

PART I: INTRODUCTION

1. Project Overview

1. PROJECT OVERVIEW

BACKGROUND

In March 1999, the National Marine Fisheries Service (NMFS) listed Puget Sound chinook salmon (*Oncorhynchus tshawytscha*) as a threatened species under the Endangered Species Act (ESA). In November 1999, the U.S. Fish and Wildlife Service listed Bull Trout as a threatened species under the ESA. In addition to the recent listing of these two species, it is anticipated that in the next several years additional salmonid and other fresh- and saltwater species native to the Puget Sound Region will be listed.

All in all, at least 106 wild salmon stocks in the Pacific Northwest have been extirpated, 214 are at high or moderate risk of extinction, and many have been listed or are being reviewed for listing under the Endangered Species Act. A number of natural and anthropogenic factors have contributed to these declines:

- Hydropower operations;
- Over exploitation;
- Artificial propagation;
- Climatic and oceanic changes, and destruction; and
- Degradation of habitat through land use and water-use practices.

Although the relative impact of these different factors varies among basins and river systems, habitat loss and degradation are considered contributing factors in the decline of most salmonid populations (Spence et al.1996).

Partly in anticipation of the recent and impending listing of multiple aquatic species in the Northwest, the state of Washington has passed several state laws directing planning efforts to address issues of habitat degradation in fresh and salt water. In 1998-99, the state of Washington passed three laws (house bills 2514 and 2496, and senate bill 5595)to direct state watershed planning. These bills outline geographic areas, organizational structures, and funding mechanisms to develop and implement watershed plans throughout the state. Bill 2514 is primarily focused on in-stream flow issues, while house bill 2496 and senate bill 5595 are primarily focused on addressing Habitat Limiting factors of decline. The geographic areas identified for both of these planning efforts are called Water Resource Inventory Areas (WRIAs), which were originally designed as stream inventory areas. The state of Washington is divided into 62 WRIAs.

Under house bill 2496 (and reasserted by senate bill 5595), the State Conservation Commission was tasked with developing a Limiting Factors Report for each of the WRIAs in the state of Washington. In addition, these bills called for lead entities in each of the WRIAs to establish a Steering Committee and Technical Committee to identify funding priorities for salmon

conservation, and to develop a strategy or plan for addressing Habitat Limiting factors to salmonid recovery in their respective WRIA.

In WRIA 9, (the geographic area including the Green/Duwamish River watershed and the independent drainages to Puget Sound from Elliott Bay south to the Puyallup watershed), the WRIA 9 Steering Committee and the Washington Conservation Commission have teamed up to develop a Habitat Limiting Factors and Reconnaissance Report to begin to lay the groundwork for the future development and implementation of a conservation plan for the WRIA.

The geographic scope of the WRIA 9 Habitat Limiting Factors and Reconnaissance Report includes WRIA 9 drainages and nearshore areas, and Vashon Island (although it is located in WRIA 15, Vashon Island falls within the jurisdictional boundaries of King County). This report covers both fresh- and saltwater habitats for salmonids in the geographic boundaries. The report:

- Brings together existing information on past and present conditions of salmonids and salmonid habitat in the watershed;
- Identifies important problems and habitat limiting factors contributing to salmonid decline; and
- Highlights gaps in current data and technical understanding.

Along with other Habitat Limiting Factors reports being developed across the state, the information in this report will help to create a consistent approach for identifying habitat functions that require protection and restoration to maintain and increase naturally spawning and self-sustaining populations of salmonids. Closer to home, the document will be used as a critical building block for continued assessment and planning efforts in WRIA 9.

The WRIA 9 Steering Committee is responsible for developing a Conservation Plan for the WRIA 9 geographic area by 2005. This Committee was established in 1998 and consists of representatives from local and state governments, the environmental community, and businesses in the WRIA. It is supported by a Factors of Decline Subcommittee (FODS) and Nearshore Technical Committee (NTC), both of which are responsible for developing the scientific basis for the planning effort. The Steering Committee is also supported by a Planning Work Group responsible for helping to move the technical information into policy; and a Public Outreach Workgroup responsible for developing and implementing a public outreach strategy for the planning effort.

