Welcome to the Conservation Lecture Series

https://www.wildlife.ca.gov/Conservation/Lectures

Questions? Contact Margaret.Mantor@wildlife.ca.gov
CDFW Conservation Lecture Series

The Conservation Lecture Series is organized by CDFW’s Habitat Conservation Planning Branch. The lecture series is designed to deliver that most current scientific information about species that are of conservation concern.

Below is a list of lectures and speakers for the Conservation Lecture Series. Lectures are open to anyone who is interested in participating. Participants may attend in-person or remotely via WebEx. Please be sure to register for each class. Lectures are recorded and posted for those unable to attend the day of the event. Visit the archive page to see recordings of past lectures.

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Upcoming Lectures

*Invasive Watersnakes – March 12, 2015, 1:00-3:00 pm. Presented by Dr. Brian Todd*

Non-native watersnakes are among the newest threats to California’s native freshwater biodiversity. Dr. Brian Todd, an Associate Professor at UC Davis, will describe his work with these species over the past several years. Dr. Todd will present an overview of the ecology and invasion history of watersnakes in California and will describe the potential risk these non-native species pose to many of California's amphibian and fish species of conservation concern. He will discuss his ongoing research and efforts to facilitate management and eradication of these non-native species.
<table>
<thead>
<tr>
<th>Lecture Title</th>
<th>Date and Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badgers in California</td>
<td>August 6, 1:00-3:00, Sacramento</td>
<td></td>
</tr>
<tr>
<td>Dr. Jessie Quinn</td>
<td></td>
<td></td>
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<tr>
<td>Metrics and Approaches for Quantifying Ecosystem Impacts and Restoration Success</td>
<td>September 24, 1:00-3:00, Sacramento</td>
<td></td>
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<tr>
<td>Dr. Zan Rubin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Joaquin Kit Fox</td>
<td>October 6, 1:00-3:00, Fresno</td>
<td></td>
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<tr>
<td>Dr. Brian Cypher</td>
<td></td>
<td></td>
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<tr>
<td>Process-based Stream Restoration to Help Farmers and Fish: Why California Needs 10,000 More Dams</td>
<td>October 13, 1:00-3:00, Sacramento</td>
<td></td>
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<tr>
<td>Dr. Michael Pollock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of Multi-Threaded Wetland Channels and the Implications for Salmonids and Ecosystem Rehabilitation</td>
<td>November 19, 1:00-3:00, Sacramento</td>
<td></td>
</tr>
<tr>
<td>Lauren Hammack</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Round-Table Discussion

• Today, 12:30
• 1700 9thStreet (corner of Q an 9th)
  – Third floor conference room
• Call-in: 1-877-336-1831, Participant #940704
PROCESSED-BASED RESTORATION DESIGN AND IMPLEMENTATION AT THE UPPER JUNCTION CITY CHANNEL REHABILITATION SITE, TRINITY RIVER, CA - EMBRACING UNCERTAINTY AND LEARNING FROM PROGRESS

California Department of Fish and Wildlife (DFW) – Conservation Lecture Series – June 15th, 2015

David (DJ) Bandrowski P.E. - Yurok Tribe
KLAMATH RIVER WATERSHED – NORTHERN CALIFORNIA
Can we actually undo the effects of what we have put on our landscape?... A call for restoration

Perseverance
The courage to ignore the obvious wisdom of turning back.
DISCUSSION TOPICS:

• OVERVIEW OF THE TRINITY
• DESIGN PROCESS
• IMPLEMENTATION SEQUENCE
• ASBUILT DATA COLLECTION
• DESIGN VALIDATION MONITORING
### Post Dam Species Population Declines

<table>
<thead>
<tr>
<th>Species</th>
<th>Decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinook</td>
<td>67%</td>
</tr>
<tr>
<td>Coho</td>
<td>96%</td>
</tr>
<tr>
<td>Steelhead</td>
<td>53%</td>
</tr>
</tbody>
</table>
THE MINING AND GOLD LEGACY
HISTORICAL CONTEXT OF THE TRINITY
PRE AND POST CONSTRUCTION (2011 AND 2012)
LOW FLOW (300 CFS)
UPPER JUNCTION CITY PROJECT – POST CONSTRUCTION (~4500cfs)
Final Design Report
Upper Junction City (UJC) Channel Rehabilitation Project Site – Phase II

