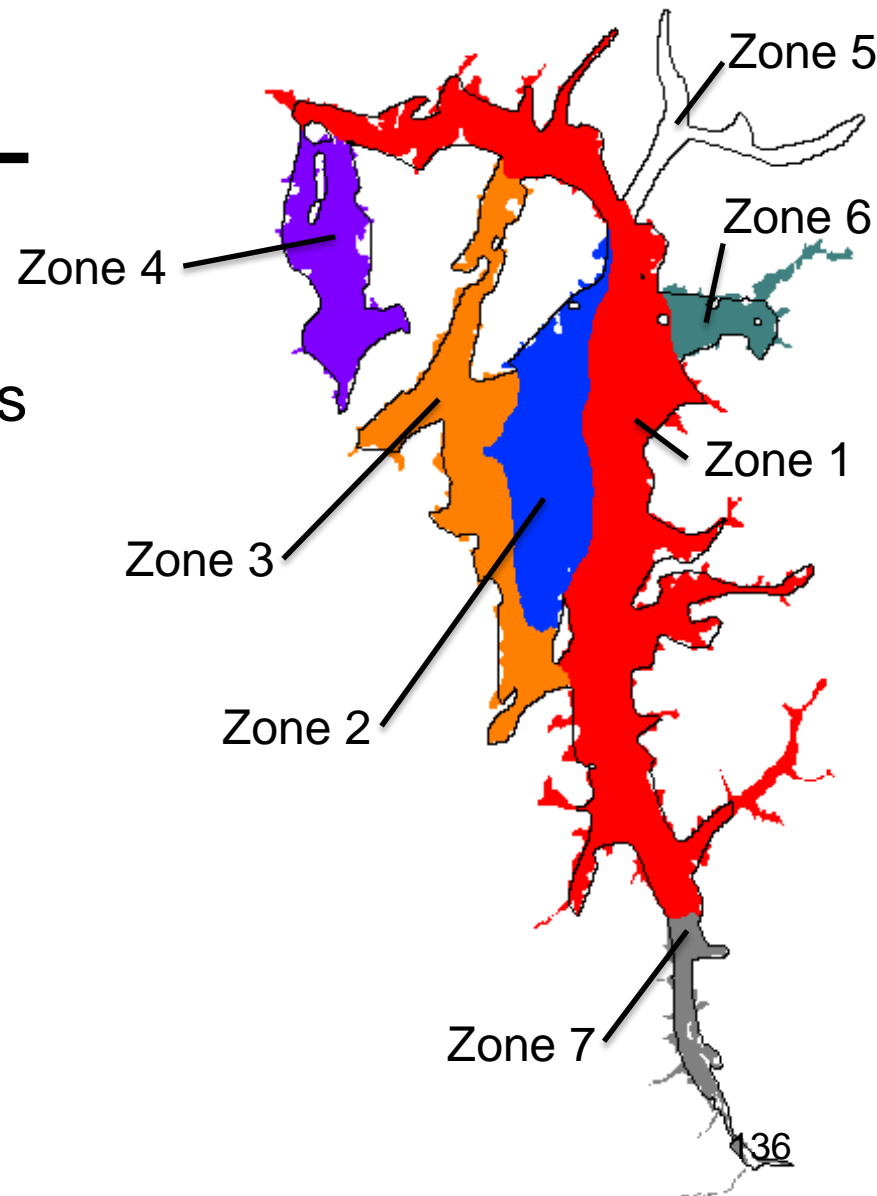




# SVIHM GROUNDWATER MODEL

- 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



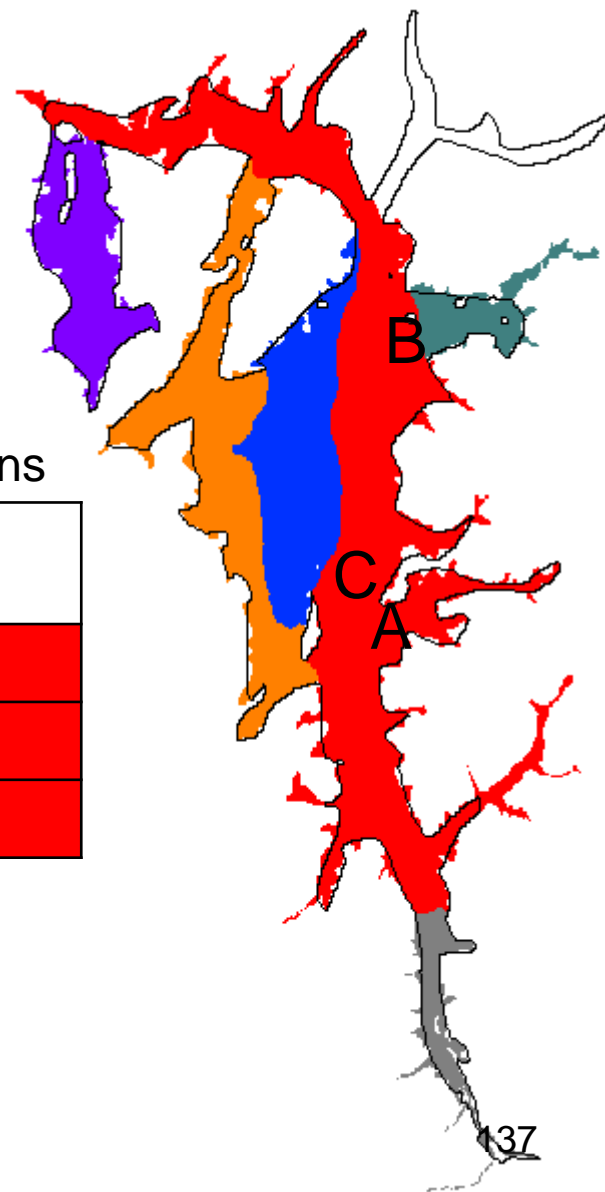
# SVIHM GROUNDWATER MODEL

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

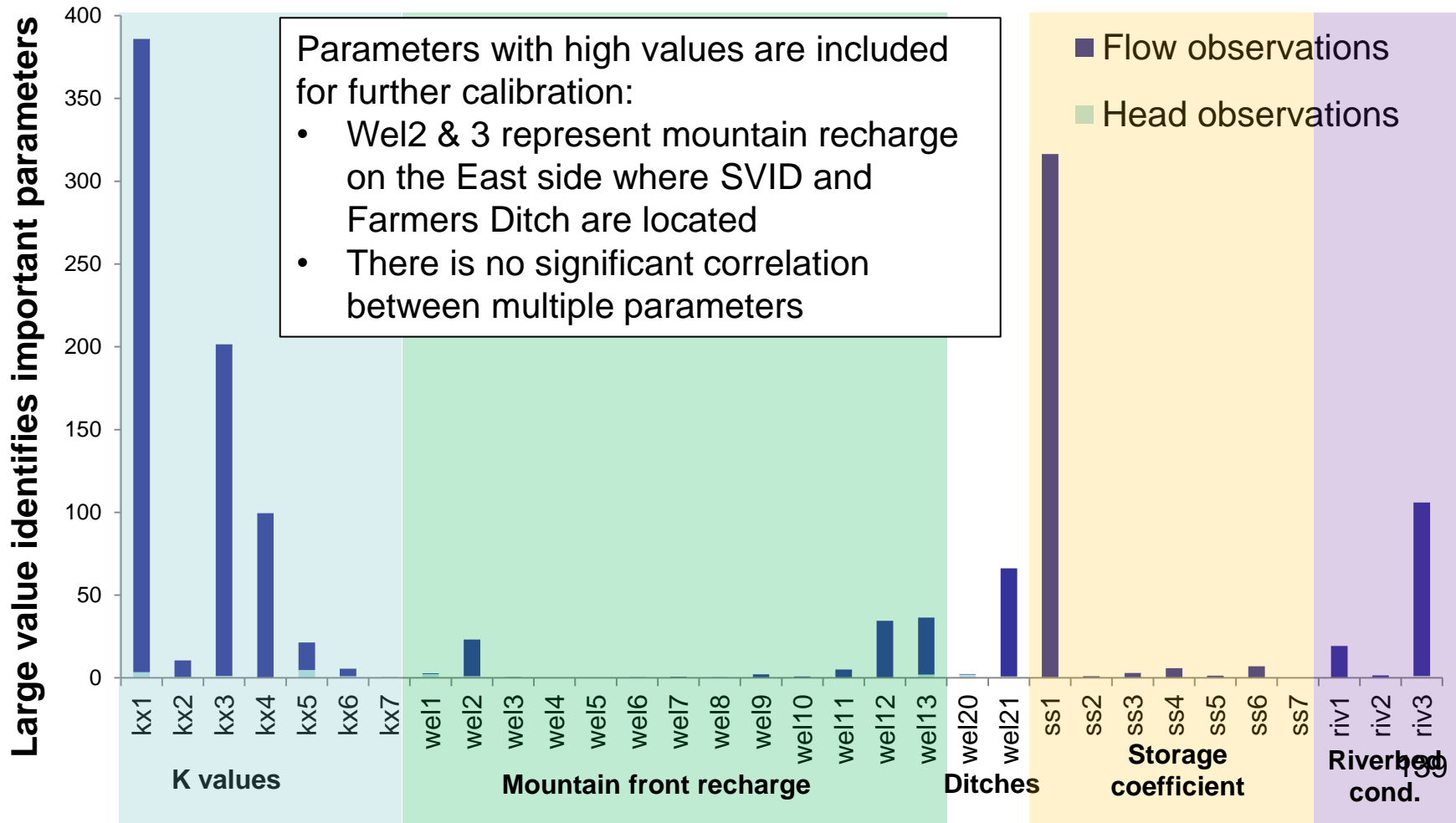
## SENSITIVITY ANALYSIS

- 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





