



WASHINGTON STATE  
DEPARTMENT OF  
E C O L O G Y

# **North Creek Fecal Coliform Total Maximum Daily Load**

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## **Submittal Report**

June 2002  
Publication Number 02-10-020

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# North Creek Fecal Coliform Total Maximum Daily Load

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## Submittal Report

by

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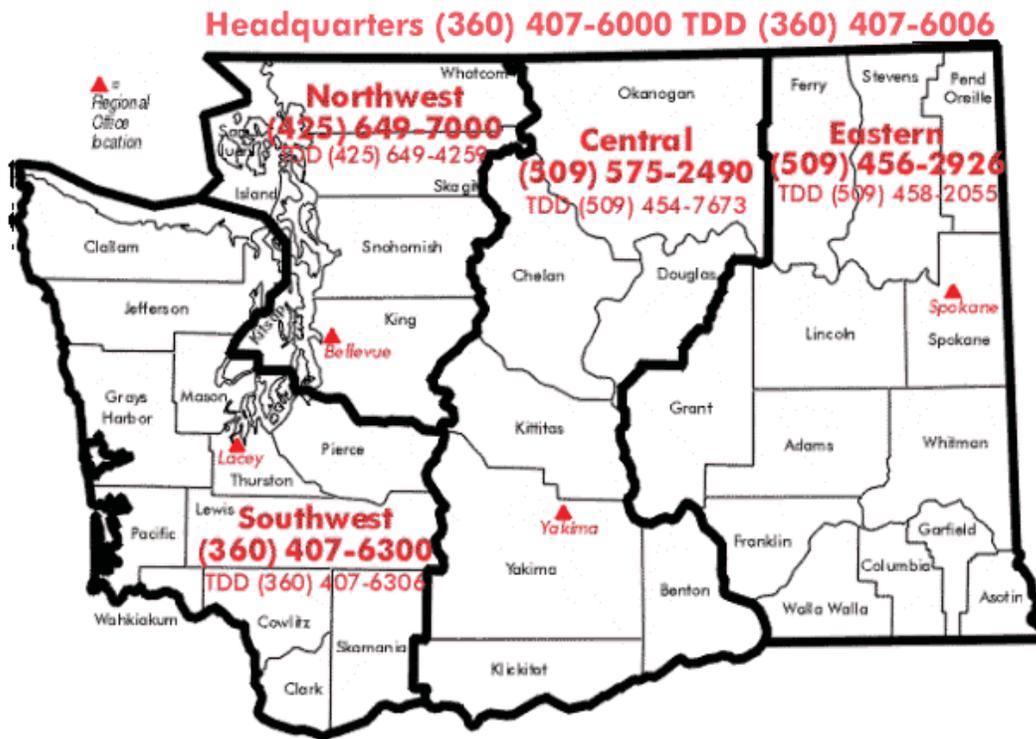


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# Introduction

Under the Clean Water Act (Section 102), every state must have regulations that protect, restore, and preserve water quality. Washington State's regulations are called the Washington State Water Quality Standards (Washington Administrative Code, Chapter 173-201A). Washington's regulations establish narrative and numeric criteria to describe the expected quality of state surface waters. The narrative criteria describe the uses for which each waterbody is intended, such as recreation, fish and shellfish production, and drinking water supply. The numeric criteria set forth the maximum concentration of pollutants allowable in each waterbody so that goals for swimmable, fishable, and drinkable waters will be measured and achieved as needed. When a lake, river, or stream fails to meet water quality standards after application of required technology-based controls, Section 303(d) of the Clean Water Act requires the state to place the water body on a list of "impaired" water bodies and to prepare an analysis called a **Total Maximum Daily Load (TMDL)**. This TMDL report was prepared because North Creek is listed on the Washington State 303(d) list for excessive fecal coliform bacteria levels and inadequate dissolved oxygen in certain locations.

The U.S. Environmental Protection Agency (EPA) has established regulations (Title 40, Part 130 of the Code of Federal Regulations, or 40 CFR 130) and developed guidance (EPA, 1991, 2001) for determining TMDLs. The goal of a TMDL is to set baselines and boundaries on the discharge of pollution into waterbodies in order to attain the levels set forth in the Water Quality Standards.

A TMDL analysis contains a written, quantitative assessment of water quality problems and a description of the pollutant sources that cause the problem. The TMDL determines the maximum amount of a given pollutant that can be discharged a waterbody, which is called the **loading capacity**. The loading capacity is then allocated among the various pollution sources. If the pollutant comes from a discrete source (referred to as a **point source**) such as an industrial facility's discharge pipe, that facility's share of the loading capacity is called a **Wasteload Allocation (WLA)**. If the pollution comes from a diffuse source (referred to as a **nonpoint source**) such as agricultural land or neighborhoods, that portion is called a **Load Allocation (LA)**. The TMDL must include a **margin of safety** that takes into account lack of knowledge about the causes of the water quality problem or its loading capacity. The TMDL must also account for **seasonal variability**. The sum of the individual allocations and the margin of safety must be equal to or less than the loading capacity.

The North Creek Fecal Coliform TMDL is being established to address impairments to contact recreation and domestic water supply caused by excessive levels of fecal coliform bacteria and to help protect fish, which are affected by the low oxygen levels. The geographic scope of this TMDL is shown in Figure 1. The *North Creek Watershed Total Maximum Daily Load Evaluation for Fecal Coliform Bacteria* (Glenn, 2001) was the initial technical study developed by the Washington State Department of Ecology (Ecology) to verify the existence of the bacteria problem and provide a basis for future water cleanup efforts in North Creek.

This report (submittal report) combines elements of the technical study with the results of the public process that developed the Summary Implementation Strategy for the North Creek TMDL. This report will be submitted to EPA for approval following the public comment period. After it is approved, Ecology will work in partnership with affected local governments, citizens, and other basin stakeholders to achieve the pollution reductions set forth in this document. The planned actions will be documented in a report called the Detailed Implementation Plan.

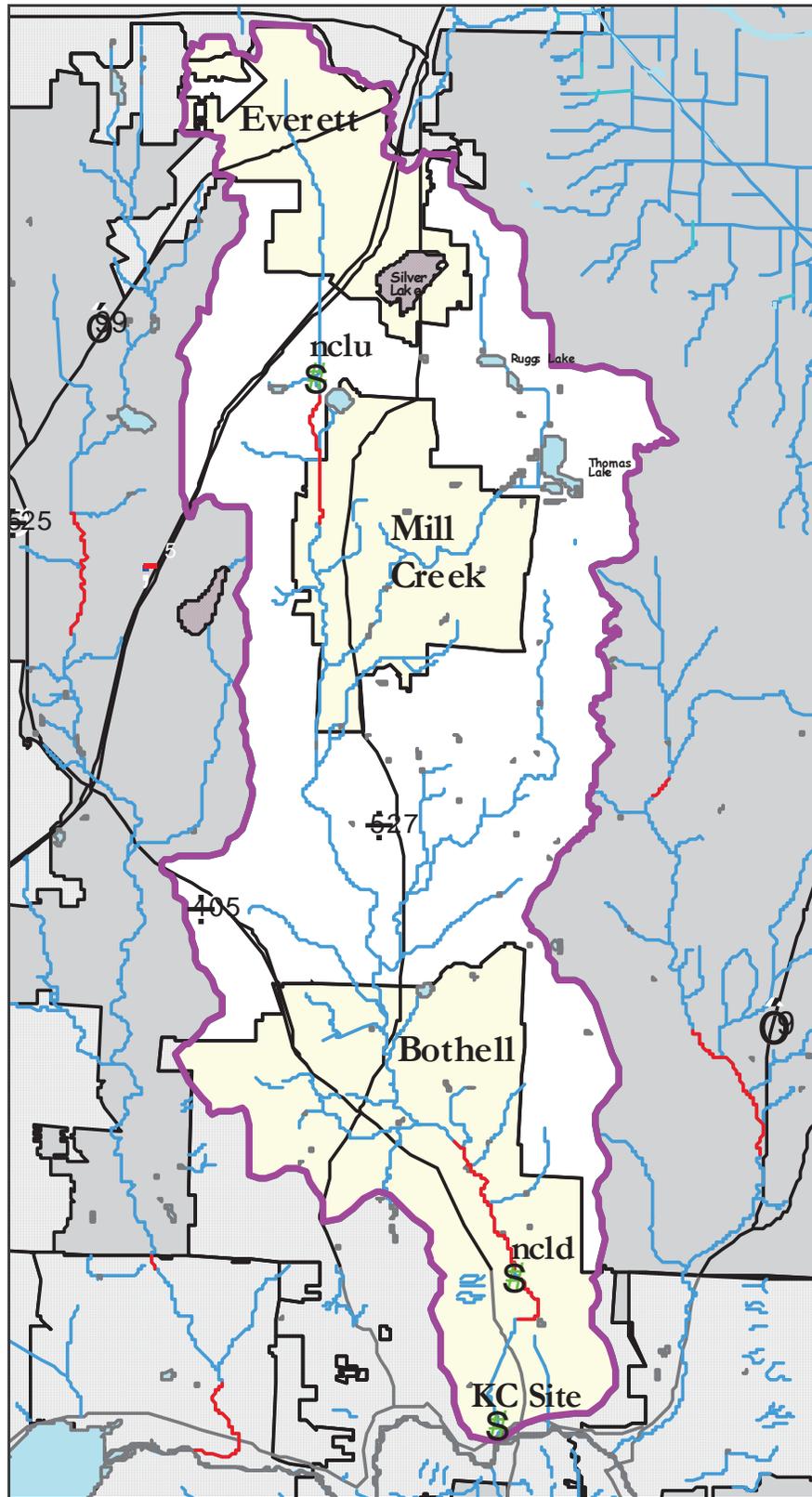


Figure 1. North Creek Watershed. Long-term monitoring sites are indicated by green dots and discussed in text. 303(d) listed streams appear in red, 303(d) listed lakes appear with red shading. North Creek basin outlined in purple.

# Basin Description

The North Creek basin drains approximately 30 square miles and discharges to the Sammamish River, which is tributary to Lake Washington. The TMDL study area is comprised of the mainstem of North Creek and all the tributaries that contribute to it. Land use within the basin is primarily urban or suburban with some pockets of rural and forested land. The basin is being rapidly developed for residential and commercial use. Urbanization and land development activities greatly affect water quality in the basin through riparian corridor alteration, conversion of forests, inadequate retention/detention of stormwater from new and existing impervious surfaces, and poorly treated stormwater run-off.

North Creek is located predominantly in south Snohomish County and is shown in Figure 1. The headwaters originate in the Everett Mall Way area of south Everett and flow southerly for 12.6 miles before discharging to the Sammamish River, within the City of Bothell. The Sammamish River drains into Lake Washington and ultimately through the Ballard Locks to Puget Sound. The last one and one half miles of North Creek is located in King County (Bothell). The stream gradient is flat, decreasing from about 50 feet per mile in the upper basin to less than 20 feet per mile near the mouth. The seven major subbasins within the watershed are mainstem North Creek, Penny Creek, Silver Lake Creek, Nickel Creek, Silver Creek, Tambark Creek, and Sulphur Springs Creek (Figure 2). The major lakes are Silver Lake, Ruggs Lake, and Thomas Lake.

The watershed is nearly 10 miles long, 3 miles wide, and encompasses an area of about 19,000 acres. Approximately 10 percent of the watershed lies within the city of Everett, 23 percent lies within the City of Bothell, 12 percent lies within the city of Mill Creek, and the remaining 55 percent lies within unincorporated Snohomish County. Five percent of the total area lies within King County and this area is within the City of Bothell.

Land use within the watershed changed drastically over the last 30 years. The trend toward small ranches and hobby farms that existed in 1965 was replaced by a trend toward large residential developments and mobile home communities, interspersed with large shopping centers, many small businesses, and supporting facilities. This trend continues today, with emphasis on commercial, light industrial, and business parks. Ninety-eight percent of the basin is now within the county urban growth area (WRIA 8 Steering Committee 2002)

The general land use zoning as provided in Snohomish County's Assessor's Office records in 1991 is classified as follows: 68% residential, , 7% commercial, 0.5% industrial, 4.5% government and education, 3.2% parks, 1.2% open space, and 15.6% other and miscellaneous. Only 3 acres were platted as agricultural land; however, many agricultural uses were included in the rural zoning designation (Snohomish County, 1994).

Pollution in the basin comes from both point and nonpoint sources. The point source contributions come from stormwater and include those discharges currently covered by National Pollutant Discharge Elimination System (NPDES) stormwater permits<sup>1</sup>, as well as those from municipal separate storm sewer systems (MS4s) that are not currently covered by NPDES stormwater permits but meet the definition of a points source in 40 CFR 122.2. Nonpoint water pollution most commonly results from poor land use management, such as inadequate

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<sup>1</sup> See the following website for more information: <http://www.epa.gov/ow/regs/permit.html>

agricultural practices, failing on-site septic systems, and untreated stormwater runoff that does not come from MS4s. Where stormwater comes from rural areas it may carry wastes from domesticated animals. Stormwater from urban areas is likely to carry pet wastes to nearby streams. Urban and suburban development is continuing in the North Creek watershed, thus, water quality impacts from stormwater runoff are increasing as well. Pollution sources are discussed in more detail later in this document under the Sources of Pollution section.

Many areas of the watershed have poor soils for locating on-site septic systems, which may be resulting in failing or inadequate septic systems, which contribute significant amounts of bacterial and nutrient pollutants.

Some areas of the watershed are still rich in wildlife, such as waterfowl, deer, and beaver. Fecal coliform bacteria originating from these sources are considered as part of the natural background and are generally not considered a source of pollution. Bacteria from natural background sources will not be addressed by water cleanup activities associated with this TMDL.

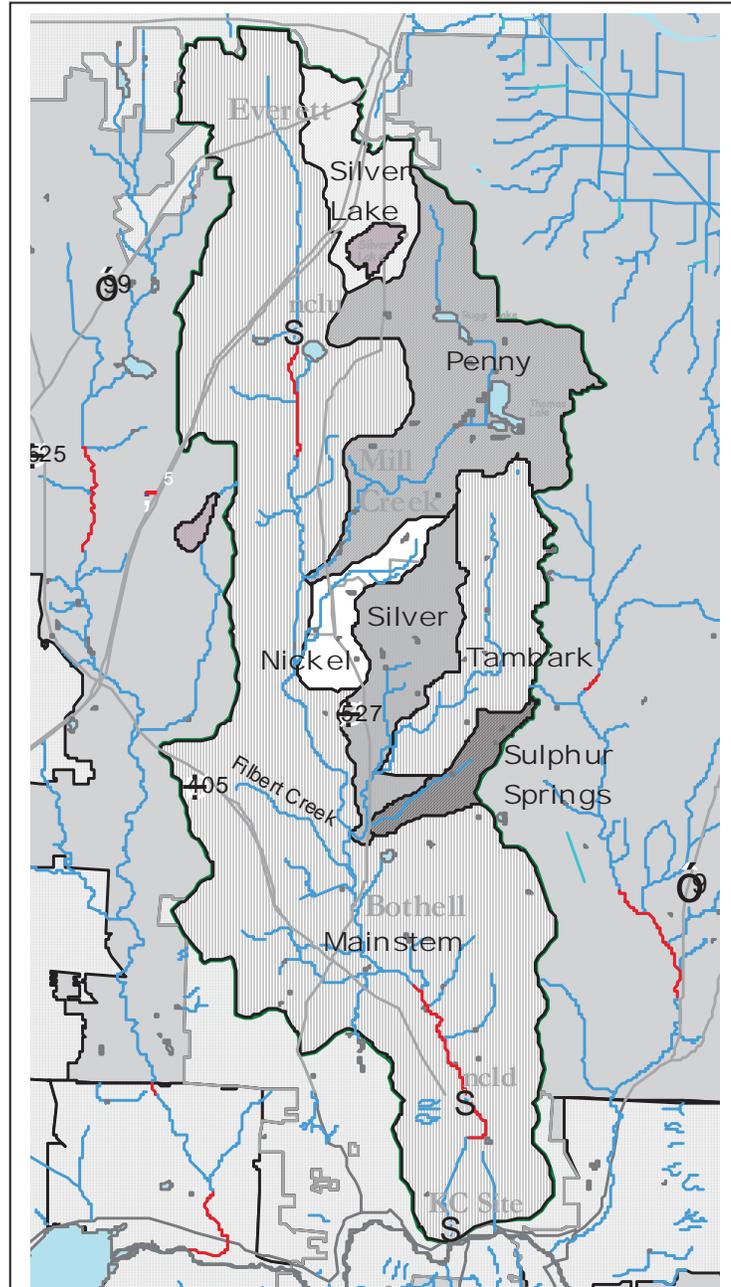


Figure 2. The seven major subbasins of the North Creek Watershed.