Federal Design Group

Upper Junction City Rehabilitation Project
Prepared by:

Federal Design Group:
- US Fish and Wildlife Service (USFWS)
- US Forest Service (USFS)
- Bureau of Reclamation (BOR)

Design Group Members:
- Charlie Chamberlin, Fisheries Biologist (USFWS)
- David Gaeuman, PhD, Geomorphologist (BOR)
- David (DJ) Bandrowski, PE, Civil Engineer (BOR)
- Eric Wiseman, Fisheries Biologist (USFS)

Date of Report: June 2012

Upper Junction City Design Report 2012

Federal Design Group:
- Bureau of Reclamation
- US Fish and Wildlife
- US Forest Service

Designers:
- DJ Bandrowski
- Charlie Chamberlin
- Dave Gaeuman
- Eric Wiseman

Disciplines:
- Civil / Hyd. Engineer
- Fisheries Biologists
- Geomorphologist
<table>
<thead>
<tr>
<th>No.</th>
<th>Design Goal</th>
<th>Design Objective</th>
<th>Measurement (metric)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Increase fry and juvenile salmonid rearing habitat</td>
<td>Increase area of shallow/slow habitat with cover in project reach</td>
<td>% change in habitat area-days. Each square meter of habitat gets credit for 1 habitat area-day for each day from January 1 through April 30 (critical rearing period).</td>
</tr>
<tr>
<td>2.</td>
<td>Increase or maintain adult salmonid holding habitat</td>
<td>Increase area of deep water in project reach</td>
<td>% change in pool area of 8 feet or greater in depth.</td>
</tr>
<tr>
<td>3.</td>
<td>Increase adult salmonid spawning habitat</td>
<td>Increase available riffle spawning habitat in project reach</td>
<td>% change in transition riffles or thalweg crossovers (features where spawning typically occurs)</td>
</tr>
<tr>
<td>4.</td>
<td>Increase and enhance wildlife habitat</td>
<td>Increase available habitat (nesting/breeding/rearing) for target species of pond turtle &amp; yellow frogs</td>
<td>% change pond turtle nesting and 1-3 year old habitat area. Increase yellow legged frog breeding and tadpole rearing area</td>
</tr>
<tr>
<td>5.</td>
<td>Increase &amp; enhance riparian, wetland, &amp; enhance upland habitats</td>
<td>Promote development of diverse riparian &amp; upland communities; Reduce invasive plant species; Preserve riparian corridor &amp; large trees where possible; etc.</td>
<td>% change in riparian vegetation area (include areas planted and areas designed for natural recruitment).</td>
</tr>
</tbody>
</table>
### Example Design Alternative Analysis - Stream Project

**Multi-Criteria Decision Analysis (MCDA) - Design Guidance**

**Developed by Peter Wilcock and others**

#### Local Objective vs. Metric for each objective

<table>
<thead>
<tr>
<th>Local Objective</th>
<th>Metric for each objective</th>
<th>Score performance of each alternative for all objectives</th>
<th>Set performance measure range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alt 1. (-) Mean (+)</td>
<td>Alt 2. (-) Mean (+)</td>
<td>Alt 3. (-) Mean (+)</td>
</tr>
<tr>
<td>Fry rearing habitat</td>
<td>Change in habitat area-days (%)</td>
<td>12</td>
<td>61</td>
</tr>
<tr>
<td>Adult holding habitat</td>
<td>Change in pool area &gt; 8ft depth</td>
<td>64</td>
<td>320</td>
</tr>
<tr>
<td>Spawning habitat</td>
<td>Change in transition riffles (%)</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Wildlife habitat</td>
<td>Change in area turtle/frog habitat</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Riparian habitat</td>
<td>Change in vegetation area (%)</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Channel complexity</td>
<td>Change in flow directions at</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>Fluvial processes</td>
<td>Change in channel stream power</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Mitigate infrastructure</td>
<td>Rank 1-5 [5 most benefit]</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Mitigate uncertainty</td>
<td>Rank 1-5 [5 most benefit]</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Public Benefit</td>
<td>Rank 1-5 [5 most benefit]</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Cost consideration</td>
<td>Total implementation cost</td>
<td>0.45</td>
<td>1.8</td>
</tr>
</tbody>
</table>
UPPER JUNCTION CITY PROJECT REACH