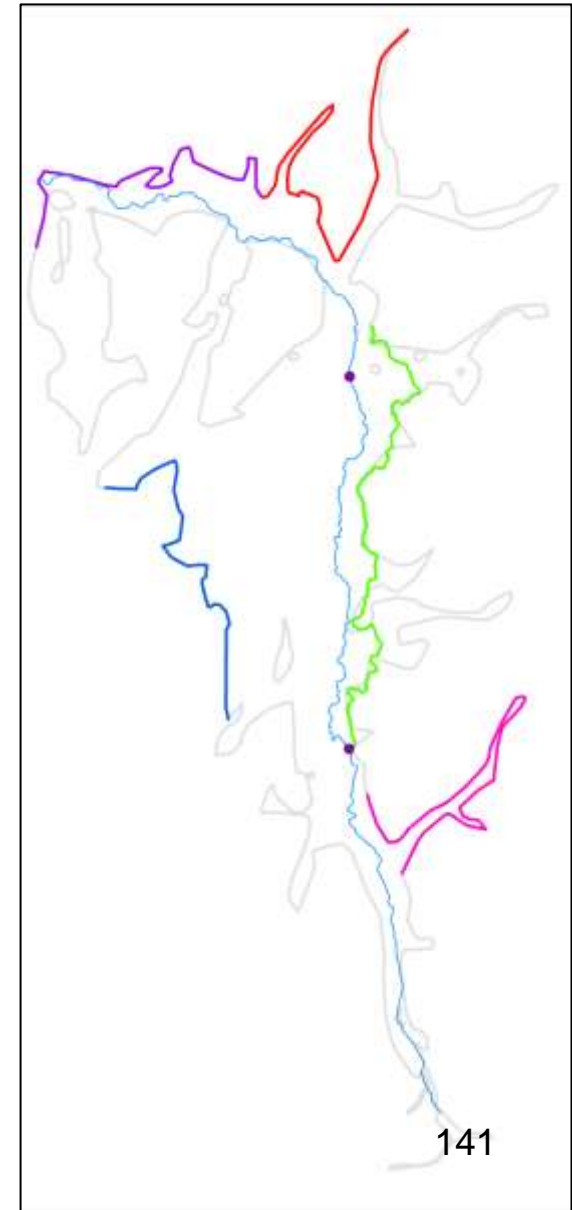
# SVIHM

## 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

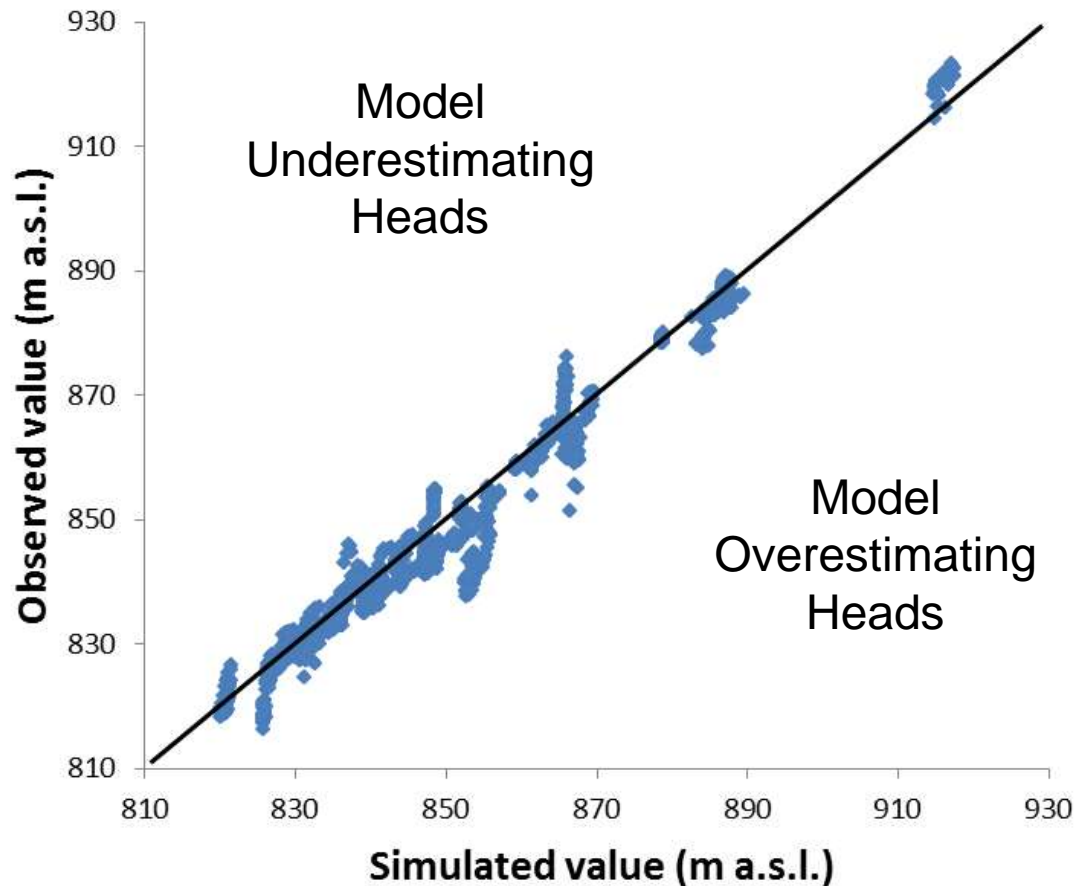
# SVIHM MODEL CALIBRATION

	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 Conductivities	riv0	38750 (ft <sup>2</sup> /day)	
	riv1		57 (ft <sup>2</sup> /day)
	riv2		605 (ft <sup>2</sup> /day)
	riv3		449931 (ft <sup>2</sup> /day)