# Water Quality Standards

The Washington State Water Quality Standards are published pursuant to Chapter 90.48 of the Revised Code of Washington (RCW). The authority to adopt rules, regulations, and standards as necessary to protect the environment is vested with the state Department of Ecology. Under Section 303(c)(3) of the federal Clean Water Act, the EPA Regional Administrator approves the water quality standards adopted by the State. Through adoption of these standards, Washington has designated certain characteristic uses to be protected and the criteria necessary to protect these uses (WAC 173-201A). The current standards were adopted in November 1997.

This TMDL concentrates on setting stream-specific targets for fecal coliform bacteria levels in North Creek, which have been recorded at levels in excess of state standards. In addition, this TMDL recognizes that there is also an

impairment of dissolved oxygen levels, which have been observed to be lower than that necessary to properly support aquatic life. Because dissolved oxygen levels are affected by many of the pollutant sources affecting bacteria levels, it is anticipated that actions to reduce bacteria levels will also improve dissolved oxygen levels. Implementation activities for this TMDL will also consider other methods of improving dissolved oxygen levels. Washington's regulations establish both narrative and numeric criteria to describe the expected quality of state surface waters. These criteria are discussed in more detail below.

**Table 1. Class AA Standards for fecal coliform bacteria and dissolved oxygen.**

Parameter	Geometric Mean (cfu/100 mL)	90 <sup>th</sup> percentile threshold (cfu/100 mL)	Minimum value
Fecal coliform	50	100	Not applicable
Dissolved oxygen	Not applicable	Not applicable	>9.5 mg/L

## Narrative Criteria

The narrative criteria in the Washington State Water Quality Standards describe the uses for which each waterbody is intended. Because North Creek is a tributary to Lake Washington, it is designated Class AA or extraordinary waters. Waters of this class shall markedly and uniformly exceed the requirements for all or substantially all uses listed as follows:

*"Characteristic uses shall include, but not be limited to, the following:*

*(i) Water supply (domestic, industrial, agricultural).*

*(ii) Stock watering.*

*(iii) Fish and shellfish:*

*Salmonid migration, rearing, spawning, and harvesting.*

*Other fish migration, rearing, spawning, and harvesting.*

*Clam and mussel rearing, spawning, and harvesting.*

*Crayfish rearing, spawning, and harvesting.*

*(iv) Wildlife habitat.*

*(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).*

*(vi) Commerce and navigation."*

[WAC 173-201A-030(1)]

## Numeric Criteria

The numeric criteria in the Water Quality Standards set forth the maximum concentration of pollutants allowable in each waterbody so that the narrative criteria, goals for swimmable, fishable, and drinkable waters, will be achieved as needed. Because North Creek and its tributaries are designated as Class AA waters, they have been assigned criteria that if met, will allow them to be available for the full range of their characteristic uses. The numeric criteria for fecal coliform and dissolved oxygen are shown in Table 1. Fecal coliform criteria for Class AA waters are described in regulation as follows:

*"fecal coliform organism levels shall both not exceed a geometric mean value of 50 colonies/100 ml, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 100 colonies/100 ml."*

[WAC 173-201A-030(2)(c)(i)(A)]

In addition, the standards limit the averaging period used in calculating the applicable geometric mean for fecal coliform:

*"In determining compliance with the fecal coliform criteria in WAC 173-201A-030, averaging of data collected beyond a thirty-day period, or beyond a specific discharge event under investigation, shall not be permitted when such averaging would skew the data as to mask noncompliance periods."*

[WAC 173-201A-060(3)]

The regulatory requirement above addresses the evaluation and determination of compliance of discrete bacterial pollution sources. In contrast, this study must necessarily analyze the entire watershed. Thus, it utilizes data collected over a long time frame in order to characterize water quality from different seasons and environmental conditions to increase the likelihood that sporadic bacterial pollution events will be observed if present.

In cases where natural background conditions exceed a standard, the Water Quality Standards state the following:

*"Whenever the natural conditions of said waters are of lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria."*

EPA, Washington State, and other states have questioned for some time whether fecal coliform bacteria are an optimal indicator of pathogenic bacteria in water. At this time, Ecology is proposing to change its freshwater bacteria criteria (Hicks 2001) and base the new criteria upon the use of Escherichia coli (E. coli). E. coli is a subset of fecal coliform bacteria. Recent studies by Ecology and King County have shown that on average, 90-100% of fecal coliform bacteria are E. coli. A regression analysis of fecal coliform and E. coli levels in the Nooksack River revealed a close relationship between fecal coliform and E. coli levels (coefficient of variation ( $r^2$ ) of 0.9865). More information on the proposed changes to the water quality standards can be found at <http://www.ecy.wa.gov/programs/wq/swqs/index.html> and later in this document.

After conversion to the new standard, it will be desirable to monitor both fecal coliform bacteria and the new indicator simultaneously to evaluate trends in fecal coliform bacteria as well as

measure compliance with the new standards. Because the sources of both of these indicator bacteria are the same and all or nearly all currently measured fecal coliform bacteria are assumed to be *E. coli* at this time, implementation activities for reducing either of these bacteria are identical and thus the change in the standards will not change the type of remedial activities needed in the North Creek basin in relation to this TMDL.

## 303(d) Listings

The federal Clean Water Act, section 303(d), specifies that waterbodies that do not meet state surface Water Quality Standards be placed on the state’s list of impaired waterbodies, or 303(d) list. In the listed waterbodies, technology-based controls for point sources are insufficient and/or the problem is nonpoint source related. States must then turn to water quality-based pollution control and TMDL evaluations (i.e., a TMDL must be established for each pollutant found in concentrations greater than its water quality criterion). Ecology’s Environmental Assessment Program conducts TMDL studies designed to address 303(d) listings following a schedule and prioritization process administered by Ecology’s Water Quality Program.

North Creek was included on Washington’s 1996 303(d) list because of numerous exceedances of fecal coliform bacteria standards; from 29 to 45% of samples collected at several locations in North Creek by Snohomish County and King County between 1992 and 1997 exceeded the upper fecal coliform criterion. Dissolved oxygen was added as a North Creek impairment to the 1998 list based upon Snohomish County’s data showing 46% of samples collected at upper station nclu were below standards (Ecology, 1998). Table 2 provides the pertinent information regarding North Creek 303(d) listings.

**Table 2 . Historical 303 (d) listings for North Creek.** Refer to Ecology’s website at [http://www.ecy.wa.gov/programs/wq/303d/1998/1998\\_by\\_wrias.html](http://www.ecy.wa.gov/programs/wq/303d/1998/1998_by_wrias.html) under “decision matrices” for more information on listing data.

Waterbody			Parameters	
Listing Year	Old Segment ID #	New Segment ID #	D.O.	FC
1996	WA-08-1065	N/A	-	X
1998	WA-08-1065	SM74QQ	X	X



# Historical Data Review

## Water Quantity

The U.S. Geological Survey (USGS) collected continuous streamflow data for North Creek during a 2½-year period (1984-1987) at a gaging station near Bothell, as well as at other locations in the watershed. Box plots of the daily average values from this station, grouped by month allowed wet and dry weather seasons to be established by simply grouping the highest and lowest contiguous month's average flows (Glenn, 2001). The dry season was determined to occur in the months of June-October, while the wet season occurs during November-May.

The seasonal flow patterns in North Creek are characteristic of many Puget Sound lowland streams (i.e., the streams exhibit a flashy response to rainfall typical in urban watersheds). The highest flows occur as a result of winter storms; no spring snowmelt runoff is evident. There is a serious potential flooding problem, particularly in the lower reaches from the Canyon Park area south to the Sammamish River; conversely, low flow during the dry summer months is also a problem.

Fifty percent of all daily flows in the dry season lie between 11 and 18 cfs, while 50 percent of wet season flows lie between 29 and 63 cfs. Streamflows below 10 cfs routinely occur during the dry season, while flood flows approaching 600 cfs and beyond have been recorded. The lowest flows typically occur between July and September, when the creek is intermittent in the upper reaches to a point below McCollum Park. Portions of Penny Creek are also intermittent.

Based on analyses of land use conditions, the level of impervious surfaces in the North Creek Basin has steadily risen since 1985 (Snohomish County 1994, Snohomish County, unpublished data)(Figure 3). Over the last fifteen years, the amount of total impervious area (TIA) has increased from 14 % to 38 % of the total basin surface.

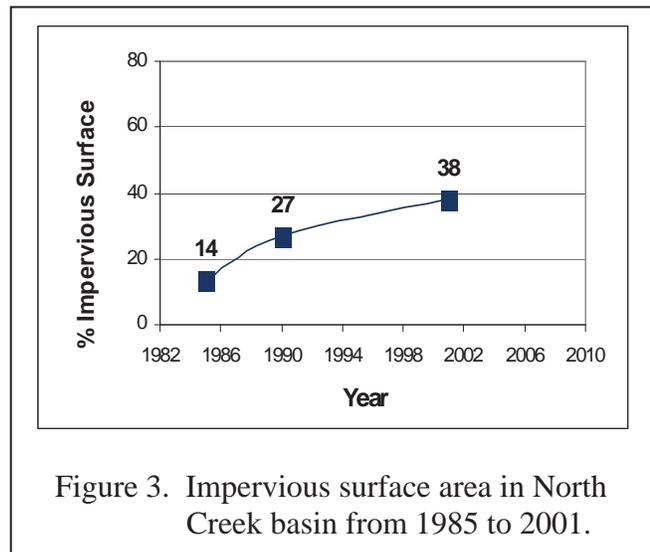


Figure 3. Impervious surface area in North Creek basin from 1985 to 2001.

## Water Quality

Water quality studies were conducted in North Creek between 1971 and 1991 by King County using data collected at their Bothell sampling station (stream mile 1.0). The King County studies focused on the lower portion of North Creek at Station 0474 which is located on the upstream side of the Highway 522 freeway bridge (SE quarter, NE quarter, sec 8, T26N, R5E). Although not necessarily representative of conditions throughout the watershed, the King County data indicated that North Creek's water quality regularly violated water quality standards. Early

monitoring by King County was a valuable impetus and source of information for the work that followed in the watershed.

In July 1990, Snohomish County initiated an Ambient Water Quality Monitoring Program for the urban areas of that county. Fecal coliform samples were collected monthly through January 1991 at eight stations throughout the North Creek watershed providing seven data points per station (for most of the stations). Monitoring was suspended in 1991 while Snohomish County prepared a universal Ambient Water Quality Monitoring Program Quality Assurance Project Plan (QAPP) for all watersheds in Snohomish County. The Snohomish County QAPP was approved by Ecology in May 1992. The monitoring program included several types of water quality sampling goals:

- Assessment monitoring to characterize various aspects of site-specific problems.
- Long-term monitoring to detect temporal trends.
- Surveys to provide broad information about conditions within a region.

Assessment monitoring, which is more intensive monitoring for a period of one year, began the Snohomish County portion of North Creek in May 1992. It focused on correlating land use types with water quality in North Creek (and Swamp Creek) during this first year. The types of land use assessed as potential sources of bacteria were noncommercial hobby farming, mixed commercial/industrial/multi-family, and single family residential. An interim project report summarized the findings from this first year of water sampling (Thornburgh, 1994). The pertinent findings are included below in the subsection on Fecal Coliform Bacteria and the later section on Sources of Pollution.

Two long-term monitoring stations were established on North Creek by Snohomish County in May 1992: McCollum Park and the county line. King County restarted sampling at its Bothell station in January 1993, which is at the same location as the 1984-87 USGS site. All three sampling stations are in operation today.

Data from the three permanent sampling stations confirmed that water quality does not meet Class AA standards because of low dissolved oxygen and elevated fecal coliform bacteria counts. Samples were analyzed by laboratories accredited by the state of Washington for these parameters. Figure 1 shows the location of the gaging and sampling stations.

A field survey was conducted on selected segments of the North Creek watershed during April 1991. A consultant had begun work on a watershed management plan for North Creek in early 1991, and the field survey was part of the water quality assessment task for the plan. The survey provided visual field assessments of current stream bank conditions, water quality, riparian and instream vegetation, aquatic biota, fisheries, and wildlife habitat. Major findings of the field survey are summarized by stream segment in Appendix C of Glenn 2001.

The *North Creek Watershed Management Plan*, prepared in accordance with Chapter 400-12 of the Washington Administrative Code, was completed and approved by Ecology in September 1994 (Snohomish County, 1994). The study examined water quality data and discussed nonpoint pollution sources, source control actions, and an implementation strategy.

## Fecal Coliform Bacteria Levels in North Creek

Fecal coliform bacteria are indicators of the presence of fecal wastes from warm-blooded animals. Livestock, failing septic systems, domestic pets, and wildlife can all contribute to elevated levels. The numeric criteria for fecal coliform bacteria were frequently exceeded at all three long-term monitoring stations (e.g., 72 of 86 samples at the King County station exceeded 50 cfu/100 mL, with a high of 4,800 cfu/100 mL, Glenn, 2001).

Appendix B in Glenn 2001 contains the raw data from the three sampling stations for all parameters sampled. The geometric mean of all wet season concentrations at each of the three stations exceeded 110 cfu/100 mL, while the geometric mean calculated from dry season concentrations exceeded 230 cfu/100 mL. Both water quality criteria were violated. Thus, the data reviewed for this report support the 303(d) listing for fecal coliform bacteria. Box plots of the distribution of the fecal coliform data are shown in Figure 4.

**Table 3 . Numeric criteria for fecal coliform bacteria for primary contact recreational use. (cfu/100mL)(WAC 173-201A)**

Waterbody classification	Waterbody use	Geometric Mean	90 <sup>th</sup> percentile threshold
Class AA (extraordinary)	Primary contact recreation	50	100
Class A (excellent)	Primary contact recreation	100	200
Class B (good)	Secondary contact recreation	200	400

## Beneficial Uses Affected

High levels of fecal coliform bacteria make North Creek is unsuitable for its full range of beneficial uses. These uses include primary contact recreation and water supply. Low dissolved oxygen levels, which have been observed North Creek, can affect the characteristic usage of the stream by salmonids for spawning and rearing activities.

## Primary Contact Recreation

The Washington State Water Quality Standards currently set the criteria for acceptable fecal coliform at different levels based upon the waterbody classification level (Table 3). Future numeric criteria for all waters designated for primary contact recreation will likely be 100 cfu/100 mL geometric mean, 200 cfu/100 mL 90<sup>th</sup> percentile value for *E. coli*. Secondary contact recreation criteria are not expected to be included when the standards are revised.

In addition to bacteria sources from small farms, both viruses and pathogenic bacteria have been detected in storm runoff from urban areas at densities high enough to suggest a potential health risk (EPA, 2001). Infections due to pathogen-contaminated recreational waters include gastrointestinal, respiratory, eye, ear, nose, throat, and skin diseases (EPA, 1986). Excessive amounts of fecal coliform bacteria in North Creek and other waterbodies indicate an increased risk of pathogen-induced illness to humans (EPA, 2001). At least one park, Snohomish County's McCollum Park, affords ready access to the creek (*i.e.*, primary contact recreation). It is assumed that numerous other locations are available for public access.

