WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

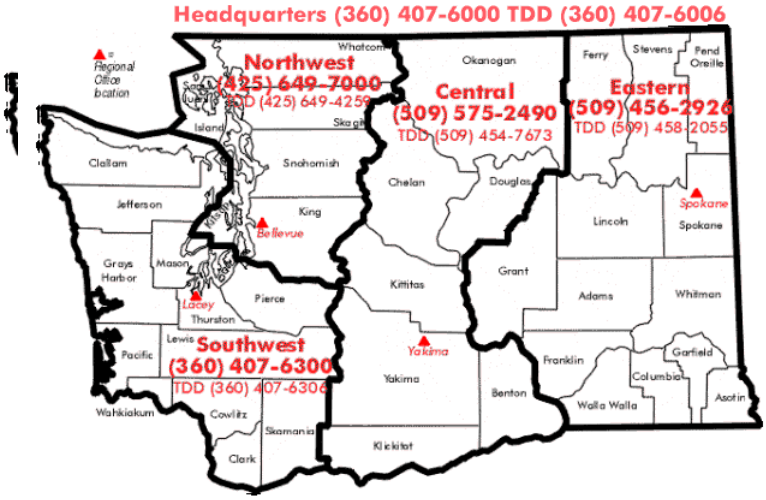
Gibbons Creek Watershed Fecal Coliform Total Maximum Daily Load

Submittal Report

June 2000
Publication No. 00-10-039
Printed on Recycled Paper

For additional copies of this report, contact:

Department of Ecology
Publications
P.O. Box 47600
Olympia, WA 98504-7600
Telephone: (360) 407-7472



The Department of Ecology is an equal opportunity agency and does not discriminate on the basis of race, creed, color, disability, age, religion, national origin, sex, marital status, disabled veteran's status, Vietnam Era veteran's status, or sexual orientation.

For more information or if you have special accommodation needs, please contact Donna Lynch at (360) 407-7529. Ecology Headquarters telecommunications device for the deaf (TDD) number is (360) 407-6006. Ecology Regional Office TDD numbers are as follows:

SWRO (TDD) (360) 407-6306
NWRO (TDD) (425) 649-4259
CRO (TDD) (509) 454-7673
ERO (TDD) (509) 458-2055

Gibbons Creek Watershed
Fecal Coliform
Total Maximum Daily Load

Submittal Report

by
Rusty Post

Water Quality Program

Washington State Department of Ecology
Vancouver Field Office
2108 Grand Boulevard,
Vancouver, Washington 98661-4622

June 2000
Publication No. 00-10-039
Printed on Recycled Paper

Table of Contents

LIST OF TABLES II

LIST OF FIGURES II

INTRODUCTION 1

BACKGROUND 3

COMPONENTS OF THE TMDL 7

LOADING CAPACITY 8

LOAD AND WASTELOAD ALLOCATIONS 12

MARGIN OF SAFETY 15

MODELING APPROACH 15

SUMMARY IMPLEMENTATION STRATEGY 16

REFERENCES CITED 22

APPENDIX A 23

APPENDIX B 25

APPENDIX C 27

APPENDIX D 29

List of Tables

Table 1. Fecal Coliform Concentrations found in Gibbons Creek ……Page 4

Table 2. Descriptions of Sampling Locations for Gibbons Creek…….Page 5

Table 3. Gibbons Creek Watershed 1998 Section 303(d) Listed Segments……..Page 5

Table 4. Fecal Coliform Loading (col/sec) in Gibbons Creek (x 10,000)……..Page 8

Table 5. Fecal Coliform Geometric Means (# colonies/100mL)……Page 9

Table 6. Antecendent Precipitation (inches) and Streamflow (cfs)……Page 11

Table 7. Fecal Coliform Geometric Means and Recommended Percent……Page 13

List of Figures

Figure 1. Location Map of Water Quality Sampling……Page 6

Figure 2. Precipitation and Flow Data……..Page 10

Figure 3. Comparison of Winter and Summer Fecal Coliform Distribution……Page 14

Introduction

The Washington State Department of Ecology (Ecology) has been delegated authority by the U.S. Environmental Protection Agency (EPA) to implement the federal Clean Water Act in Washington State. Under the Clean Water Act, each state has its own water quality standards designed to preserve, protect and restore water quality. 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 that the state place the water body on a list of "impaired" water bodies, commonly known as the '303(d) list'. The Act also mandates that states establish Total Maximum Daily Loads (TMDLs) for surface waters that do not meet state water quality standards. The U.S. Environmental Protection Agency (EPA) has established regulations (40 CFR 130) and developed guidance (EPA, 1991) for setting TMDLs.

