Reach Scale Floodplain Reconnection and Enhancement:
Achieving the Objectives of the Columbia River BiOp

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John Crandall | Confluence Aquatics

February 3rd, 2015
Outline

• Location
• Planning
• Design
• Construction
• Results
If this was a real power outage...you would wish you had backup....
Location – Methow River Valley, Washington

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Lay it all out there...

Planning
# Years in the Works

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2000</td>
<td>DRAFT NOAA Fisheries FCRPS BiOp</td>
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<td>2008</td>
<td>NOAA Fisheries FCRPS BiOp</td>
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<tr>
<td>2010</td>
<td>USBR Tributary Assessment</td>
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<tr>
<td>2011</td>
<td>USBR M2 Reach Assessment</td>
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<td></td>
<td>Conceptual Alternatives Developed</td>
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<td></td>
<td>Alternative Evaluation Report</td>
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<tr>
<td></td>
<td>WFI &amp; WDFW 30% Designs</td>
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<tr>
<td></td>
<td>WFI 60% Designs</td>
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<tr>
<td></td>
<td>WFI 100% Designs</td>
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<tr>
<td></td>
<td>Winter</td>
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<tr>
<td></td>
<td>Spring</td>
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<tr>
<td></td>
<td>Summer</td>
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<tr>
<td></td>
<td>Fall</td>
</tr>
<tr>
<td>2012</td>
<td>WFI Construction</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
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<td></td>
<td>Spring</td>
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<tr>
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<td>Summer</td>
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<td>Fall</td>
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<tr>
<td>2013</td>
<td>WDFW 100% Designs</td>
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<td></td>
<td>Winter</td>
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<td></td>
<td>Spring</td>
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<tr>
<td></td>
<td>Summer</td>
</tr>
<tr>
<td></td>
<td>Fall</td>
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<tr>
<td>2014</td>
<td>WDFW Construction</td>
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<td></td>
<td>Monitoring continues</td>
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<td>2017</td>
<td></td>
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<td>2018</td>
<td>New BiOp?</td>
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**Reach Scale Floodplain Reconnection and Enhancement:**
Achieving the Objectives of the Columbia River BiOp
Site Selection

Opportunities
- Reconnect disconnected habitat
- Address limiting factors
- Work with natural processes
- Show what’s possible

Constraints
- River user safety
- Landowner cooperation
- Construction access and impact
- Quick timeline
Location – Whitefish Island (WFI) Site

- Second Side Channel South of Winthrop
- Majority owned by Methow Salmon Recovery Foundation
- Side Channel Outlet near SR 20
- Typically went dry in the summer
- Often stayed dry through the winter

Location – WDFW Floodplain Site

- Across from the airport and an irrigation diversion
- Majority owned by Washington Department of Fish and Wildlife
- Some private land
- Levee cut off floodplain
- Side channel expanded during large floods
- Alcove wetland isolated by road

Whitefish Island

Geomorphic Analysis

- Active side channel migration
- Limited low-flow connectivity
- Some floodplain access
- Riprap along SR 20
- Glacial terraces on main channel left bank
- Downstream bedrock control
WDFW Floodplain

Geomorphic Analysis

- Levee on right bank
- Recent dam removal
- Grade control at side channel inlet and main chl.
- Dynamic lower side channel
- Road isolates wetland
- Glacial terraces on main channel left bank
- Downstream bedrock control
Whitefish Island & WDFW Floodplain

Alternatives Assessment

- **Biological benefit**
  - Perennial side channel
  - Deep pools
  - High-flow refuge
  - Wetland connectivity

- **Natural process**
  - Floodplain connectivity
  - Bar and pool development

- **Risk and impacts**
- **Relative costs**
- **Feasibility**
Figure it out & Draw it up...