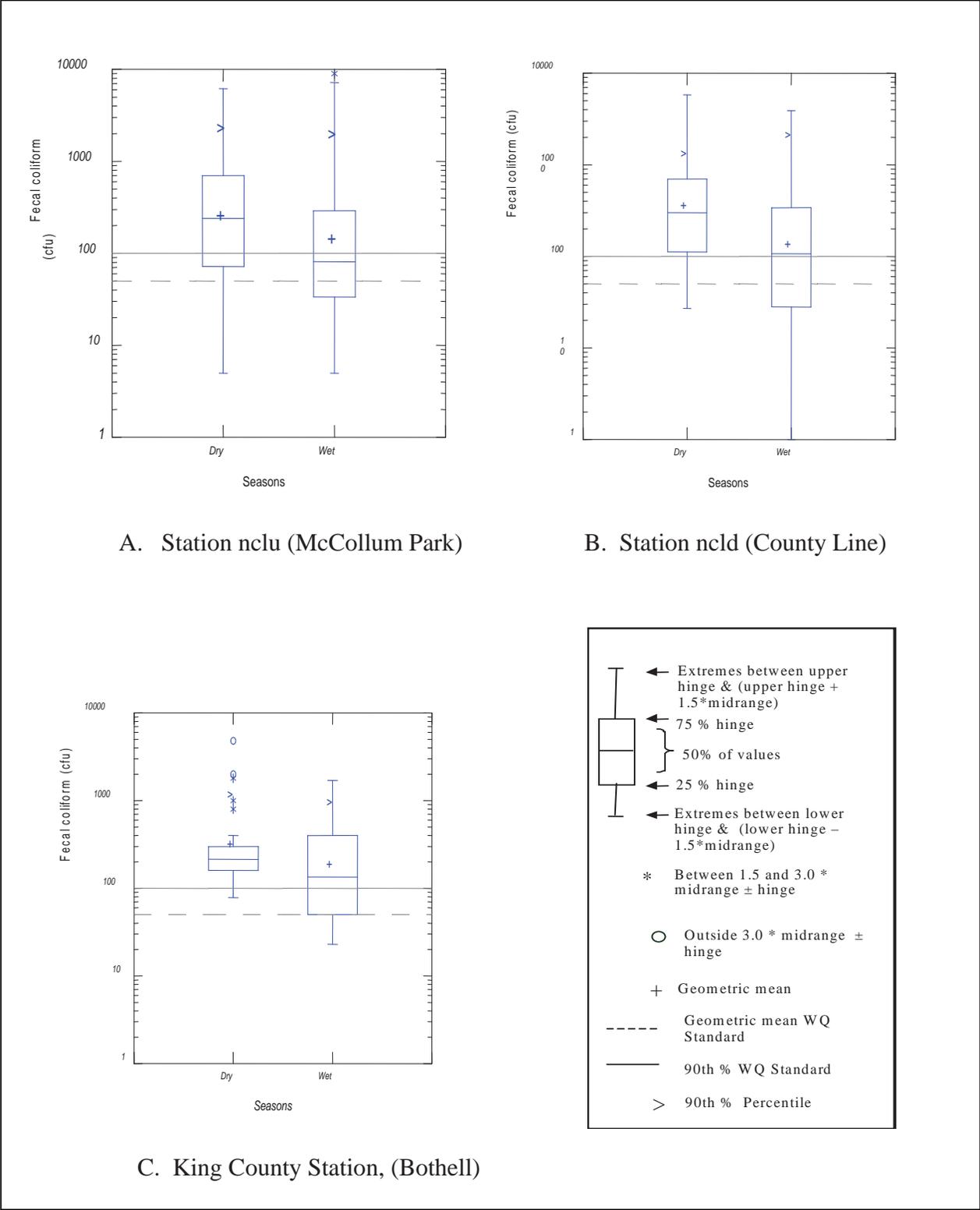


Figure 4. Box plots of the North Creek wet and dry season fecal coliform bacteria data (Glenn 2001). A) Snohomish County Sampling Station nclu at McCollum Park, B) Snohomish County sampling station ncll at county line, and C) King County sampling station in Bothell near the mouth of the creek.

## Fishery Habitat

The North Creek Watershed Management Committee ranked fisheries habitat as the most important beneficial use in North Creek (Snohomish County, 1994). North Creek is considered a valuable stream by the Muckleshoot Indian Tribe and is known to have populations of Chinook, Sockeye, Kokanee, and Coho Salmon as well as Cutthroat Trout and Steelhead (King County, 2001a). The Lake Washington/Cedar/ Sammamish (WRIA 8) Steering Committee (WRIA 8 Committee) recently analyzed subareas within the Greater Lake Washington Watershed that are utilized by Chinook salmon for production at various life stages. North Creek was identified as a satellite subarea, meaning that Chinook salmon are present most years (more than half the years of a typical four- to five-year life cycle (WRIA Steering Committee 2002). The Penny Creek tributary is not currently a productive salmon stream due to the presence of a barrier dam located just 0.5 miles upstream of its confluence with North Creek. The City of Mill Creek is working to improve the fish passage problem on Penny Creek.

Fecal coliform bacteria are associated with fecal matter, which is known to contain nutrients that support plant and animal growth. Algae and other organisms which utilize these nutrients can deplete oxygen under certain environmental conditions. The direct relationship between fecal coliform levels and their accompanying nutrient input to North Creek has not been determined; however, to the extent that these sources are above natural background levels, their reduction should help improve dissolved oxygen levels. Dissolved oxygen levels monitored during the bacteria sampling for this TMDL were below the state numeric criteria in 19% of samples collected at the lower creek stations. At the upper station, 38% of dissolved oxygen samples fell below standards.

## Water Supply

Lower summer flows and questionable water quality limit the usefulness of North Creek as a significant source of water for the basin. A total of 69 water rights applications have been filed to date. Fifty-nine of these have been granted by Ecology, and 13 permits have been canceled.

Irrigation, stock watering, and domestic use are the most common purposes listed on water right withdrawals from North Creek. Thirty-one applications have been filed to irrigate over 800 acres, primarily for small hobby farms and ranches located in the rural eastern portion of the watershed. The only known commercial agricultural operations are a chicken farm, and a greenhouse. There are 33 applications for domestic use; it is not clear whether any of these surface water withdrawals are currently used as potable water supplies. No major manufacturing facilities operate in the basin.

# Sources of Pollution

Bacterial pollution in the basin is from diffuse sources. The predominant sources can be grouped into the categories of agriculture, on-site disposal (septic) systems, and post-development activities attributable to urban development that are conveyed to North Creek via stormwater (e.g., domesticated animals and rodents). Sediments and local wildlife are also potential sources of fecal coliform bacteria.

## Agriculture

Agricultural inputs include animal waste from pasture and concentrated animal areas, waste storage facilities, land application of poorly composed wastes, and stream access by animals. Animals with access to the creeks contribute both fecal coliform bacteria and oxygen-demanding organic matter. The local conservation district does not keep records of agricultural activity in the basin. However, a windshield survey indicated that numerous hobby farms, small ranches, and livestock pastures still operate in the basin. Data for fecal coliform bacteria and nutrients indicate that animal access is a major source of diffuse pollution caused by poor management practices. Key findings from the assessment monitoring done by Snohomish County (Thornburgh, 1994) related to potential agricultural sources were as follows:

- Both large-animal wastes and on-site disposal systems are potential sources of bacteria (and nutrients) in the hobby farming areas.
- Very high levels of bacteria were measured at a site where Penny Creek enters the city of Mill Creek. This site is downstream of several potential sources of bacteria, including Pacific Topsoils, a buffalo farm, and an area served by on-site disposal systems.

Recent windshield surveys of the North Creek Watershed revealed that numerous small farms (hobby farms) still exist throughout the watershed. However, the buffalo farm noted in Glenn 2001 is no longer in operation.

## On-site septic systems

Septic systems, when improperly located, not maintained, failing, or bypassed, can contribute bacterial contamination to streams through surface or groundwater flows. *The North Creek Watershed Management Plan Technical Supplement* states on page 2-10 that, “Most of the soils in the North Creek watershed are unsuitable for septic systems, because they are poorly drained with an underlying hardpan.” Extensive areas of the watershed remain unsewered (Figure 3-3 from the *Technical Supplement*; Snohomish County, 1994). In addition, even though sewer service is provided in many areas, there may be a substantial number of homes that continue to use on-site disposal systems, because hookup is not always required when a new sewer line is installed. Failing on-site septic systems have recently been observed in several locations in the Bothell area.

## Stormwater

Stormwater runoff, while not an original source, must be factored in as a pathway under post-development activities. The major pollutants in runoff from urban areas are sediment, nutrients, oxygen-demanding substances, road salts, heavy metals, petroleum hydrocarbons, pathogenic bacteria, viruses, and toxic chemicals. These are generated directly from the use of insecticides, road salts, and fertilizers, and indirectly from automobile exhaust, oil drippings from trucks and cars, brake lining wear, and various urban activities (EPA, 1997).

During urbanization, pervious, vegetated ground is converted to impervious, unvegetated land. Land imperviousness in urban areas takes the form of rooftops, roads, parking lots, and sidewalks. The amount of impervious surface can range from 35 percent or lower in lightly urbanized areas to nearly 100 percent in heavily urbanized areas. Increases in pollutant loadings generated from human activities are associated with urbanization, and imperviousness results in increased stormwater runoff volumes and altered hydrology in urban areas. Urban runoff carries these increased pollutant loadings to surface waters, typically without treatment (EPA, 1997).

As urban and suburban development continues, stormwater runoff from ever-expanding impervious areas has become more pronounced. Impervious areas generate large volumes of stormwater runoff that is delivered to streams much more quickly than normal. This results in the scouring of stream banks and streambeds and increased sediment loadings to surface waters. These in turn can cause streams to widen and increase in temperature. In the lower reaches of North Creek, impervious surfaces have increased storm flows to the point where the current 2-year flood event is now greater than the historical 100-year flood event (Snohomish County, 1994). Impervious surface has increased from approximately 14% in 1985 to 38% in recent years (Snohomish County, unpublished data). These high flows are also an indication that water that normally traveled slowly in subsurface pathways is no longer available to feed North Creek throughout the year, thus reducing critical summer base flows and resulting in a concentrating effect of dry season pollutants due to lack of dilution.

Pets and waterfowl are primary sources of bacteria conveyed by stormwater runoff in urbanized areas. A study of bacterial loading in urban streams by Young and Thackston (1999) found that fecal bacteria densities were directly related to the density of housing, population, development, percent impervious area, and domestic animal density. Improper landscaping practices can also be a source of excessive levels of fecal coliform and nutrients. Improperly applied and improperly composed manure products can contribute fecal bacteria sources. Fertilizing lawns and gardens beyond the agronomic uptake by plants can lead to runoff of nutrients in stormwater.

Stormwater within the North Creek watershed that is generated in the unincorporated areas of Snohomish County is classified as point source pollution and is regulated by Ecology's National Pollutant Discharge Elimination System (NPDES) Municipal Phase I Stormwater Management Program. Stormwater generated by industrial sites and by construction site clearing greater than five acres are point sources regulated by Ecology's General Stormwater Permit Program. In 2003, Mill Creek, Bothell and Everett are required to apply for Municipal Phase II Stormwater Permits

## Sediments

In addition to the presence of fecal coliform bacteria in the water column, many studies have shown the presence and survival of these bacteria, as well as pathogens, in marine and freshwater sediments (Nix et al., 1994). Resuspension of bacterial indicators can significantly increase in the water column when sediments are disturbed (Weiskel et al. 1996, Yagow and Shanholtz, 1998).

The increasing usage of recreational waters can cause resuspension of bacterial indicators and pathogens when they are in the sediments--there are often much higher concentrations of bacteria in the sediments than in the overlying waters (Burton et al. 1987). Levels of fecal coliform bacteria and specific pathogenic organisms have been shown to survive for longer periods of

time in the sediments than in the overlying water column (Sherer et al., 1992, Burton et al., 1987, Thomann and Mueller, 1987).

## Local Wildlife

Typically, bacteria contributed to surface waters from local wildlife are considered natural background and not a target for reduction by TMDLs. However, where human activities have resulted in the aggregation of excessive numbers of waterfowl, strategies should be developed to discourage, exclude, or limit their access to waters and to increase public awareness of waterfowl impacts to public health and water quality.

# Total Maximum Daily Load Analysis

The Clean Water Act requires states to establish a TMDL for each pollutant violating water quality standards. In the simplest terms, a TMDL process determines the sum of all point and nonpoint source loads that a waterbody can receive and still meet water quality standards. Loads are measured in mass/time units such as pounds per day or colonies/day. The quality of the water itself (*i.e.*, the way it directly affects organisms, including humans) depends on the concentration of pollutants – measured in mass/volume units such as mg/L or colonies/100mLl.

This report recommends a two-pronged approach for addressing the 303(d) listings for fecal coliform bacteria and dissolved oxygen. A TMDL is established to control bacteria levels. Most of the sources of bacteria are also sources that affect dissolved oxygen levels. After the bacteria control measures are implemented, the follow-up monitoring will also determine if dissolved oxygen levels meet or exceed levels set forth in the Water Quality Standards, or if a separate TMDL for dissolved oxygen will be necessary.

## Loading Capacity for Fecal Coliform Bacteria

The dynamic nature of bacteria loading makes assignment of fixed allocations for point and nonpoint source discharges challenging. This TMDL, which involves diffuse sources and a high percentage of impervious surfaces, addresses loading capacity in terms of concentration. Water-quality based allocations are recommended that reflect the expected reduction of in-stream bacteria under defined flow conditions. The loading capacities for North Creek were developed for the purpose of determining the total amount of pollutant that can pass by each monitoring station without causing water quality standards to be exceeded. Each station provides a reference for calculating the relevant statistics and amount of pollutant reduction needed in order to meet standards.

The loading capacity for North Creek is presented in three parts: the total amount of pollutant that can pass by each of the three permanent monitoring stations without causing the standards to be exceeded. Each station provides a reference for calculating the amount of pollutant reduction needed. The loading capacity at each of the three monitoring stations for each season is the concentration needed to meet the two, separate and distinct, parts of the Class AA fecal coliform bacteria criterion:

- “Fecal coliform organism levels shall not exceed a geometric mean value of 50 colonies/100 mL.
- “...shall not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 100 colonies/100 mL.”

## Modeling Approach

The Statistical Theory of Rollback was used to calculate target percent reductions and target geometric means for the North Creek TMDL (Ott, 1995). The approach involves calculating a *percent reduction needed* for: (1) both parts of the numeric fecal coliform criteria, (2) both the wet and dry seasons, and (3) each of the three monitoring stations. Next, *target percent*

*reduction* values are established for each site and season by selecting the more restrictive of the percent reductions needed for the two parts of the criterion. Finally, a *target geometric mean* is calculated for each site and season. The geometric mean of future fecal coliform levels for each season from each monitoring station must be equal to or less than the target geometric mean to ensure meeting both parts of the water quality criterion, assuming future sampling data has the same distribution characteristics as data used in this study.

Sample means and 90<sup>th</sup> percentiles were calculated separately for wet and dry seasons. The wet season was determined to occur in the months of November through May, while the dry season occurs during June-October. The controlling factors in determining the percent reduction needed at each station are the upper 90<sup>th</sup> percentiles (Table 4). Target percent reductions based on existing 90<sup>th</sup> percentiles at each station ranged from 86 to 96 percent and the resulting target geometric means ranged from 19 to 45. With a minimum target percent reduction of 86%, it is apparent that substantial reductions in fecal coliform bacteria concentrations are needed. The target geometric means, driven by existing 90<sup>th</sup> percentiles at each station, are well below the part one water quality standard criterion for fecal coliform of 50-colonies/100 mL.

Raw data for North Creek stream monitoring stations grouped by wet and dry season, along with results from each step involved in the Statistical Rollback Method can be found in Glenn, 2001.

## **Load and Wasteload Allocations**

An allocation is defined as the portion of the receiving water loading capacity that is attributed either to one of its existing or future sources of pollution, or to natural background sources. A pollutant loading allocation assigned to a particular point source is a wasteload allocation (WLA), and that assigned to a nonpoint source is a load allocation (LA). Fecal coliform concentrations are reported in units of “colonies per unit volume,” which cannot be meaningfully translated into units of mass per unit time. Federal regulations allow TMDLs to be expressed in “other appropriate measures” (40 CFR 130.2(i)). The WLAs and LA for fecal coliform bacteria in North Creek are expressed in units of concentration and percent reduction and are distributed to each source based on land area. The sum of these allocations is equal to the loading capacity needed to meet the water quality standards.

The stormwater contributions of fecal coliform in the North Creek watershed originate from both point and nonpoint sources of pollution. Point sources include those discharges currently covered by NPDES stormwater permits, as well as those municipal separate storm sewer systems (MS4s) that are not currently covered by NPDES stormwater permits, but which meet the regulatory definition of point sources at 40 CFR 122.2.

Similar sources of bacteria contribute to both point and nonpoint pollution in North Creek (e.g., pet and livestock waste, stormwater, and failing septic tanks). However, calculating allocations for wet weather sources, such as urban stormwater, is difficult because discharges are highly intermittent, are usually characterized by very high flows over short time intervals, and carry a variety of pollutants whose nature and extent varies by land use. Similarly, EPA recognizes that considerable uncertainty is usually inherent in estimating pathogen loading from nonpoint sources (EPA, 2001). For these reasons, and due to a lack of data distinguishing point and nonpoint pollution, equal allocations were made to each source type (i.e., 50% point source, 50% nonpoint source). Bacterial pollution is assumed to be uniformly distributed by land area over the basin (Appendix C).