The WRIA 9 planning effort also supports the Tri-County Model Conservation Planning Effort. The Tri-County initiative brings together local governments, environmental groups, and businesses in Snohomish, King, and Pierce Counties to address the habitat-related factors of salmonid decline. King County is the Lead Entity for the WRIA 9 Salmon Conservation Planning Effort and provides staff support to the Steering Committee and supporting committees. Several State and Federal grants and programs have helped fund this planning effort. In addition, other local jurisdictions within the WRIA boundary provide staffing (and beginning in 2001, significant funding) to this effort.

WRIA 9 PLANNING PRODUCTS

The WRIA 9 salmonid conservation planning effort is a multi-species effort, focused on habitat issues affecting the decline of salmonids and other species. The effort is expected to take five years and is broken up into four stages:

- Habitat Limiting Factors and Reconnaissance Report;
- Strategic Assessment;
- Near-term Action Agenda; and
- A WRIA 9 Comprehensive Conservation Plan. (taken from the WRIA 9 Steering Committee Approved Work Program, July 2000).

HABITAT LIMITING FACTORS RECONNAISSANCE REPORT

The Habitat Limiting Factors and Reconnaissance Report brings together existing information on conditions of salmonids and salmonid habitat in the WRIA. It is based largely on a collection of readily available information in the literature and institutional knowledge. It identifies important problems and clear factors contributing to salmonid decline, and highlights current gaps in data and technical understanding. This document will serve as a critical building block for the Strategic Assessment, and will provide the scientific foundation for the development of a Near-term Salmon Action Agenda.

STRATEGIC ASSESSMENT

The Strategic Assessment will build on information in the Habitat Limiting Factors and Reconnaissance Report. It will involve original research and collection and analysis of data to fill important information gaps identified by the Habitat Limiting Factors and Reconnaissance Report. This will result in a richer, more comprehensive understanding of problems and opportunities in the watershed related to salmonid conservation and recovery. The Strategic Assessment will be initiated in 2001 and will culminate in a report to the WRIA 9 Steering Committee in approximately June 2003. This work will provide the scientific foundation for the development of a Comprehensive Conservation Plan for WRIA 9.

NEAR-TERM ACTION AGENDA

This document will recommend early and interim action projects, policies, and programs, based on the results of the Habitat Limiting Factors and Reconnaissance Report. It will include recommended actions related to habitat protection and restoration, and policy and program responses to other high-priority habitat limiting factors in the watershed. This agenda will guide decisionmaking and action by local governments and other implementers in WRIA 9 while the final conservation plan is being completed. The goal is for the Steering Committee to adopt a Near-term Action Agenda by the end of 2001. This Agenda will then serve as an important building block for development of the Comprehensive Conservation Plan.

COMPREHENSIVE CONSERVATION PLAN

The Comprehensive Conservation Plan is the ultimate product of the WRIA 9 planning process. It will guide long-term salmonid conservation and recovery actions in the watershed. The WRIA 9 Steering Committee will guide development of the Plan. The goal is to have the Plan approved by the National Marine Fisheries Service and the US Fish and Wildlife Service by June 2005.

HABITAT LIMITING FACTORS AND RECONNAISSANCE REPORT SCOPE

PURPOSE

As noted above, the Habitat Limiting Factors and Reconnaissance Report is intended to serve as the Conservation Commission's Habitat Limiting factors report for WRIA 9 and as the initial phase in the WRIA 9 salmonid habitat conservation planning effort. The report is specifically intended to:

- Provide a summary of what is known about current and past salmonid species and habitat conditions in the WRIA for future reference;
- Provide baseline information for the WRIA (based on known information) for use in the implementation of an adaptive management program.
- Identify habitat factors of decline in the WRIA and associated data gaps and key findings; and
- Provide preliminary guidance for policy makers to determine next steps in the recovery process.

CONTENTS

The Habitat Limiting Factors and Reconnaissance Report is divided into an Executive Summary and the following chapters:

- **Part I: Introduction.** Includes a background and overview of the planning effort, a brief description of the watershed, a discussion of salmonid habitat needs, a Green/Duwamish salmonid stock status report, and a genetics report.
- **Part II: Factors of Decline/Conditions.** Includes habitat factors of decline for the Mainstem Green/Duwamish River, tributaries to the Green/Duwamish River, independent tributaries that flow directly to Puget Sound in WRIA 9, and stream systems on Vashon Maury Island. Nearshore conditions and factors of decline are also included in this chapter.
- **Part III: Summary.** Includes an assessment, consisting of key findings and data gaps for each factor of decline discussed in part two, and conclusions which include watershed principles, a watershed strategy, and some specific action recommendations.