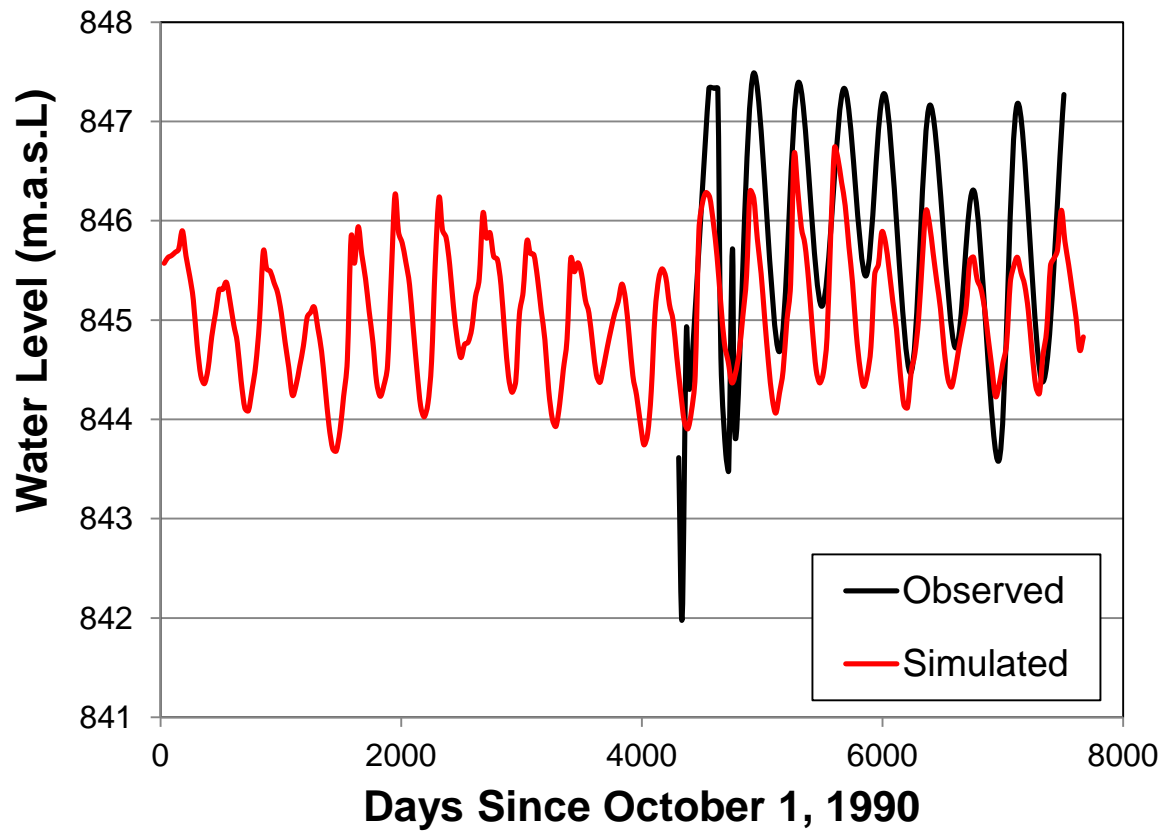
# SVIHM MODEL CALIBRATION



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

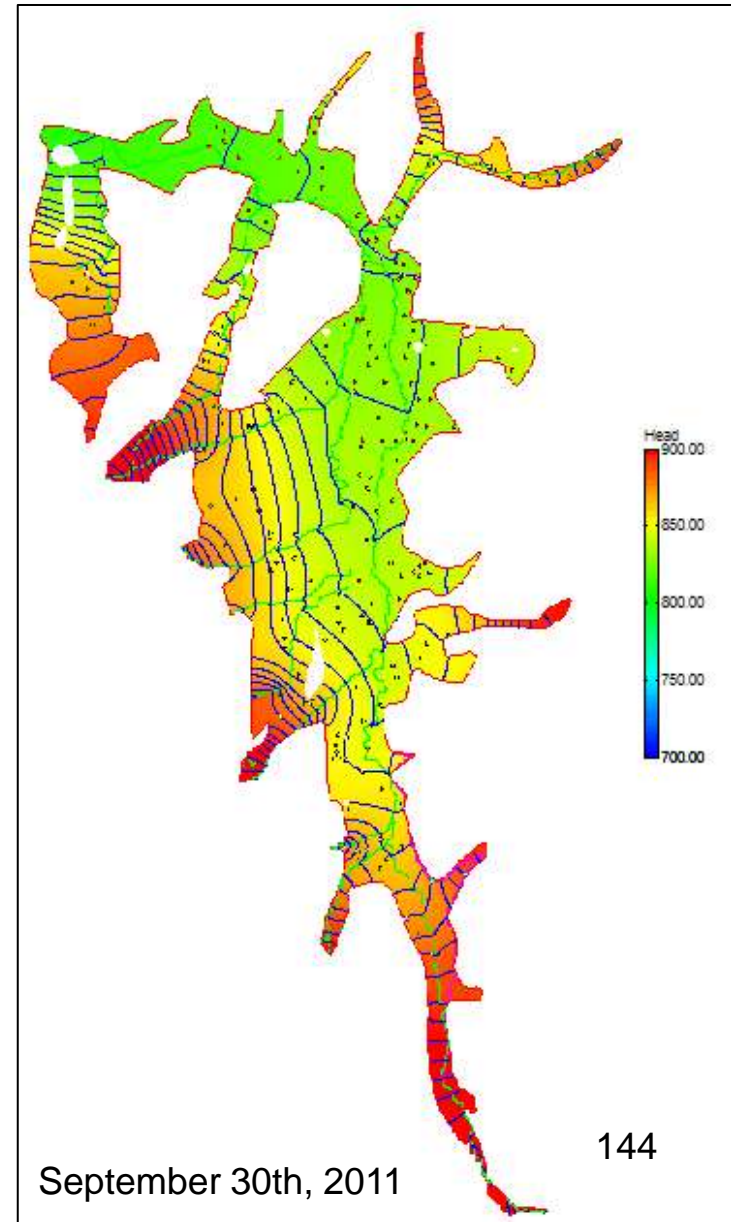
# SVIHM MODEL CALIBRATION

DWR 2



# 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







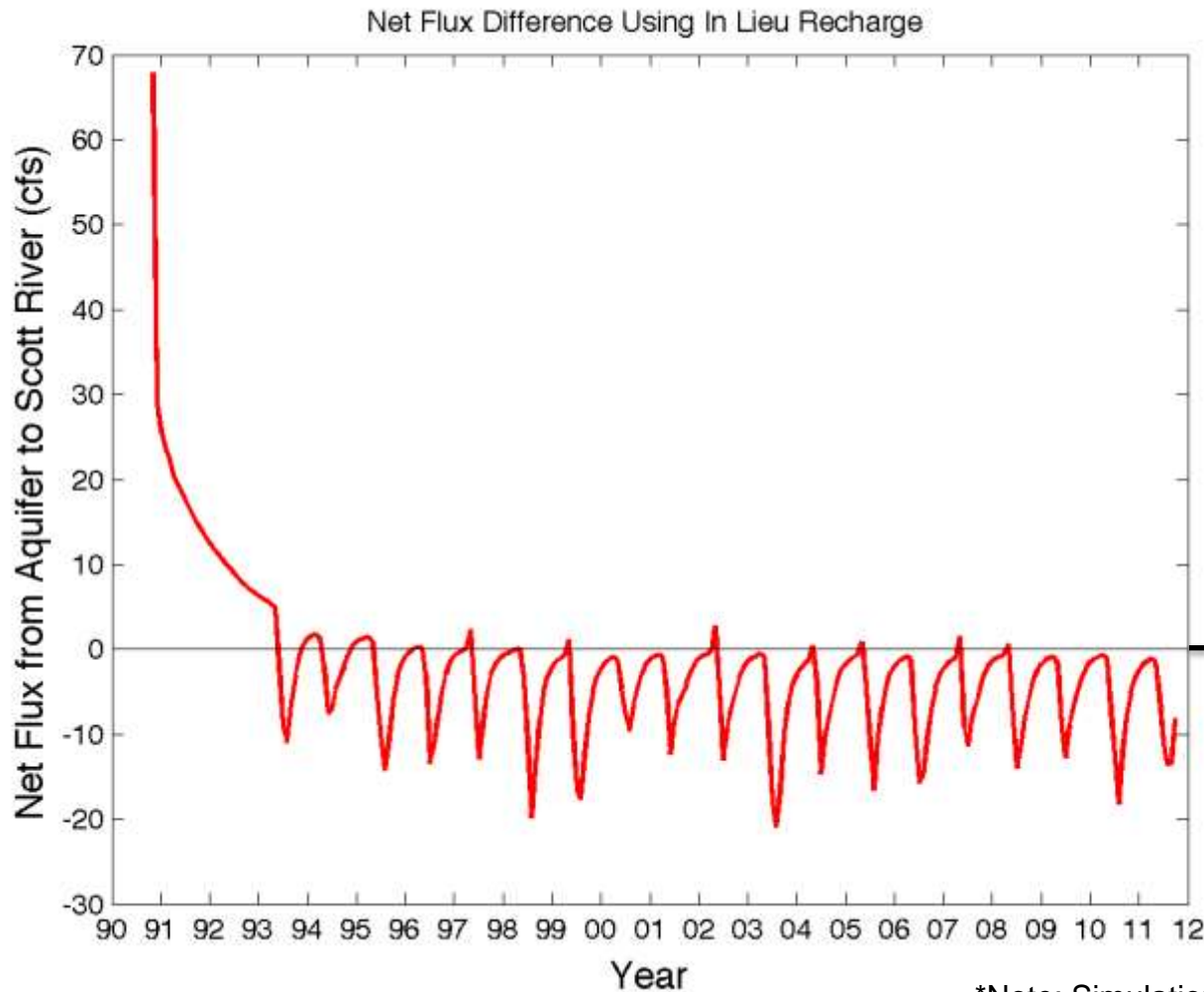