**Table 4. North Creek wet and dry season fecal coliform geometric means, 90<sup>th</sup> percentiles and associated % reduction goals (Glenn, 2001).**

Station	First Criterion Geometric Mean <50 cfu/100 mL				Second Criterion 90% of samples < 100 cfu/100 mL			
	Existing Geometric Mean		% Reduction Needed		Existing Upper Tenth Percentile		% Reduction Needed	
	Wet Season cfu/100 mL	Dry Season cfu/100 mL	Wet Season %	Dry Season %	Wet Season cfu/100 mL	Dry Season cfu/100 mL	Wet Season %	Dry Season %
<b>nclu</b> (McCollum Park)	128	230	61	78	1,241	2,366	92	96
<b>ncl d</b> (County line)	111	292	55	83	1,497	1,532	93	93
<b>KC Site</b> (mouth)	155	264	68	81	722	861	86	88

**Table 5. Target percent reductions and target geometric means for stream sampling stations on North Creek (Glenn, 2001).**

Station	Target Percent Reduction		Target Geometric Mean	
	Wet Season %	Dry Season %	Wet Season cfu/100 mL	Dry Season cfu/100 mL
<b>nclu</b> (McCollum Park)	92	96	23	25
<b>ncl d</b> (County line)	93	93	19	35
<b>KC Site</b> (mouth)	86	88	34	45

Assessing the actual, or relative, contribution of point and nonpoint sources through additional source identification monitoring at this time would significantly delay the onset of implementation actions. A lack of refined source identification information or the effectiveness of management efforts should not delay source control measures that can be implemented in the near term (EPA, 2001). Consistent with these findings, the fecal coliform wasteload allocation

**Table 6. North Creek bacteria TMDL allocations.<sup>1</sup>** Load and wasteload allocations expressed as % of the total loading allowed at each of the three monitoring stations below.

Geographic Location	# of Acres	% of total land area	Wasteload Allocation <sup>2</sup>	Load Allocation <sup>3</sup>
Everett	1,884	62.2	31.1 %	---
Snohomish County	1,143	37.8	18.9 %	---
All areas	3,027	100	50%	50%

A. Monitoring station **nclu**. Total loading at nclu is represented by target geometric means (in cfu/100 mL): 23 for wet season, 25 for dry season.

Geographic Location	# of Acres	% of total land area	Wasteload Allocation <sup>2</sup>	Load Allocation <sup>3</sup>
Everett	1,884	11.0	5.5 %	---
Mill Creek	2,239	13.0	6.5 %	---
Bothell	3,161	18.4	9.2 %	---
Snohomish County	9,887	57.6	28.8 %	---
All areas	17,171	100	50%	50 %

B. Monitoring station **nclld**. Total loading at nclld is represented by target geometric means (in cfu/100 mL): 19 for wet season, 34 for dry season

Geographic Location	# of Acres	% of total land area	Wasteload Allocation <sup>2</sup>	Load Allocation <sup>3</sup>
Everett	1,884	10.2	5.1 %	---
Mill Creek	2,239	12.2	6.1 %	---
Bothell	4,192	22.8	11.4 %	---
Snohomish County	10,105	54.8	27.4 %	---
All areas	18,420	100	50%	50 %

C. **KC Site** monitoring station. Total loading at KC site is represented by target geometric means (in cfu/100 mL): 34 for wet season, 45 for dry season

<sup>1</sup> Contributions of bacterial pollution from point and nonpoint sources are assumed uniformly distributed by land area, with 50 percent coming from point sources and 50 percent coming from nonpoint sources.

<sup>2</sup> Wasteload allocation = 0.5 \* (% total point source land area)

<sup>3</sup> Load allocation = 0.5 \* (% total nonpoint source land area)

for point source stormwater runoff in North Creek is inherent in the target geometric mean at each North Creek station (Table 5) and represents a loading such that stream concentrations will not exceed water quality criteria for fecal coliform bacteria.

Point sources were differentiated on the basis of municipal stormwater permits and the land area they cover. Thus, municipalities holding, or anticipated to hold, NPDES stormwater permits are assigned a percentage of the target wasteload allocation relative to their basin land area above each station. Allocation formulas are shown in the Table 6 footnotes with individual allocations expressed as a percentage of the total loading allowed at each station.

## Load Allocations

Concentration-based load allocations were established for each monitoring station along North Creek shown in Figure 1. Allocations were first developed as percent reductions and target geometric means. Table 4 lists the dry and wet season levels for both the geometric means and the 90th percentiles estimated from the monitoring data for each site. The percent reductions required by each part of the criteria were compared, and the most restrictive criterion was used to establish the recommended target geometric mean, or load allocation, shown in Table 5. The statistical method used to set the targets is discussed in Ott, 1995. Because point and nonpoint sources of fecal coliform bacteria pollution were not distinguished in this study, equal allocations were made to each source type (i.e., 50% point source, 50% nonpoint source). Thus 50% of the loading capacity was allocated to nonpoint sources. Load allocations for nonpoint pollution were set at each of the three North Creek monitoring stations as shown in Table 6.

## Wasteload Allocations

There are no commercial dairies located within the North Creek watershed. Pacific Topsoils operates a composting facility along 35<sup>th</sup> Ave. just above Penny Creek and the Thomas Lake wetlands complex. Pacific Topsoils is not considered a significant source of fecal coliform pollution and has no allocation for fecal coliform bacteria in the North Creek Watershed. The only other point sources within the North Creek basin that could contribute bacterial pollution are those addressed in through Ecology's Municipal Stormwater Permitting program.

Concentration-based wasteload allocations were established for all monitoring stations along North Creek shown in Figure 1. Allocations were first developed as percent reductions and target geometric means. Table 5 lists the dry and wet season targets for both the geometric means and the 90th percentiles estimated from the monitoring data for each site. The percent reductions required by each part of the criteria were compared, and the most restrictive criterion was used to establish the target geometric mean, or wasteload allocation, for each station as listed in Table 5. The statistical method used to set the targets is discussed in Ott, 1995. Because point and nonpoint sources of fecal coliform bacteria pollution were not distinguished in this study, equal allocations were made to each source type (i.e., 50% point source, 50% nonpoint source). Thus 50% of the loading capacity was allocated to point sources.

Wasteload allocations for each of the point sources were set at each of the three North Creek monitoring stations as shown in Table 6. Snohomish County and the cities of Mill Creek, Bothell, and Everett were assigned wasteload allocations as part of this TMDL. The use of best

management practices (BMPs), pollution control and prevention activities, and monitoring requirements are expected to be incorporated in the development and implementation of municipal stormwater programs in lieu of effluent limits, consistent with current EPA policy. It is assumed that adequately designed and maintained BMPs will ensure compliance with the water quality standards.

## Seasonal Variation

Seasonal variation is addressed in the TMDL technical study (Glenn, 2001) by establishing target geometric means and percent reductions for both wet and dry seasons.

Three key findings from the one year of assessment monitoring (Thornburgh, 1994) were:

1. Fecal coliform levels are significantly higher during the dry season than during the wet season.
2. High dry season fecal coliform levels may be due, in large measure, to extreme low flows and little dilution.
3. There was a pattern of higher fecal coliform levels at the residential sites than at the hobby farm sites, especially during the wet season.

Box plots in Figure 3 substantiate point No. 1 above. Factoring in the seasonal flow results suggests that the pollution loading is continuous and steady because concentration and flow are inversely related. Winter flows are about 2.5 times greater than dry weather flows and dilute the level of bacteria. Similarly, dry season data, substantiates the relationship between flows and available dilution in point No. 2 as concentrations are relatively high during the dry season, when flows and associated dilution effects are dramatically lower.

The possible influence of storm events on fecal coliform concentrations was examined. The values in Table 4 under the heading *Existing Upper Tenth Percentile* are extraordinarily high. (Ten percent of all monthly sampling results are above these values.). Dry season values higher than those in the wet season suggest that the continuous, steady pollution loading is amplified when sampling events coincide with the “first-flush” of storms, whether wet or dry season storms. Thus, there is also a storm-related component to the loading. However, it appears that there is no significant seasonal variation in pollutant loading, just dramatic fluctuations in flows and high first flush concentrations of bacteria.

## Margin of Safety

The Clean Water Act requires that a margin of safety be identified to account for uncertainty when establishing a TMDL. The margin of safety can be explicit in the form of an allocation or implicit in the use of conservative assumptions in the analysis. Conservative assumptions inherent in the North Creek TMDL are as follows:

- The implementation of bacteria source control measures and cleanup of the North Creek basin has already begun and will continue even when standards are met.
- The statistical rollback method used to establish the target geometric means for the concentration-based allocations provides a more restrictive geometric mean count, in most cases, than the Class AA geometric mean criteria. Thus, the target geometric mean

values in Table 4 are conservative. The lower geometric mean provides an implicit margin-of-safety for meeting the concentration-based TMDL

- As control measures are implemented and additional data are obtained through monitoring, the success of source control measures should be assessed at each control point in the watershed. In the event that target allocations are not met, adjusting existing control measures or implementing new controls in any given segment will adaptively manage TMDL implementation. The process of adaptively managing in response to monitoring results provides an implicit margin-of-safety, because compliance can be determined for each control point in the watershed and control measures will have a cumulative effect downstream.

The extraordinarily high values in Table 4 under *Existing Upper Tenth Percentile* mean that the geometric means of all future results for the three monitoring stations must, in turn, be very low in order to meet the part two (100 colonies/100 mL) fecal coliform criterion. Because body contact recreation is minimal during storms, this approach provides a significant margin of safety.



# Summary Implementation Strategy

## Overview

The 1997 Memorandum of Agreement between the EPA and the Ecology requires that a TMDL submittal include a Summary Implementation Strategy. The purpose of the summary strategy is to present an outline or “blueprint” of how the state and watershed stakeholders will make progress toward achieving water quality standards in the impaired water bodies.

The implementation of the North Creek Fecal Coliform TMDL will be guided by *Washington’s Water Quality Management Plan to Control Nonpoint Source Pollution* (Ecology, 2000). This plan was developed to include all nonpoint source pollution control efforts by federal, state, tribal, and local governments as well as citizen groups. The plan resulted from a collaborative effort and identifies gaps in existing programs, sets a strategy for improving those programs, provides tools, recommends timelines, and outlines methods for determining success. The plan meets federal mandates in Section 319 of the Clean Water Act and Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990.

Coordination and cooperation between the Muckleshoot Tribe, State and local agencies, and local governments will be major factors in the successful implementation of nonpoint source control measures within the target timeframe. Local agencies, such the Snohomish Conservation District, Snohomish County Public Works, the Snohomish Health District, and the cities of Bothell, Mill Creek, and Everett have already begun working cooperatively on nonpoint TMDL issues that will control bacterial sources of pollution. Ecology plans to support local entities in implementing the existing *North Creek Watershed Management Plan* (Snohomish County Public Works, 1994) prepared under WAC 400-12 and developed by Snohomish County and other basin stakeholders.

The Summary Implementation Strategy section of this TMDL submittal report will inventory the existing water pollution control activities in the basin and discuss those in the planning stage. Ecology will work with basin stakeholders to build upon these existing programs and will promote strategies that address issues not otherwise managed by existing programs.

The Growth Management Act requires each city to identify critical areas such as wetlands and steep slopes. Wetlands are important to the capture and management of stormwater, which ultimately recharges local streams and provides dilution of polluting substances. Steep slope management is important to prevent erosion and the deposition of sediments into local waters, which can contribute to the reduction of dissolved oxygen levels. The development and enforcement of water pollution control ordinances, pet waste ordinances, and the establishment of adequate buffer widths will help reduce the discharge of nonpoint source pollution to watershed streams.

Ecology anticipates that if state and local coordination proceed as expected, by December 2008 each of the sampling stations within the North Creek watershed will be within water quality standards for bacteria. Filbert, Tambark, and Penny Creeks are anticipated to be achieving the standards by 2006.

## Current Water Cleanup Activities

This Summary Implementation Strategy will be used as an outline for developing a Detailed Implementation Plan (or Water Cleanup Plan), which is required under the Memorandum of Understanding between Ecology and EPA. The Water Cleanup Plan for the North Creek Fecal Coliform TMDL will be developed in cooperation with local agencies, tribes, land owners, and citizen groups and will be coordinated with current local watershed planning, water quality permitting, and ESA efforts. This section describes major basin stakeholders within the North Creek Watershed and their respective roles and current activities in helping to implement the TMDL.

There are a number of watershed management efforts within the North Creek Watershed that have been completed, are ongoing, or are in the planning stages, and which are discussed below. *The North Creek Watershed Management Plan* (Snohomish County, 1994) was perhaps the most comprehensive approach to recognizing and addressing the diffuse pollution sources within the basin and includes numerous implementation recommendations that will be reviewed during the development of the North Creek Water Cleanup Plan. Implementation actions called for by the *North Creek Watershed Management Plan* that should help reduce bacteria concentrations and improve dissolved oxygen levels are listed in Table 7.

**Table 7. Recommended water cleanup activities from the *North Creek Watershed Management Plan* (1994).**

Action	Priority	Status
Conservation District Staffing	Moderate	Funding unstable
Watershed Steward	High	Completed
Stream Rehabilitation Projects	Low-high	Ongoing
Implementation of Agricultural BMP	High	Incomplete
Agricultural Practices Enforcement	High	No ordinance
Revolving Loan Program for failing on-site septic systems	High	Incomplete
Wetland Retention Incentives	Moderate	Ongoing
North Creek GIS Database Integration	High	Ongoing
Land Acquisition (wetlands, riparian corridors)	High	Ongoing, funding needed
Illicit connection survey	High	Incomplete
Monitoring strategies	High	Ongoing
Streamwalks	Mod-high	Incomplete
On-site septic survey	High	Incomplete
Inventory of on-site septic systems	Mod-high	Ongoing
Farm inventory	Moderate	Incomplete
Pumper Certification Training	High	Completed
Conservation Plans	High	Incomplete
Farm Owner Education	Moderate	Incomplete
On-site septic system educational material	Moderate	Completed
Public Education Brochures	Moderate	Completed
Watershed Keepers Program	Moderate	Completed

## Federal, Tribal, and State Resources

### Muckleshoot Indian Tribe

The Muckleshoot Indian Tribe is a sovereign nation with land use authority within their reservation. The North Creek watershed is within the Tribe's Usual and Accustomed Area. The Muckleshoot Tribe participated in the development of the *North Creek Watershed Management Plan*. The Muckleshoot Indian Tribe also has a Fisheries Department with a water quality program that may be helpful for assessing the success of implementation activities. Coordination of tribal, state, and county monitoring efforts within the TMDL area will be pursued by Ecology.

### Ecology

Ecology has been delegated authority under the Federal Clean Water Act by EPA to establish water quality standards, administer the NPDES wastewater permitting program, and enforce water quality regulations. Ecology has broad authority to protect water quality under RCW 90.48. Ecology responds to complaints, conducts inspections, and issues NPDES permits in the North Creek watershed as part of its responsibilities under state and federal laws and regulations.

In 1995, Ecology issued a municipal stormwater permit to Snohomish County under Phase I EPA rules. The County currently has an NPDES stormwater permit which covers an aggregate area of roughly 55 percent of the watershed addressed in this TMDL. This permit is currently being revised and is expected to be reissued in 2002. Ecology anticipates that the Snohomish County General NPDES Stormwater Permit will contribute to the TMDL implementation process.

Ecology anticipates issuing Phase II municipal stormwater permits to the cities of Everett, Mill Creek, and Bothell in 2004. Ecology expects that these permits will include stormwater monitoring components that will contribute to the follow-up monitoring needed for this TMDL. Each of the local governments receiving the Phase II permit intends to develop and implement their stormwater programs to help address the goals of this TMDL. Specifically, pet waste management, public education, and programs to detect illicit connection are among the activities that will be crafted to reduce bacterial pollution entering North Creek. All local governments have expressed an interest in collaborating on the development of monitoring plans and sharing of monitoring data.

Ecology will pursue the development and implementation of farm plans and "Best Management Practices" (BMPs) at small farms within the watershed through cooperative efforts with the Snohomish Conservation District. In conjunction with local authorities, Ecology will use formal enforcement, including fines, if compliance through voluntary efforts or its permitting authority, is unsuccessful. Ecology will focus its efforts where agricultural discharges have occurred or may potentially occur.

Ecology's Northwest Regional Office has one staff person assigned to conduct salmon-recovery related activities including technical assistance and water quality enforcement. Ecology will coordinate with Snohomish County and the Snohomish Conservation District for documentation, response, and correction of water quality problems on small farms. Ecology expects that within three years, nonpoint pollution from small farms in the North Creek watershed will be significantly reduced. Ecology will also coordinate with other basin stakeholders, as resources allow, to address bacteria and dissolved oxygen problems through its salmon-recovery efforts.

