Columbia River Cold Water Refuges Plan

Prepared by:
U.S. Environmental Protection Agency
Region 10
COLD WATER REFUGE

21°C (70°F)

14°C (57°F)
Plan Focused on Lower Columbia River
Regulatory Background

- Oregon numeric temperature water quality standard for the Lower Columbia River is 20°C, plus
  - Must have *sufficiently distributed CWR* to aid migrating salmon and steelhead
  - CWR are areas that are at least 2°C cooler than the main channel

- EPA issued the Plan to meet the Reasonable and Prudent Alternative in National Marine Fishery Service’s 2015 Biological Opinion on EPA’s approval of Oregon’s temperature water quality standards

- Plan also is the basis for the CWR targets in EPA’s Columbia/Snake River Temperature TMDL & can be used by the States in their associated TMDL implementation plans
1. Describes the CWR areas in the Lower Columbia River

2. Characterizes how salmon and steelhead use CWR

3. Assesses the amount of CWR needed to meet Oregon’s CWR narrative standard

4. Identifies actions to protect, restore, or enhance CWR

5. Recommends future CWR studies and monitoring
12 Primary CWR in Lower Columbia River (23 Total CWR)
## Lower Columbia River CWR
(12 Primary - color highlighted/23 Total)

<table>
<thead>
<tr>
<th>Tributary Name</th>
<th>River Mile</th>
<th>August Mean Mainstem Temperature (DART)</th>
<th>August Mean Tributary Temperature (NorWeST)</th>
<th>August Mean Temperature Difference</th>
<th>August Mean Tributary Flow (NHD &amp; USGS*)</th>
<th>Plume CWR Volume (&gt; 2°C Δ)</th>
<th>Stream CWR Volume (&gt; 2°C Δ)</th>
<th>Total CWR Volume (&gt; 2°C Δ)</th>
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<tbody>
<tr>
<td>Skamokawa Creek (WA)</td>
<td>30.9</td>
<td>21.3</td>
<td>16.2</td>
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<td>23</td>
<td>450</td>
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<td>110</td>
<td>446</td>
<td>556</td>
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<td>Abernethy Creek (WA)</td>
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<td>806</td>
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<td>Cowlitz River (WA)</td>
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<td>107*</td>
<td>740</td>
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<td>7</td>
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<td>120</td>
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<td>220</td>
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<td>54</td>
<td>874</td>
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<td>72</td>
<td>2,100</td>
<td>888</td>
<td>2,988</td>
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<td>Rock Creek¹ (WA)</td>
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<td>21.2</td>
<td>17.4</td>
<td>-3.8</td>
<td>47</td>
<td>530</td>
<td>1,178</td>
<td>1,708</td>
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<td>Herman Creek (OR)</td>
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<td>21.2</td>
<td>12.0</td>
<td>-9.2</td>
<td>45</td>
<td>168,000</td>
<td>1,698</td>
<td>169,698</td>
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<td>Wind River (WA)</td>
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<td>14.5</td>
<td>-6.7</td>
<td>293</td>
<td>60,800</td>
<td>44,420</td>
<td>105,220</td>
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<td>Little White Salmon (WA)</td>
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<td>13.3</td>
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<td>248*</td>
<td>1,097,000</td>
<td>11,661</td>
<td>1,108,661</td>
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<tr>
<td>White Salmon River (WA)</td>
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<td>21.2</td>
<td>15.7</td>
<td>-5.5</td>
<td>715*</td>
<td>72,000</td>
<td>81,529</td>
<td>153,529</td>
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<td>Hood River (OR)</td>
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<td>21.4</td>
<td>15.5</td>
<td>-5.9</td>
<td>374</td>
<td>28,000</td>
<td>0</td>
<td>28,000</td>
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<td>Klickitat River (WA)</td>
<td>176.8</td>
<td>21.4</td>
<td>16.4</td>
<td>-5.0</td>
<td>851*</td>
<td>73,000</td>
<td>149,029</td>
<td>222,029</td>
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<td>Deschutes River (OR)</td>
<td>200.8</td>
<td>21.4</td>
<td>19.2</td>
<td>-2.2</td>
<td>4772*</td>
<td>300,000</td>
<td>580,124</td>
<td>880,124</td>
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<td>Umatilla River¹ (OR)</td>
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<td>20.9</td>
<td>20.8</td>
<td>-0.1</td>
<td>87*</td>
<td>0</td>
<td>10,473</td>
<td>10,473</td>
</tr>
</tbody>
</table>
Cowlitz River CWR

1.5 million m³
CWR volume
Herman Creek/Cove CWR

170,000 m³ CWR volume
Little White Salmon River/Drano Lake
CWR

1.1 million m³
CWR volume
Deschutes River CWR

135_Deschutes River

880,000 m³ CWR volume

Water Temperature (°C)

