Prototype modifications within a flood control channel to improve fish passage in Mill Creek near Walla Walla, WA

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Overview

- Location of Project
- Flood Control Purpose
- Fish Passage Barriers
- Hydraulic Design
- Construction
- Post construction hydraulic assessment
- Future Work
Mill Creek near Walla Walla, WA
Flood Control Purpose

- In 1931 a major flood in Walla Walla caused flood control project to be built between 1935 to 1942.
  - Diversion structure with off-stream reservoir
  - Concrete lined channel through town
  - Levees with bed stabilizers

- Majority of the improved channel managed locally
- USACE still operates 2 diversions and approx. 1 mile of improved channel

Gabions later capped by concrete
Flood Control Purpose

- Upstream reaches of Mill Creek with good fisheries habitat
- Diversion channel for flood flows
- Off-stream flood control and recreation reservoir
- Section of federally managed improved channel
- Section of locally managed improved channel
- Diversion for irrigation rights

Mill Creek Flood Control Project

Bennington Lake

BUILDING STRONG®
The project has been very effective at limiting flood damage from a creek with a flashy flow regime.

- Limits flow to 3500 cfs in channel
  - 20-yr Q = 3800 cfs, 100-yr Q = 7050 cfs
- Prevented major flood damage as recently as 1996
Fish Passage Barriers

- 84 sills through the federal reach of Mill Creek

High Water Surface Differential
- 0.6 ft – 1.6 ft with most ~ 1 ft
- < 0.8 ft criteria used for bull trout

Low Flow Depth
- As low as 2” over sill crest
- 6 ft long crest in stream direction
- > 1 ft criteria desired for salmon

Fish Passage Discharges
- NMFS guidelines 5% to 95%
- Used 10 cfs to 400 cfs for design
  - Actual 24 to 365 cfs
Hydraulic Design

- **Multiple restrictions reduced alternatives**
  - Real estate was not available to set back levees
  - Alternatives could not increase WSE at 3500 cfs
  - Scour at levee toe was not acceptable
  - Concern if sill was cut it would fail
  - Fish Passage from 10 to 400 cfs

- **Selected alternative**
  - V shaped weir
    - Center = Higher depth
    - Edge = lower velocity
  - For sills with drops > 0.8 ft drops
    - Needed 2 weirs and intermediate pool
    - Used pool & chute fishway concept
    - Intermediate pool sized to meet turbulence criteria of EDF/V of (4.0 ft-lb/s)/ft³
Hydraulic Design

- Used Spreadsheet to initially size one step and two step drop designs.
- Used HEC-RAS to check flood capacity and account for sill variability.
- Used spreadsheet again to post process HEC-RAS output to verify WSE change, depth, turbulence and calculate scour.
Construction

- 3 sills were modified
  - Budget and desire to see prototype
  - 2 double weir and 1 single weir structure

- Construction
  - July – September 2012
Construction
Post construction Assessment

- The hydraulic assessment consisted of observations at key discharges:
  - Dec 12, 2012
  - 411 cfs
  - Near High Fish Passage Design Flow
Post Construction Assessment

- Highest Discharge since construction – 1,260 cfs (4-20-13)
Post Construction Assessment

- Low Flow was assessed at 37 cfs on 7/10/13
  - Measure Water Surface Differential
  - Measure Head and Depth over the Weir
  - Look at sediment scour and deposition
Post Construction Assessment

- Met design objectives
  - $\Delta$WSE – 0.5 to 0.79 ft
  - Depth at weir crest – 0.86 to 1.05 ft
  - Depth behind weir crest – 1.0 to 1.1 ft

- Minimal scour and deposition
  - Estimate of 5 and 8 ft$^3$, compared to full pool volume of ~ 780 ft$^3$
Future Work

- Currently planning construction of additional sill modifications in 2015 with same design
- Exploring designing some natural channel options
  - Roughened channels and similar designs offer interesting alternative but it is a difficult environment
Questions