The goal of a TMDL is to ensure the impaired water will attain water quality standards. A TMDL includes a written, quantitative assessment of water quality problems and of the pollutant sources that cause them. The TMDL determines the amount of a given pollutant that can be discharged to the water body and still meet standards, called the **loading capacity,** and allocates that load among the various 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**. If it comes from diffuse sources (referred to as **nonpoint source**) such as stormwater runoff, that share is called a **load allocation**.

The TMDL must also consider **seasonal variations** and include a **margin of safety** that takes into account any lack of knowledge about the causes of the water quality problem or its loading capacity. The sum of the individual allocations and the margin of safety must be equal to or less than the loading capacity.

The Washington State Department of Ecology (Ecology) is establishing a Total Maximum Daily Load (TMDL) for Gibbons Creek watershed for fecal coliform bacteria. This TMDL will address potential impairments of beneficial uses in the watershed listed in the 1998 Section 303(d) list of impaired surface waters.

Applicable Criteria

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

This TMDL is designed to address impairments of characteristic uses caused by fecal coliform bacteria. The characteristic uses designated for protection in the Gibbons Creek watershed streams are as follows:

"Characteristic uses. 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)."

[WAC 173-201A-030(2)(b)]

The water quality standards describe criteria for fecal coliform for the protection of characteristic uses. Listed streams in the Gibbons Creek watershed are designated as Class A.

"General classifications applying to various surface water bodies not specifically classified under WAC 173-201A-130 or 173-201A-140 are as follows:...All other unclassified surface waters within the state are hereby classified Class A"

[WAC 173-201A-120(6)]

"fecal coliform organism levels shall both not exceed a geometric mean value of 100 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 200 colonies/100 mL."

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

The water quality standards describe the averaging periods in the calculation of the geometric mean for the fecal coliform criteria:

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

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

Background

Setting and Land Use

Gibbons Creek is located in eastern Clark County and flows into the Columbia River just east of the town of Washougal (Figure 1). In the upper watershed, the creek and its tributaries flow through relatively steep, incised valleys as the water travels down the northern slope of the Columbia River Gorge. The gradient lessens considerably as the creek reaches the floor of the valley, near the Evergreen Highway (Highway 14) crossing.

Prior to 1992, Gibbons Creek flowed westerly for the lower mile before discharging into the Columbia River. The lower creek channel was then modified, and now drains nearly due south from the highway crossing, through the Steigerwald Lake Wildlife Refuge, to the Columbia River. For most of this lower mile, the creek flows through an artificial, elevated channel before discharging into the Columbia River through a fish ladder structure. Because this portion of the channel is elevated (built on a dike), the surrounding land does not drain into Gibbons Creek, but instead drains into the old remnant channel. Therefore no land south of Highway 14, including the wildlife refuge and industrial park, contributes runoff into Gibbons Creek. Water quality in the remnant channel was the subject of a separate but concurrent investigation by Ecology (Erickson and Tooley, 1996).

Land use in the watershed consists largely of rural residential development with small farms, gardens, and/or animal-keeping operations along the slopes of the Columbia River Valley. The eastern fringe of the town of Washougal extends into the western portion of the watershed, including community subdivisions, schools, a gravel pit, and a golf course, all within the Campen Creek drainage area. New residential construction was occurring in the Campen Creek subbasin during the study period. Most of the study area is unincorporated with residences having on-site disposal systems (septic systems). There are no known point source dischargers within the Gibbons Creek basin.

Historical Water Quality Data

Prior to the 1996 TMDL Assessment, the only water quality data available were those measured by the Ecology Ambient Monitoring Program. These data were collected monthly from October 1991 to September 1992 at the Evergreen Highway crossing. Ehinger (1993) summarized findings as follows:

> "Fecal coliform counts were high with ten of the twelve samples exceeding 100 colonies/100 mL."

Ehinger's study found FC concentrations ranging from 37 to 910 colonies/100 mL (Table 1). The geometric mean of all measurements was 230 colonies/100 mL and 50 percent of the samples exceeded 200 colonies/100 mL; therefore, both parts of the water quality standard were violated. These data were the basis for Gibbons Creek's inclusion on the 303(d) list (Ecology, 1994).

Table 1. Fecal Coliform Concentrations Found in Gibbons Creek during October 1991 through September 1992 (Ehinger, 1993)

Year	Month	Fecal Coliform Concentration (# colonies/100 mL)
1991	October	450
	November	150
	December	37
1992	January	480
	February	140
	March	69
	April	360
	May	910
	June	730
	July	190
	August	140
	September	310
Geometric Mean:		**230**

The 1987 Water Quality Plan for Clark County (Intergovernmental Resource Center, 1987) states: "The water quality of Gibbons Creek is likely to be affected by septic system effluent in the upper reaches of the drainage basin, and agricultural runoff in the lower reaches." However, since that plan was written, additional residential development has taken place. Suspected sources of elevated FC levels include failing septic systems and agricultural run-off from small farms and animal-keeping operations.

