



Snohomish County

# Puget Sound Tributaries Drainage Needs Report

Executive Summary

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The Puget Sound Tributaries Drainage Needs Report (DNR) is one of a series of 11 drainage plans completed for most of Snohomish County's Urban Growth Areas (UGAs). The purpose of this plan is to identify flooding and surface water problems and to recommend solutions.

In order to gain a better understanding of the drainage systems, streams, and wetlands within the unincorporated UGAs of Snohomish County, the Snohomish County Council authorized, in 2001, the accelerated development of drainage plans for these areas. The purpose of the DNR project is to plan for existing and future drainage infrastructure needs in a way that identifies how to reduce road and property flooding, protect and enhance aquatic habitat, and reduce stormwater pollution. This Puget Sound Tributaries DNR is one of a series of 11 individual reports that were prepared, in addition to a summary report for the entire DNR project.

## Overview

The Puget Sound Tributaries DNR study area generally covers the unincorporated Urban Growth Areas (UGAs) between the cities of Edmonds and Mukilteo, in southwest Snohomish County (see Figure 1-1). Lund's Gulch Creek, Norma Creek, and Picnic Point Creek each consists of a perennial main stem that flows from its relatively flat headwaters, through forested ravines, and out to Puget Sound.

**Scope of Analyses:** For the Puget Sound Tributaries study area, detailed hydrologic and hydraulic models were created to analyze flooding problems within the Lund's Gulch and Norma Creek basins. This analysis was limited to the main stem creeks and trunkline conveyance systems above the steep ravines. No modeling was performed for Picnic Point Creek. Less detailed analyses were also conducted to assess habitat, water quality, and erosion problems in this study area.

Land uses near the upper reaches of Lund's Gulch Creek and Norma Creek consist primarily of suburban residential neighborhoods and commercial development along the Highway 99 corridor. The majority of the Lund's Gulch basin is in unincorporated

11	Flooding Projects	\$1,443,000
7	Habitat Projects	1,656,000
1	Water Quality Project	143,000
6	Erosion Projects	712,000
1	Flooding/Habitat Project	433,000
2	Flooding/Erosion Projects	877,000
<b>28</b>	<b>Total Recommended Projects</b>	<b>\$5,264,000</b>

Snohomish County, with the cities of Edmonds and Lynnwood in the southwest and southern portions of the basin, respectively. These areas are experiencing rapid growth, as many forested and low-density rural areas are being developed. Land use in the Norma Creek basin consists primarily of medium to high-density residential development, with some

undeveloped forest and wetland areas.

The DNR Study identified a total of 77 problems in the Puget Sound Tributaries study area. Of these, 29 are flooding problems, most of which are due to undersized pipes and channels in the developed areas of the basin. In addition, the study found 16 habitat problems, such as fish barrier culverts and inadequate vegetation to provide good habitat.

The overall water quality of the Puget Sound Tributaries is poor, typical of other highly developed watersheds. Ten location-specific water quality problems were identified within the study area. Also, severe bank erosion and channel widening was observed at several locations along the steeper reaches of the main stems. This accelerated erosion can be largely attributed to increased flow rates that have accompanied urbanization in the upper portions of the basins.

As indicated in Table ES-1, a total of 28 projects are recommended to address the identified problems, some of which address more than one problem. The projects that address flooding problems generally consist of replacing existing drainage pipes, culverts, and ditches with larger ones, along with constructing a few detention facilities where they can cost-effectively reduce creek flows. Typical habitat projects consist of culvert upgrades to remove fish passage barriers and revegetation improvements along some stream channels and/or adjacent riparian corridors. A typical water quality project consists of retrofitting roadside ditches into biofiltration swales so that they effectively treat stormwater runoff.

The estimated implementation cost of these recommended projects is \$5.3 million. In order to implement the recommended projects, a number of issues will need to be resolved, such as available funding, project responsibility, prioritization of projects, detailed design, construction sequence, and permits.