DIGITAL TERRAIN MODELING (DTM) – ALTERNATIVE ANALYSIS
Repeat Digital Terrain Models (DTM’s)
2D HYDRAULIC MODELING – UJC MODEL FRAMEWORK
SRH-2D SOFTWARE – PREDICTIVE BASED DESIGN APPROACH
2D HYDRAULIC MODELING – DESIGN CONDITIONS
FLOWS = 450, 2700, 7500 cfs
Criteria met for total area (ft²)
Depth, velocity, and cover = 16,785
Depth and velocity only = 43,146
Cover only = 12,900
Total = 72,831
DESIGNING OF OFF CHANNEL PONDS THROUGH HYPORHEIC CONNECTIONS
“INFILTRATION GALLERY” - HYPORHEIC INLET TO POND REDUCES LOSS OF CONVEYANCE AND RISK OF INLET FILLING
Coupled 2D Morpho-Dynamic and Bank Erosion Modeling at the Upper Junction City Channel Rehabilitation Project Site, Trinity River, CA
MORPHODYNAMIC MODELING - RESULTS
2D Hydraulic Output – 7500 cfs – Velocity Vectors at Large Wood Jam and Sheer Stress Output
Balancing Stream Power – Ability to Do Geomorphic to Developing Habitat Through Process
LEARNING FROM PROGRESS THROUGH MONITORING AND EVALUATION

HOOPA VALLEY TRIBE
P.O. Box 417
Hoopa, CA 95546

U.S. FISH AND WILDLIFE SERVICE
1655 Heinden Road
Arcata, CA 95521

YUROK TRIBE
2500 Hwy. 96
Weitchpec, CA, 95525

PRIVATE PROPERTY
NO TRESPASSING
NO HUNTING
NO BIologists OR
BIOLOGICAL INVESTIGATIONS
BY ANYONE.

WALT ANDERSON
BOX 297 - RED ROCK, NM - 88055
Design Performance Goals (from the Upper Junction City Design Report):

1. Double shoreline rearing habitat with cover through the length of the flow split.
2. Create 350m² of new low velocity eddy habitat at 450 ft³/s.
3. Create 6000m² of new side-channel & connected pond rearing habitat at flows of ~2500 ft³/s.
4. Limit flow velocities at 7500 ft³/s to less than 1 ft/s over at least 4600 m² of floodplain.
5. Retain 95% of bankfull flow in mainstem through the upstream third of the site at 7500 ft³/s.
6. Limit conveyance of the R-5/R-6 side channel to 6% of the total flow at 7500 ft³/s.
7. Reduce floodplain conveyance adjacent to the R-4 flow split to near zero at 7500 ft³/s.
POST CONSTRUCTION – ASBUILT CONDITION
4,500 cfs
PRE AND POST HABITAT MAPPING – MODEL VALIDATION
Terrain Model Data Collection – Bathymetry and LiDAR
POST CONSTRUCTION – 3D LASER SCANNING OF WOOD
Tell me and I’ll forget. Show me, and I may not remember. Involve me, and I’ll understand.