Sample Date


1 mi
Bonneville Dam Temperatures and Fish Passage

Adult Salmon & Steelhead Passage at Bonneville Dam
June - September 2007-2016 Average

Refuge use

Number of Fish/Day

Date

Fall Chinook  Steelhead  Sockeye  Summer Chinook  Temperature


14  15  16  17  18  19  20  21  22  23  24

27500
25000
20000
15000
10000
5000
0

Fish use of CWR

**Steelhead**
- 18-19°C threshold for CWR use
- 70-80% steelhead use CWR when temps are 21-22°C

**Fall Chinook**
- 21°C threshold for CWR use
- 15-30% use CWR with 21-22°C
- Underestimate – no plume use

Source - Keefer et. al. 2009
Source - Goniea et. al. 2006
Steelhead use of CWR
Columbia River between Bonneville Dam and The Dalles Dam

Steelhead 24-156; tagged 8-26-2002

Temperature (C)

Fish 30-minute
BON daily mean
ICH daily mean

Little White Salmon
White Salmon
Dalles
John Day
McNary
Goose
LoMo
Lyons

26 Aug 30 Aug 3 Sep 7 Sep 11 Sep 15 Sep 19 Sep 23 Sep 27 Sep 1 Oct

Bonneville
The Dalles

University of Idaho
College of Natural Resources

92
94
96
100
112
115
116
119
120
122
123
125
127
128
129
Fall Chinook use of CWR example

![Graph showing temperature changes with key events like Start, The Dalles, John Day, Harvest, Little White Salmon, White Salmon, Unknown CWR near McNary, and Unknown CWR near McNary. The graph includes data points tagged 8-14-2000 (DST 2650B).]
Bonneville Dam vs The Dalles Dam
Steelhead Passage

Steelhead Passage Bonneville Dam vs The Dalles Dam
10 Year Average (2007-2016)

- Number of fish/day
- Temperature deg C

Date

Bonneville Dam
The Dalles Dam
Temperature
Accumulation of Steelhead in Bonneville Reservoir Reach

- 60,000 – 70,000 Steelhead in CWR
- 85% of Steelhead in 0.2% of water
# of Steelhead in Each Bonneville Reach CWR

<table>
<thead>
<tr>
<th>Tributary Name</th>
<th>Tributary Temp</th>
<th>Plume CWR Volume (&gt; 2°C Δ)</th>
<th>Stream CWR Volume (&gt; 2°C Δ)</th>
<th>Total CWR Volume (&gt; 2°C Δ)</th>
<th>% of CWR in BON Reach</th>
<th># Steelhead in Each CWR (1999-2016 Avg)</th>
<th># Steelhead in Each CWR High Year (2009)</th>
<th># Steelhead in Each CWR Low Year (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eagle Creek</td>
<td>15.1</td>
<td>2,100</td>
<td>888</td>
<td>2,988</td>
<td>0.2%</td>
<td>109</td>
<td>259</td>
<td>39</td>
</tr>
<tr>
<td>Rock Creek</td>
<td>17.4</td>
<td>530</td>
<td>1,178</td>
<td>1,708</td>
<td>0.1%</td>
<td>63</td>
<td>148</td>
<td>22</td>
</tr>
<tr>
<td>Herman Creek</td>
<td>12.0</td>
<td>168,000</td>
<td>1,698</td>
<td>169,698</td>
<td>9.5%</td>
<td>6,216</td>
<td>14,726</td>
<td>2,188</td>
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<td>Wind River</td>
<td>14.5</td>
<td>60,800</td>
<td>44,420</td>
<td>105,220</td>
<td>5.9%</td>
<td>3,854</td>
<td>9,131</td>
<td>1,357</td>
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<tr>
<td>Little White Salmon River</td>
<td>13.3</td>
<td>1,097,000</td>
<td>11,661</td>
<td>1,108,661</td>
<td>61.9%</td>
<td>40,613</td>
<td>96,208</td>
<td>14,297</td>
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<td>White Salmon River</td>
<td>15.7</td>
<td>72,000</td>
<td>81,529</td>
<td>153,529</td>
<td>8.6%</td>
<td>5,624</td>
<td>13,323</td>
<td>1,980</td>
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<tr>
<td>Hood River</td>
<td>15.5</td>
<td>28,000</td>
<td>0</td>
<td>28,000</td>
<td>1.6%</td>
<td>1,026</td>
<td>2,430</td>
<td>361</td>
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<tr>
<td>Klickitat River</td>
<td>16.4</td>
<td>73,000</td>
<td>149,029</td>
<td>222,029</td>
<td>12.4%</td>
<td>8,133</td>
<td>19,267</td>
<td>2,863</td>
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<td><strong>Total</strong></td>
<td></td>
<td>1,501,430</td>
<td>290,403</td>
<td>1,791,833</td>
<td>100%</td>
<td>65,639</td>
<td>155,492</td>
<td>23,107</td>
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</tbody>
</table>
Steelhead CWR use appears to be an adaptation to warmer Columbia River temperatures