# SVIHM

## 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



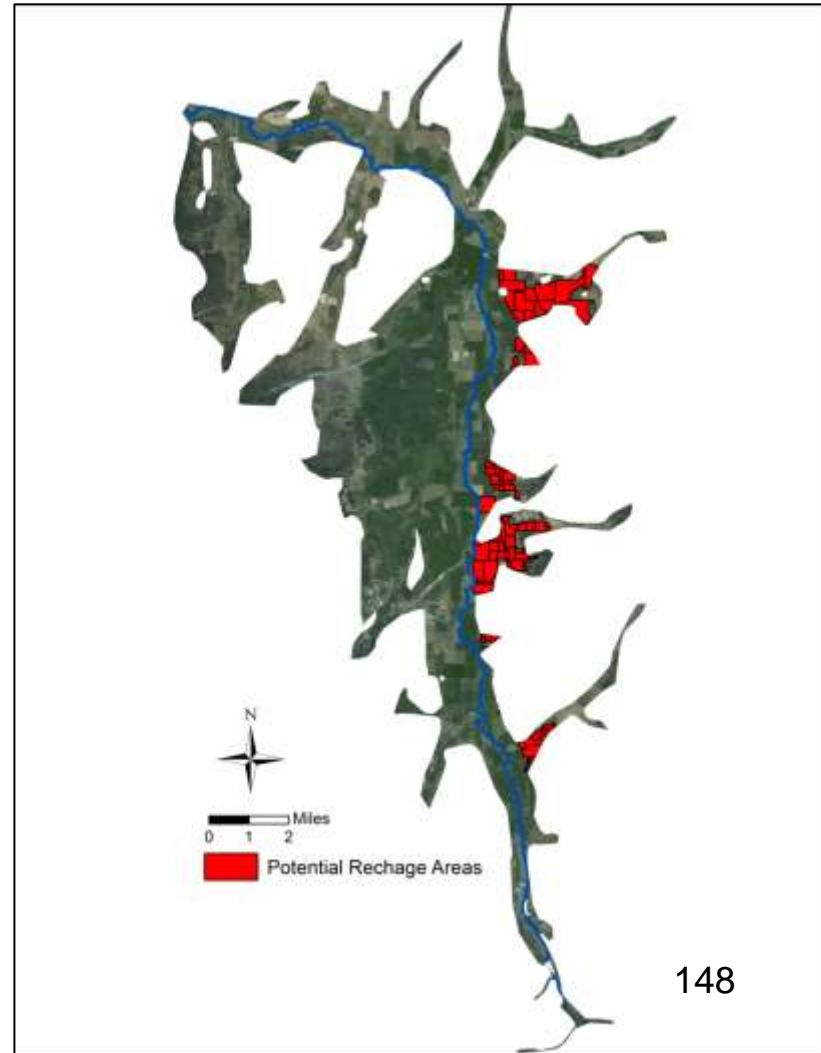
Decreased Streamflow



Increased Streamflow

# 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





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# **Scott Valley Groundwater Advisory Committee**