## **Study Area**

The Puget Sound Tributaries DNR study area generally covers the areas in the unincorporated Southwest UGA that drain west directly into Puget Sound (see Figure 1-2). In particular, this includes nearly the entire Lund's Gulch Creek basin, the entire Norma Creek basin, and roughly half of the Picnic Point Creek basin. Lund's Gulch Creek, Norma Creek, and Picnic Point Creek each consist of a main stem that flows year round from its relatively flat headwaters, through a steeper section with large ravines, and then discharges to Puget Sound. Lund's Gulch Creek drains about 2.4 square miles, Norma Creek drains about 1.5 square miles, and Picnic Point Creek drains about 2.0 square miles.

## **Flooding**

For this project, detailed hydrologic and hydraulic models were developed to quantify existing and future surface water conditions within the Lund's Gulch Creek and Norma Creek basins and to evaluate potential solutions to identified problems. In general, hydrologic models were used to estimate the amount of stormwater runoff that would be generated during a storm or series of storms. These data were then input to hydraulic models that were used to simulate routing through the stormwater conveyance systems, which consist of stream channels, wetlands, ditches, culverts, and enclosed storm drain

systems. The combination of hydrologic and hydraulic modeling and analysis facilitated the evaluation of current and potential future flooding problems.

Of the systems that were analyzed within the study area, a number of localized flooding problems were identified. Most of the identified problems involved storm drains or culverts with insufficient conveyance capacities. Complete descriptions of the flooding problem areas and the estimated frequency of flooding are provided in Section 8.0.

The hydrologic and hydraulic models were also used to evaluate potential solutions to the identified flooding problems as well as to the identified fish passage problems. The potential solutions were grouped into two alternatives for the Lund's Gulch Creek and Norma Creek basins. For both basins, the first alternative included projects that would increase the capacity of the existing conveyance system with some minor detention improvements while the second alternative included a combination of conveyance improvements with more significant stormwater detention storage. In general, the two modeling alternatives were found to be equally effective in eliminating the identified existing and potential future flooding and fish passage problems in the both basins.

For the Norma Creek basin, the increase in peak flow rates and in the duration of erosive flows in the creek caused by the proposed conveyance improvements in Alternative 1 was generally found to be negligible. This is primarily due to the nature of the flooding problems and to the location of one of the proposed projects upstream of Lake Serene. As a result, the detention ponds included in Alternative 2 were not needed to offset any increase in flows caused by the proposed conveyance improvements, since the increase was negligible. Therefore, the four conveyance improvement projects in Alternative 1 for the Norma Creek basin were selected for the recommended plan. Should the County choose to address the erosion problems in this basin, then one of the two detention ponds in Alternative 2 was determined to be effective in helping to reduce the increase in flows related to future development.

For the Lund's Gulch Creek basin, both alternatives include some previously planned improvements to the regional detention pond at 52<sup>nd</sup> Avenue West that are designed to reduce downstream erosion in the steep reaches of the creek. For Alternative 1, most of the proposed conveyance improvements are located in the plateau upstream of the existing 21-acre wetland along 48<sup>th</sup> Avenue W, which would effectively negate any peak flow increases associated with these improvements. When combined with the improvements to the regional pond at 52<sup>nd</sup> Avenue W, the peak flow rates and the duration of erosive flows in the creek would be slightly reduced. For Alternative 2, the addition of two proposed detention ponds upstream of the 21-acre wetland have little impact on peak flows downstream of the wetland and the regional 52<sup>nd</sup> detention pond, but would help to further reduce erosion in the creek. Since the proposed detention ponds in Alternative 2 are not needed to offset the increase in flows from the proposed conveyance improvements, the improvement projects in Alternative 1 were selected for the recommended plan. Should the County choose to address the erosion problems in this basin, then both detention ponds in Alternative 2 were determined to be effective in helping to reduce the increase in flows related to future development. Another option for addressing erosion in the creek that was considered, but not modeled due to the high cost, would involve the installation of a bypass pipeline that would convey high flows from 52<sup>nd</sup> Avenue W to Puget Sound.

In addition, several smaller projects were developed to address flooding problems in the study area without the use of detailed hydrologic and hydraulic models. These projects

were identified as potential early action projects that could be implemented more quickly than some of the other projects.