1996 TMDL Assessment

The Washington State Department of Ecology conducted a fecal coliform total maximum daily load assessment of Gibbons Creek from September 1994 to January 1995. The intent was to establish a nonpoint source loading capacity for fecal coliform bacteria, recommend load allocations for control of sources throughout the basin, and identify specific problem areas for follow up action or continued study.

Two mainstem Gibbons Creek sites, two Campen Creek sites, and two unnamed tributaries to Gibbons Creek were sampled as described in Table 2 and shown in Figure 1. Three water quality surveys were conducted at the above six sites. The first survey was conducted in late summer on September 8, 1994. The second and third surveys were conducted during winter on November 9, 1994, and January 17, 1995.

Table 2. Description of Sampling Locations for Gibbons Creek Fecal Coliform Total Maximum Daily Load Study

Station ID	Description	Latitude	Longitude	Township	Range	Section
GC1	**Gibbons Creek** - below confluence with Campen Creek at Evergreen Highway crossing	45°34'29"	122°18'51"	1N	4E	16
GC2	**Campen Creek** - mouth, above confluence with Gibbons Creek	45°34'40"	122°18'52"	1N	4E	16
GC3	**Campen Creek** - upstream site at Bailey Road crossing	45°35'07"	122°19'32"	1N	4E	9
GC4	**Unnamed Tributary** #1 - mouth, above confluence with Gibbons Creek	45°35'00"	122°18'21"	1N	4E	10
GC5	**Unnamed Tributary** #2 - mouth, above confluence with Gibbons Creek	45°34'58"	122°17'55"	1N	4E	10
GC6	At confluence of Gibbons Creek and two unnamed tributaries (uppermost Gibbons Creek site)	45°34'43"	122°16'45"	1N	4E	11

Water Quality and Resource Impairments

As a result of measurements made that show criteria are exceeded, Gibbons Creek is included on Washington's 1998 Section 303(d) list (Table 3).

Table 3. Gibbons Creek Watershed 1998 Section 303(d) Listed Stream Segments

Stream Name	**Listed Parameter**	**Location (Township-Range-Section)**
Gibbons Creek	Fecal Coliform	T1N, R4E, SEC16

The streams of the watershed support anadromous fish runs of cut throat and rainbow trout, steelhead, and coho salmon (USFWS, 1996).

Conclusions and Recommendations

Both parts of the water quality criterion for FC were exceeded in Campen Creek, (1) the geometric mean of all samples at each site is not to exceed 100 colonies/100mL, and (2) no more than 10 percent of all samples may exceed 200 colonies/100 mL. The second part was exceeded throughout the Gibbons Creek watershed. Study results indicate that the primary FC loading problem is occurring throughout the basin in summer and also in Campen Creek year-round.

A phased TMDL is recommended for the Gibbons Creek watershed. It is recommended that a Load Allocation (LA) for FC be set for the mainstem Gibbons Creek at GC1 and Campen Creek at GC2 to meet the water quality criterion:

Figure 1. Location Map of Water Quality Sampling Sites (1996 TMDL Assessment)

Components of the TMDL

The five components of any TMDL as required by the Clean Water Act are defined as:

Loading Capacity: The greatest amount of loading that a water can receive without violating water quality standards. In the Gibbons Creek watershed, the loading capacity of fecal coliform bacteria has been established as the state water quality standard of 100col/100mL.

Wasteload Allocation: The portion of a receiving water's loading capacity that is allocated to an existing or future point source of pollution. The Gibbons Creek watershed has no permitted discharges, therefore the waste load allocation is set at zero.

Load Allocations: The portion of a receiving water's capacity that is attributed either to one of its existing or potential nonpoint sources of pollution or to natural background sources. The Gibbons Creek watershed load allocation for fecal coliform from all sources is equal to the loading capacity (as the state water quality standard). Reductions in fecal coliform needed to achieve the load allocation (capacity) range from 78 percent in the mainstem Gibbons Creek to 83 percent in Campen Creek, the primary tributary of Gibbons Creek.

Seasonal Variation: Water quality data collected in the Gibbons Creek watershed show a pattern of seasonal variation. Fecal coliform bacteria counts were variable, with higher counts throughout the basin in late summer months and consistently high FC levels in Campen Creek. This would be consistent with continuous and steady FC sources, independent of rainfall, such as failing septic tanks, or may represent a situation where FC sources have been depleted (washed off) by previous rainfall events.

Margin of Safety: The statute 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.

