Kelley Creek Confluence Restoration Monitoring

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Presentation Outline

1. Kelley Creek Confluence project description
2. Pre-construction monitoring: Survey of old Kelley Creek channel
3. Implementation monitoring
4. Ongoing Monitoring Program:
   - Hydraulic performance
   - Habitat: Low flow; high flow
   - Fish presence
   - Vegetation Establishment
5. Summary of data and project performance
Kelley Creek
Project Goals

- Provide fish and wildlife habitat
- Reduce downstream flooding
- Improve Water Quality
Kelley Creek Confluence Restoration
Intro to project site

- Restoration project was completed in 2004
- Ongoing monitoring program began in winter 2004
- Monitoring program is first of its kind for the City of Portland
Pre-Construction
Reference Survey of Old Channel

- Modified Oregon Department of Fish and Wildlife habitat survey methods
- Pre-construction survey data is the reference for the ongoing monitoring program
Implementation Monitoring

Inspection

- Substrate did not conform to specs.
- Wood anchoring problems
- These potential problems are now monitored regularly

As-built profile survey matched plans
Hydraulic Performance Monitoring

- Photo documentation during low and high flow
- Low-flow channel and floodplain inspection
- Longitudinal and cross sectional channel surveys
- Pebble counts at riffles
Hydraulic Monitoring
Photo points
Hydraulic Monitoring
Flood Events

• Design Discharge (9 month)
Hydraulic Performance
Channel Stability

Design Criteria for the channel

- Channel can migrate:
  
  +/- 6 inches vertically
  
  +/- 4 feet laterally

- Headcutting at grade control riffles not acceptable

- Avulsion not acceptable
CROSS SECTION ELEVATIONS OF KELLEY CREEK INCLUDING 2004, 2005, AND 2006 SURVEYS

SECTION 5
PROFILE STATION
RED = 2007 SURVEY
BLUE = 2005 SURVEY
GREEN = 2004 ASBUILT GRADE

SECTION 6
PROFILE STATION
RED = 2007 SURVEY
BLUE = 2005 SURVEY
GREEN = 2004 ASBUILT GRADE

SECTION 7
PROFILE STATION
RED = 2007 SURVEY
BLUE = 2005 SURVEY
GREEN = 2004 ASBUILT GRADE

SECTION 8
PROFILE STATION
RED = 2007 SURVEY
BLUE = 2005 SURVEY
GREEN = 2004 ASBUILT GRADE

PROFILE EXAGGERATION: 5x
scale: 1" = 40 feet
Hydraulic Monitoring
Pebble Counts

- Riffle substrate gradation
- Mean pebble size varying, but within acceptable range

Riffle 1
Cumulative Particle Size Distribution

Riffle 4
Cumulative Particle Size Distribution
Aquatic Habitat Monitoring

- Does created habitat persist?
- Does created habitat conform to design criteria?

Pre-Construction reference survey

- Modified Oregon Dept Fish & Wildlife methods
Aquatic Habitat - summer rearing

• Total habitat area
  - 286 m², pre-design
  - 400 m², design criteria
  - 570 m² in 2007
### Aquatic Habitat - summer rearing - pools

<table>
<thead>
<tr>
<th></th>
<th>design criteria</th>
<th>pre-project</th>
<th>2007</th>
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</thead>
<tbody>
<tr>
<td>Pool area (% wetted area)</td>
<td>&gt; 40%</td>
<td>59%*</td>
<td>34%</td>
</tr>
<tr>
<td>Residual pool depth, m</td>
<td>&gt; 0.5</td>
<td>0.13</td>
<td>0.45</td>
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<tr>
<td>Large wood, #/100 m</td>
<td>&gt; 20</td>
<td>0</td>
<td>51</td>
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* not persistent
Aquatic Habitat - summer rearing - riffles

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<th>2007</th>
</tr>
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<tbody>
<tr>
<td>gravel-cobble substrate</td>
<td>&gt;90%</td>
<td>71%</td>
<td>98%</td>
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<tr>
<td>% fines (&lt; 2 mm)</td>
<td>&lt; 10%</td>
<td>13%</td>
<td>1.6%</td>
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</table>
Spawning Riffles
Aquatic Habitat - summer rearing

\[(\text{Hab. Unit Freq. Score} \times 0.233) + (\text{Tot. Hab. Area Score} \times 0.233) + (\text{Pool area Score} \times 0.078) + (\text{Pool depth Score} \times 0.078) + (\text{Comp. Pool Score} \times 0.078) + (\text{LWD Score} \times 0.15) + (\text{Substrate Score} \times 0.15) = \text{Overall score for summer-time habitat.}\]

Weighted average of score

- 1.00, all design criteria met
- 0.30, pre-project (2004)
- 0.94, 2007
Aquatic Habitat – Winter High Flow Refuge

- Dammed and backwater pools desirable
- Visual estimate of total area with depth > .15m, velocity < .15 m/s
- No high flow refuge was present pre-project
Species Composition
Total from all Fish Surveys
Vegetation Monitoring

- Plant establishment during growing season
- Invasive weed coverage
- Plant density and mortality rate per species
- Effectiveness of mowing, mulching and spraying treatments
- Function of irrigation system
Vegetation Monitoring Results

2,041 Woody Species Plants per acre

- Overall 26% mortality rate
  - Red alder highest rate at 68%
  - Overall 67% recruitment rate

Red alder highest rate at 237%- seeds establish better in compacted mineral soil than plants

- Willow and dogwood survival rate is higher than other restoration sites due to temporary irrigation
  - Willow mortality rate 10%, Dogwood 0.0%
Monitoring Results
Vegetation

- Seed germination poor in some places due to clay soils
- In one highly compacted area - site has been seeded 3 times
- Floodplain sediment deposits are helping vegetation establishment
- Native fowl manna grass present - highly desirable for waterfowl
- Exotic ground cover 12%
Overall Monitoring Results

- Modest adjustments in planform as expected
- Small changes in grain size distribution
- Project maintains a high amount of available fish habitat, good pool complexity and fair summer pool depths
- Pool area and depth is likely better than data suggests
- High percentage of native fish, some salmonids
- Some bullfrogs are present
- High vegetation survival and recruitment rate
- Sediment deposits on the floodplain
- Low invasive weed introduction
- It’s a learning process
Kelley Creek Confluence

Restoration Monitoring

THANKS!

Oregon Watershed Enhancement Board
Questions?

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