A total of 14 flooding projects were selected for the Puget Sound Tributaries DNR recommended plan. This includes 11 projects that primarily address flooding problems as well as three projects that address other identified problems, such as erosion and habitat, in addition to flooding.

## Habitat

Aquatic habitat assessments were performed in multiple drainage areas within the county, including the Puget Sound Tributaries DNR study area. Combining data from all drainages into a regional analysis makes it possible to explore relationships among physical and habitat/biological variables over a broader range of conditions than would be found in any one drainage area. The results of the regional analysis are provided in a separate document, *Aquatic Habitat Summary: Current and Future Conditions of Urban and Urbanizing Streams of Snohomish County* (Snohomish County, 2002).

For the habitat assessment, sites were selected for examination and data collection that are representative of the variety of habitat conditions found within the watershed. Instream habitat, biotic condition, and fish passage were the major points of focus for the habitat assessment at these sites.

The Puget Sound Tributaries contain a total of 7.0 kilometers of fish-bearing streams, of which approximately 3.1 kilometers of stream were surveyed. Within the surveyed reaches, the streams were observed to be significantly lacking in both large woody debris (LWD) and instream pools. Only 11 functional pools were recorded along the surveyed reaches. Off-channel habitat is sparse and generally small when present.

In addition, riparian areas along fish-bearing streams and wetlands within the study area were examined using recent aerial photos. Analysis was then performed to examine interrelations of habitat components and factors that could affect habitat quality. Stream riparian areas with moderate to high LWD recruitment potential and shade and relatively wide corridors are the predominant condition for the majority of the Puget Sound Tributaries. However, 15 fish-bearing stream reaches have low LWD recruitment potential, low shade, and/or narrow riparian width.

A sampling and analysis program for biotic integrity was also conducted and the results indicate poor biotic integrity. The results are consistent with the generally poor habitat conditions observed during the stream surveys.

A total of six culvert-related or natural fish blockages were identified in the study area. Some of these were determined to be complete barriers to fish passage and some were considered to be partial barriers during certain periods of high flow conditions. Summary information for each culvert is presented in Appendix C.

A total of 16 habitat problems were identified in the Puget Sound Tributaries DNR study area. A variety of CIP projects were developed in order to address some of the identified habitat problems. The projects include installing LWD along stream corridors, planting various types of native riparian vegetation, removing invasive vegetation, and replacing culverts. Permission to access private land will be necessary for all of the recommended habitat CIP projects.

A total of 7 CIP projects that address only habitat problems are included in the Puget Sound Tributaries DNR recommended plan.

## Water Quality

An assessment of existing water quality conditions and associated problems within the Puget Sound Tributaries was also performed. It included characterization of existing water quality conditions in surface waters of the basin, as well as a discussion of general and specific water quality problems in the DNR area. The water quality analysis is primarily based on review of available data and reports with limited field observation. Although the characterization of existing water quality conditions is based on information covering the entire Puget Sound Tributaries, the identification of specific water quality problems focused primarily on the DNR study area.

The data evaluation indicates that the overall water quality of Norma Creek is poor, and is typical of other well-developed urban residential watersheds. Degradation of water quality can largely be attributed to pollutants associated with the surrounding land uses, as well as to a lack of treatment facilities. Although few water quality data are available for Lund's Gulch Creek or Picnic Point Creek, the water quality of these creeks can be expected to be comparable to that of Norma Creek, based on the general similarities in land use, topography, and observation of stream conditions.

Norma Creek is not meeting Class AA criteria for fecal coliform and dissolved oxygen, and is on the Ecology 1998 303(d) list of impaired waterbodies for both parameters. Other water quality problems include elevated metals and sediment. The primary sources of these water quality problems are presumed to be urban residential areas, commercial areas, roadways, and excess sediment from eroding stream banks, slopes, and construction sites.