Loading Capacity

Identification of the loading capacity is an important step in developing TMDLs. EPA defines the loading capacity as "the greatest amount of loading that a water can receive without violating water quality standards." The loading capacity provides a reference for calculating the amount of pollutant reduction needed to bring a water into compliance with water quality standards. By definition, a TMDL is the sum of the allocations. An allocation is defined as the portion of a receiving water's loading capacity that is assigned to a particular source.

An analysis of FC loading into the mainstem of Gibbons Creek from Campen Creek and the other tributaries was conducted using the following expressions:

(1) $FC_Z = [(FC_{GC1} * Flow_{GC1}) - (FC_{GC2} * Flow_{GC2})]/Flow_Z$

where FC = fecal coliform concentration (colonies/100 mL),
Z represents Gibbons Creek above confluence with Campen Creek, and
$Flow_z$ was calculated as the difference of $Flow_{GC1}$ and $Flow_{GC2}$

(2) FC Loading (col/sec) = Flow (cfs) * FC (col/100 mL) * 284.7

where 284.7 is the conversion factor used for calculating FC loading (Kittrell, 1969)

The intent of this simplified analysis was to examine the relative contribution of FC loading into station GC1 and did not address the effect of bacterial decay, deposition and resuspension. It should be noted that FC samples in Campen Creek were collected approximately two hours apart during each survey and may not be representing the same set of conditions, especially during Survey 1 when sampling coincided with a rainfall event.

As shown in Table 4, the area draining into Campen Creek is contributing the greatest proportion of FC load to the watershed in relation to the other tributaries. FC relative load from Campen Creek during the study period ranged from 51 percent (Survey 2) to roughly 100 percent (Survey 3).

Table 4. Fecal Coliform Loading (col/sec) in Gibbons Creek (x 10,000)

Station ID	Survey 1	Survey 2	Survey 3
GC1	200	82	83
GC2	140	42	86
GC3	150	7.0	6.8
GC4	38	1.8	4.6
GC5	20	1.7	3.6
GC6	17	4.3	*
Z	56	40	-5.8

* = no flow data obtained
Z = station representing Gibbons Creek above the confluence with Campen Creek

The data show significant variation in the relationship between fecal coliform concentrations and flow. Fecal coliform levels are highly affected by the timing of sampling in relation to the

antecedent hydrograph and show "first flush" characteristics. Therefore, development of a single regression equation to predict fecal coliform concentration based on flow is not defensible with the limited data available.

Table 5. Fecal Coliform Geometric Means (#colonies/100 mL) Found in Gibbons Creek

STATION ID	Survey 1	Survey 2	Survey 3	ALL SURVEYS
GC1	2,000	82	50	200
GC2	5,600	180	210	590
GC3	4,900	45	23	170
GC4	1,100	12	16	60
GC5	980	10	12	49
GC6	990	25	4	46
ALL STATIONS	2,000	35	24	120

The loading capacity should be estimated for both parts of the fecal coliform criteria. However, the standards dictate that the geometric mean be computed from data collected within a 30-day period since longer averaging periods would skew the results to show noncompliance. The basis for state water quality standards comes from EPA (1976) criteria that require five samples over a 30-day period to compute the geometric mean. The limited data collected in the 1996 TMDL Assessment do not contain the minimum number of samples to defensibly compute a geometric mean. Therefore, the instantaneous measurements were assumed to represent the upper 10th percentile of the averaging period for derivation of the loading capacity based on the higher fecal coliform criterion, 200 col/100mL, in order to provide an additional inherent margin of safety. The loading capacities were then derived within the range flows measured (high, medium, low) for each stream segment based on the peak instantaneous load approach.

Figure 2. Precipitation and Flow Data for Gibbons Creek

Table 6. Antecedent Precipitation (inches) and Streamflow (cfs) for Sampling Events

Survey Number	Date	Precipitation*	Station GC1	Station GC2	Station GC3	Station GC4	Station GC5	Station GC6
1	9/8/94	0.04	3.5	0.9	1.1	1.2	0.7	0.6
2	11/9/94	1.19	35	8.3	5.5	5.4	6.1	6.1
3	1/17/94	0.00	58	15	10	10	11	-

* Precipitation (inches) at City of Washougal Wastewater Treatment Plant in 24 hours preceding sampling date

\- No data obtained

Approximately 0.32 inch of rain fell on the first sampling date. Antecedent precipitation was 0.04 inches for the previous 24 hours, and averaged 0.12 inches/day in September preceding Survey 1. However, July and August were generally dry with total monthly rainfalls of 0.16 inches and 0.29 inches, respectively (city of Washougal Wastewater Treatment Plant, 1995).

Precipitation prior to Surveys 2 and 3 was generally rainy. As indicated in Table 6, the lowest flow rates were observed during the summer survey (September 8, 1994), while the highest flow rates were observed during the last winter survey (January 17, 1995).