- Native American Saying -

DJ Bandrowski P.E., Project Engineer
djbandrowski@yuroktribe.nsn.us
906-225-9137
Evaluating Restoration Effects on Juvenile Salmon Habitat in a Large Regulated River System in Northern California

Aaron Martin – Yurok Tribe
Trinity River Restoration

- Restoration goals include
  - Restore natural salmon production
    - 64 km restoration reach
    - Rearing habitat availability limiting factor

- Restoration strategy
  - Process based restoration
    - Restored streamflow – simulated spring snowmelt events
    - Coarse sediment augmentation
    - Channel rehabilitation (~47 sites)

- Project evolution
- Adaptive management
Restoration Reach
Proposed Channel Rehabilitation Sites
Channel Rehabilitation to Date
Rearing Habitat Assessment Methods

• Develop habitat definitions
  – HSC identified specific depths and velocities
• Habitat guilds
  • Chinook and coho salmon
    – Fry (<50 mm FL)
    – Presmolt (50-100 mm FL)
• Map shallow/slow areas and cover independently
Rearing Habitat Assessment Methods

Reporting Metrics:
- Optimal habitat
- Total habitat

Conducted validation studies using snorkel counts to prove definitions
Habitat Mapping Example
Comparison of sites

Total habitat

Bank rehabilitation site
Evaluating fish response

- Can use the habitat maps/categories to help develop a sampling strategy to look at fish use.
- What design elements are most heavily utilized by juvenile fish (i.e., LWD, ponds, alcoves, flow)?
- Do juvenile salmonids use all identified rearing habitat equally?
A Sample of Monitoring Effort

- Sampling is distributed amongst categorical habitat bins based on depth, velocity, and cover (DVC) proportional to availability.
- A habitat unit or “Polygon” of like DVC is identified, delineated, and physical parameters are measured.
- The polygon is revisited after a 24 hour period to allow fish present to return to normal behavior.
- The polygon is surveyed for the presence of fish simultaneously by two divers.
Fish use at 2 sites by feature type
Fish density*

*Unpublished data
Bringing it back to design

- Habitat mapping at rehab sites has been a key element feeding design evolution since 2008.
- Relatively quick assessment, accurate results, able to cover a lot of ground
- Important to track progress through time, after site has had time to evolve
- Consider including fish use as part of evaluation
Channel Rehabilitation Assessment Example

[Map showing the Upper Dark Gulch Site and surrounding areas]
Before Construction 2008

- Riparian encroachment
- Main channel disconnected from floodplain
  - Intermediate streamflows
- Lack of habitat complexity
Project Design

Project Goal - Increase salmonid rearing habitat at all flows

Design Elements include:
- Berm Removal
- Floodplain lowering
- Side channel creation
- Addition of large wood and riparian plantings
- 24,000 CY excavation
Habitat Assessment

- Conducted pre and post-construction mapping (2008 & 2009)
- Mapped site at 5 flows (300, 450, 700, 1200, 2000 cfs dam release)
- Revisited site in 2013 after 2011 high flow event
- Reported optimal and total habitat
Pre vs Post-construction

**Optimal Habitat**

- Y-axis: Habitat Area (sq m)
- X-axis: Q (cfs)

**Total Habitat**

- Y-axis: Habitat Area (sq m)
- X-axis: Q (cfs)
High Streamflow Event 2011
Optimal habitat

- Post
- Pre
- Revisit

Total habitat

- Post
- Pre
- Revisit

Revisit (post high flow)
What Happened?!?
Topographic Change
Riparian Development

2009

2013
Acknowledgements

• Trinity Habitat Team
  – Nicholas A. Som, Dan Menton, Matt Smith-Caggiano, Mike Sundman, Nick Van Vleet & Arcata Fisheries Staff (USFWS)
  – Kyle DeJuilio, Andreas Krause, Hank, Jeremy & Larry Alameda (YTFP)
  – Rocky Jones, Thomas Masten, Seth Brenten, Keith Hostler (HVTFP)
• Trinity River Restoration Program staff

For more information see
Restoration of Complex Habitat Assemblies in Sediment Rich Ecosystems: Examples from Lower Klamath Tributaries

Rocco Fiori (Fiori GeoSciences) & Sarah Beesley (Yurok Tribal Fisheries Program)
Discussion Topics

Complementary wood loading & off-channel construction techniques in 2\textsuperscript{nd} to 5\textsuperscript{th} Order Streams
- Bank Based Jams
- Bar Apex Jams
- Stumps
- Off-Channel Features