**Tom Menne  
President**

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## **NCRWQCB Presentation**

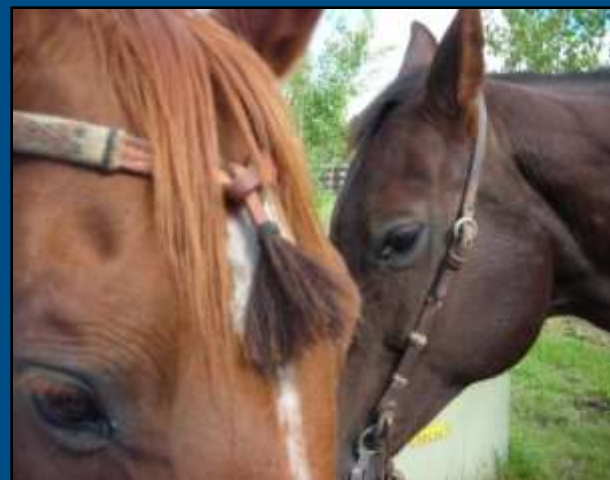
October 9, 2014

Jared Bottcher and Nell Kolden



# Klamath Basin Rangeland Trust: MISSION

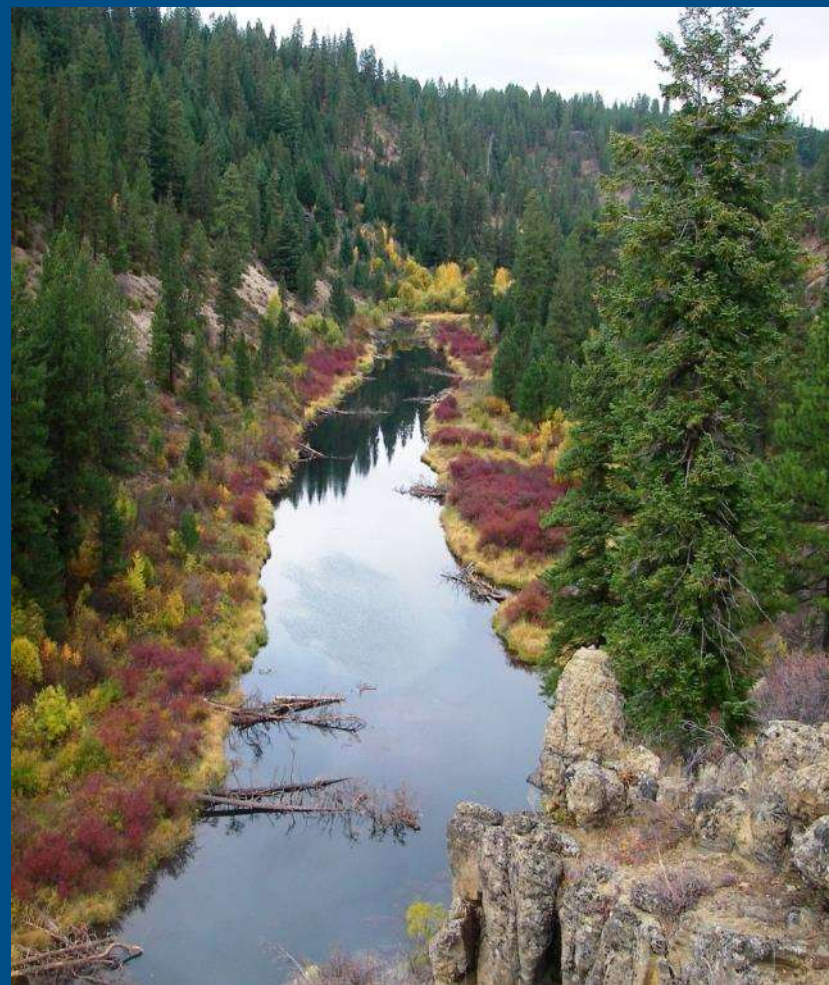
- To restore and conserve the quality and quantity of water flowing in the Upper Klamath Basin
- To enhance the natural ecosystem, restore ecosystem processes, and supply needed water for downstream agriculture, ranching, and native fish and wildlife populations.





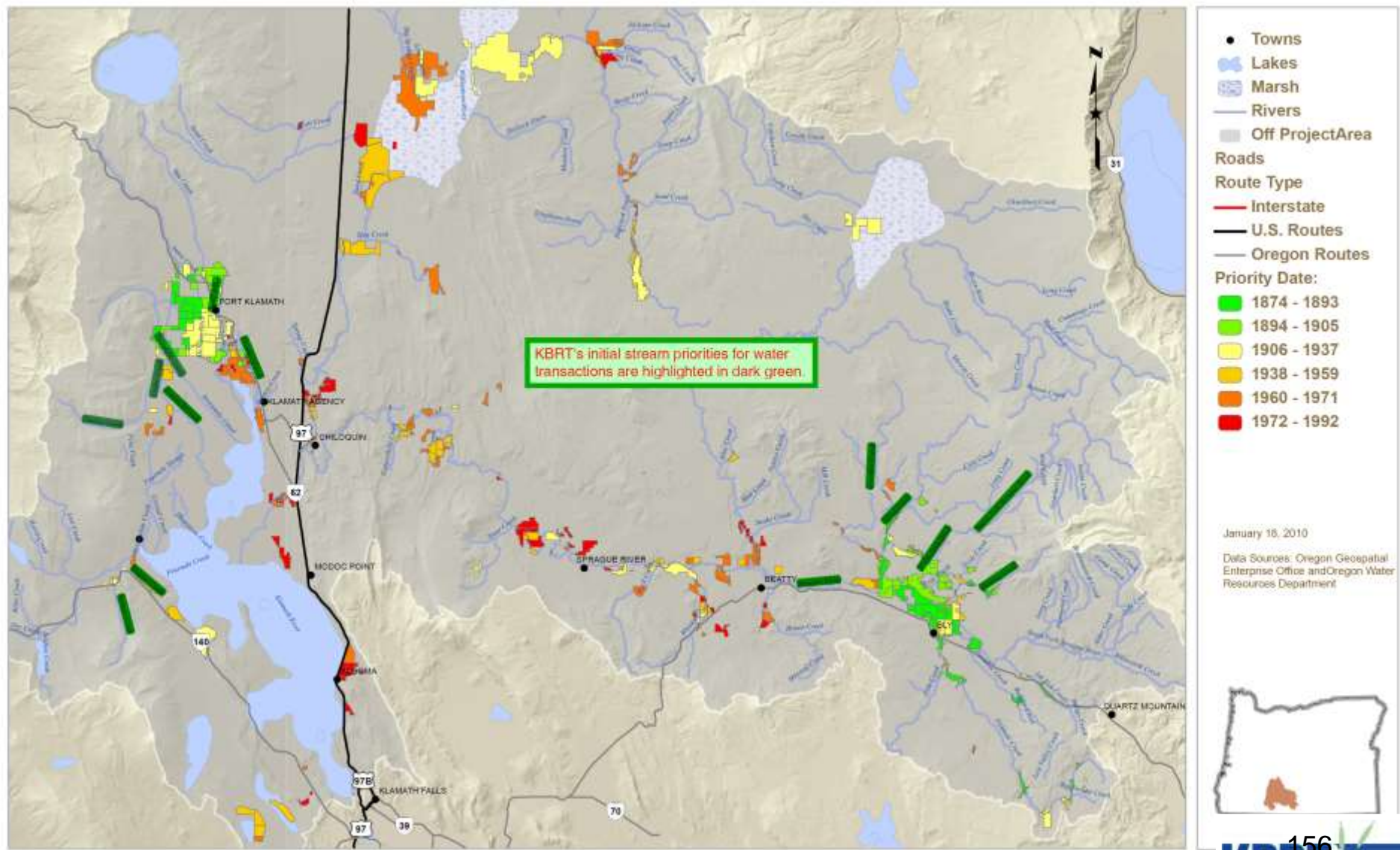
# Klamath Basin Rangeland Trust: ACTIVITIES