The streamflows measured during the three surveys (3.5, 35, and 58 cfs for September, November, and December, respectively) were close to the historical mean monthly flows (3.9, 35, and 54 cfs). Therefore, the flow rates observed during the study period are likely representative of those respective months.

Load and Wasteload Allocations

Wasteload Allocations

Since there are no discharges in the Gibbons Creek watershed that are permitted by Ecology, the waste load allocation for all streams covered in this TMDL are zero.

Load Allocations

A phased approach is recommended for the Gibbons Creek TMDL, as is appropriate for basins with largely nonpoint source contributions. With a phased approach, load allocations (LAs) are defined, control measures are implemented, and the basin continues to be monitored to assess the effectiveness of the nonpoint source controls. If water quality targets are not met, additional nonpoint management techniques need to be implemented.

The study results indicate two general problems:

(1) high FC levels throughout the basin in the late summer, and
(2) consistently high FC levels in Campen Creek.

The CWA specifies that TMDLs can be expressed in terms of either mass per time (i.e., load), toxicity, **or other appropriate measure** (emphasis added) (40 CFR 130.2(i)). It is recommended that a Load Allocation for FC be set for the mainstem Gibbons Creek at GC1 and Campen Creek at GC2 to meet the water quality criterion:

- The geometric mean of all samples at each site is not to exceed 100 colonies/100 mL, and
- No more than 10 percent of all samples may exceed 200 colonies/100 mL.

For purposes of calculating the percent reduction of FC concentrations needed at GC1, data collected from the ambient monitoring program were pooled with data collected during the 1996 TMDL Assessment. The pooled data shows a significant seasonal pattern, with generally higher fecal coliform concentrations in the summer than the winter. The histogram in Figure 3 shows two distinctly different seasonal log-normal distributions of FC concentrations (Summer: April through October, and Winter: November through March). Although these seasons were selected based on fecal coliform concentrations, they are consistent with the streamflow pattern of Gibbons Creek, with relatively low average monthly streamflows in the summer months and high flows in the winter months.

Because of the seasonality of the data, percent reductions were calculated by season (Table 7). In the winter, essentially no reductions are necessary. In the summer, however, a 78 percent reduction in fecal coliform concentrations is needed to meet the TMDL load allocation. In Campen Creek, the first part of the water quality criterion was violated throughout the study period and there was insufficient data for determining seasonality. Therefore the percent reduction needed, 83 percent, was based on surveys from all dates (Table 7).

Table 7. Fecal Coliform Geometric Means and Recommended Percent Fecal Coliform Reductions for Gibbons Creek

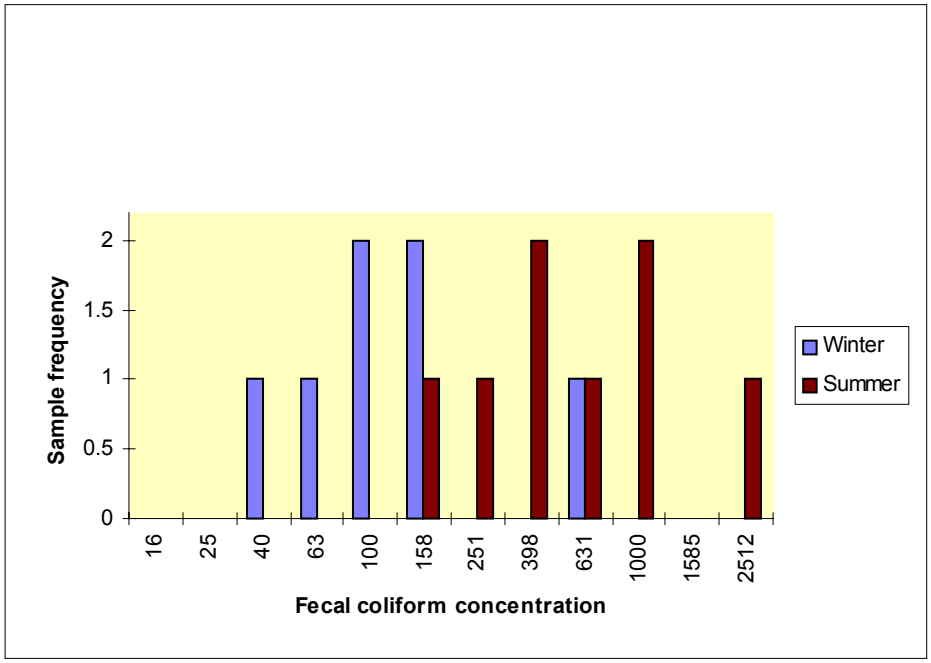
Station ID	Geometric Mean (#colonies/100 mL)			Load Allocation (#colonies/100 mL)	Percent Reduction Needed		
	summer	winter	year-round		summer	winter	year-round
GC1	453	101	-	100	78	1	-
GC2	-	-	590	100	-	-	83

The LAs proposed are intended to bring the water quality of Gibbons Creek into compliance with FC standards. However, it is not certain whether the LAs would be protective enough to meet the second criterion of the FC standard, especially in winter. Use of a phased TMDL approach will allow reconsideration of water quality management goals after evaluating the effectiveness of the LAs.