Design
Hydrology – Peak Flows

Figure C-2
Flood Frequency Analysis, Methow River at Winthrop, Washington

- 100,000
- 10,000
- 1,000

- Observed Peaks
- 5% Confidence Limit
- LPIII Curve
- 95% Confidence Limit
- Historical Peaks

Annual Exceedance Probability

Return Period (years)
Fish Use Timing

Chart 2
Typical life stage timing of spring Chinook in the Upper M2 Reach

- Incubation
- Adult Migration
- Spawning
- Rearing
- Juvenile Migration

Discharge (cfs)
- Mean Daily Discharge
- Maximum Daily Discharge
- Minimum Daily Discharge
- Spring Chinook Use Periods

Day of Year
Example Design Analysis

Table 1
Design Scour Depths for Structures at Specified Design Flows

<table>
<thead>
<tr>
<th>Structure Type – Location</th>
<th>Design Event</th>
<th>Design Scour (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A¹ – Island Apex</td>
<td>100-year</td>
<td>13.7</td>
</tr>
<tr>
<td>Type Ac – At side channel entrance</td>
<td>100-year</td>
<td>11.9</td>
</tr>
<tr>
<td>Type At¹² – Side Channel</td>
<td>100-year</td>
<td>9.0</td>
</tr>
</tbody>
</table>

\[ d_s = 1.1 \cdot \frac{L_e}{d_l}^{0.4} \cdot Fr^{0.33} \cdot d_1 \]

where:
- \(d_s\) = Scour Depth (predicted)
- \(L_e\) = Length (effective)
- \(d_l\) = Upstream Hydraulic Depth
- \(Fr\) = Froude Number (dimensionless number), where
  \[ Fr = \frac{V}{\sqrt{g \cdot d}} \]

- \(V\) = flow velocity
- \(g\) = gravitational acceleration
- \(d\) = flow depth

Figure 20. Water depth and velocity vectors in vicinity of Alcove Floodplain Channels A and B for 9,450 ft³/s (2-year flood).
Build it and they will come...

Construction
Side Channel Enhancement

- ELJs
  - Pools, cover, refuge, sediment sorting
- LWD
  - Roughness, refuge, cover
Floodplain Habitat

- LWM added to floodplain
- Low cost – high benefit
- Connected to wetlands

- Provides refuge
- Slower velocities
- Clearer water
Live Crib

- Riparian buffer
- Planted at multiple levels
- Tree growth will stabilize slope over time

Crib protects SR 20 in the interim

Rootwads help maintain deep pools and provide cover
Levee Removal

- Contained the 10-year event
- 3 to 5 feet over 900 linear feet removed
Floodplain Connectivity

- Connected at a 2-year event
- Refuge for juvenile fish
- Connected to wetlands
- Supports riparian growth
- Extensive initial plantings
- LWM added for complexity
- Removed rock at entrance
- Lowered connection elevation
- ELJs maintain pools and connectivity over time
- ELJs limit high-flow proportion
Alcove Wetland Connection

- Off-channel habitat
- Upstream and downstream access
- Clear water during spring
- Outflow in the summer
- Groundwater allows juveniles to over-winter
They came…

Results
Nooooooooooooooooooooooo00000000000000000000000000000000!
Salmonid Abundance in Engineered Logjams, Methow River
Density of salmonids observed in Engineered logjams Methow River
Summary

- BiOp Objectives
- Collaborative Planning & Design Process
- Floodplain Reconnection
- Side Channel Enhancement
Acknowledgements

Primary Clients
U.S. Bureau of Reclamation

Methow Salmon Recovery Foundation

Funding & Partners
Bonneville Power Administration
Upper Columbia Salmon Recovery Board
Washington Department of Fish & Wildlife
Washington Department of Ecology
Washington Department of Natural Resources
U.S. Geological Survey

Contractors
BCI, Inc. | Boulder Creek | KRCI | Methow Natives | Palm Construction

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Questions?
Additional Information

Methow Salmon Recovery Foundation
http://www.methowsalmon.org/

U.S. Bureau of Reclamation

https://www.youtube.com/watch?v=hn1Kz_isszA

Anchor QEA

Journal Articles

## FRCPS BiOp Habitat Quality Improvements

### Table 5

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</thead>
<tbody>
<tr>
<td>Upper Columbia Steelhead</td>
<td>Upper Columbia River—below Chief Joseph</td>
<td>Entiat River</td>
<td>6</td>
<td>8</td>
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<tr>
<td></td>
<td></td>
<td>Methow River</td>
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<td>14</td>
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<td>Upper Columbia Spring Chinook</td>
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