



# APPENDICES

## Seattle Public Utilities Urban Creeks Watershed Analysis

This appendix documents the urban creeks watershed analysis performed for Seattle Public Utilities by Washington Trout, Aquatic Resource Consultants, Earth Systems, Perkins Geosciences, and the Seattle Public Utilities Creek Monitoring Team. The principal study objectives are to assess the condition of six watersheds, and to use the information to help guide future projects and programs affecting the watersheds and to monitor and quantify changes in them.

### Introduction

The watershed analysis study was initiated during the summer of 1999, partly in response to a transition in Seattle Public Utilities' approach to stormwater management, which is being broadened from one focused primarily on stormwater conveyance to one which involves more integrative planning at the watershed level. The transition in the utilities' approach to stormwater management includes a need to assess salmon habitat protection issues under the Endangered Species Act. In particular, to assess if and how stormwater management practices potentially affect salmon and their habitat. The watershed analysis is an effort to assess at a general level the condition or 'health' of Seattle's urban watersheds by inventorying biological resources, identifying critical fish habitat, and by assessing physical processes and impacts to those processes.

Seattle's urban creek systems receive significant amounts of runoff as the result of urban development and the creation of impervious surface. Drainage problems have become more numerous and severe, resulting in substantial flooding during storm events. In response, the Drainage and Wastewater Utility was created in 1987 by expanding the sewer utility to include drainage functions. A Comprehensive Drainage Plan was prepared in 1989 and updated in 1995. The plan included a series of capital improvement projects and a drainage management program. Drainage rates were established to fund priority elements of the utility's capital program (primarily the trunk or backbone drainage system) over a period of years, and to implement other elements of the drainage management plan.

The urban creeks watershed analysis focuses on Seattle's larger drainage basins, where salmonid species have been observed or might be found. The six urban creeks systems that are covered by the analysis include Thornton, Pipers, Taylor, Longfellow, Fauntleroy, and Schmitz creeks. In addition, reconnaissance-level inventories have been performed on most of the remaining smaller creek systems in the City.

The urban creeks watershed analysis was based upon the State's protocols for watershed analysis (WAC 222-22) and for stream typing (WAC 222-16-030, as modified by the Emergency Forest Practices Rules March 20, 2000). Both of these protocols were developed for forested systems, and thus, the fit is not always perfect for urban systems, which have been altered by extensive development.

An effort was made to proceed in a step-wise fashion to develop an integrated picture of the six watersheds. Establishing fish presence was an important objective of the aquatic inventories, and watershed analysis consequently included presence/absence surveys, stream typing, habitat surveys, and annual spawning and smolt trapping surveys. The biological inventories were supplemented with macro invertebrate sampling. The data have undergone quality assessment and mapping into GIS. This appendix summarizes methodologies used for each step of the study and summarizes preliminary observations.



## Methods/Steps of the Watershed Analysis

### Presence/absence surveys (1999)

- ❑ conducted as part of stream typing survey of Thornton, Pipers, Longfellow, Taylor, Fauntleroy and Schmitz creeks in July-August, 1999
- ❑ spot-checked areas for the presence of fish (particularly higher in the tributaries) using electrofishing equipment

### Stream typing/water typing (1999)

- ❑ followed water typing system described in the Forest Practices Rules (WAC 222-16-030), and modified under the Forest Practices Emergency Rules (March 20, 2000)
- ❑ presence of fish is the primary indicator of fish-bearing waters (Types 1 through 3)
- ❑ presence of natural barriers (particularly gradient changes) is a primary indicator of non-fish-bearing waters (Types 4 & 5)
- ❑ results are mapped on GIS

### Culvert assessment (1999-2001)

- ❑ followed protocol developed by Washington Trout and the Washington Department of Fish and Wildlife (WDFW) to identify fish passage barriers
- ❑ culverts were inspected and measured for the following parameters: perch height, capacity (size/width relative to stream), gradient, flow velocity through culvert, residual pool depth at outlet, and accessibility
- ❑ culverts were rated as passable, impassable for certain species or life stages, or as illegal barriers (following WDFW's fish passage criteria)