Ecology administers an annual grant and loan program aimed at improving the quality of Washington waters. Much of the funding for the *North Creek Watershed Management Plan* was provided by an Ecology grant. For fiscal year 2003, Ecology estimates that \$120 million in loan money and nearly \$15 million in grant funds will be available to local governments and other entities. During 2001, Ecology provided approximately \$150,000 in grant funding to the Adopt-A-Stream Foundation to create the North Creek Streamkeepers. The Streamkeepers is an effort to engage the local government, citizens, and businesses in the North Creek Watershed in a sustained effort to improve and protect water quality and fish habitat so that salmon will still be there in 100 years. Specific activities of the Streamkeepers are discussed in more detail later in this document. Ecology will continue to work in partnership with the Adopt-a-Stream Foundation in regarding the North Creek Streamkeepers program.

Ecology intends on reviewing the *North Creek Watershed Management Plan*. The Plan should be updated if needed and implemented to the extent that resources are available. Ecology will also provide input as needed to the WRIA 8 Salmon Recovery Process as it relates to water quality issues.

Ecology will work with Washington State Department of Fish & Wildlife, U.S. Fish & Wildlife Service, Snohomish County, and the cities to identify public areas adjacent to surface waters with potential for impact from waterfowl. Responsible parties are Ecology, Department of Fish & Wildlife, U.S. Fish & Wildlife, Snohomish County, and local governments. Ecology will also coordinate with and, when possible, facilitate joint projects and efforts with the Adopt-A-Stream Foundation and the WRIA 8 Salmon Recovery Forum.

Ecology has developed a brochure entitled "A Citizen's Guide to Reporting Water Quality Problems" (<http://www.ecy.wa.gov/biblio/0110039.html>). It was designed to be modified by local governments to help distribute information to citizens on how to report pollution problems when they are occurring. Ecology will encourage municipalities in the basin to utilize it as they develop their Phase II permit programs.

## Natural Resource Conservation Service

The Natural Resource Conservation Service (NRCS), a federal service agency within the U.S. Department of Agriculture, has developed design standards and specifications used in the development of farm plans. The NRCS has a long history of developing and revising BMPs for the protection of surface and ground waters from activities related to agricultural practices. Many of these BMPs are designed to control animal waste run-off to surface waters, which is a potential source of bacterial water pollution in some areas the watershed. The Environmental Quality Incentives Program through the NRCS offers financial, educational, and technical assistance for the installation or implementation of water quality BMPs. The Farm Service Agency administers cost share programs to provide funding for farm improvements and farm plan implementation. In order for the proposed improvements to be eligible for cost share monies, they must meet or exceed the standards and specifications developed by the NRCS. The Snohomish Conservation District works closely with the NRCS.

## Local Government Resources

### Snohomish County

Snohomish County was the lead agency in preparing the *North Creek Watershed Management Plan*. The Plan describes the watershed's physical, chemical, and hydrologic characteristics as well as its biological resources. Capital improvement projects and other activities to improve the

water quality of North Creek are recommended along with the proper implementing authority. Some of the many recommendations included in the Plan are general in nature, but they will address bacteria pollution related to specific locations and activities. A brief summary of the recommended actions to reduce bacterial levels are listed in Table 7. The County has implemented many of the activities in the plan including:

- Establishment of a basin steward
- Establishment of a Watershed Keepers Program
- Development of a long-term monitoring program
- Integration of North Creek resource and geographic data with GIS
- Identification and inventory of land for acquisition
- Development of a master drainage plan for Tambark Creek corridor protection

The County uses the Plan to help prioritize its water quality activities in the basin and will accomplish identified tasks as budget and other resources allow. The County will collaborate with Ecology in reviewing the Plan during the development of this TMDL's Detailed Implementation Plan.

Snohomish County's Surface Water Management Division (SWM) has monitored North Creek in various locations since 1990 and has continued long-term monitoring at the two mainstem stations identified in Figure 1 since 1992. The County's monitoring data is available on the internet at <http://www.co.snohomish.wa.us>. Snohomish County will continue to monitor these two locations as funds are available and will coordinate ambient water quality monitoring with local governments to minimize duplication of effort and maximize the assessment of water quality in the North Creek watershed. The County has recently agreed to coordinate with the City of Bothell in the joint monitoring and development of source control actions for the Filbert Creek subbasin subject to the availability of grant funding.

Snohomish County adopted a Water Pollution Control Ordinance (Chapter 7.53 SCC) in March 1998. The purpose of this ordinance is to protect the quality of Snohomish County's surface and ground waters by providing technical assistance, requiring BMPs, and establishing an enforcement process. The Water Pollution Ordinance prohibits the discharge of animal wastes to Snohomish County streams. Surface Water Management staff investigates water quality problems, determine whether violations of the ordinance have occurred, and provide technical assistance to resolve the problem. Since beginning of program in 1994, 162 complaints have been reported and investigated in North Creek. The most common problems reported in this watershed are petroleum products, chemical wastes, commercial washing, and failing sewers and septic systems. Since 1998, the County has identified and screened 77 outfalls in the North Creek watershed as part of its Phase I permit requirements. Results of the screening direct site-specific investigations and technical assistance. The County will continue to respond to water quality complaints at the request of Ecology, or be available to conduct joint investigations as staff time is available. Snohomish County has adapted Ecology's brochure entitled "A Citizen's Guide to Reporting Water Quality Problems" for their local use.

The County's Planning and Development Section (PDS) has established an agricultural liaison position, which assists farmers in addressing complicated permitting issues such as those related to manure management through composting or lagoon construction. The liaison is currently

developing the County's compost code, which will aid in the control of bacteria discharged from compost facilities and compost products.

Snohomish County has a strong public outreach program, which consists of educational programs for students, teachers, and the general public. This includes the Watershed Keepers Program noted earlier as well as the Salmon Watchers Programs. The County also has a native plant salvage program that generates hundreds of hours of volunteer time each year in watershed restoration projects, and a watershed steward is assigned to work with North Creek stakeholders on water quality projects throughout the basin.

In February 1999, the County approved an Endangered Species Act (ESA) Early Action Program. Early Action Program activities with direct bearing on North Creek water quality include:

- Member of the WRIA 8 Salmon Recovery Steering Committee. Participation in preparation of *Cedar-Sammamish Salmon Conservation Plan*, which to date has produced a *Salmon Habitat Limiting Factors Assessment* and *WRIA 8 Near Term Action Agenda* for projects benefiting salmonids, with an emphasis on ESA listed Chinook salmon.
- Stream habitat assessment, biological and hydrologic flow monitoring in North Creek
- Review of effectiveness and revision of County Critical Areas regulations (on-going) (Chapter 32.10 SCC) and other regulatory authority for land uses within the North Creek Watershed. Standard buffer width requirements are set for urban and rural streams in the county and will enhance and protect water quality by through the control of stream temperatures from shading and buffering streams from pollution generating areas.
- Capital improvements and land acquisition activities that directly or indirectly protect or restore aquatic habitat and water quality--acquire and restore up to 50 acres of riparian habitats along North Creek.
- Retrofits of residential stormwater detention facilities.
- Review and revision of road maintenance BMPs including rights-of-way, stormwater detention and conveyance systems best management practices (BMPs).

Snohomish County is working on the following projects, which will have a bearing on long term water quality in the basin.

- Master drainage study (Drainage Needs Report) of all urban growth areas w/in the County
- WRIA 8 Salmon Conservation Plan
- Low Impact Development (LID) project development

Snohomish County has identified altered hydrology as a significant problem in the North Creek basin. Maintaining groundwater at levels that provide adequate base flows when rainfall is not present is critical to prevent a concentrating effect of existing urban pollutants in North Creek. The Drainage Needs Report will provide a template for analyzing the hydrology of the areas most affected by development in the near future. The Low Impact Development practices help address this hydrologic problem as well as the attenuation of excessive peak flow during precipitation events. An experimental LID ordinance was written in 2001 and staff is in the early stages of exploring a pilot LID project, which may be located in the North Creek basin.

Snohomish County has regulatory authority over land uses in the watershed where farming activities are likely to occur. The County will work collaboratively with livestock owners, the Snohomish Conservation District, citizen groups, property owners, and resource agencies to implement farm plans and reduce agricultural pollution. Responsible parties are Snohomish County and the Snohomish Conservation District.

## King County

King County has also been active in the North Creek watershed with regard to monitoring and stream assessment activities. King County's Department of Natural Resources and Parks (DNR) has monitored water quality at the mouth of North Creek from 1980 to the present and will continue this monitoring in the future. Their monitoring data is available on the world wide web at <http://dnr.metrokc.gov/wlr/waterres/streams/north.htm>. Although the City of Bothell has annexed all land within the North Creek watershed in King County, the County remains active in monitoring and other watershed activities within the limited portion of the basin that is located within King County boundaries. In May 2001, in conjunction with the University of Washington, DNR's Water and Land Resources Division completed the Habitat Inventory and Assessment of Three Sammamish River Tributaries: North, Swamp, and Little Bear Creeks (King County, 2001b). King County also facilitates and participates in the WRIA 8 Salmon Recovery Steering Committee.

## City of Everett

The City of Everett is the largest of the three cities discharging stormwater to North Creek, but only a small fraction of the City is within the North Creek watershed. Everett participated in the development of the *North Creek Watershed Management Plan* and has enforcement authority for water quality related issues. Surface Water Management, which is part of the City's Public Works Department, has several ongoing programs to address pollutants entering local surface waters. Citizens can report pollution problems to a 24-hour emergency telephone number or send e-mail to the City's surface water web site. The web site also provides information on how citizens and educators can learn more about water pollution issues as well as how to get involved in local activities. The business community can also participate in the City's "Partners for Clean Water" program.

The City sponsors volunteer groups aimed at stenciling storm drains (dump no waste drains to stream), installing Grate Mates, and provides charity benefit car wash kits that remove point source pollutants from the drainage system. The car wash program has been developed to offer residents a way to perform charity car washes while avoiding impacts to local surface waters—efforts such as these help improve dissolved oxygen levels throughout North Creek. Everett was the key sponsor of the Grate Mate program during its development stage. City staff have located several failing septic tanks in the North Creek watershed over the past twenty years and played an active role in enforcing solutions to these failing septic tank systems (either connections to the public sewer system or repairs to the existing septic tank system). The City in 1999 inspected all businesses within the North Creek watershed for illicit connections to the stormwater system; only one illicit connection was found. Everett has mapped all detention facilities and drainage lines within City limits using GIS and inspects 171 detention systems annually to help control peak flows and stream scouring in North Creek. Everett has also acquired key riparian habitat at three locations within the headwaters of North Creek.

The City is currently working on an innovative project to improve the hydrologic regime in North Creek. The upper reaches of the basin are heavily urbanized and experience high peak flows during winter months and low, or no flow, during parts of the summer. The City has purchased 7.5 acres of land adjacent to 124<sup>th</sup> St in order to create a stormwater infiltration and storage facility. The concept is to store winter storm flows in an underground reservoir and pump the water back into North Creek in the summer. The City will continue to evaluate the feasibility of this project and Ecology will provide timely regulatory recommendations as needed.

The City of Everett has two permanent ambient monitoring stations in the North Creek watershed: one is located on the mainstem above McCollum Park, and the other on Silver Lake Creek. Monitoring on the mainstem of North Creek (about 0.5 mile above McCollum Park, near the intersection of the creek and Interstate 5) shows that fecal coliform levels are slowly trending downward but annual averages are still consistently above state standards. The City conducted a study of fecal coliform levels in Silver Lake, which is tributary to North Creek. Since the interception of numerous on-site septic systems and their connection to sewer service, fecal coliform levels have decreased an order of magnitude. Ecology will be reviewing the data during the preparation of the 2003 Clean Water Act 303(d) list to determine if the waterbody should be removed from the list. The City of Everett also maintains three stormwater sampling stations within the North Creek watershed.

City staff views funding as a significant issue in resolving the water quality problems in North Creek.

## City of Mill Creek

City of Mill Creek has established a surface water utility in recent years to enable it to manage its stormwater. City staff is one of the organizers of an ongoing tri-county workgroup addressing the needs of local governments as they prepare their Phase II stormwater programs. The City participated in the development of the *North Creek Watershed Management Plan*.

Slightly under half of the residential community of Mill Creek is part of the Mill Creek Community Association, which also owns and maintains a nature preserve along Penny Creek. The residential community discharges its stormwater to the Mill Creek Golf Course and the nature preserve. Although this stormwater is discharged to ponds on the golf course, there is little detention and considerable sediment deposition is observed just upstream of the Gerhardt fish ladder dam. The Association is responsible for maintaining storm drainage facilities located within their subdivision. There appear to be opportunities for improving hydrology and sediment deposition in the Penny Creek subwatershed that could help improve dissolved oxygen levels in the long term.

The City believes that an educational campaign on proper pet waste management could yield benefits to local waters based upon the large number of residents bordering small streams. Like the cities of Everett and Bothell, Mill Creek has instituted a car wash program that makes available a basin insert/pump assembly that pumps car wash wastewater to the local sewer system. In addition, the City has developed a large, attractive sign indicating that the car wash is a “Creek-safe” activity. This activity can reduce organic loading and help improve dissolved oxygen levels, especially during low flow periods.

The City’s initial contribution to the efforts of this TMDL will be through its educational efforts regarding car wash activities, the management of pet wastes, and the labeling of storm drains.

These activities will take place during 2003 and 2004. Additional monitoring, illicit discharge identification, and enforcement activities will be developed as part of the development of their Phase II Municipal Stormwater Program and the TMDL water clean up plan in late 2003 and early 2004. Mill Creek has already adopted Ecology's new Western Washington Stormwater Manual.

## City of Bothell

The City of Bothell is very active in maintaining and improving local water quality and is currently developing its Phase II Municipal Stormwater Program. The City owns 50 acres of land that is classified as critical areas/wetlands adjacent to North Creek and Filbert Creek just below 208<sup>th</sup> ST SE in an undeveloped clearing called Thrasher's Corner Park. The City is working with the University of Washington to develop a long-range restoration plan to restore the riparian corridor at Thrashers Corner Park. The restoration will remove non-native reed canary grass and replant with native cover to establish nutrient input (macroinvertebrate) and provide shade.

Bothell established a stormwater utility in 1994 and has been working actively to reduce bacterial pollution within its city limits. The City sponsors programs aimed at stenciling storm drains (dump no waste drains to stream), installing Grate Mates, and provides charity benefit car wash kits that remove point source pollutants from the drainage system. The car wash program has been developed to offer residents a way to perform charity car washes while avoiding impacts to local surface waters—efforts such as these help improve dissolved oxygen levels throughout the lower sections of North Creek.

City staff have located six failing septic tanks over the past two years and an area of failing septic systems along 31<sup>st</sup> Ave. SE was recently decommissioned and connected to sanitary sewer. The City in 1999 worked with King County on an illicit connection program aimed at reducing phosphate loading in the drainage system. Bothell has mapped all detention facilities and drainage lines within City limits using its Geographic Information System (GIS) and has inspected over 350 detention systems annually to help control peak flows and stream scouring in North Creek. Bothell was a committee member for the *North Creek Watershed Management Plan* and is currently an active member with the Sammamish River Near Term Action Plan (WRIA 8). Bothell adopted the King County 1998 Surface Water Design Manual in 1999 for all developments within the City Limits. Bothell answers and investigates approximately 100 drainage/flooding/water quality/spill complaints a year. Bothell currently performs monitoring at one location on mainstem North Creek for fecal coliform bacteria, pH, dissolved oxygen, turbidity, flow, temperature, phosphate, and nitrate/total nitrogen on a weekly basis.

Bothell is home to a number of corporate business parks including Canyon Creek Park, Schnitzer Corporate Office Park, and Monte Villa, Quadrant, Home Depot, AT&T and Bristol Farms. The bacterial contribution of this type of land use is not well understood at this time, but likely sources include waterfowl waste from stormwater ponds and rooftops. Because this TMDL also addresses dissolved oxygen depletions, point source discharges of surfactants and other oxygen depleting substances from the business parks should be addressed. In addition, the relatively shallow groundwater table in the area of the parks may provide an opportunity for landscaping practices that encourage shading of surfaced waters and minimizing the use of chemical fertilizers, which include nitrogen based compounds. The City will work with the business parks

to encourage pollution prevention--practices and protection of any relevant surface waters within the business parks.

The City chose North Creek for an extensive water quality restoration program and has applied for Centennial Clean Water Funding from Ecology to address the TMDL for fecal coliform pollution. The City is developing a 2-phase program that will 1) provide regional monitoring coverage, 2) outreach education, 3) illicit discharge detection and other source control inspections, and 4) ensure that detention facilities are inspected throughout the Bothell portion of the North Creek basin. If fully funded, the program is expected to span 5 years and will also include stream walks and the mapping of outfalls.