- **Part IV: Glossary and Bibliography.** Contains a glossary of key terms and acronyms as well as a bibliography for the report.
- **Part V: Appendix.** The appendix includes many graphics that support the report including fish distribution maps. Several supporting documents for the Habitat Limiting Factors and Reconnaissance Report are also included in the appendix.

METHODOLOGY

The Habitat Limiting Factors and Reconnaissance Report was developed by the WRIA 9 Factors of Decline Subcommittee (FODS), with support on nearshore and estuarine issues provided by the Nearshore Technical Committee. Both committees are made up of technical staff from local, state, and federal agencies. The Nearshore Technical Committee also includes representatives from non-profit agencies, the University of Washington, the tribes, and the private sector. The effort was broken into two phases:

- Phase 1 consists of presenting existing information on each habitat factor of decline in the WRIA and identifying key findings and data gaps for each of the limiting factors.
- Phase 2 of the effort, provides an assessment of report findings and offers preliminary recommendations.

RESEARCH OF HABITAT FACTORS OF DECLINE

To facilitate a habitat factors of decline analysis, FODS subdivided the WRIA 9 drainages into four areas:

- The mainstem Green/Duwamish River and larger tributaries;
- Other select tributaries of the Green/Duwamish River;
- Independent tributaries to the Puget Sound including those on Vashon Island; and
- The nearshore and estuary environments.

The Mainstem Green River was further subdivided into four sub-watersheds:

- The Upper Green River sub-watershed [upstream of the Howard Hanson Dam at river mile (RM) 64.5)];
- The Middle Green sub-watershed (RM 32-RM 64.5);
- The Lower Green River sub-watershed (RM 11 to RM 32); and
- The Duwamish River(downstream of RM 11).

FODS began by researching each identified habitat factor of decline in the Mainstem Green/Duwamish and major tributaries and identifying key findings and data gaps for each. They

then moved to an analysis of smaller tributaries to the Green/Duwamish and those draining directly to Puget Sound. Habitat factors of decline were noted for each tributary and key findings and data gaps identified. The Nearshore Technical Committee took the lead in developing a summary of factors of decline, key findings, and data gaps for the nearshore and estuary environments.

ASSESSMENT OF DATA AND NEXT STEPS

Once existing information on factors of decline was assembled and key findings were agreed upon, FODS developed an assessment matrix for each of the sub-basins studied. The purpose of the matrix is to display habitat information for each stream/river reach in a tabular format to provide a quick summary of the factors of decline for salmonids, and to show trends in habitat quality throughout the system. In addition, FODS developed a broad, long-term strategy to move the watershed toward recovery. FODS then walked through each factor of decline and made several recommendations for each. Because this is an overarching document for the watershed and does not prioritize recommendations, FODS will also develop an annual “direction document” which will be intended to provide direction for the given year for both the Strategic Assessment and the Near-Term Action Agenda.

WRIA 9 BASIN CHARACTERIZATION

WATER RESOURCE INVENTORY AREA 9 OVERVIEW

The climate in the Green River watershed is generally mild, with wet winters and dry, cool summers. Annual precipitation varies widely, ranging from over 100 inches in the Cascade foothills and decreasing westward to 35 inches in Seattle. The human population in WRIA 9, estimated to be 564,000 in the 2000 census, is mostly concentrated within the lower (west) end of the watershed, but the fastest rate of population increase is in the suburban cities and nearby unincorporated areas east of Seattle (King County 2000).