The existing pollutant loads are from nonpoint sources that must be assigned load allocations based on the loading capacity. As such, EPA guidance (1991) suggests a phased approach where the TMDL is monitored for effectiveness.

Seasonal Variation

Figure 3. Comparison of Winter and Summer Fecal Coliform Distributions in Gibbons Creek at GC1



Water quality data collected in the Gibbons Creek watershed show a pattern of seasonal variation. Fecal coliform bacteria counts were variable, with higher counts throughout the basin in late summer months and consistently high FC levels in Campen Creek. Highest FC concentrations were found during Survey 1, in late summer (Table 7). Station GC2 at Campen Creek consistently had the greatest FC concentrations in relation to other station locations. The much lower FC concentrations in November and January compared to September suggest that the diluting effect of higher streamflow is more than compensating for any additional rainfall washoff of FC sources. This would be consistent with continuous and steady FC sources, independent of rainfall, such as failing septic tanks, or may represent a situation where FC sources have been depleted (washed off) by previous rainfall events.

The pattern of FC loading along Campen Creek was different in the late summer than in the winter. In September, the upstream loading was roughly 100 percent of the downstream loading, whereas in November and January, the upstream loading was only 17 percent and 8 percent of the downstream loading, respectively. This indicates that the land draining to the reach between stations is contributing a proportionately larger share of FC in the winter than in the summer.

Margin of Safety

The statute 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.

EPA has developed a methodology for deriving fecal coliform TMDLs for areas with limited data (EPA, 1999). Using the most extreme fecal coliform loading measured is a conservative assumption that serves as an inherent margin of safety. The assumed instantaneous fecal coliform loads represent the upper 10th percentile of data in a 30-day averaging period for comparison to the water quality standards.

Modeling Approach

A modeling approach was not used in the Gibbons Creek TMDL Assessment completed in 1996.

Summary Implementation Strategy

➢ Introduction

The purpose of this Summary Implementation Strategy (SIS) is to present the concept of how the waters covered in the Gibbons Creek Fecal Coliform Total Maximum Daily Load Assessment will achieve water quality standards over time. This SIS meets the requirements of a TMDL submittal for approval as outlined in the 1997 Memorandum of Agreement between the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology). The SIS includes a description of the activities conducted to date and the process of how a Detailed Implementation Plan will be developed. The Gibbons Creek Water Cleanup Plan is an entirely non-point source TMDL.

➢ Overview

Gibbons Creek and its tributaries are located in eastern Clark County and flow into the Columbia River just east of the town of Washougal. In the upper watershed, the creek and its tributaries flow through relatively steep, incised valleys as the water travels down the northern slope of the Columbia River Valley. The gradient lessens considerably as the creek reaches the floor of the Columbia River Valley, near the Highway 14 crossing.

Land use in the watershed consists largely of rural residential development and small farms along the slopes of the Columbia River Valley. Many of the residences keep a small number of horses and/or cattle. The eastern fringe of the town of Washougal extends into the western portion of the watershed, including a school, golf course, and new residential development.

A technical study conducted by Ecology in 1994 and 1995 (Gibbons Creek Fecal Coliform Total Maximum Daily Load Assessment, April 1996), determined fecal coliform bacteria contamination of Gibbons Creek exceeded water quality standards. The study also revealed higher than normal levels of three other parameters: nutrients, turbidity and temperature. No additional activities, studies or monitoring have been conducted by Ecology since the TMDL Assessment released in 1996. Limited data on habitat and temperature is available from state and federal fish and wildlife agencies.

There are no permitted discharges (municipal, industrial or agricultural) of fecal coliform bacteria in the basin. Elevated bacteria counts can only be attributed to non-point sources. Elevated levels of nutrients, temperature and turbidity can only be attributed to non-point sources as well.

➢ Implementation Plan Development

Ecology initiated the TMDL or Water Cleanup Planning process for Gibbons Creek in February 2000 by holding an internal meeting to identify lead, support and technical staff within the agency, and committing to development of an implementation plan. Ecology hosted a series of four public meetings in March and April 2000, inviting individuals, organizations and agencies to help develop and implement a cleanup plan. Public participation resulted in the development of an outline of the Draft Water Cleanup Plan, which was released for a 30 day public comment period in April 2000. This outline and the comments received will guide development of the Detailed Implementation Plan scheduled for completion by October 2000. The Draft Water Cleanup Plan Outline and public comment Responsiveness Summary are attached for reference.