Several water quality problems were identified in the study area. Most of these were associated with general conditions or activities found throughout the area, whereas a few site-specific problems were also identified. One of the recommended CIP projects would involve the retrofit of an existing detention pond in the Lund's Gulch basin to provide some water quality treatment. Other projects included in the recommended plan to address different problems would also provide some improvement to water quality, such as the projects that reduce erosion and, to a lesser degree, projects that improve riparian habitat conditions.

## Erosion and Sedimentation

Channel erosion and sedimentation along the streams in the basin were assessed through a geomorphic channel evaluation. The channel evaluation was based on the results of a field reconnaissance, review of hydraulic and habitat information provided by Snohomish County and the consultant team, and published reports and maps. Detailed field reconnaissance was conducted over the full length of the Picnic Point Creek, Norma Creek, and Lund's Gulch Creek main stem channels.

The creeks display generally steep gradients through their upper and middle reaches, and much lower gradients just upstream of the channel mouth. At several locations along the steeper reaches, severe bank erosion and channel widening can be observed. This accelerated erosion can be largely attributed to increased flow rates that have accompanied urbanization in the upper portions of the basins. Sediment is transported

from the eroded areas to lower gradient reaches where a significant portion of the bedload is deposited. Stormwater pipe outfalls from developed upland areas that discharge onto the steep slopes of the ravines have also been recognized as problems in the creeks.

Six site-specific CIP projects were developed to solve selected erosion and sedimentation problems. This includes two projects that would tightline flows down the ravine walls along Lund's Gulch Creek and Norma Creek for drainage systems that discharge at the tops of the ravine walls and cause erosion. This also includes four small projects that address localized erosion problems that were considered to be potential early action projects. In addition, some of the recommended flooding projects will have components to address localized erosion-related problems.

## Recommended Plan

The recommended projects were grouped into six different categories, based on the types of problems that were addressed by each project. The first four categories include projects that primarily address only one type of problem: flooding, habitat, water quality, or erosion. The other two categories include projects that address multiple kinds of problems, including flooding/habitat and flooding/erosion. The lists of recommended projects for each of these categories are included in Tables 10-3 through 10-8 in Section 10 of this report. Appendix G contains additional details for each project in project summary sheets, which include a summary, a cost estimate, and a sketch of the proposed improvements. Table ES-1 contains a summary of the recommended CIP projects for the Puget Sound Tributaries.

Though a funding analysis was not conducted for this project, it is readily apparent that the total cost of the recommended projects for the entire DNR project exceeds the County's ability to fund these projects using current revenue sources. Even though the County is not obligated to implement the recommended projects, it was useful to prioritize the projects. To compare the relative benefits of individual CIP projects, evaluation criteria were developed for the four technical areas of this study: flooding, habitat, water quality, and erosion. While the scores assigned to each project provide a general comparison based on these technical criteria, they do not account for other factors that could influence the implementation of the projects, such as public/private responsibility, upstream/downstream impacts, and available funding.

Successful implementation of the recommended CIP projects within the Puget Sound Tributaries would result in reduction of 26 identified flooding problems, habitat enhancement in selected reaches, and modest improvements to water quality and erosion.

An important consideration is that the construction of CIP projects, which the County would implement, is dependent on the availability of public funds. Based on the current allocation of County revenues for surface water purposes, the County does not have sufficient funds allocated to implement all of the recommended CIP projects that would not be the responsibility of private property owners. The County will need to consider the relative importance of the recommended projects in the Puget Sound Tributaries DNR with the rest of DNR study areas, in order to use the limited funds most effectively. Since a funding analysis was beyond the scope of the DNR project, the County will need to perform a separate evaluation to determine how much funding would be available to construct the recommended County CIP projects.

The following other actions should also be implemented:

- Programmatic maintenance of the drainage infrastructure
- Additional analysis of the remaining drainage systems in the study area that were not evaluated for this DNR
- Additional analysis of the recommended flooding and fish passage CIP projects prior to final design
- Additional analysis to evaluate the need to retrofit ravine-top discharges to reduce erosion
- Additional analysis to evaluate the need to retrofit existing detention ponds to improve water quality and/or increase storage capacities
- Additional analysis to evaluate the need to retrofit existing ditches to improve water quality