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



# Instream Flow Restoration & Protection

## WTP Initial Stream Reach Priorities

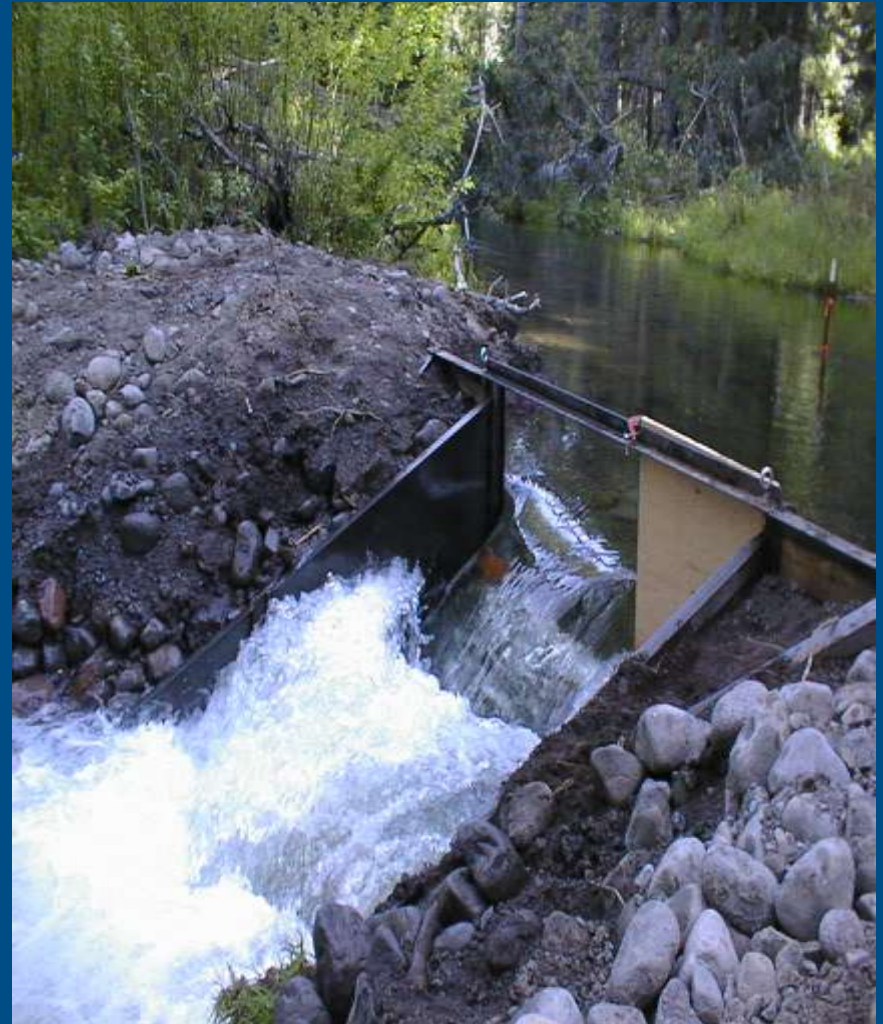




# Instream Flow Restoration & Protection



Before Leasing



After Leasing



# 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

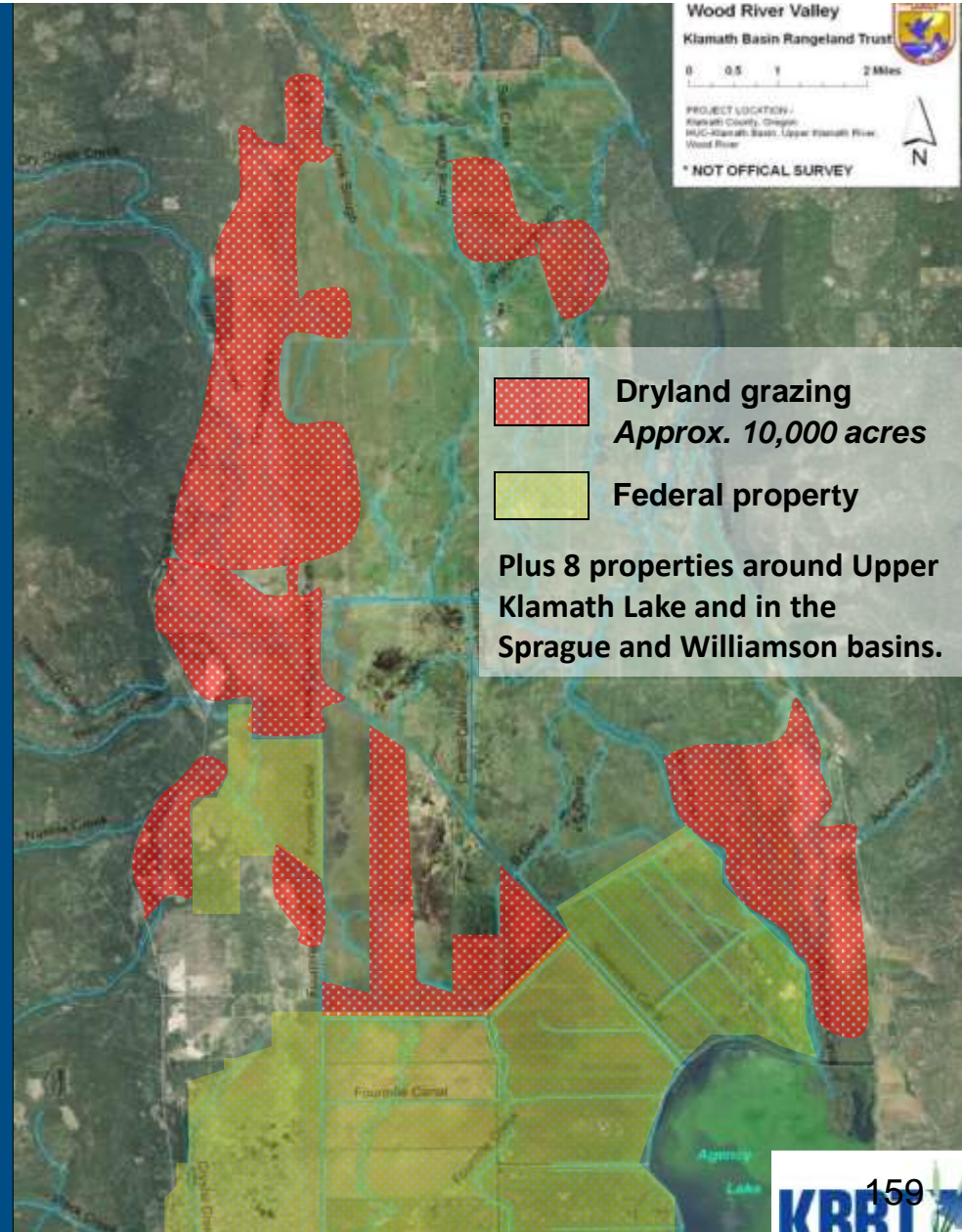


# Instream Flow Restoration & Protection

## 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.





# Ecological Restoration

## Diffuse Source Treatment Wetland Program





## 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

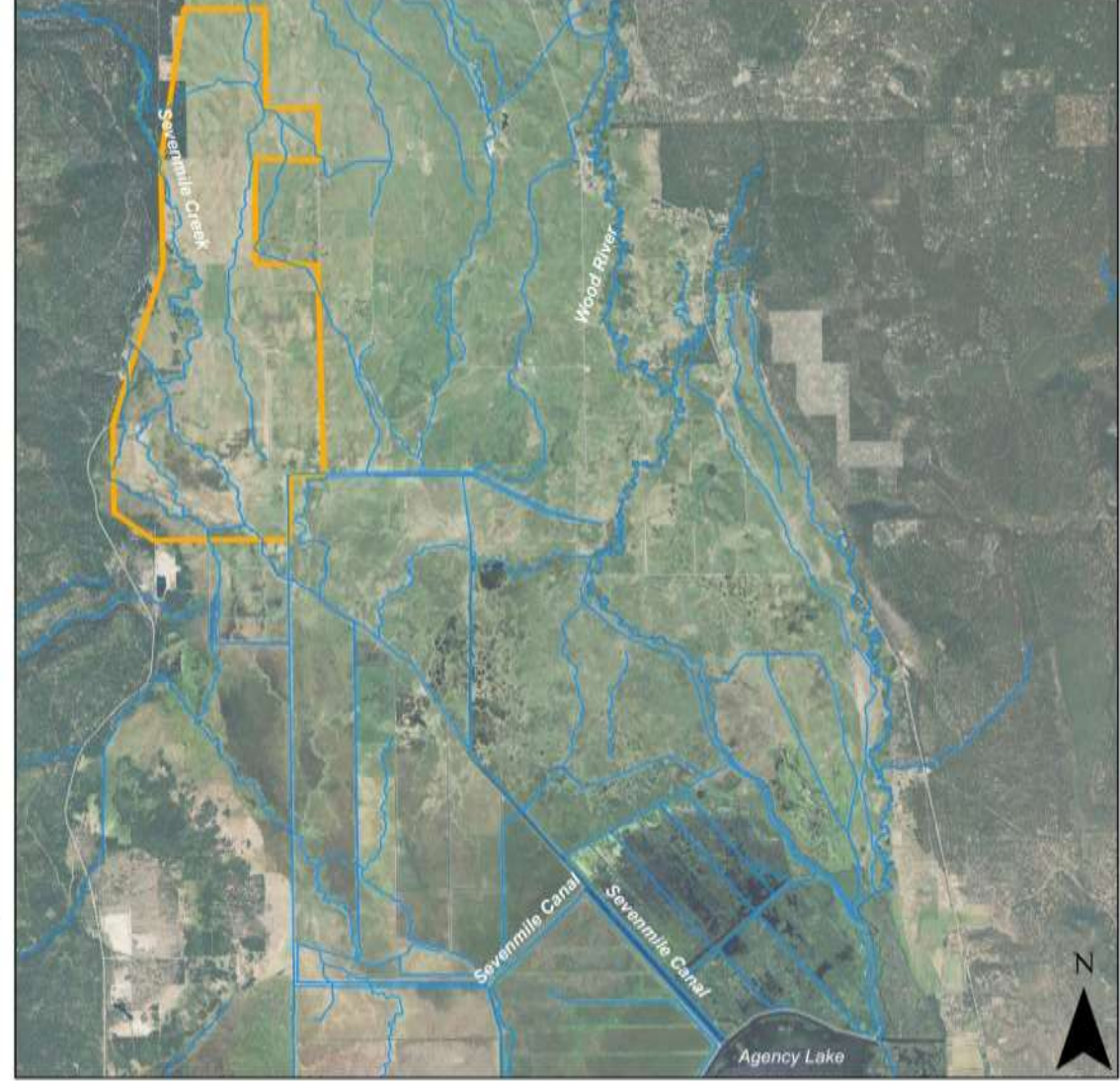
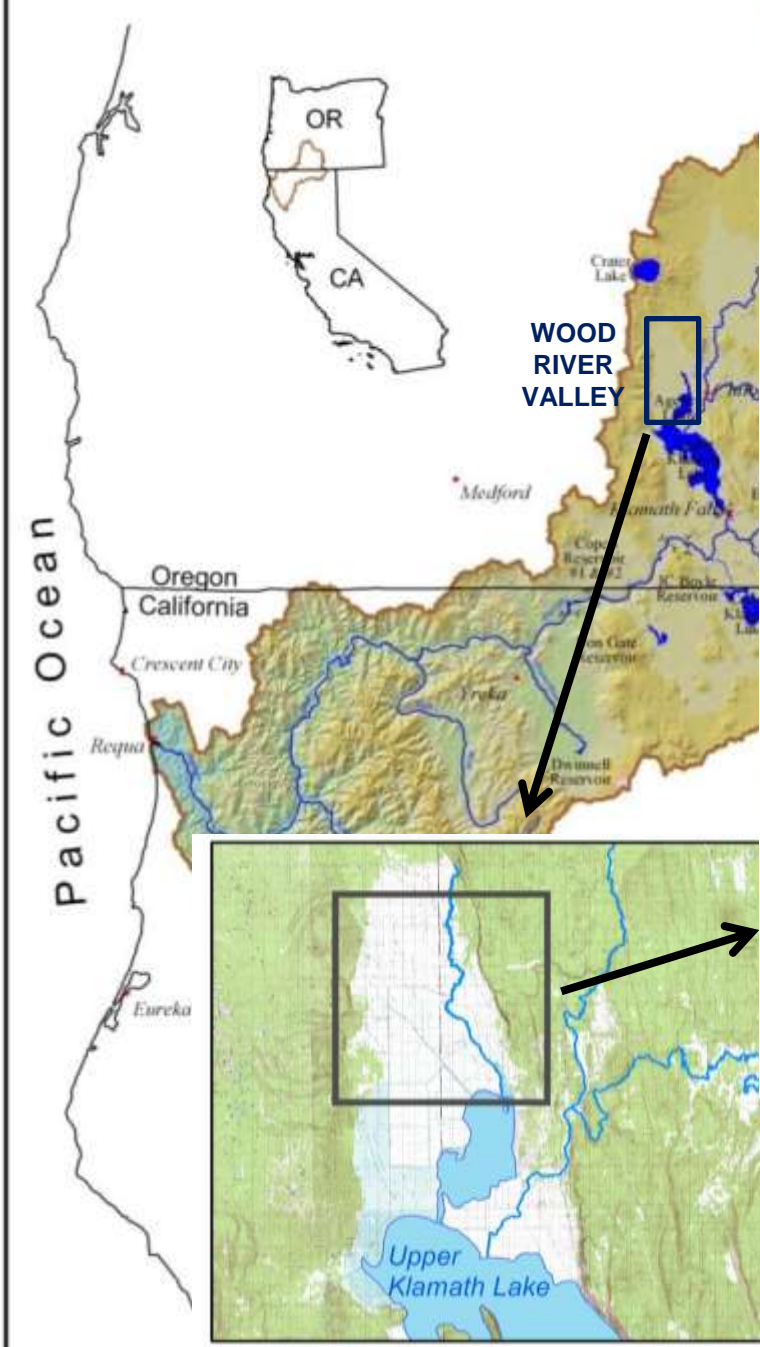
## Restoration Tool: DSTWs

- 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





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# Ecological Restoration

## 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

# Ecological Restoration

## 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!

Stillwater Sciences





# Reclamation Water Quality Activities Upper Klamath Basin



**Presenter: Rick Carlson**  
**KBAO Physical Scientist**

**RECLAMATION** 170

# 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)





# 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, NH<sub>3</sub>, NO<sub>3</sub>, TP, OP)
  - Corresponding Flow Measurements
  - Field Parameters
  - BOD<sub>5</sub>, CBOD<sub>5</sub>, 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

SCALE 1" = 6000'