During the process of developing the outline of the Draft Water Cleanup Plan for fecal coliform bacteria, planning participants agreed to also address the other three parameters of concern (nutrients, turbidity and temperature) identified in the TMDL Assessment.

To address the four pollution parameters, the Plan Outline was divided into four main categories of activities that are the most likely sources of pollution: Farms, Septic Systems, Riparian/Streamside, and Construction/Landclearing. There is also a section on Monitoring that will track changes in water quality in the creek and assist in the identification of pollution sources. To address the four pollution types, each of the four categories is divided into five parts: Identify Sources, Identify Control Measures, Identify Resources, Identify Other Needs, and Timeline. The outline will serve as the basis for the Detailed Implementation Plan. Public Comment on the Draft Water Cleanup Plan Outline proposed modifying the existing group categories/names. Development of the Detailed Implementation Plan will reflect this subtle change in structure. It is expected that this change will lend itself to a simpler, more appropriate organizational structure better suited to planning and implementation of plan elements.

A significant consideration in development of this TMDL is that there are two other concurrent planning processes underway; Watershed Planning and Salmon Recovery. It is expected that this TMDL will likely result in an implementation plan that will function as the basis for the other two planning processes covering this basin. Coordinating this process with the other two should reduce duplication, build relationships, develop a wider understanding of the watershed, provide an example of planning and implementation, and increase the likelihood of funding and other support to or from the other planning groups. Also, it is important to note that the Gibbons Creek watershed is home to listed and proposed threatened and endangered species of fish as well as non-listed stocks. Water quality improvements resulting from TMDL implementation activities will also function as fish spawning, rearing and habitat improvements.

- **Involved Parties**

The following is a description of the key agencies and other groups that have regulatory authority, information, resources or other interests that will be included in the coordinated effort to develop and implement a Detailed Implementation Plan.

City of Washougal
US Fish and Wildlife
Clark Public Utilities
Washington Department of Fish and Wildlife
Clark Conservation District
Lower Columbia Fish Recovery Board
Washington State Department of Transportation
Local Citizens
Clark County
Southwest Washington Health District
Washington Department of Ecology
Natural Resources Conservation Service
Clark County Homebuilders Association
Local Media

- **Approaches to Meet Load Allocations**

The load allocation for this basin for fecal coliform bacteria has been defined as the state water quality standard of 100 colonies per 100mls. Although a load allocation has not been established for the other three parameters of concern in the basin, the state water quality standards will apply. The overall approach to meet these load allocations requires a combination of strategies with a wide array of non-point source controls and BMPs. To summarize the approach: identify pollution sources, identify control measures, identify available resources, identify other needs (funding, equipment, personnel, etc.) and set a timeline.

The first step is to identify potential sources, either by land-use type or by general location from monitoring results and other available information. The second step is to locate specific sources of pollution and contact the owners/operators. Voluntary source control through education and technical assistance is the preferred method for pollution reduction. Compliance and enforcement are available as a more formal process in controlling pollution sources, but are expected only in situations where education and technical assistance efforts fail to get pollution controls in place.

It is expected that public awareness and education programs will be a significant part of the Detailed Implementation Plan and will result in pollution reductions.

It should be noted that the sample data collected in 1994-5 as part of the TMDL Assessment, indicated watershed conditions and land uses at that time. Land use changes since that study period may have resulted in changes in pollution levels. Implementation of the Monitoring Plan should provide a more accurate picture of current water quality conditions in the basin. It is possible that the results garnered in the Monitoring Plan will alter the approach taken in the Detailed Implementation Plan. The current and proposed structure for this TMDL readily accommodates an adaptive management approach to attain water quality standards in the basin.

One essential element of the Detailed Implementation Plan will be defining Success Measures. The primary success measure will be fecal coliform bacteria reductions, but other measures will also be discussed and proposed for inclusion in the detailed implementation plan.

- **Implementation Activities**

Examples of activities related to the various pollution source types is outlined below and in the Draft Water Cleanup Plan Outline (see Appendix D).

If On-site Septic System (OSS) failures are identified through the maintenance and inspection program, the owners will be given technical assistance to get the repairs or replacements completed. The SWWHD will implement the provisions of their OSS program. Ecology and the SWWHD are currently negotiating a Memorandum of Agreement to prioritize the Gibbons Creek basin in the district's workload planning.

