



Snohomish County

Snohomish UGA Drainage Needs Report

Executive Summary

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The Snohomish UGA 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 these plans 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 Urban Growth Areas (UGAs) of Snohomish County, the Snohomish County Council authorized, in 2001, the accelerated development of drainage plans in these areas. These drainage plans are documented in a series of 11 individual reports, known as drainage needs reports (DNRs), as well as in an additional summary report for the entire project. The Snohomish UGA DNR is one of the 11 individual reports that were prepared.

Overview

The study area for this DNR consists of the unincorporated portions of the Snohomish Urban Growth Area (UGA) (see Figure 10-1). Although the analyses for this DNR focused on the unincorporated UGA, areas within the City of Snohomish were also analyzed in cases where they either affected or were affected by conditions in the unincorporated UGA. The Snohomish UGA is located in west central Snohomish County. The Snohomish UGA study area generally includes the unincorporated UGA east and north of the City of Snohomish, with two small sections located at the southern end of the UGA. The study area covers portions of several watersheds, with the largest portion lying in the Cemetery Creek basin. Portions of the study area also lie within the Bunk Foss Creek basin, the Blackman's Lake/Swifty Creek basin, the Snohomish River basin, and the Pilchuck River basin. The entire Snohomish UGA eventually drains into the Snohomish River, which crosses through the southern end of the UGA.

The Snohomish UGA DNR describes problems associated with flooding, habitat, and water quality under both existing and future land use conditions. Existing problems are generally worsened by future development that increases the amount of impervious area and reduces the amount of forested area.

Due to budget limitations, the hydrologic and hydraulic analyses performed for this DNR were limited to the Cemetery Creek basin that is located within the unincorporated UGA, which is the basin that covers the largest portion of the study area and was identified by the County as the highest priority area. One additional localized flooding problem area within the Cemetery Creek basin was also studied. Habitat and water quality analysis work was

Scope of Analyses: For the Snohomish UGA DNR study area, detailed hydrologic and hydraulic models were created to analyze flooding problems along the main stem of Cemetery Creek, two of its tributaries in the Cemetery Creek basin and one local drainage system that has experienced historical problems. Due to budget constraints, additional problem areas that were identified in the study area were not analyzed. Less detailed analyses were also conducted to assess habitat and water quality problems in the study area.

performed for portions of Cemetery Creek, Bunk Foss Creek, and the Lower Pilchuck River.

The DNR study identified a total of 29 surface water problems in the Snohomish UGA study area. Of these, three are flooding problems within the basin due to undersized or damaged culverts in a developed area of the basin. In addition, the study found 19 habitat problems, such as fish barrier culverts and inadequate vegetation to provide good habitat. The eight water quality problems found in the Snohomish UGA study area are fairly typical of urbanizing areas. Many of these problems have occurred due to the incremental development of the area, where existing drainage systems and streams are unable to handle the increased stormwater.

Table ES-1 Recommended CIP Projects for the Snohomish UGA Study Area		
1	Flooding Project	\$ 236,000
9	Habitat Projects	1,863,000
5	Water Quality Projects	386,000
15	Total Recommended Projects	\$2,485,000

The recommended plan for the Snohomish UGA study area addresses one of the identified flooding problems as well as nine of the more significant habitat problems for which cost-effective solutions were developed. The recommended plan also includes five water quality projects. In addition, a number of non-capital-project actions are recommended that are primarily aimed at improving water quality. The recommendations include a total of 15

projects. The project that addresses the flooding problem consists of replacing the existing culvert with a larger one. 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 a roadside ditch into a biofiltration swale so that stormwater runoff is effectively treated.

The estimated implementation cost of these recommended projects is \$2.5 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 permitting.

Flooding

Detailed hydrologic and hydraulic models were developed to quantify existing and future surface water conditions within the Cemetery Creek basin section of the study area and to evaluate potential solutions to identified problems. In general, a hydrologic model was 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 the hydraulic model that was used to simulate routing through the stormwater conveyance system, which primarily consisted of stream channels and culverts. The combination of hydrologic and hydraulic modeling and analysis facilitated the identification and evaluation of current and potential future flooding problems, and to size solutions to those problems.

Of the systems that were analyzed within the study area, three flooding problems were identified. Two of these problems are associated with culverts along Cemetery Creek that have insufficient conveyance capacity under future land use conditions. One culvert was predicted to have insufficient capacity to convey storm flows with a predicted frequency of once every 25 years and the other culvert could not convey storm flows predicted to occur once every 100 years. The second culvert was also identified as a partial fish passage barrier. The third identified problem is a local flooding problem on

private property caused by a buried culvert. Complete descriptions of the flooding problem areas and the estimated frequency of flooding are provided in Section 8.0.

The recommended plan for the Snohomish UGA DNR includes a CIP project to address only one of the two culvert conveyance problems identified in this study. This is because the DNR standards described in Section 7.0 recommend replacement for culverts that flood once every 25 years, but not for culverts that flood once every 100 years. The solution to the culvert conveyance problem where flooding occurs once every 25 years is to replace the existing culvert along Cemetery Creek with a larger culvert that also meets Washington Department of Fish and Wildlife (WDFW) fish passage requirements. Several culverts along Cemetery Creek were identified during the habitat analyses (discussed in the following section) as total or partial fish barriers. Since the solutions to these problems involve culvert upgrades at four locations, those solutions were modeled along with the culvert upgrade at the flooding problem location as part of the alternatives analysis.

