FINAL REPORT-
INSTREAM FLOW ASSESSMENT PILOT PROJECT

Prepared for:

Shared Strategy for Puget Sound

Prepared by:

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Leaders in water resource technology

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CREDITS AND ACKNOWLEDGMENTS

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Introduction to the Instream Flow Assessment Pilot Project

For several years the central Puget Sound region has seen a growing interest in understanding the effects of changing hydrology and related instream conditions on salmon populations and how these factors can be managed to support salmon recovery goals. Key drivers for this interest include the listing of chinook salmon and bull trout under the Endangered Species Act (ESA) in 1999, which raised the importance of evaluating key factors that must be addressed to ensure the achievement of sustainable and harvestable salmon populations. Hydrology, and more specifically how various land and water management actions relate to instream uses including salmon recovery, is recognized generally as one of these key factors.

Several projects over these years have attempted to make progress in ensuring that the region appropriately addresses instream flow issues relevant to salmon recovery in a Recovery Plan. These projects include the work by the Shared Strategy for Puget Sound toward completing a Recovery Plan for chinook salmon in Puget Sound; watershed plans by watersheds around the state developed under RCW 77.85 and/or RCW 90.82; the Governor's Central Puget Sound Initiative to develop a comprehensive regional water strategy meeting water needs for people and fish; and an assessment of instream flow problems funded by WDFW. Each of these efforts engaged a range of water stakeholders in exploring the technical, institutional and/or policy issues that influence instream flow management actions. They also contributed to the recognition that addressing instream flow issues would be fundamental to meeting salmon recovery goals.

The Instream Flow Assessment Pilot Project presented in this report represents another step toward an understanding of instream flow conditions that will support the achievement of these goals. This project was developed in late summer of 2004 through the work of the Water Quantity Subcommittee of the Shared Strategy Development Committee. The project was initiated with the November 13, 2005 release of a Request for Qualifications (RFQ) (see Appendix) that noted the following set of project purposes

1. Help address the coincident interest, expressed in various salmon recovery and water planning processes, to ensure hydrologic factors related to salmon recovery are appropriately addressed

2. Provide a cost effective tool(s) for evaluating current and future land and water management actions related directly to instream flow conditions and their influence on achieving watershed plan salmon goals (i.e., identifying "flow problems")

3. Support consideration and implementation, by decision-makers, of beneficial land and water management actions that affect instream flows and salmon recovery

4. Ensure ecosystem-based definition of flow problems and solutions, as per state Independent Science Panel direction

5. Build on and integrate existing tools/data that are useful in addressing the analysis tasks

6. Identify, and address as possible, existing limits on data availability and data/model consistency across watersheds, for example those described in the WDFW report

7. Create a tool supporting analysis incorporating varying degrees and types of hydrologic effects (e.g., diversions and land cover changes, climate variability and climate change, freshwater inputs to estuary areas)

This project represents a case study in the application of widely-used hydrologic and ecological modeling tools to determine the impact of land use and water management activities on stream flow regime and, in turn, the effects of stream flow regime changes on habitat and salmon populations in the Puget Sound basin. In responding to the broad purposes expressed in the RFQ, the project team scoped and implemented the project with an emphasis on the following tasks and outcomes:

- Develop and document a procedures that can be applied in other Puget Sound basins to assess land and water management impacts on flow regime and in turn on salmon populations
- Apply the procedures to derive pilot-basin-specific insights into land and water management actions that either reduce or increase salmon populations in the pilot basins
- Apply the procedures to derive generalizations regarding management action impacts in other basins within the Puget Sound ESU.
- Identify needed improvements in modeling procedures and in the knowledge base required to apply them in decision-making settings

This report documents the project team's experience in linking a hydrologic model – Hydrologic Simulation Program-Fortran (HSPF) – that "translates" land cover and water consumption scenarios, to stream flow scenarios with an ecological model – Ecosystem Diagnosis and Treatment (EDT) – that was assumed to "translate" flow and flow-related variables along with other habitat descriptors to salmon populations. Results of the ecological model were also compared with simple index-based methods relating watershed characteristics, in particular hydrology, to salmon habitat conditions. This report is written for an audience comprised primarily of scientists and planners supporting the implementation of salmon recovery plans and programs that influence instream flows.

The pilot study focused on two discrete sub-basins in Water Resource Inventory Area (WRIA) 5, which encompasses the Stillaguamish watershed and nearby smaller direct drainages to Puget Sound. The sub-basins were chosen in part because they help illustrate management actions that are or will be fairly common around Puget Sound and affect instream flow conditions. Four illustrative scenarios representing a range of land use and water management intensities were simulated with the models. These scenarios were crafted to provide a stringent test of the modeling-based approach and tools. This report consists of six chapters that: 1) describe the pilot basins 2) formulate hypotheses regarding human effects on flow regime and flow regime effects on salmon populations both generally and specifically in the pilot basins 3) describe the development and application of the hydrologic modeling of the scenarios, 4) describe the linkages between the hydrologic model and ecological model, 5) describe development of and application of the ecological model to determine effects salmon populations, and 6) discuss management implications of the results.

The results and documentation of this pilot study will undergo a formal peer review process to assess the overall analysis approach and its usefulness in salmon recovery and instream flow management decision-making settings. Peer reviewers will also be asked to identify any necessary or advantageous improvements to the analysis approach that would improve its usefulness.