Biologic Hot Spots
- Tributary Confluences
- Pre-existing Side Channels & Wetlands
- Springs
- Beaver Activity

Long Term Approach
Wood loading & augmentation applied until natural recruitment supplies wood needed to restore geomorphic function and self-maintaining habitat requirements
Guiding Concepts

Habitat Changes Related to Large Wood Loading

Benegar et al. (In Review) Evaluation of constructed wood jams in a forest, gravelbed stream.
Guiding Concepts

Habitat Changes Related to Large Wood Loading

Benegar et al. (In Review) Evaluation of constructed wood jams in a forest, gravelbed stream.
Guiding Concepts

Habitat Changes Related to Large Wood Loading

Benegar et al. (In Review) Evaluation of constructed wood jams in a forest, gravelbed stream.

**Percent Wood Cover**

\[ y = 0.0054x + 0.0012 \]

\[ R^2 = 0.8585 \]

**Residual Pool Depth**

\[ y = 0.0192x + 0.2315 \]

\[ R^2 = 0.50 \]

**Gravel Storage**

\[ y = 0.0101x + 0.0173 \]

\[ R^2 = 0.72 \]

**Habitat Heterogeneity**

\[ y = 0.0283x + 0.70 \]

\[ R^2 = 0.64 \]
In channels <50 m bankfull width, wood with $D_{wd}/d_{bf} > 0.5$ and $L_{wd}/w_{bf} > 0.5$ is generally stable.

Key pieces (stable wood):
- Racked wood
- Loose wood

Mostly mobile wood:
- Bar apex jams
- Meander jams
- Channel spanning jams
- Log steps

Mostly stable wood:
- Mostly mobile wood


Guiding Concepts

Hyporheic Exchange Mechanisms and Function


Geomorphic Controls on Hyporheic Exchange. From: Wondzell & Gooseff (Pre-Print).

Project Locations

Hunter Creek
DA = 61.6 km² (23.8 mi²)

Klamath Estuary

McGarvey Creek
DA = 23.0 km² (8.9 mi²)

Terwer Creek
DA = 80.2 km² (31 mi²)
Hunter Creek Site 1

Pre-Construction

As-Built

Side Channel

BAJ 1

Alcove

BBJ
Hunter Creek Site 4

As-Built 2012

Post 5-yr RI flood WY15
Hunter Creek Site 7 - BAJ 1

First flows 2014

Post 5-yr RI flood WY15
Hunter Creek Site 7
BAJ 2, BBJs & Stumps
Hunter Creek Site 7
BAJs and BRJ

As-Built 2014

First flows 2014
Hunter Creek BAJ 3 - Chaos Jam

Pre-Project 2012

Construction 2012
Hunter Creek BAJ 3 - Chaos Jam

As-Built 2014

First flows 2014
Hunter Creek Site 7 Bank Based Jams

- Digger Log & Stump
- Bar Roughness Jam
Hunter Creek Site 7
BAJ 6

As-Built 2014

First Flows 2014
Hunter Creek Site 7 - BAJ 6

Post 5-yr RI Flood WY15
Hunter Creek Site 7 – PADR 1 & 2

Pre-Construction 2014

As-Built 2014
Hunter Creek Site 7 – PADR 1 & 2
Hunter Creek Site 7 – PADR 1 & 2

First Flows 2014

Post 5-yr RI flood WY15
Hunter Creek Site 7 – PADR 1 & 2

First Flows 2014

Post 5-yr RI flood WY15
Terwer Creek
Terwer Creek
Integrated Use of ELJs, Alcoves & BioEngineering

Alcove A

ELJ 1
ELJ 2
ELJ 3
ELJ 4

Alcove B

Willow Baffles

Crib Wall Jam
Terwer Creek
First Winter Post-Project

ELJ 1

Side Channel
Terwer Creek

Pre-Construction 2008

Post-Construction 2009

ELJ 1

Side Channel
McGarvey Creek – Alcove II

- Infiltration Gallery
- PIT Tag Antenna
- Log Jam at Confluence
Juvenile Coho Use of Off-Channel Habitats