## Snohomish Conservation District

The Snohomish Conservation District (SCD) is a nonregulatory public agency that provides many services to commercial dairies and small farmers. These services include education, technical assistance, farm planning, and financial assistance. The SCD farm planners help small farm owners develop *best management practices* (BMPs) for the protection of water quality. When Ecology or a local jurisdiction documents a bacteria water quality problem at a farm, the farm is referred to SCD for development of a farm plan. The farm plan must meet or exceed standards and specifications established by the Natural Resources Conservation Service (NRCS).

The SCD currently has several cost-share programs targeted for the protection of water quality within Snohomish County, including, but not limited to, fencing, manure management, gutters, and riparian corridor management. In early 2002, the SCD applied for an Ecology Centennial Clean Water Grant in order to increase its activities and level of service in the North Creek Watershed. Ecology will work closely with Snohomish County to identify and prioritize farm-related bacterial water quality problems and refer them to the SCD for farm planning.

Ecology, Snohomish County, and the Snohomish Conservation District need to work together to review the success of agricultural water quality improvement approaches to date and to identify and implement the specific approaches to reduce agricultural pollution which have proven to be effective. It is expected that within five years, as more small farms develop and implement farm plans or BMPs, fecal coliform levels will be measurably reduced in the more rural areas of the watershed.

All commercial and small livestock farms in the North Creek Watershed should develop and implement a farm plan that meets or exceeds the standards and specifications established by the NRCS. Ecology will work with Snohomish County and the Snohomish Conservation District to develop an outreach program to educate commercial and small livestock farms on the need to have an adequate farm plan. Responsible parties are Snohomish Conservation District, Snohomish County, and Ecology.

## Snohomish Health District

The Environmental Health Division of the Snohomish Health District (SHD) issues Solid Waste Permits, oversees the On-Site Sewer System Program, and conducts some water quality monitoring for bacteria in the County. The SHD is responsible for investigating complaints of failed on-site septic systems and requiring corrective measures such as on-site system maintenance, renovation, or hook-up to sewer systems where available. In addition to certifying septic system installers and licensing septic system pumpers, the SHD has a public outreach program for homeowners on the proper operation and maintenance of septic systems. The

District is working with Snohomish County SWM and Ecology to develop a low interest loan program for assisting low income property owners in repairing failed systems. The loan program will broaden the assistance opportunities available through the Snohomish County Housing Authority (<http://hasco.org/index.html>), which offers second mortgages to moderately low income homeowners (family of two must have income of less than \$42,000).

Failing on-site septic systems are just one of the potential contributors of bacterial pollution to local surface waters. Because of the large investment of public resources needed to investigate the presence of unreported failing on-site systems, the District will be working with Ecology to develop criteria that indicate the need for sanitary surveys in relation to this and similar TMDLs in Snohomish County. Unreported failing septic systems have the potential to create a localized health threat as well as contribute to bacterial pollution in local surface waters. The criteria will be used by local and county governments in their watershed analyses to provide relevant data that the District can then use to make resource determinations and recommendations to their governing board. The District will be available to respond to individual on-site septic system failures reported by local governments as a result of streamwalks and local complaints.

In August, 2000, SHD amended of Chapter 7.1.2 of Snohomish Health District Sanitary Code to help protect individuals using natural swimming areas. The code amendment requires educational material be posted to discourage the feeding of waterfowl, excludes pets from swimming areas and nearby flowing streams, and discourages children who are not toilet trained from entering the water.

Neither the County nor the SHD has an established program for the inspection of commercial dog kennels. In Chapter 8 of the Snohomish Health District Code, dog wastes can be placed in the garbage, buried on site, or discharged to sanitary sewer pending local sewer district approval. The SHD has brochures on the proper disposal practices for dog wastes available to the public.

The SHD will work with Snohomish County and local municipalities in the development and review of pet waste handling and disposal BMPs and for the protection of public health and surface waters from pet wastes.

In early 2002, the SHD applied for Centennial Clean Water Grant funding to implement an on-site septic system “Drainfield Awareness Project.” If funded, the project will help educate homeowners on the proper operation and maintenance of their on-site septic systems. Programs such as this will help reduce future failures and help homeowners recognize existing problems that may be contributing to bacterial pollution problems in North Creek.

## Other Resources

### Adopt-A-Stream Foundation

The Adopt-A-Stream Foundation (AASF) is a non-profit 501(c)(3) environmental education and habitat restoration organization that offers citizens tools to help them play a vital role in protecting and enhancing the watersheds in which they live <http://www.streamkeeper.org/foundation.htm>. The AASF operates the Northwest Stream Center located along the upper reaches of North Creek in McCollum Park. The AASF considers clean water an integral part of a healthy spawning and rearing habitat for wild salmon, steelhead, trout, and other wildlife and a key element to providing natural settings essential for the rest and relaxation for local residents. The long term goal of AASF is to ensure the protection and care of every stream, including North Creek, by encouraging

schools, community groups, sports clubs, civic organizations and individuals to adopt their streams, and to become Streamkeepers. The AASF is currently developing a program tentatively called the “North Creek Streamkeepers.” Funded largely by an Ecology Centennial Clean Water Grant, the Streamkeepers program will seek to enjoin all basin stakeholders in a sustained effort to improve and protect North Creek. AASF has recently hired a project lead for the North Creek Streamkeepers. The AASF has begun a program of working with local governments to stencil all stormdrains in the basin to reduce the input of pollutants and increase public awareness. The Streamkeepers plan on accomplishing the following activities:

- Invite the Muckleshoot Tribe, local governments, businesses and civic organization to serve as members of the Streamkeepers,
- Conduct eight quarterly meetings,
- Create a database of all North Creek riparian land owners,
- Notify media of Streamkeeper actions,
- Print and distribute 50,000 *Streams: Guidelines for Survival* pamphlets to basin residents,
- Revegetate ¼ mile of riparian zone along North Creek in McCollum Park and up to 1000 linear feet along Nickel Creek and Tambark Creek,
- Perform targeted water quality monitoring within North Creek,
- Provide numerous activities for citizen volunteers to improve the North Creek Watershed, and
- Other actions as detailed in the Ecology Centennial Clean Water Fund Grant agreement.

## University of Washington, Bothell/Cascadia Community College

The University of Washington, Bothell and Cascadia Community College (UWB-CCC) are co-located on a 127 acre site just upstream from the junction of North Creek and the Sammamish River near the north end of Lake Washington. The State of Washington has recently initiated the restoration of the North Creek stream channel and floodplain on the UWB-CCC campus. The design focuses on the restoration of underlying physical, chemical and hydrological features of the stream channel and floodplain, including the creation of a new stream channel and complex floodplain microtopography. An average one hundred foot native plant buffer area separates the restoration from the regional bicycle trail and the campus along the western edge.

Among the guiding principles for future use of the site is the requirement that “Proposed activities should have negligible impacts on native biological elements, hydrology, soils, and fundamental ecological processes of the site unless it is determined such impacts are desirable with regard to the long-term goals of the site.” The quality of the environment in this important part of North Creek will now be largely determined by the quality of the water it receives from the upstream land users. The federal Clean Water Act Section 404 permit for the site requires monitoring of the site for 10 years following completion of the restoration project. This monitoring will include water quality monitoring in North Creek and may assist evaluation of bacteria source control measures taken in conjunction with the TMDL. In addition to monitoring, routine maintenance will be required to ensure the success of the wetlands restoration.

It was recognized early in the planning phases of the project, that the restoration could be a valuable educational resource. This is one of the biggest floodplain restorations in the Pacific

Northwest and it will undoubtedly attract considerable attention. Ecology will work with the UWB-CCC Wetlands Oversight Committee to advocate that North Creek Water Cleanup goals to improve dissolved oxygen levels be included in the long-term goals for the UWB-CCC wetlands restoration site. Ecology will work with UWB-CCC to assist in the wetlands restoration project and utilize data from this location at the mouth of North Creek to help gauge the broad success of Water Cleanup efforts. The restoration of forested floodplain vegetation along this distal portion of North Creek will contribute to the goals of this TMDL by increasing shading and thus improving dissolved oxygen levels.

## WRIA 8 Salmon Recovery Steering Committee

The Lake Washington/Cedar/Sammamish (WRIA 8) Steering Committee (WRIA 8 SC), comprised of elected officials, representatives from business and environmental interests, concerned citizens, and state and federal agencies, is overseeing the salmon conservation planning effort in WRIA 8. In February 2002, the WRIA 8 Steering Committee and associated salmon recovery committees representing 26 local jurisdictions - consisting of King and Snohomish counties and 24 cities in those counties--developed a *Draft Near-Term Action Agenda for Salmon Habitat Conservation in the Cedar/Sammamish Watershed* (WRIA 8 SC, 2002). The *WRIA 8 Near-Term Action Agenda* identifies poor water quality (temperature and other) as a factor of decline for Chinook salmon in WRIA 8 and provides guidance and project recommendations for habitat protection, restoration projects, research, monitoring, public outreach and education, and adaptive management to assist in the recovery of Chinook salmon populations.

The WRIA 8 Near-Term Action Agenda identified North Creek as a ‘Satellite Subarea’ within WRIA 8 where Chinook salmon are present most years (more than half the years of a typical four-to-five year life cycle)(WRIA 8 SC, 2002). The Action Agenda recommends 11 projects, 10 action alternatives, and 3 areas of research that address identified factors of salmon decline in North Creek. One of the project recommendations is to implement the North Creek Fecal Coliform TMDL and support associated priority implementation actions (North P #11). Ecology will continue to work with the WRIA 8 Steering Committee to implement stream improvement projects that help address bacteria and dissolved oxygen water quality impairments as well as assist in salmon recovery efforts.

## Sewer Districts

In the North Creek watershed, there are no municipally-owned domestic wastewater treatment systems discharging directly into North Creek or its tributaries. However, an extensive network of sewer collection and conveyance systems exists in the basin to serve existing development. The area is served primarily by the Alderwood Water District, Silver Lake Sewer District, the City of Bothell, and to a lesser extent the City of Everett and the Mukilteo Sewer District. Currently, sewer districts do not require an NPDES permit unless they have a direct surface water discharge. Discussions on the need to permit sewer districts have been taking place for several years at the national level and are continuing. Ecology regulates sewer districts only when overflows occur and historically these events are rare. Both Ecology and State Health regulations do not permit the discharge of untreated wastewater to surface waters. Where failing septic systems are discovered, and especially where systemic failures are detected due to poor geologic conditions, the cooperation of local sewer districts to help connect problem areas to sewer will be important to the success of this TMDL.

Ecology's Phase I and II stormwater permits will require local and county government to determine if the sanitary sewer collection systems within the North Creek Watershed include high flow bypasses. In addition, it is anticipated that local sewer districts will be issued NPDES permits within the next five years. These permits are expected to include provisions to detect and report unauthorized discharges of municipal wastewater. When problems are found, Ecology will engage in compliance activities, which may include consultation or formal enforcement. Responsible parties are Ecology, local governments, and local sewer districts.

## Local Businesses

All local businesses should help to control, and eliminate where possible, pollution originating from their sites. Large landholders such as the many business parks and corporate sites in the lower North Creek basin should assess their properties for potential pollution sources and develop long term plans to abate and control them. Ecology will work with all basin entities through the North Creek Streamkeepers and individually as resources allow, to help develop local clean up plans.

## Local Citizens

Local citizens play a critical role in improving the water quality of North Creek. Through a thoughtful review of one's daily activities, many citizens can have an immediate impact on the quality of water in North Creek by doing certain tasks differently. By preventing car wash water from mixing with stormwater, properly disposing of pet wastes, and avoiding the addition of grass clippings or any other foreign substance into neighboring creeks, the bacteria levels can be reduced and dissolved oxygen levels can be improved. Where feasible, rainwater soaked into lawns and gardens can help feed local streams or reduce peak flows in local streams. Local citizens can also get involved in stream rehabilitation, communicate their interest in the environment to local elected officials, and educate others on how to improve water quality in North Creek. All government agencies and the Adopt-a-Stream Foundation will work cooperatively with local citizens to improve North Creek. Citizens will also be invited to participate in the development of the detailed water cleanup plan for North Creek following the approval of this TMDL.

## High Priority Water Cleanup Activities

Ecology and local government are already working to solve the problem of bacterial pollution in North Creek. Some activities have already been accomplished and others are in the planning or development stage as described earlier. Ecology has determined that the following activities are a high priority for immediate action and should be rated highly for financial assistance to improve water quality in the North Creek watershed. Additional activities will be prioritized in the detailed water cleanup plan (Action Plan) to be developed following the approval of this TMDL.

- Water quality monitoring to establish baseline pollutant levels, identify pollution sources, and document improved water quality following implementation of water cleanup activities,
- Enforcement of existing water quality regulations,
- Coordination of water cleanup activities among all basin stakeholders,
- Small farm technical assistance and cost-sharing for BMP implementation,

- Development and implementation of pet waste management programs,
- Identification and correction of failing on-site septic systems,
- Identification of illegal discharges to stormwater conveyance systems and illegal direct discharges to North Creek and its tributaries,
- Detection and elimination of illegal water withdrawals,
- Improvement of basin hydrology through necessary hydrologic studies, protection and acquisition of wetlands contributing to North Creek base flows, implementation of low impact development (LID) practices, stormwater management as per the Western Washington Stormwater Manual (especially as it pertains to infiltration), and other innovative concepts that will improve summer base flows (such as flow augmentation and associated activities such as the purchase of water rights),
- Pollution prevention activities aimed at reducing the level of both fecal coliform bacteria levels and oxygen-depleting substances to North Creek and its tributaries,
- Riparian shading,
- Stream restoration activities to increase shading, improve microclimate conditions, reduce erosion, and provide buffers from pollution generating activities, and
- Improvement of substandard and poorly functioning stormwater detention facilities and increased maintenance of stormwater detention facilities where necessary.

## **Adaptive Management**

The adaptive management approach for the North Creek TMDL calls for evaluating whether BMPs are effective at causing North Creek to attain water quality standards after five years of implementation activities. Following the successful implementation of BMPs and adequate sampling representing all climatological, hydrological, and land use characteristics, a reassessment of compliance with water quality standards can be made. If water quality standards for both fecal coliform bacteria and dissolved oxygen are met without meeting the target geometric means or target percent reductions specified in Table 4, then the objectives of this TMDL are met and no further reductions or additional BMPs are needed. If the target geometric means and target percent reductions in Table 4 are met, but the stream still does not meet water quality standards for dissolved oxygen, then BMPs established in the water cleanup Action Plan (also called the Detailed Implementation Plan or DIP) shall be made more stringent or revised in such a way as to improve dissolved oxygen levels.

For the first five years following approval of this TMDL and the development of its associated Action Plan, the emphasis will be on implementation and development of monitoring programs. Both targeted source control monitoring and routine long-term ambient monitoring are needed. As fecal coliform source control measures and activities are successfully completed, the implementation of this TMDL will be based on the adjustment of source control efforts throughout the watershed as determined by ambient water quality monitoring. If new fecal coliform sources are found that were not previously identified, they will be corrected through appropriate jurisdictions.

On-going ambient monitoring being conducted by King County and Snohomish County will continue and will assist in enabling the implementing jurisdictions to revise and shift implementation efforts as necessary in order to bring all tributaries back into compliance with water quality standards. Cities within the basin should assist with monitoring of watersheds under their control and share data with citizens, local businesses, and other jurisdictions as needed. Ecology will continue to offer assistance in developing and implementing monitoring programs through its annual Centennial Clean Water Grant Program.

## Reasonable Assurances

Improved water quality will be achieved through the combined efforts of all basin stakeholders. To support this TMDL, Ecology will work cooperatively with all basin stakeholders to promote the implementation of activities contained in the Action Plan. In addition, Ecology will utilize its existing resources and authorities under RCW 90.48, including its delegation of the NPDES permitting program, to implement this TMDL. This Water Cleanup Plan, its TMDL targets, and the associated implementation activities listed in the future Action Plan, are not in themselves enforceable. However, Ecology is obligated to implement the approved TMDL. For this reason, water cleanup activities contained within the Action Plan, or otherwise identified as necessary to begin the cleanup of North Creek, will be either referenced in or directly incorporated into NPDES permits as described below.

All of the North Creek Watershed will be covered by either a Phase I or Phase II Municipal Stormwater Permit in the near future; therefore, Ecology will work intensively with the affected municipal governments with the goal of setting forth reasonable, achievable, and effective strategies for meeting the targets established in this TMDL and will include these activities in the Action Plan. Ecology's expectations for TMDL implementation by NPDES permit holders will be measured against the accomplishment of water cleanup activities that are incorporated into their permit, either directly or by reference to the Action Plan.