The Green/Duwamish River is a sixth-order, 93-mile-long river system that originates in the Cascade Mountains about 30 miles northeast of Mount Rainier and flows into Puget Sound at Elliott Bay in Seattle. The Green River basin comprises 566 square miles and is bounded on the north by the Cedar-Sammamish watershed (WRIA 8) and to the south by the Puyallup watershed (WRIA 10). The mean annual flow in the lower Green River (measured at the Auburn gage) is currently 1,350 cfs, the average historic minimum flow prior to construction of Howard Hanson Dam was approximately 140 cfs, and the maximum historic recorded flow is 28,000 to 30,000 cfs. Since construction of Howard Hanson Dam, the average minimum flow is 210 cfs, and the maximum recorded flow was approximately 11,500 cfs. Part of the large discrepancy between current and historical maximum flows is the fact that the watershed and flows have been reduced by 70 percent due to diversions of the White, Black, and Cedar Rivers. (Schaefer et. al. 2000)

The nearshore environment encompasses the shorelines of Puget Sound that fall within WRIA 9, as well as Vashon and Maury Islands. The northern boundary of the WRIA 9 nearshore is West Point, and the southern boundary is just north of Dumas Bay in the City of Federal Way. Its seaward boundary is the outer limit of the photic zone [approximately -20m below Mean Lower Low Water(MLLW)], or the depth beyond which there is insufficient sunlight penetration for

active photosynthesis. The nearshore environment extends landward to include coastal landforms such as bluffs, the backshore, sand spits and coastal wetlands, as well as marine riparian vegetation on or adjacent to any of these areas. In addition, the nearshore environment includes sub-estuaries such as the tidally influenced portions of river and stream mouths.

WRIA 9 PHYSIOGRAPHY

The Green/Duwamish basin can be divided into six physiogeographic parts:

- The Upper Green Sub-watershed [headwaters to the Howard Hanson Dam at RM 64.5];
- The Middle Green River (Howard Hanson Dam to the Soos Creek Confluence at RM 32);
- The Lower Green sub-watershed (Soos Creek confluence to the Black River confluence at RM 11);
- The Duwamish_River sub-watershed (downstream of RM 11);
- Independent Tributaries to Puget Sound (including tributaries on Vashon Island); and
- The Nearshore sub-watershed.

Upper Green River Sub-watershed

From the vicinity of Blowout Mountain and Snowshoe Butte, the river flows generally west and northwest for approximately 25 miles through narrow-valleyed, steeply sloped, densely forested terrain, gathering flows from Sunday, Sawmill, Champion, Smay and Charlie Creeks, as well as from the North Fork Green River. (Schaefer et. al. 2000). This sub-watershed contains about 45% of the Green/Duwamish watershed area and stream mileage. Logging has occurred in this area, and the upland vegetation is a checkerboard of old-growth, second-growth, and recently logged areas. Tacoma Public Utilities (TPU) operates a well field in the North Fork Green River drainage above Howard Hanson Dam. Immediately below the North Fork Green River confluence at approximately RM 64.5 is Howard Hanson Dam, which the U.S. Army Corps of Engineers constructed in 1961 as a flood control facility. The reservoir behind the dam currently provides up to 106,000 acre-feet of storage at elevation 1,206 feet.

Middle Green River Sub-watershed

At approximately RM 61.0, TPU maintains municipal water supply diversion facilities which have blocked anadromous fish migration since construction of this facility in 1913. Below TPU's diversion, the Green River flows between narrow, steeply sloped valley walls through mostly forested mountain terrain before emerging from the mouth of the Green River Gorge at approximately RM 46.4 at the upstream end of Flaming Geyser State Park. At this point, the river flows through a broad, gently sloped valley with mostly agricultural land uses. In contrast with upstream areas, extensive portions of this reach are affected by levees and revetments that constrain channel migration while not necessarily containing floodwaters. Several large state and county parks abut the river in this segment, providing largely forested land.

Lower Green River Sub-watershed

Downstream from the Soos Creek confluence, the Green River enters increasingly urbanized areas within the Cities of Auburn, Kent and Tukwila. Except for occasional stretches of park land, this stretch of the river is bordered by an increasingly densely developed mixture of residential, commercial and industrial land uses. The entire Green River mainstem throughout this reach is degraded with poor habitat quality. The construction of a nearly continuous system of revetments and levees within this area has eliminated functional riparian habitats along many miles of the river channel and has disconnected most remnant side channels and tributaries from the active floodplain.