Preliminary Data

# Off-Channel Habitat Restoration Cost Effectiveness

<table>
<thead>
<tr>
<th>Location</th>
<th>Wetted Habitat Area (m²)</th>
<th>Average Juvenile Abundance (# of yrs)</th>
<th>Average Fish Density (#/m²)</th>
<th>Cost* ($/m²)</th>
<th>Cost $/fish (30 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terwer Alcove A</td>
<td>458</td>
<td>35 (3)</td>
<td>0.07</td>
<td>49</td>
<td>22</td>
</tr>
<tr>
<td>Terwer Alcove B</td>
<td>1330</td>
<td>66 (5)</td>
<td>0.05</td>
<td>141</td>
<td>95</td>
</tr>
<tr>
<td>McG Alcove 1</td>
<td>723</td>
<td>115 (4)</td>
<td>0.16</td>
<td>150</td>
<td>32</td>
</tr>
<tr>
<td>McG Alcove 2</td>
<td>300</td>
<td>139 (3)</td>
<td>0.46</td>
<td>220</td>
<td>16</td>
</tr>
<tr>
<td>McG Alcove 3</td>
<td>527</td>
<td>59 (2)</td>
<td>0.13</td>
<td>123</td>
<td>36</td>
</tr>
<tr>
<td>McG Alcove 4</td>
<td>600</td>
<td>162 (1)</td>
<td>0.27</td>
<td>125</td>
<td>16</td>
</tr>
<tr>
<td>Hnt Alcove 1</td>
<td>200</td>
<td>27 (4)</td>
<td>0.8</td>
<td>78</td>
<td>20</td>
</tr>
</tbody>
</table>

* Construction costs are based on the wetted habitat area created and are preliminary estimates that include wood loading, monitoring and other project related costs.

Ogston et al. (2014) Watershed-scale effectiveness of floodplain habitat restoration for juvenile coho salmon in the Chilliwack River, British Columbia.

Roni et al. 2010. Estimating changes in coho salmon and steelhead abundance from watershed restoration: how much restoration is needed to measurably increase smolt production?
Carah et al. (2014) Low-Cost Restoration Techniques for Rapidly Increasing Wood Cover in Coastal Coho Salmon Streams

Wood Loading Costs
Next Steps

VALLEY FLOOR MANAGED AS TRANSPORTATION & FLOOD CORRIDOR

ECO-HYDRAULIC FUNCTION DISRUPTED BY FLOODPLAIN ROADS, LEVEES AND OTHER LAND USES

VALLEY FLOOR MANAGED AS FLOODPLAIN

RELOCATE ROAD

DISEMCUMBER THE CHANNEL MIGRATION ZONE

BEAVER AS LEAD-ENGINEER
Salmon Need Habitat – We Need Salmon

Thank You
Off Road Vehicle Impacts
Contributors

- Rocco Fiori – Engineering Geologist/Operating Engineer, Fiori GeoSciences
- Sarah Beesley – Fisheries Biologist, Yurok Tribal Fisheries Program
- Aldaron McCovey - Fisheries Technician, Yurok Tribal Fisheries Program
- Steven Nova - Fisheries Technician, Yurok Tribal Fisheries Program
- Robert Grubbs – Fisheries Technician, Yurok Tribal Fisheries Program
- Scott Silloway – Fisheries Biologist, Yurok Tribal Fisheries Program
- Andrew Antonetti – Fisheries Biologist, Yurok Tribal Fisheries Program
- Walter Mecklenburg – Fisheries Biologist, Yurok Tribal Fisheries Program
Funding Partners, Landowners and Cooperators

- U.S. Fish and Wildlife Service
- U.S. Bureau of Reclamation
- National Oceanic and Atmospheric Administration
- CA Dept of Fish and Wildlife
- Green Diamond Resources Company
- Yurok Tribe Watershed Restoration Dept.
- Yurok Tribe Environmental Program
Round-Table Discussion

• Today, 12:30
• 1700 9thStreet (corner of Q an 9th)
  – Third floor conference room
• Call-in: 1-877-336-1831, Participant #940704