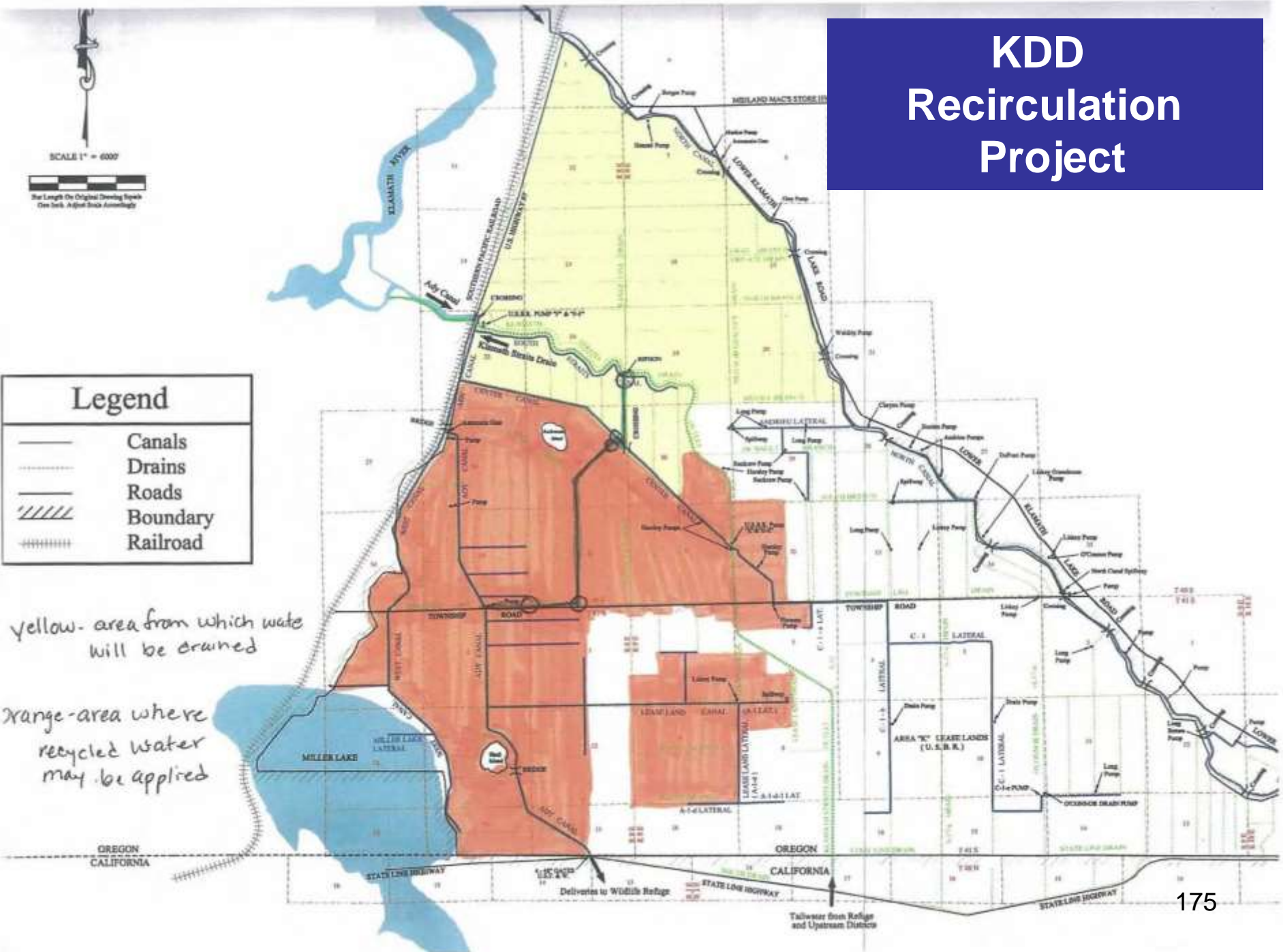
The Length On Original Drawing Equals  
One Inch. Adjust Back Accordingly

## Legend

	Canals
	Drains
	Roads
	Boundary
	Railroad

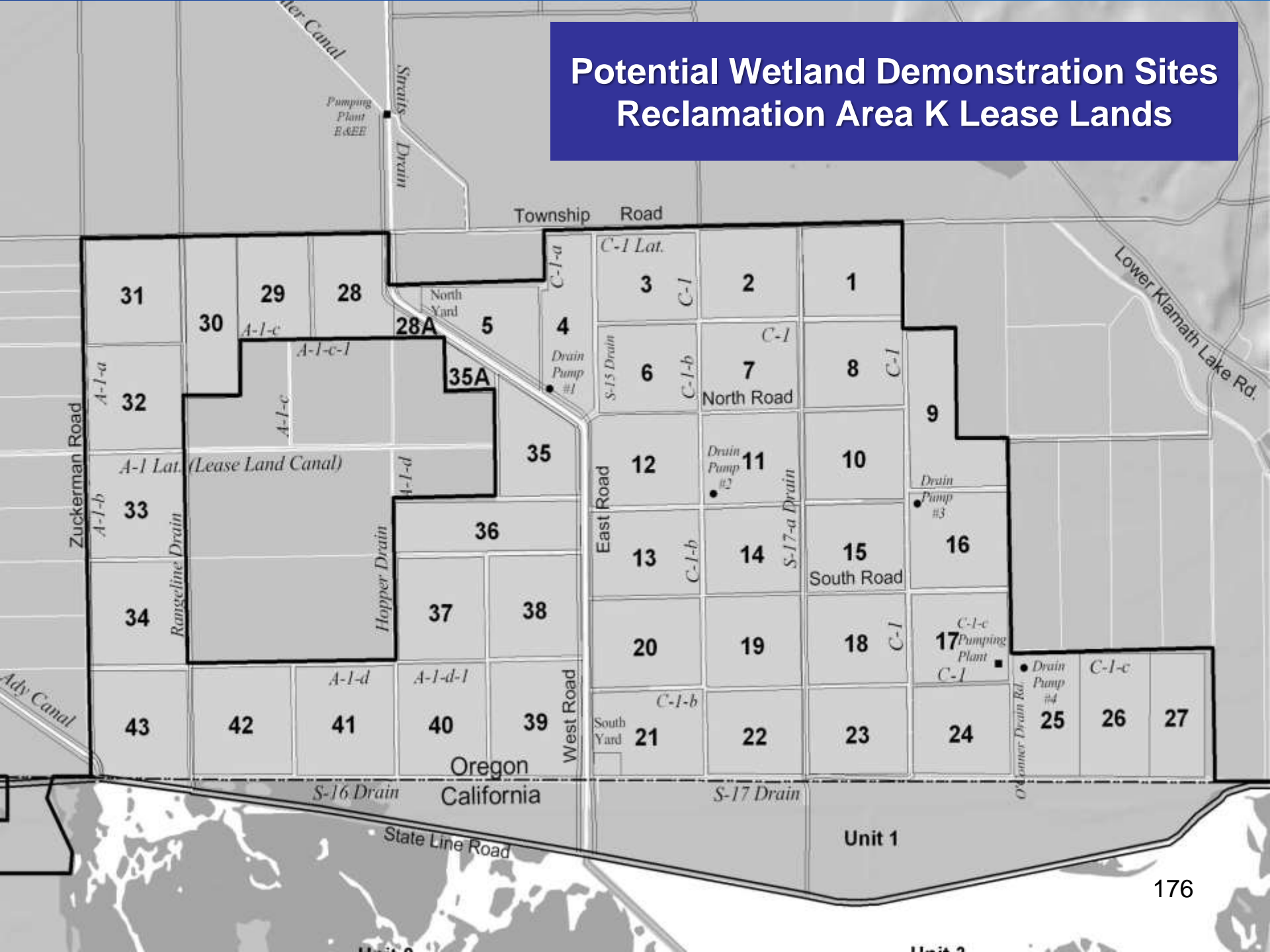
*yellow- area from which water  
will be drained*

*orange-area where  
recycled water  
may be applied*





# 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





No, two years and \$500,000 is out. How about thirty years and \$500,000,000 ---- is that good for you?



Legacy  
Conditions  
Create Need  
for  
Long-Term  
Ecosystem  
Rehabilitation  
Funding