### Habitat surveys (2000 -2002)

- ❑ multiple survey teams surveyed all six streams during the low flow period (August and September)
- ❑ intended to be an inventory of available instream habitat, potential instream spawning gravel, streambed substrate, streambank condition (particularly location/type of streambank hardening), and of general riparian condition (lawn, forested, paved, etc.)
- ❑ Timber Fish and Wildlife habitat assessment

protocol was streamlined to enable completing surveys during low flow period

- ❑ result was a broad-brush inventory of the instream habitat of each watershed, which is being mapped on GIS

### Channel condition surveys (initiated April 2001)

- ❑ geomorphic surveys of the six creeks to assess instream sediment recruitment, transport, and deposition rates/processes, and to identify land use practices affecting these processes
- ❑ protocols include but are not limited to Montgomery-Buffington channel-type classification, Henshaw bank stability class, Harvey & Watson/Simon stage of incised-channel evolution, Henshaw relative bed stability, Rosgen entrenchment ratio

### Spawning surveys (1999-2003)

- ❑ conducted in Thornton, Pipers, Fauntleroy, Taylor and Longfellow during fall 1999-2002, and in Thornton during spring 2000-2003
- ❑ surveys is expected to continue during fall, 2003

### Smolt trapping (2000-2003)

- ❑ carried out in cooperation with WDFW as part of the State's annual smolt-trapping program for the Lake Washington and Green River systems
- ❑ smolt traps are placed in urban creeks for a one to two week period, corresponding to the anticipated peak outmigration period for coho from the Lake Washington tributaries
- ❑ traps were placed in Thornton Creek during the first week of May 2000, and in Thornton and Longfellow creeks for one to two weeks in May 2001-2003
- ❑ smolt trapping is expected to continue during May, 2004

### Other ongoing sampling efforts

- ❑ macro invertebrate samples were collected from Thornton, Pipers, Longfellow, Fauntleroy, Taylor, Puget Ridge, and Schmitz creeks from 1994 to present, except 1997, following the protocols used to calculate benthic index of biological integrity values (B-IBI)
- ❑ macro invertebrate sampling preceded the



urban creeks watershed analysis study, and is being conducted separately by the Seattle Public Utilities Creek Monitoring Team

- ❑ other types of sampling which are being conducted separately from the watershed analysis by the Community Services Division of SPU include: water quality sampling in response to spills to help identify sources of contaminants, detention pond inspections, and flow measurements
- ❑ NOAA Fisheries is leading an investigation to identify cause(s) of why a high proportion of coho salmon die before spawning in creeks that are located in developing areas. Species other than coho do not appear to be affected. SPU is supporting this research effort through ongoing spawning surveys and by the collection of tissue samples.

### Preliminary Observations

There is a total of approximately 35 miles of mainstem and tributaries within the six urban watersheds included in the study: Thornton, Pipers, Longfellow, Fauntleroy, Schmitz, and Taylor. Of that 35 miles, approximately 20 miles are potentially fish-bearing, and have been classified as either a 2 or 3, following water typing system described in the Forest Practices Rules (WAC 222-16-030), and modified under the Forest Practices Emergency Rules (March 20, 2000). The water typing system is based upon the presence or absence of fish, combined with physical criteria.

Type 2 Water is used by substantial numbers of anadromous or resident game fish for multiple life stages, whereas Type 3 Water may be used by anadromous fish for some life stages, and is assumed to be used by resident game fish. Currently, resident fish are present in approximately 11 of the 20 miles of potentially fish-bearing habitat, and anadromous fish have access to approximately four miles. Anadromous fish spawn in Thornton, Pipers, Longfellow, and Fauntleroy creeks, and at the mouth of Taylor Creek. Some of the urban creeks do support coho through their first year, but produce very low numbers of smolts (averaging eight per day in Thornton Creek and one per day in Longfellow Creek). Watershed analysis results generally indicate that some of the existing conditions, which appear to be factors of concern for salmonids in these six systems include: fish passage barriers, habitat quality (particularly the lack of instream complexity), and water quality.

Assessments results are being compiled into a set of maps and graphs for each of the six watersheds. Each set contains information on channel condition; geology and geometry; habitat distribution, quantity and quality; fish distribution (actual and potential); fish passage barriers; and on land use and drainage (outfall subcatchment areas). Limited information is provided on riparian conditions. Questions can be directed to Katherine Lynch, Urban Creeks Biologist and project manager of the watershed assessment (206) 233-5194, [katherine.lynch@seattle.gov](mailto:katherine.lynch@seattle.gov).