Habitat Conditions in the Lower Snoqualmie, Tolt, and Raging Rivers

Josh Kubo
Environmental Scientist
King County Water and Land Resources Division
Special Thanks

- Snoqualmie Watershed Forum
- King County Flood Control District Cooperative Watershed Management Grant

King County Staff
- Josh Baldi
- Chris Gregersen
- Kollin Higgins
- Dan Lantz
- Beth leDoux
- Kate O’Laughlin
- Elissa Ostergaard
- Ken Rauscher
- Dave White
- Jo Wilhelm

Snoqualmie Tribe Staff
- Matt Baerwalde
- Angela Dillon
- Heather Minnella

Snohomish River Basin Partners
- Brian Footen
- Gretchen Glaub
- Frank Leonetti
- Morgan Ruff
- Mike Rustay
- Colin Wahl
Special Thanks

Matt Baerwalde on the Raging River
2017 Habitat Surveys

- Snoqualmie River (RM 5.3 - 37.8)
- Tolt River (RM 0 - 6)
- Raging River (RM 0 - 6)
2017 Habitat Surveys

- Snoqualmie River (RM 5.3 - 37.8)
- Tolt River (RM 0 - 6)
- Raging River (RM 0 - 6)
- EDT Reaches used in 2005 Salmon Plan
Surveyed Attributes

Field Surveys
• Bank conditions
• Large woody debris
• Instream habitats and floodplain features
• Channel and floodplain modifications

Desktop Evaluation
• Riparian conditions
Evaluating Progress

SNOQUALMIE WATERSHED AQUATIC HABITAT CONDITIONS REPORT: SUMMARY OF 1999-2001 DATA

November 2002

Fran Solomon and Melissa Boles

SNOQUALMIE WATERSHED AQUATIC HABITAT CONDITIONS REPORT: SUMMARY OF 1999-2001 DATA

November 2002

Fran Solomon and Melissa Boles

Snohomish River Basin Salmon Conservation Plan

JUNE 2004

2005 Salmon Plan

50yr goal

10yr goal

Progress

Progress provided by the Snoqualmie Watershed Forum
Stream Bank Conditions
Stream Bank Conditions

Armored Banks

- Snoqualmie River = 40%
- Tolt River = 30%
- Raging River = 40%
Stream Bank Conditions

Since Adoption of 2005 Salmon Plan

• Armor = Snoqualmie_3 (Stillwater, Camp Gilead, Chinook Bend), Snoqualmie_5 (Upper Carlson), and Tolt_1A (Lower Tolt)

<table>
<thead>
<tr>
<th>EDT Reach</th>
<th>River Miles</th>
<th>Modified Banks</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2000/2001</td>
<td>2017</td>
</tr>
<tr>
<td>Snoqualmie_3</td>
<td>~19.7 – 23.7</td>
<td>60.6%</td>
<td>51.5%</td>
</tr>
<tr>
<td>Snoqualmie_4</td>
<td>~23.7 – 31.4</td>
<td>39.5%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Snoqualmie_5</td>
<td>~31.4 – 34.6</td>
<td>63.4%</td>
<td>59.1%</td>
</tr>
<tr>
<td>Snoqualmie_6</td>
<td>~34.6 – 37.8</td>
<td>28.8%</td>
<td>35.9%</td>
</tr>
<tr>
<td>Tolt_1A</td>
<td>~0 – 1.8</td>
<td>94.8%</td>
<td>83.2%</td>
</tr>
</tbody>
</table>
Stream Bank Conditions

Since Adoption of 2005 Salmon Plan

- Armor = Snoqualmie_4 (end of Neal Rd & near Griffin Creek), Snoqualmie_6 (SE David Powell Rd)

<table>
<thead>
<tr>
<th>EDT Reach</th>
<th>River Miles</th>
<th>Modified Banks</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2000/2001</td>
<td>2017</td>
</tr>
<tr>
<td>Snoqualmie_3</td>
<td>~19.7 – 23.7</td>
<td>60.6%</td>
<td>51.5%</td>
</tr>
<tr>
<td>Snoqualmie_4</td>
<td>~23.7 – 31.4</td>
<td>39.5%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Snoqualmie_5</td>
<td>~31.4 – 34.6</td>
<td>63.4%</td>
<td>59.1%</td>
</tr>
<tr>
<td>Snoqualmie_6</td>
<td>~34.6 – 37.8</td>
<td>28.8%</td>
<td>35.9%</td>
</tr>
<tr>
<td>Tolt_1A</td>
<td>~0 – 1.8</td>
<td>94.8%</td>
<td>83.2%</td>
</tr>
</tbody>
</table>
Stream Bank Conditions