- Current temperatures are about 2°C warmer than the 1950s
  - 10 days above 20°C and 0 days above 21°C in an average year (1950s)
  - 57 days above 20°C and 27 days above 21°C in an average year (Current)
Columbia River Historical Temperature Trends

- Maximum and average August water temperature, Columbia River at Bonneville Dam
  - National Research Council 2004

- July mean temperature, 0.05 days/yr, $P << 0.001$
  - Crozier et al. (2008, Evol App)

- Mean temperature (°C)
  - EPA 2020
Future Lower Columbia River Temperatures (Aug mean)

Assumes a continuation of the 0.3C/decade trend (since 1960)
Amount of CWR needed to attain Oregon’s CWR standard

- Evaluated based on current conditions
- Maintain the CWR volumes in the 12 primary CWR plus provide additional CWR in the Umatilla River
  - Cool the Umatilla River consistent with the Oregon DEQ and Umatilla Tribe Umatilla River Temperature TMDLs, in part by restoring late summer flows
- Restore other tributaries to increase CWR and potentially ‘create CWR’ in light of predicted continued Columbia River warming is also recommended
- Important to recognize that OR CWR standard is not intended to allow for or compensate for Columbia River temperatures in excess of 20°C

Depends on Columbia River Temperature (Aug Mean)

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>20°C (Historic)</td>
<td>21.5°C (Current)</td>
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<tr>
<td>22.5°C (2040)</td>
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</table>
Actions to Protect and Restore CWRs (Chapter 7 in CWR Plan)

Tributary Assessment ‘Snapshots”

Factors affecting temperature

Climate Change

Water Withdrawals

Dams and Hydromodifications

Riparian and Channel Conditions
1. Protect CWR Tributaries Through Existing Regulatory Programs

- Federal Forest plans
- State forest practices
- Columbia River Gorge Management Plan
- County Shoreline Master Plans/land use regulations
- Wild and Scenic River Plans
- State limits on new water withdraws/in-stream flow rules
- FERC flow requirements for Dams
- State water quality standard limits on new thermal discharges

Cowiltz Watershed
2. Restoration Actions within CWR Tributary Watersheds

- Salmon Recovery Plans and implementation actions
- Temperature TMDLs and Plans
- Watershed Resource Plans
- Restore stream vegetation, channel complexity, floodplain function and summer flows in target reaches
- Projects generally supported with public funds (BPA, salmon recovery, clean water, agricultural conservation)
- Counteract predicted increased temps from climate change

Fig. 5: Klickitat River Shade Difference between System Potential and Current Shade, Peter Leinheiser, 7/1/17
3. Manage Dams to Release Cool Summer Flows

- Cowlitz River (Mayfield Dam)
- Lewis River (Merwin Dam)
- Sandy River Basin (Bull Run Dam/Reservoir)
- Deschutes River (Pelton Round Butte Project)
- Visa-a-vis state 401 certs/FERC licenses or HCP
4. Restore Confluence Areas

- Sediment has built up at the confluence and in the embayments of CWRs
- Potentially reducing fish access and volume of CWRs
- Recommend feasibility studies to restore confluence areas and remove sediment
Additional Umatilla Basin Water Exchange

Umatilla River

- Pump Columbia River water for irrigation and reduce withdrawals from the Umatilla River to restore flows
- Part of Umatilla Tribe (CTUIR) water rights claim settlement negotiations
- Requires Congressional Funding
Creek withdrawal currently supplies hatchery

If replaced with groundwater supply it would cool river and increase CWR Volume

ODFW defined Eagle Creek a “thermal sanctuary” and owns hatchery
Enhance Oneonta Creek CWR
(Lower Columbia Estuary Partnership Design)
Columbia River Gorge management plan updated to protect salmon, address climate change, support cideries

Updated Oct 19, 2020: Posted Oct 19, 2020

A. **Streams and riparian areas** – protecting and enhancing aquatic and riparian systems. This includes expanding stream buffers, requiring vegetation enhancement, protecting cold water refuge habitats for fish, and other approaches.

(1) Apply a 200-foot buffer width to these EPA priority cold water refuge streams within the GMA: the Sandy River, Wind River, Little White Salmon River, White Salmon River, Hood River, Klickitat River, and...
Oregon Closes Steelhead Fishing in Three Oregon CWR (Deschutes River, Herman Creek and Eagle Creek)

New Oregon Rules Protect Migrating Columbia Wild Steelhead and Salmon Within Cold Water Refugia