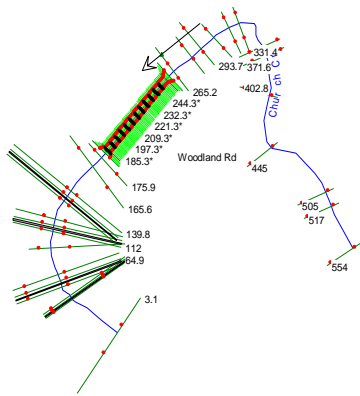




# Church Creek Culvert Retrofit Design for Improving Upstream Fish Passage

## Stillaguamish River Basin, Washington

R2 was contracted by Snohomish County Public Works to design modifications to the steep concrete box culvert with a perched outfall on Church Creek at Woodland Road. This project was funded by a Salmon Recovery Funding Board grant, with support from Snohomish County and the Stillaguamish Tribe.



analysis, permitting support, final design, and services during construction. The project was completed in 2005 and has greatly improved fish passage, while maintaining a stable road corridor and adjacent stream channel.

Placing baffles in the culvert to reduce flow velocity for fish passage also reduces culvert capacity. A careful analysis developed design flows to ensure that the culvert could still pass flood events. This analysis included: regression equations, determination of bankfull conditions, and comparison to nearby flow gages to develop a high level of confidence in the design flow values.



Completely replacing the culvert would have been very expensive and economically infeasible, so a design utilizing internal baffles and downstream rock weirs was implemented. This work included: hydrologic and hydraulic

### Project Elements:

- Fish Passage and Protection
- Hydrologic/Hydraulic Analysis and Modeling
- Sediment Transport/Geomorphology
- Permitting, Design, and Cost Estimating
- Construction Assistance

Two detailed HEC-RAS flow models were developed to assist with design of the culvert baffles and rock grade control weirs. Sediment transport and scour were also analyzed to assure the recommended design would provide a stable bed and project features.