Since Adoption of 2005 Salmon Plan

- Armor = Stillwater, Camp Gilead, Chinook Bend, Upper Carlson, and Lower Tolt
- Armor = end of Neal Rd & near Griffin Creek, SE David Powell Rd

Goals  Progress
26 miles    1.9 miles
5.2 miles
Large Woody Debris
Large Woody Debris (LWD)

LWD Abundance (pieces per mile)

- Snoqualmie River = 41.4
- Tolt River = 159.7
- Raging River = 76.8
Large Woody Debris (LWD)

LWD Abundance (pieces per mile)
- Snoqualmie River = 41.4
- Tolt River = 159.7
- Raging River = 76.8

LWD with Rootwads
- Snoqualmie = 63%
- Tolt River = 48%
- Raging River = 49%
Since Adoption of 2005 Salmon Plan

- **Up** in wood abundance
- **Up** in wood jam abundance

### Goals vs Progress

<table>
<thead>
<tr>
<th>Goals</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 jams</td>
<td>18 jams</td>
</tr>
<tr>
<td>20 jams</td>
<td></td>
</tr>
</tbody>
</table>
Regional LWD Abundance Standards

- Standard for coastal rivers (NMFS 1996)
- Standard for unmanaged forested basins (Fox and Bolton 2007)

### Graphs

#### 2017 LWD with NMFS (1996)
- 2017 Key Pieces
- NMFS Condition Standard

#### 2017 LWD with Fox and Bolton (2007)
- 2017 LWD Pieces
- Fox and Bolton Standard (25th percentile)
Instream Habitats

Instream Habitats

• Snoqualmie River = pools and glides
• Tolt and Raging river = pools and riffles
• Snoqualmie River riffles = downstream of Tokul Creek, Raging River, and Tolt River
Instream Habitats

Pool forming Features

• Snoqualmie River = rip-rap
• Tolt and Raging = wood, bedrock, and boulders
Channel and Floodplain Modifications

- Culverts and outfalls (21)
- Piling arrays (29)
- Flap gates (5)
- Water irrigation pumps (24)
Channel and Floodplain Modifications

- Culverts and outfalls (21)
- Piling arrays (29)
- Flap gates (5)
- **Water irrigation pumps** (24)
Riparian Conditions
Riparian Conditions

Prior to 2005 Salmon Plan

Current Land Cover

150-ft wide riparian corridor
Riparian Conditions

Riparian Land Cover

- Trees
- Shrubs
- Agriculture (farm fields, pasture, crops, etc.)
- Impervious surfaces
- Bare ground
- Other (water, lawns, rocks, vegetated gravel bars, etc.)
2015 Tree Coverage

- Snoqualmie River = 40.4%
- Tolt River = 85.7%
- Raging River = 70.6%

Since Adoption of 2005 Salmon Plan

- tree coverage in Snoqualmie (4.1%) and Tolt (11.8%), no increase in Raging
Riparian Conditions

Specific Land Cover Changes
Riparian Conditions

Specific Land Cover Changes – areas of channel migration

- Trees to Other
- Shrubs to Other
Riparian Conditions

Specific Land Cover Changes – areas outside of channel migration

Snoqualmie River
- Agriculture to Shrubs & Trees
- Shrubs to Trees

Tolt River
- Shrubs & Bare Ground to Trees

Raging River
- Shrubs to Trees
Riparian Conditions

Specific Land Cover Changes – areas outside of channel migration

Snoqualmie River
- Agriculture to Shrubs & Trees
- Shrubs to Trees

Tolt River
- Shrubs & Bare Ground to Trees

Raging River
- Shrubs to Trees

Various cover → shrubs & trees

Goals
- 640 acres

Progress
- 128 acres
- 164 acres
FishViews

• 360° virtual tour with panoramic imagery & hydrologic data
• Mainstem tour = Raging River to Tolt River
• Desktop survey = collected habitat attributes through virtual survey
FishViews

Stream bank conditions
  • Similar observations

Instream & off-channel habitats and floodplain features
  • Pool/glide discrepancies
  • Fewer backwaters & tributaries observed

Large woody debris and jams
  • Similar abundances (except jams)
  • Fewer jams observed
  • Length/width discrepancies in

Channel and floodplain modifications
  • Fewer modifications observed
FishViews

- Cost effective
- Tours can be archived
- Great way to view restoration projects and riverscapes
- Paired with field surveys
Conclusions

- Bank conditions
- Large woody debris
- Instream habitats and floodplain features
- Channel and floodplain modifications
- Riparian conditions

- 1.9 miles restored
- down & up in armor
- Ongoing bank degradation
Conclusions

- Bank conditions
- Large woody debris
- Instream habitats and floodplain features
- Channel and floodplain modifications
- Riparian conditions

- 18 LWD jams
- large wood abundance
- Still well below standards
Conclusions

- Bank conditions
- Large woody debris
- Instream habitats and floodplain features
- Channel and floodplain modifications
- Riparian conditions