Green/Duwamish Estuary

Downstream from the Black River confluence (RM 11) (which is also considered the upstream limit of tidal influence), the Green River continues as the Duwamish River, which flows past scores of industrial and commercial facilities as well as scattered urban parks and single and multi-family residences. The Duwamish River and Elliott Bay have been extensively modified over the last 100 years, including the filling of 97 percent of their original wetlands and shallow sub-tidal habitats. These habitats have also been adversely affected by extensive river channelization and dredging (Schaefer et. al. 2000). Substantial sediment contamination and water quality problems have also been documented in the Duwamish River and Elliott Bay.

Independent Tributaries

The nearshore tributaries of WRIA 9 include 15 independent streams that directly enter Puget Sound. Bordered by Fauntleroy Creek to the north and Little Joe's Creek to the south, these streams are all typical of Puget Sound lowland drainages that receive their flow from springs, lake outlets, rainfall and groundwater runoff. Miller and Des Moines Creeks are the largest and generally have the largest amount of information. All of the Nearshore creeks in WRIA 9 have experienced the types of habitat degradation associated with industrial development and/or urbanization.

Nearshore

The WRIA 9 nearshore includes dozens of habitat types that support hundreds of species. However, residential, commercial, and industrial development has altered the WRIA 9 nearshore environment significantly by interrupting habitat-forming processes, destroying or altering habitat, and degrading water and sediment quality. Healthy marine riparian vegetation has disappeared from much of the mainland shoreline, and acres of marshes and tidal flats have been filled or dredged. On the mainland shoreline, few natural areas remain, even in parks. A greater number of undeveloped areas persist on Vashon and Maury Islands. Significant data gaps remain in scientists' understanding of this complex and rich environment.

HISTORICAL OVERVIEW

Historically, the White, Green, Black and Cedar rivers flowed into the Duwamish River, and the system drained an area of over 1,600 square miles. In the early 1900s, the White, Black and

Cedar rivers were diverted, reducing the Green/Duwamish drainage area to 556 square miles (Schaefer et. al. 2000)

Development in the watershed began in the mid-1800s with the building of settlements and homesteads near the present-day towns of Tukwila and Kent. In the 1870s through the 1890s major rail lines were constructed in the Green River valley. The Green/Duwamish basin was one of the first areas west of the Cascades to be logged, and the majority of logging in the lowlands occurred between 1870 and 1910.

Major flooding occurred on the White and Green Rivers in 1906. Shortly thereafter, the White River was diverted into the Stuck River, which flowed into the Puyallup River. This diversion was completed in 1911. Diversion of the White River reduced flows at the mouth of the Duwamish from an estimated 2,500-9,000 cubic feet per second (cfs) to a mean annual flow of 1,700 cfs (Fuerstenberg et al., 1999).

In 1916, completion of the Lake Washington Ship Canal diverted the Cedar River from the Green/Duwamish Watershed into Lake Washington, and eliminated the Black River. The diversion of the White, Black and Cedar Rivers reduced the size of the Green River watershed to just over 30 percent of its original area.

Development in the Duwamish River Estuary accelerated in the late 1800s. Excavation of the Duwamish Waterway through the estuary was begun in 1895 and was completed in 1917. Construction of this waterway converted approximately 17.5 linear miles of meandering, distributed channel into 10 miles of deep, uniform channel with a substantial hardened shoreline (Schaefer et. al. 2000). Material excavated during construction of the waterway was used to fill adjacent intertidal shallows and wetlands. Based on historic maps, the pre-development estuary included approximately 1,230 acres of tidal freshwater marshes, 1,270 acres of tidal marsh-land, and 1,450 acres of intertidal mudflats and shallows. By 1940, essentially all of the estuary's shallows, flats, marshes, and swamps were converted to filled, flat land suitable for industrial development.

Tacoma completed construction of the Headworks Dam for water supply near the town of Palmer in 1913, completely blocking fish migration to the upper river and tributaries. In 1962, the Howard Hanson Dam was completed by the Corps of Engineers to the east of Eagle Gorge of the upper Green River. The main purpose of the dam is flood control, with water supply and fisheries conservation as additional authorized purposes, although no fish passage facilities are incorporated into this dam. (Schaefer et. al. 2000)

Despite the many alterations in the watershed and estuary, the Green/Duwamish system continues to support important fisheries and represents a valuable resource to be protected and restored.