To address the one flooding problem four fish barrier (habitat) problems, the study analyzed two CIP alternatives. Alternative 1 involves culvert upgrades. Alternative 2 includes the same conveyance improvements as Alternative 1, plus two detention ponds located along Bickford Avenue north and south of 52nd Street SE which provide a combined storage volume of 15.4 acre-feet. The first alternative would typically increase downstream flows and potentially cause downstream impacts. However, the implementation of the proposed detention ponds in the second alternative does not mitigate the effects of the increase in peak flows caused by the installation of larger culverts for fish passage in the lower Cemetery Creek in a way that justifies the significantly higher cost for the second alternative. Therefore, Alternative 1 is recommended for this subbasin.

However, it is noted that the proposed culvert replacement for the flooding problem is on private property and it is likely that the existing culvert can be left in place and the top of the driveway could be redesigned as an overflow that allows the creek to flow over the top of the driveway and back into the creek. This would result in minor driveway flooding but no property or structure flooding.

In addition, the solution to the local flooding problem on private property is not a CIP project, but includes a recommendation for field investigations to radio-locate the upstream end of the buried culvert. Once the location is identified, a further solution can be developed.

Habitat

The habitat assessment began with selecting sites thought to be representative of the variety of habitat conditions found within the study area. Areas outside the unincorporated UGA were examined if they represented a potential to significantly affect areas within the unincorporated UGA. Instream habitat, biotic condition, and fish passage were the major points of focus for the habitat assessment at these sites. In addition, riparian areas along fish-bearing streams and wetlands within the unincorporated areas of the Snohomish UGA DNR study area were examined using recent aerial photos and a portion was field checked. Analysis was then performed to examine interrelations of habitat components and factors that could affect habitat quality.

The following instream habitat components, for those streams that were surveyed in the Snohomish UGA DNR study area, were determined to be *unsuitable* by Snohomish County criteria and *not properly functioning* according to National Marine Fisheries Service (NMFS) assessment criteria: bank condition, fine sediment, large woody debris (LWD) condition, and pool and microhabitat condition.

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 19 habitat problems were identified in the Snohomish UGA DNR study area. A variety of CIP projects were developed in order to address some of the identified riparian 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, and it is assumed that this can be obtained for those projects that propose plantings.

Four of the 19 habitat problems identified were total or partial fish passage barriers associated with existing culverts along Cemetery Creek. Summary information for each culvert is presented in Appendix C. Solutions were developed for these four culverts that consist of culvert replacements designed to meet WDFW fish passage criteria. These solutions were modeled as part of the alternatives analysis described in the previous section.

A total of 9 habitat CIP projects (including the four culvert upgrades) are included in the Snohomish UGA DNR recommended plan.

Water Quality

An assessment of existing water quality conditions and associated problems within the Snohomish UGA DNR study area was also performed. This part of the study focused on the Cemetery Creek, Blackman's Lake, and the Bunk Foss Creek basins. It included characterization of existing water quality conditions in surface waters, as well as a discussion of general and specific water quality problems in the DNR study area. The water quality analysis is primarily based on review of available data and reports with limited field observation.

A total of eight water quality problems were identified within the Snohomish UGA DNR study area. The majority of these problems were associated with untreated runoff from high-use roadways. In addition, other problems were a result of pollution generated by commercial and light-industrial areas, pasture and agricultural lands, and residences. Five water quality CIP projects are included in the Snohomish UGA DNR recommended plan. These include retrofitting five existing roadside ditches to be wider, fully-grassed bioswales.

Recommended Plan

Since the total cost of the recommended projects exceeds the County's ability to fund all of the identified CIP projects using current revenue sources, it was necessary to prioritize the projects. Sections 9.0 and 10.0 provide details of this selection and prioritization process. Table ES-1 indicates the number of projects and the total costs of the recommended CIP projects by the three project categories.

Successful implementation of all 15 CIP projects within the Snohomish UGA DNR study area will result in reduction of flooding problems, habitat enhancement in the higher priority habitat areas, and modest improvements to water quality. The recommended list includes some projects that would primarily benefit private property owners, which the County would not be responsible to implement.

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 County-funded CIP projects. The County will need to consider the relative importance of the recommended projects in the Snohomish UGA 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 additional actions are recommended to be implemented:

- Programmatic maintenance of the drainage infrastructure and source control options to improve water quality.
- Additional analysis of the remaining drainage systems in the study area that were not evaluated for this DNR.
- Additional analysis of another alternative along Cemetery Creek that would involve relocating the existing stream channel along the west side of SR 9.
- Additional analysis on Cemetery Creek at the Riverview Road crossing.
- Field investigation to develop solution to local flooding problem on 72nd Street SE (west of 89th Avenue SE).
- Additional analysis of potential habitat projects on the Lower Pilchuck River.
- Additional analysis to evaluate the need to retrofit existing ditches to improve water quality.
- Coordination with City of Snohomish to implement water quality improvements.
- Small farm best management practices.