Ecology is currently revising Snohomish County's Phase I Municipal Stormwater permit and anticipates that it will be reissued in 2003. The Cities of Everett, Mill Creek, and Bothell are expected to receive Phase II Municipal Stormwater permits by the end of 2004. Ecology intends on implementing this TMDL through both the Phase I and Phase II permits in the shortest reasonable timeframe while providing flexibility to find cost-effective strategies to implement activities and track progress toward achieving the TMDL targets. Ecology expects that this TMDL and Submittal Report will be approved by EPA before the Phase I and Phase II permits are reissued or issued, respectively. Because the contents of these permits have not been finalized and a public review of the permits has not yet taken place, Ecology currently anticipates the following courses of action:

- In the event that the Action Plan is completed before the Phase I and Phase II Permits are reissued/issued, Ecology will establish appropriate TMDL implementation actions (identified in the Action Plan) through permit requirements.
- If the Action Plan has not yet been completed at the time the Phase I permit is reissued, Ecology will include core implementation actions in the required Stormwater Management Program to begin progress in reducing TMDL targeted pollutants. If the Action Plan has not yet been completed when the Phase II permit is issued, standard Stormwater Management Program requirements will be used until the permit is reissued.

- Upon completion of the Action Plan, Ecology will determine whether the current level of implementation activities are consistent with those set forth in the Action Plan and may establish additional TMDL implementation actions through either a modification of the existing permit or through the issuance of an administrative order.
- In all cases, Ecology will incorporate all applicable and appropriate Action Plan activities at the time of permit reissuance.

As part of the adoption of the Western Washington Stormwater Manual, BMPs will be incorporated into Snohomish County's Stormwater Management Program as specified in the new permit.

Ecology is currently in the process of reviewing all industrial stormwater permits with a potential for introducing fecal coliform bacteria, or oxygen depleting compounds, into the North Creek watershed. Where a high potential exists, Ecology will conduct inspections. Any water quality problems observed through this process will be corrected through an NPDES permit or appropriate enforcement mechanism. These inspections will be completed by February 1, 2004.

Other legal authorities include Snohomish County's water quality ordinance (Chapter 7.53 SCC) and Chapter 7.1.2 of Snohomish Health District's sanitary code. All of the municipal entities within the North Creek Watershed have a surface water utility in place to help fund the water cleanup activities needed to reduce bacterial pollution and each of the cities is actively working on the development of their respective Phase II Stormwater Management Programs.

The City of Bothell intends on expanding its water quality monitoring beyond the one site now employed regardless of whether or not it receives additional funding from Ecology. The City of Everett also intends on continuing monitoring at its long-term sites.

In addition to NPDES permitting activities, Ecology will prioritize the involvement of its nonpoint source salmon recovery specialist to investigate animal waste complaints from small farms, which affect both bacteria concentrations and salmon habitat.

The Snohomish Conservation District presently has resources to address critical problems in the North Creek Basin. They have applied for a Centennial Clean Water Fund Grant from Ecology to increase their activities in North Creek regarding small farm planning and technical assistance.

Adaptive management will call for BMP modification if monitoring shows that standards are not being met.

## **Monitoring Strategy**

EPA (1991) guidance calls for a monitoring plan for TMDLs where implementation will be phased over time. The monitoring is conducted to provide assurance that the control measures will achieve attainment with water quality standards. Long-term monitoring will be important to ensure compliance with the requirements of the North Creek Fecal Coliform TMDL.

Ecology does not currently have any long-term monthly ambient monitoring stations in the North Creek watershed. It is anticipated that data used to assess the quality of North Creek will be generated primarily by basin stakeholders including Snohomish County, the three city governments, and King County. It is hoped that other ambient water quality monitoring

opportunities will be developed for citizen basin stewards. Ecology anticipates that future Phase I and II permits will contain monitoring requirements.

For monitoring the effectiveness of the North Fecal Coliform TMDL, Ecology will work with all basin stakeholders on establishing monitoring plans. Quality assurance plans will be developed to ensure that the resulting data will meet TMDL data quality objectives. These plans will identify appropriate monitoring objectives, strategies, schedules, and resources. Current monitoring of North Creek by Snohomish and King Counties is expected to continue as funds are available. The City of Bothell currently monitors one site and intends on expanding its water quality monitoring in North Creek. The city has applied for an Ecology Centennial Grant to fund five years of monitoring. Regardless of whether or not the grant is received, the City of Bothell plans on increasing its monitoring program. The City of Everett also intends on continuing monitoring at its long-term sites. The Adopt-A-Stream Foundation is also funded to do targeted water quality monitoring. Expanded monitoring by all parties will be encouraged.

Because of the limited number of monitoring stations for this TMDL, Ecology will help identify and coordinate monitoring efforts to maximize the value of monitoring data and to prevent redundant testing efforts. Ecology will continue to rely on the use of Snohomish County and King County monitoring data from sampling locations where allocations were established in order to determine if target fecal coliform levels are being met. In conjunction with the review of Snohomish and King County data and data from all other sources, after five years Ecology will assess the water quality of the North Creek watershed for fecal coliform bacteria and dissolved oxygen.

If for some reason county data is no longer collected by King and Snohomish Counties in the future at the locations where targets are set, under Ecology's watershed approach, temporary monitoring stations will be deployed at strategic locations for a one-year period every five years.

## **Potential Funding Sources**

Local agencies that develop implementation projects under this TMDL can potentially be funded through the Centennial Clean Water Fund, State Revolving Loan Fund Program, and the Federal Section 319 Grant programs. All three of these programs have the same annual application cycle, which ends in February of each year.

The Washington State Legislature has provided substantial grant monies for salmon recovery projects. Stream enhancement projects that protect and enhance water quality while they benefit fish may be proposed through the WRIA 8 Salmon Recovery process. Such projects will protect and/or enhance riparian corridors and are expected to result in improved control of nonpoint source bacterial pollution and improvement of dissolved oxygen levels through reductions of pollutant inputs and by improving streamside microenvironments to reduce water temperatures.

The Snohomish Conservation District, NRCS, and Snohomish County currently have a number of grants, loans and/or cost share monies that are oriented towards addressing nonpoint agricultural water pollution issues. Examples of these programs are the Environmental Quality Incentive Program (EQIP) and the Conservation Reserve Enhancement Program (CREP). These programs assist farmers/landowners with implementation of BMPs that help minimize nonpoint water pollution and help provide assurance that long-term improvement of environmental conditions on selected agricultural lands will continue.

TMDL-related monitoring and assessment projects could be funded through the Department of Ecology's Environmental Assessment Program (EAP). Project proposals can be developed through regional Ecology staff. Proposals are evaluated annually in February. EAP staff develops project designs and is open to joint project efforts through cooperation with local agencies.

Regional Ecology staff has developed a local grants and loan resource database to help basin stakeholders find funding for a variety of watershed improvement projects. This database is constantly being updated and is available to stakeholders upon request.

## **Summary of Public Involvement Methods**

### **North Creek Watershed Fecal Coliform Technical Report**

Ecology has met with or contacted the Muckleshoot Tribe, the Cities of Bothell, Mill Creek and Everett, Snohomish County, Snohomish Health District, Snohomish Conservation District, and the AASF to explain the TMDL process and to provide information and solicit participation in the North Creek Water Cleanup. Copies of the report were also made available to each entity. Ecology did not hold a formal workshop for the Technical Report but instead made it available for additional comment during the public involvement process for this submittal report.

### **North Creek Fecal Coliform TMDL Draft Submittal Report**

Ecology's public comment period on this Draft Water Cleanup Plan ran from April 25, 2002, through May 25, 2002. Announcements of the opening of the public comment period appeared in the Everett Herald, Mill Creek Enterprise, and the Kenmore/Bothell Reporter. Forty-three copies of the report were mailed or hand-delivered to the Muckleshoot Tribe, local government staff, and other interested parties.

A public workshop to provide information on the North Creek Fecal Coliform TMDL was held on May 8, 2002, at the Adopt-A-Stream Foundation office at McCollum Park from 6:30 to 8:30 pm. Approximately 1,200 flyers were mailed during the week of April 14, 2002, to watershed residents and interested parties. The address of the Foundation is 600-128<sup>th</sup> St SE, Everett, WA, 98208-6353.

Directions:

- Option 1: From Interstate 405, take I-5 north to the 128<sup>th</sup> ST SE exit and go east. Travel a little over 0.5 miles and turn right into McCollum Park. Travel to the back of the Park and look for the signs directing you to the public meeting.
- Option 2: From Bothell/Everett Hwy at Mill Creek, go north to Dumas Road. Turn left into the Park and Ride and continue into the Park. In the back of the Park you will find the Adopt-A-Stream Foundation building.

Information from the contacts during the comment period will be used to prepare for implementation of this TMDL. Public comment will continue as the Water Cleanup Action Plan (also called the Detailed Implementation Plan or DIP) is prepared. Numerous comments were received during the public comment period on the North Creek Fecal Coliform TMDL and comments and responses are summarized in Appendix A.



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# Appendix A

## Response to Comments



Comments regarding factual inaccuracies, improved wording, or those that clarify policy positions by other government agencies have been directly incorporated into the text of the final submittal report. All other comments are summarized below. In order to avoid redundant responses to similar or related comments, some comments have been combined.

**1. Comment:** Three recent TMDLs, the Snohomish River Tributaries, the Skagit River, and Gray's Harbor did not include wasteload allocations. Why then, is a wasteload allocation appropriate for North Creek?

**Response:** Each of the proposed TMDLs noted above contained wasteload allocations. The Snohomish Tributaries TMDL contained an allocation for Phase I permit holder Snohomish County that was similar to that proposed for North Creek. In the Snohomish Tributaries Fecal Coliform TMDL, equal reductions [50%/50%] in both point and nonpoint sources were targeted. EPA did not require anticipated Phase II communities to receive wasteload allocations in the Snohomish Tributaries and Skagit TMDLs, possibly due to the fact that it would be several years until the Phase II permit was written and issued. In the case of the Skagit River (approved) and Grays Harbor (draft) TMDLs, municipal wastewater treatment plants and industries were assigned wasteload allocations. In the Grays Harbor TMDL, Ecology has not confirmed that either Cosmopolis or Aberdeen will require coverage under the Phase II permit; therefore, wasteload allocations to those entities have not be assigned.

**2. Comment:** Wasteloads should not be allocated until the sources of fecal coliform contamination have been identified. Clearly, the submittal report has not adequately identified sources of contamination given that a 50%/50% allocation between non-point and point sources of pollution was assumed. Fecal coliforms can come from numerous sources and considerable more effort is needed to determine which sources are prevalent in North Creek.

**Response:** The contributors to the bacterial pollution in both the point and nonpoint pollution sources that received allocations in this TMDL are very similar (e.g., pet and livestock waste, stormwater, and failing septic tanks). Assessing the actual, or relative, contribution of each would significantly delay the onset of implementation actions. Where Ecology and basin stakeholders determine the need for additional source identification activities, they can be included in the Action Plan. In this way, other implementation activities and monitoring can begin as soon as possible. The EPA, which is responsible for review and approval of the TMDL and which provides oversight on Ecology TMDL activities, also believes that a lack of refined source identification information should not delay source control measures that can be implemented in the near term. Waiting for results of additional source identification monitoring at this time would significantly delay the approval of this TMDL and some of its implementation efforts.

**3. Comment:** One method that can be used to identify sources of contamination is DNA source tracking. It is recommended that the Department of Ecology use DNA source tracking to identify sources of contamination in North Creek. BMPs could then be focused on those sources of contamination found to be prevalent in the North Creek Watershed.

**Response:** Identification of fecal coliform sources through DNA tracking is one bacterial source tracking tool that can be useful for targeting follow-up actions to clean up polluted waterways. However, while these bacterial source tracking techniques show promise, they are still in the early stages of development. One of the biggest draw-backs of these techniques is that they

provide very little quantitative information at this time (Microbial Source Tracking Workshop-Summary of Proceedings, March 2002 at [http://www.sccwrp.org/tools/workshops/source\\_tracking\\_workshop.html](http://www.sccwrp.org/tools/workshops/source_tracking_workshop.html)). Ecology supports the continued development and targeted use of this tool to help identify sources of bacterial pollution and develop appropriate cleanup activities. Ecology recommends that basin stakeholders consider the results of the existing water quality and DNA source tracking studies in their area for guiding near-term actions to reduce bacteria levels in their watersheds. If initial implementation actions are unsuccessful in reducing bacteria levels Ecology believes that bacterial source tracking tools such as DNA ribotyping can be of help in tracking down possible sources. However, in most cases these types of tools are expensive to implement on a large scale.

**4. Comment:** The submittal report should clearly state how the TMDL would be enforced. Ecology has indicated in previous meetings that enforcement of the TMDL would be through NPDES permits. That is, Phase I and II NPDES stormwater permittees would be required to implement BMPs designed to reduce fecal coliform contamination. Importantly, NPDES permittees will not be required to meet the target reductions, or goal geometric mean concentrations in tables 4 and 5. It is extremely important to clearly state this within the submittal report.

**Response:** A TMDL is not in itself an enforceable document. Ecology is however obligated to implement the approved TMDL. Activities specified in the Water Cleanup Action Plan (also called the Detailed Implementation Plan or DIP) are expected to be incorporated into NPDES permits that address the discharge of bacteria to North Creek. The performance of those activities would then become permit conditions, which are enforceable. Please refer to new text added to the sections Adaptive Management and Reasonable Assurances, which now provide more detail on these issues. Also see Response to Comment number 4.

**5. Comment:** The wasteload allocation implies that upstream dischargers and landowners will be allocated an area proportional amount of the concentration at all three monitoring stations. Given that the TMDL will be enforced by requiring NPDES permittees to implement BMPs within their jurisdictions, the concentration of fecal coliforms downstream of their jurisdiction should be irrelevant. Upstream jurisdictions have no control over land use activities downstream of their jurisdictions and should not be accountable for land use activities downstream of their jurisdiction that cause water quality standards exceedances.

**Response:** Federal law requires that TMDLs address the pollutant loading capacity of a waterbody. Although Ecology has some flexibility in how this is done, the TMDL must be expressed in terms of either "...mass per time, toxicity, or other appropriate measure." Ecology has found that using bacterial concentrations to represent the inherent mass of bacteria present at the time of study is most appropriate in the case of the North Creek Fecal Coliform TMDL. Regarding Ecology's expectations for Phase I and II permittees, Ecology will not hold a jurisdiction accountable for pollution generating activities that occur outside its legal boundaries. Where it is shown that water leaving a jurisdiction's legal boundaries meet the targets set forth in this TMDL, or where implementation activities have taken place and water quality standards are being met, Ecology considers that jurisdiction to have completed the TMDL implementation activities necessary to meet the intent of this TMDL. However, pollutants and other substances that enter North Creek upstream eventually end up downstream and therefore must be proportionally accounted for through the allocation process. In the event that upstream jurisdictions are meeting standards while downstream jurisdictions are not, Ecology encourages upstream jurisdictions to consider cooperative projects with downstream jurisdictions.

**6. Comment:** The wasteload allocation should be removed. If a wasteload allocation is made, then upstream jurisdictions should only be held accountable for fecal coliform concentrations at the closest downstream monitoring station.

**Response:** Ecology is being required by EPA to establish wasteload allocations for municipal separate storm sewer systems (MS4s) to be covered by the Phase II permit. Ecology will not hold a jurisdiction accountable for pollution generated outside its legal boundaries. During the development of the Action Plan activities, Ecology will be encouraging permittees to establish regular water quality monitoring stations at their jurisdictional boundary in order to aid in the assessment of the success of implementation activities to reduce fecal coliform pollution and improve dissolved oxygen levels. Where a jurisdiction has established such a monitoring station and implementation activities have occurred and sufficient data exists to show that water quality standards are being met, Ecology will consider that jurisdiction to have met the intent of this TMDL and to have reached the goal of the TMDL

**7. Comment:** Municipalities affected by municipal NPDES phase II stormwater permit program are required to apply for phase II permits in 2003. Given that DOE has already stated that they will not meet their deadline for adopting NPDES phase II general permit conditions, it is highly unlikely that any NPDES phase II permits will be issued in 2003. Therefore, I suggest changing the last sentence to read, "In 2003, Mill Creek, Bothell and Everett are required to apply for municipal phase II stormwater permits".

