

**DESIGN GUIDELINES APPROVED FOR USE IN DESIGNING WATER CROSSINGS
OVER FISH-BEARING WATERS IN WASHINGTON STATE**

**California Salmonid Stream Habitat Restoration Manual Part XII Fish
Passage Design and Implementation¹**

Notes for appropriate use to comply with WAC 220-660-190

June 29, 2015

Part XII Fish Passage Design and Implementation was prepared specifically for the State of California and the conditions and rules in California. That said, the general content of these guidelines are in line with (or more conservative) than the **Water Crossing Design Guidelines²(WCDG)**. In Washington State, fish passage is required for all water crossings in fish-bearing waters (RCW 55.77.030). WAC 22-660-190(2) further requires that “All water crossings must retain up-stream and downstream connection in order to maintain expected channel processes.” We recommend reading the entirety of WAC 220-660-190 to fully understand WDFW’s expectations for water crossings. Using the notes below as a guide, the designer can use **Part XII Fish Passage Design and Implementation** to design a crossing acceptable under Washington law.

This document has been prepared as a single, continuous chapter with a separate set of appendices.

Page 8-Bullet 4: WAC 220-660-190 requires fish passage on all fish bearing streams. If, after careful scientific study and policy review, a barrier is required to isolate a fish population, the barrier should be constructed as a separate structure and the crossing replaced in compliance with WAC 220-660-190.

Page 21-¶2: Forced profiles are considered roughened channels by the State of Washington and must meet the conditions and requirements of WAC 220-660-200 Fish Passage Improvement Structures.

Page 24-¶2: See previous comment regarding forced profiles.

¹ Love, M and K. Bates. 2009. **Part XII: Fish Passage Design and Implementation, California Salmonid Stream Habitat Restoration Manual**. California Department of Fish and Game.

² Barnard RJ, Johnson J, Brooks P, Bates KM, Heiner B, Klavas JP, Ponder DC, Smith PD, Powers PD. 2013. **Water Crossings Design Guidelines**. Washington Department of Fish and Wildlife: Olympia, Washington.

Page 26-¶1: Artificially steepening the profile of a stream to maintain a culvert nickpoint by any means (i.e. roughened channel, weirs, fishway...) is considered a fish passage improvement structure and must meet the conditions and requirements of WAC 220-660-200.

Page 29-¶1: The use of a “Low Slope” culvert design without a bed installed will be handled on a case-by-case basis, only on streams with adequate bedload and low risk sites expected to achieve a natural bed by the next migration season. This type of design would be considered ad hoc and must include monitoring and a commitment to repair/restore; as described in WAC 220-660-190(3)(c)ii.

Page 33-¶2: See comment above regarding bedless installation.

Page 34-¶6: The constructed channel within a crossing must have continuous banks, overbank areas, and channel bottom in addition to a continuous thalweg.

Page 36-¶1: See comments above regarding initial placement of bed material, and bedless installation.

Page 37-¶4: The materials installed on the channel banks should be within the particle size gradation estimated for the reference reach/design flows.

Page 39-¶4: Culverts with installed beds less that do not include a factor of safety in addition to BFW (for instance, $\text{culvertbed} = 1.2 * \text{BFW} + 2'$ or $= 1.3 * \text{BFW}$ or an equivalent factor) will be considered in locations that are well confined (for instance, a floodplain utilization ratio < 1.5 , see **WCDG P 75** for a definition of FUR), where it can be shown computationally that stream processes and geomorphic conditions will be continuous through the length of the crossing and the downstream adjacent reach.

Page 40-¶1: Note that vertical variation in a round or arch pipe will be accompanied by a varying bed width. The expected vertical variation should not cause a reduction in channel width below what is deemed the appropriate channel width.

Page 40-¶3: A headwater rise to culvert rise ratio of 0.8 (termed “submergence” here) is excessive for this type of culvert and bed scour is likely to occur under these conditions.

Page 42-Bullet 3: See comment above regarding bedless culvert installation.

Page 43-¶7: Floodplain culverts are rarely used in Washington State. If floodplain culverts are going to be used, they should be evaluated in a comprehensive way considering scour, debris occlusion, fish stranding, potential avulsion and related issues.

Page 44-¶2: See comments above regarding bedless installations.

Page 45-¶4: Fords shall meet all material requirements described in WAC 220-660-190.

Page 50-¶9: All hydraulic designs are considered Fish Passage Improvement Structures and must meet the criteria and requirements of WAC 220-660-200.

Page 52-¶2: All Fish Passage Improvement Structures must meet velocity, depth, drop, and turbulence requirements of WAC 220-660-200. These requirements have been developed specifically for the species in Washington and alternative state’s criteria are not acceptable.

Page 54-¶5: The **WCDG** list acceptable EDF values for various hydraulic designs (baffles, roughened channels, etc).

Page 73-¶5: In Washington all roughened channels must meet the hydraulic criteria in WAC 220-660-200.

Page 74-Bullet 2: It is recommended that the roughened Channel width not to be reduced below the natural channel bankfull width.

Page 74-Bullet 4: Additionally, take care to prevent overly large particles that are spaced densely with low relative submergence that would cause porosity at low flows.

Page 80-¶1: See comments above regarding hydraulic criteria.

Page 82-¶3: See note above regarding hydraulic criteria (max drop).

Page 82-¶4: The use of grade control at the inlet or outlet of a culvert creates what WDFW considers a fishway, which is treated as a Fish Passage Improvement Structure subject to the criteria and requirements of WAC 220-660-200.

Page 93-¶3: All weir projects will be treated as Fish Passage Improvement Structures and subject to the criteria and requirements of WAC 220-660-200.

Page 107-¶1: The State of Washington views fishways as Fish Passage Improvement Structures and they must meet the criteria and requirements of WAC 220-660-200.

Page 116-¶1: See note regarding minimum level of turbulence with drop structures above.

Page 128-¶1: Regardless of the goal of the design, fishways in fish bearing streams up to expected high fish passage flows must meet the hydraulic criteria of WAC 220-660-200.

Page A-8: Hydraulic criteria shall be the values listed in WAC 220-660-200.

Page A-10: Projects that are not completely passable must follow the mitigation sequence in WAC 220-660-080.