- Differences in planform
- Pool forming features
Conclusions

- Bank conditions
- Large woody debris
- Instream habitats and floodplain features
- Channel and floodplain modifications
- Riparian conditions

- Several modification
- Water irrigation pumps
Conclusions

- Bank conditions
- Large woody debris
- Instream habitats and floodplain features
- Channel and floodplain modifications
- Riparian conditions

- 164 acres planted
- Shrubs & trees
- Reached 10yr goal
Questions
Riparian Conditions

2015 Tree Coverage
- Snoqualmie River = 40.4%
- Tolt River = 85.7%
- Raging River = 70.6%
## Riparian Conditions

### Since Adoption of 2005 Salmon Plan
- ↑ tree coverage in Snoqualmie River (4.1%)

<table>
<thead>
<tr>
<th>Land Cover Type</th>
<th>Acres</th>
<th>Percent Coverage</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002</td>
<td>2015</td>
<td>2002</td>
</tr>
<tr>
<td>Agriculture (Farm Fields, Pasture, etc.)</td>
<td>401.3</td>
<td>341.1</td>
<td>30.9%</td>
</tr>
<tr>
<td>Bare Ground</td>
<td>0.9</td>
<td>3.3</td>
<td>0.1%</td>
</tr>
<tr>
<td>Impervious Surfaces</td>
<td>72.9</td>
<td>68.7</td>
<td>5.6%</td>
</tr>
<tr>
<td>Other (Water, Lawns, Rock, Vegetated Gravel Bars)</td>
<td>59.9</td>
<td>58.9</td>
<td>4.6%</td>
</tr>
<tr>
<td>Shrubs</td>
<td>292.7</td>
<td>260.7</td>
<td>22.5%</td>
</tr>
<tr>
<td>Trees</td>
<td>472.1</td>
<td>497.1</td>
<td>36.3%</td>
</tr>
</tbody>
</table>
## Riparian Conditions

### Since Adoption of 2005 Salmon Plan

- ▲ tree coverage in Tolt River (11.8%)

<table>
<thead>
<tr>
<th>Land Cover Type</th>
<th>Acres</th>
<th>Percent Coverage</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002</td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td>Agriculture (Farm Fields, Pasture, etc.)</td>
<td>0.4</td>
<td>0.6</td>
<td>−</td>
</tr>
<tr>
<td>Bare Ground</td>
<td>7.2</td>
<td>0.5</td>
<td>▼</td>
</tr>
<tr>
<td>Impervious Surfaces</td>
<td>9.7</td>
<td>9.8</td>
<td>▼</td>
</tr>
<tr>
<td>Other (Water, Lawns, Rock, Vegetated Gravel Bars)</td>
<td>12.7</td>
<td>9.1</td>
<td>▼</td>
</tr>
<tr>
<td>Shrubs</td>
<td>32.4</td>
<td>16.0</td>
<td>▼</td>
</tr>
<tr>
<td>Trees</td>
<td>174.5</td>
<td>211.8</td>
<td>▲</td>
</tr>
</tbody>
</table>

Since the adoption of the 2005 Salmon Plan, tree coverage in the Tolt River has increased by 11.8%.
## Riparian Conditions

### Since Adoption of 2005 Salmon Plan
- Minimal change in tree coverage in Raging River

<table>
<thead>
<tr>
<th>Land Cover Type</th>
<th>Acres 2002</th>
<th>Acres 2015</th>
<th>Percent Coverage 2002</th>
<th>Percent Coverage 2015</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture (Farm Fields, Pasture, etc.)</td>
<td>1.2</td>
<td>0.5</td>
<td>0.7%</td>
<td>0.3%</td>
<td>▼</td>
</tr>
<tr>
<td>Bare Ground</td>
<td>0.4</td>
<td>2.1</td>
<td>0.2%</td>
<td>1.2%</td>
<td>▲</td>
</tr>
<tr>
<td>Impervious Surfaces</td>
<td>17.6</td>
<td>18.0</td>
<td>10.0%</td>
<td>10.3%</td>
<td>▲</td>
</tr>
<tr>
<td>Other (Water, Lawns, Rock, Vegetated Gravel Bars)</td>
<td>16.3</td>
<td>17.2</td>
<td>9.3%</td>
<td>9.8%</td>
<td>▲</td>
</tr>
<tr>
<td>Shrubs</td>
<td>14.7</td>
<td>13.7</td>
<td>8.4%</td>
<td>7.8%</td>
<td>▼</td>
</tr>
<tr>
<td>Trees</td>
<td>124.7</td>
<td>123.5</td>
<td>71.3%</td>
<td>70.6%</td>
<td>▼</td>
</tr>
</tbody>
</table>