**Response:** See revised text in the final submittal report

**8. Comment:** Contact recreation within North Creek occurs very infrequently. Consequently, re-suspension of sediments cannot be a significant source of fecal coliforms. Therefore, the discussion of sediments should be deleted from the report.

**Response:** The Washington State Water Quality Standards consider primary contact recreation to be a beneficial use for North Creek. Although much of North Creek is unsuitable for contact recreation by adults due to its size, many areas of the creek are both accessible and properly sized for contact recreation by children. Sediments can also be suspended as a result of high flows caused by surface runoff from precipitation events. For these reasons, the resuspension of sediments should continue to be considered a potential source of fecal coliform bacteria in North Creek.

**9. Comment:** Short of disinfecting the stream, the target percent reductions in these tables are not feasible. In our DNA source tracking analysis of Swamp Creek, 42% of our known sources of e-coli were local wildlife. On page 16, it is stated that local wildlife are considered natural background and not a target for reduction by TMDLs. However, our DNA source tracking data suggest that 90%+ reduction will not be feasible without significant reductions in local wildlife. Furthermore Klebsiella, a naturally occurring bacteria not associated with fecal contamination, can in some cases (for example, Glenwood Creek) represent 10% of fecal coliforms in a water sample. It is not clear in the submittal report what role % reduction will play in enforcing the TMDL. From our May 10, 2002 meeting, TMDL enforcement would be based upon implementation of BMPs. This is appropriate because enforcement of TMDLs should never be based upon unachievable criteria and the 90%+ reductions in tables 4 and 5 are not achievable without disinfection of the stream.

**Response:** Although identification of fecal coliform sources through DNA tracking can be a valuable tool for targeting follow-up actions, Ecology does not believe that the relative contribution of each source can be accurately quantified at this time. Thus, Ecology does not draw the same conclusions from the Glenwood Creek study data as is stated above. Regarding the percent reductions in the submittal report and how they will be used to achieve the targets set forth in the TMDL, readers are referred to the response for Comment 4. Ecology does not plan on establishing numeric limits in NPDES permits as they pertain to the North Creek Fecal Coliform TMDL.

**10. Comment:** The first sentence in the section Margin of Safety states that the Clean Water Act (CWA) requires a margin of safety when establishing a TMDL. If the CWA does not quantify the magnitude of the margin of safety, is the margin of safety proposed appropriate for an urbanizing watershed such as North Creek? Apparently, the margin of safety must be higher where data is limited. This is another reason why additional data should be collected prior to adopting a TMDL.

**Response:** Ecology concurs with the EPA regarding relationship between the Margin of Safety and value of additional data. In EPA's guidance on developing pathogen TMDLs (EPA 2001), EPA states the following regarding the issue of margin of safety and uncertainty in a TMDL:

“Considerable uncertainty is usually inherent in estimating pathogen loading from nonpoint sources as well as predicting water quality response. The effectiveness of management measures (e.g., support of agricultural BMPs) in reducing loading is also subject to significant uncertainty. These uncertainties, however, should not delay development of the TMDL and implementation of control measures. EPA regulations (40 CFR 130.2(g)) state that load allocations for nonpoint sources “are best estimates of the loading which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading.” USEPA (1991a; 1999) advocated the use of a phased approach to TMDL development as a means of addressing these uncertainties. Under the phased approach, load allocations and wasteload allocations are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to the attainment of water quality standards. The approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.”

**11. Comment:** Ecology anticipates that North Creek will be meeting fecal coliform bacteria standards by Dec 2008. This is not realistic and will create unrealistic expectations, especially given that we still do not know the sources of contamination. Unless there are examples in similar urbanized watersheds where BMPs have drastically reduced fecal coliform concentrations within six years, an anticipated compliance date should not be included.

**Response:** As part of a settlement of a lawsuit brought against the EPA Region X office by the NW Environmental Advocates and the NW Environmental Defense Center for the slow pace of completing TMDLs, Ecology entered into a Memorandum of Agreement with the EPA and agreed to provide certain information in all TMDL submittal reports. Among the required information for each submittal is the establishment of a timeframe for meeting water quality standards. In the North Creek Fecal Coliform TMDL, it is assumed that implementation actions identified in the Action Plan, and carried out both voluntarily and as part of the Phase I and Phase II permit programs, will reduce fecal coliform pollution to levels below the state water

quality standards. Ecology acknowledges that there is limited information available on accomplishing similar goals in similar watersheds.

**12. Comment:** Purchase of existing water rights and flow augmentation should be considered as high priority activities.

**Response:** Ecology supports efforts to purchase water rights and augment flow. The draft TMDL referred to these activities as “innovative concepts.” Additional text has been added to clarify this in the final submittal report.

**13. Comment:** Ecology recommends improvement of substandard detention facilities. This recommendation should be clarified. If this recommendation is to retrofit existing detention facilities to add water quality BMPs, bacteria loading may actually increase. For example, adding a wet pond to an existing dry detention pond will increase detention time and create a permanent pool of water. This will likely increase, rather than decrease, the quantity of bacteria discharged from the pond.

**Response:** Ecology has included the design, operation, and maintenance of stormwater detention facilities as a high priority water cleanup activity primarily because of the impact of high flows to North Creek. The problems associated with many existing stormwater facilities are improperly functioning flow control structures, inadequate frequency of cleaning, and undersizing of facilities relative to current standards in the Western Washington Stormwater Manual. These problems lead to higher peak flows in local waterbodies, which in turn can contribute to lower dissolved oxygen problems where erosion, sedimentation, and stream widening occur.

**14. Comment:** The 2nd paragraph under the section Adaptive Management implies that a monitoring program sufficient to represent all climatological, hydrological and land use characteristics will be required. The last sentence in the 2nd paragraph states that any new source will be “corrected through the appropriate jurisdictions.” What does this mean exactly? Nowhere else in this document is it suggested that such an intensive monitoring program is necessary or desired.

**Response:** Ecology must reassess the quality of North Creek waters after five years of implementation activities. In order to show that North Creek has shown the necessary improvement, adequate numbers of samples, during both the wet and dry seasons, must be taken at the monitoring points where TMDL targets have been set. Ecology will be encouraging local municipalities, and private citizens where appropriate, to perform ambient water quality monitoring to identify and reduce pollutant sources and eventually to ensure that the waters of North Creek remain clean and safe. To date, there is limited data on the water quality of streams tributary to North Creek. It is anticipated that monitoring of these streams will help pinpoint problem areas and focus implementation efforts. For example, if monitoring detects high fecal coliform levels at the mouth of a tributary stream, additional monitoring along the length of the tributary may reveal a specific problem area. That area would then become the focus of pollution reduction activities for that stream. If the problem was determined to be failing septic tanks, then the appropriate jurisdiction would be contacted—in this case the local health district. If the problem was determined to be due to poor practices by an agricultural facility or small farm, then Ecology, local officials, and the Snohomish Conservation District would be the appropriate jurisdictions. Notwithstanding any requirements of the Phase I or Phase II permit

programs, the extent of monitoring will be a function of the voluntary efforts of local governments, citizens, and other stakeholders.

**15. Comment:** People need more information on how to protect North Creek. For example, they do not know the correct way to dispose of pet wastes. Information should be provided on how to properly manage this waste source and otherwise protect North Creek.

**Response:** Ecology received a number of excellent suggestions for clean up activities related to the education of local citizens and businesses on the proper management of pet wastes. Among the ideas were the following: proper management of pet wastes (bag it and put in trash, flush down the toilet), educate the public at veterinary offices, pet stores, the Humane Society and PAWS, hang up signs saying “Don’t dump over the fence,” send out flyers, put information on pet food bags, and include information along with dog licenses. Suggestions for reducing pollutants that deplete oxygen levels were also made including education on the following topics; wash cars on the grass not the street, use commercial car washes, and hang signs up about proper fertilizer use—consider doing it where fertilizers are sold. Putting public service announcements in phone books was also suggested. Ecology will share this information with all basin stakeholders and will encourage these activities in the development of educational efforts for the Action Plan.

**16. Comment:** Pet waste runoff from dog parks should be investigated as a potential pollution source.

**Response:** Ecology concurs that all areas within the watershed where pet activity is concentrated should be examined for the potential to add bacterial pollution to North Creek during the development of the Action Plan. Where appropriate, Ecology will be recommending that pet waste management systems be installed and maintained and that appropriate educational programs be developed and implemented.

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# Appendix B: Technical Report

**Bound Separately as Ecology Publication Number 01-03-020**  
"North Creek Watershed Total Maximum Daily Load Evaluation for Fecal  
Coliform Bacteria"

May be accessed online at:

<http://www.ecy.wa.gov/biblio/0103020.html>

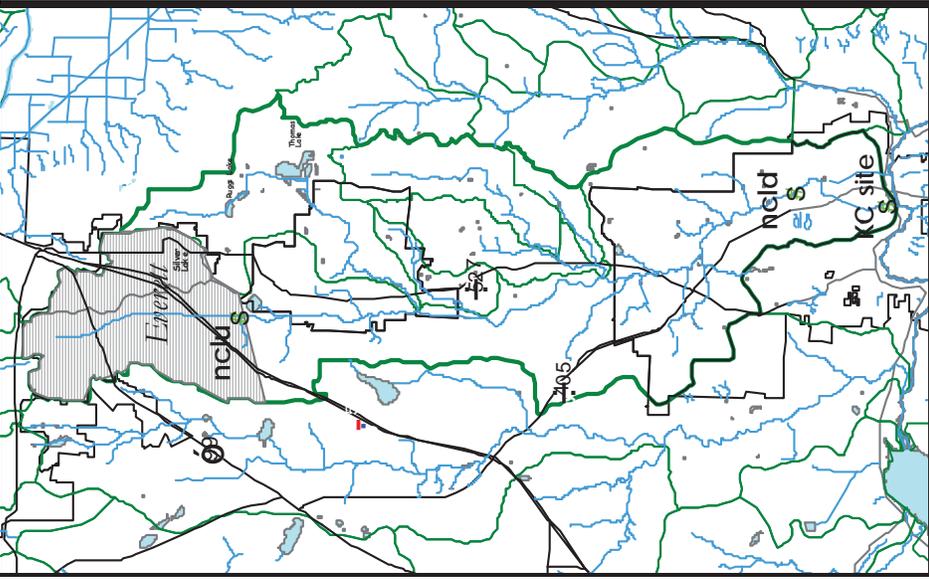
Norm Glenn, June 2001



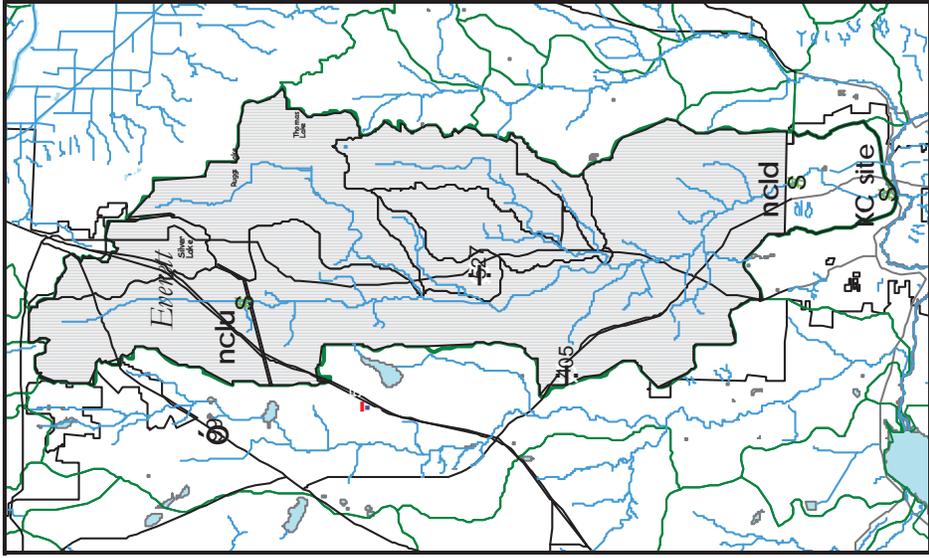
## **Appendix C**

# **Geographic Areas Used to Determine Allocations for Each Monitoring Point Along North Creek**

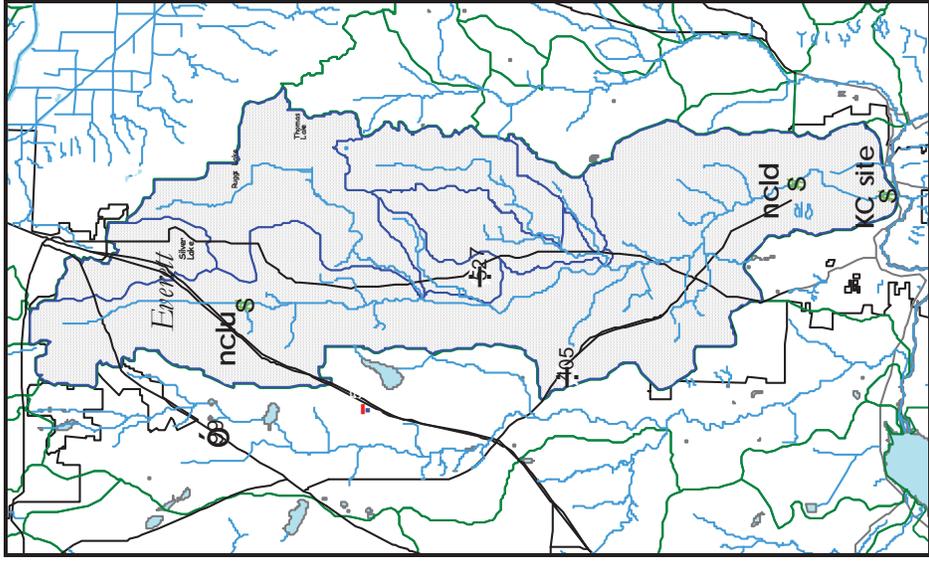




nclu area



nclid area



KC site area



**Appendix D**

**Washington's Water Quality Management  
Plan To Control Nonpoint Sources of  
Pollution**

**Executive Summary**



## **Washington's Water Quality Management Plan To Control Nonpoint Sources of Pollution, Executive Summary**

Nonpoint pollution is pollution that enters a water body from water-based or land-use activities, including atmospheric deposition; surface water runoff from agricultural lands, urban areas, and forest lands; subsurface or underground sources; and discharges from boats or other marine vessels.

Nonpoint source water pollution is a growing threat to the environment and public health. It's the accumulation of sediment, chemicals, toxics, nutrients, debris and pathogens that rain water and snow melt pick up and carry into the nearest body of water. Sometimes nonpoint pollution can be traced to several sources; sometimes it cannot be traced at all.

Washington has been a leader in addressing NPS pollution for many years. We already have many tools to achieve cleaner water through nonpoint source management. Some are regulatory while the majority are voluntary programs. Watershed efforts have addressed problems in most parts of the state. There are numerous examples of innovative approaches to management and funding.

In spite of all the work accomplished to date, salmon recovery and protection require more urgent efforts to control NPS pollution. Ground water contamination and shellfish downgrades are further indicators that pollution is increasing faster than our efforts to prevent it or clean it up. Development and changing landscapes are significant sources of the emerging problems. Non-urban land uses are shrinking but continue to produce chronic problems.

Though many innovative approaches are available in Washington, several factors limit their success: the high cost of fixing old problems, local land use decisions, the lack of agency coordination and focus, and the lack of information concerning watershed processes and conditions.

The President's Clean Water Action Plan requires each state to update its plan for managing nonpoint pollution in 1999, in order to qualify for grants under the Clean Water Act (CWA) (Section 319). Washington's potential share is about \$3.8 million per year, half of which is typically awarded to local governments and private nonprofit organizations.

This plan also addresses a separate set of federal requirements under the Coastal Zone Management Act Reauthorization Amendments of 1990 (Section 6217). This statutory requirement affects approximately \$2.8 million in federal coastal zone management funds.

The plan is a statewide look at protecting Washington's natural resources from nonpoint pollution. It is a collaborative effort of a wide range of entities. It identifies gaps in existing programs, sets a strategy for improving those programs, recommends timelines, and outlines methods for determining success.

We have used three approaches to evaluate and plan these efforts:

- Nine "Characteristics of a Successful Nonpoint Program" provided by EPA in 1996 under section 319 of the federal Clean Water Act,

- Fifty-six Management Measures provided in 1992 by EPA and NOAA which describe the minimum elements that coastal states should include in NPS programs, and
- Opinions and ideas of agencies and organizations in the nonpoint arena.

This plan reflects current efforts and creative, practical new ideas from all our partners and interested citizens. The recommendations focus on how we can improve existing efforts by stronger implementation, increased funding, or doing something new.