Agricultural sources identified as contributors to fecal coliform bacteria pollution will be referred to Clark Conservation District (CCD). The CCD, under the guidance of NRCS, will assist landowners in developing or modifying an existing farm plan to eliminate the potential to pollute. During the remainder of 2000, the CCD will continue to work with small farm owners to implement BMPs using the existing Ecology Centennial Grant for funding.

Clark Public Utilities has offered to assist with stream restoration measures and public education.

Clark County Public Works Department will continue to implement their stormwater program and assist with educational activities.

City of Washougal has committed to assist in identification of potential pollution sources and implementation of existing city ordinances. The city has also offered to assist with implementing some elements of the Monitoring Plan. The city will also assist with educational activities.

An education campaign/program will be developed. All participants in the TMDL planning process will be asked to assist in this key area. It is expected that educational activities will be coordinated with the volunteer monitoring program.

The Monitoring Plan will be initiated in June 2000. Monitoring will begin before the Detailed Implementation Plan is completed.

➢ Summary of Public Involvement

The initial public meeting introduced the participants to the TMDL Assessment and the water cleanup planning process. This was followed by two additional public meetings where planning participants identified more specific strategies, roles, needs, and timelines as proposed in the Draft Water Cleanup Plan Outline, which was released for public review and comment. One additional meeting was held to discuss and refine the approach to the Monitoring Plan. These meetings constitute the bulk of the public participation strategy entailed in development of this SIS and the Draft Water Cleanup Plan Outline. The Outline will serve as the basis for the Detailed Implementation Plan to be completed by October 2000.

Ecology will continue working with Clark County, city of Washougal, Port of Camas Washougal, US Fish and Wildlife, State Fish and Wildlife, Clark Public Utilities, Clark Conservation District, Southwest Washington Health District, the Lower Columbia River Fish Recovery Board, and many local organizations and individuals to develop the Detailed Implementation Plan, through a process of peer review and periodic stakeholder meetings. Stakeholders meetings will be used to keep planning and implementation participants appraised of the implementation activities and to reach consensus on appropriate implementation strategies, corrective actions and timelines. Local media coverage has been extremely helpful thus far and it is expected to continue. Three newspapers, two TV stations and one radio station are monitoring and covering the group's progress. A web site containing documents specific to this TMDL as well as general information is currently available.

Additional public involvement is essential to successful implementation of the Gibbons Creek Water Cleanup Plan.

➢ Monitoring Strategy

The Gibbons Creek Monitoring Plan is currently under development. The overall strategy and purpose of the plan was discussed and agreed to by the monitoring group in April 2000. The Monitoring Plan will be initiated in June of 2000, and will cover all four parameters of concern. The Monitoring Plan will address three primary goals: confirm existence of water quality pollution exceedences, help pinpoint potential sources of pollution, and provide long-term indicators of changes in water quality and the success or failure of pollution control measures.

The Monitoring Plan will be based on the Quality Assurance Project Plan established for Ecology's 1996 TMDL Assessment, but will include two additional monitoring stations, both in the Campen Creek basin. A reduced suite of sample parameters will reduce costs and keep the focus on the four parameters of concern.

Volunteer monitoring by local residents and school groups will supplement data generated by the Monitoring Plan, provide educational opportunities and involve the local population in measuring the effectiveness of pollution control measures.

Potential Funding Sources

The Centennial Clean Water Fund, Section 319, and State Revolving Fund grants are available to fund activities by jurisdictions to help implementation of the water cleanup plan. Non government organizations can apply to be funded by a 319 grant fund to provide additional assistance. Ecology will work with the stakeholders to prepare appropriate scopes of work, to implement this plan, and to assist with applying for grant opportunities as they arise. Ecology will be involved in monitoring by participating in sample collection and laboratory analysis.

Funding for specific projects or control measures that meet the guidelines for salmon recovery funding may be available through the Lower Columbia Fish Recovery Board.

Many elements of the implementation plan will be covered by minor adjustments of existing staff and resources and shifting priorities within various agencies and organizations. Some programs administered by local agencies, such as stormwater programs, are relatively new or are only recently being staffed and funded. Thus a good portion of the implementation can be funded within existing resources.

Acronyms and Abbreviations

BMP	Best Management Practice
CCD	Clark Conservation District
DNMP	Dairy Nutrient Management Plan
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
NPDES	National Pollution Discharge Elimination System
NRCS	National Resource Conservation Service
OSS	On-Site Sewage System (OSS)

References Cited

SASSI, 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. Washington Department of Fisheries, Washington Department of Wildlife and Western Washington Treaty Indian Tribes. Olympia, WA.

U.S. Environmental Protection Agency. 1976. Quality Criteria for Water. Washington, D.C.

U.S. Environmental Protection Agency. 1987. The Enhanced Stream Water Quality Models QUAL2E and QUAL2E-UNCAS: Documentation and User Manual. EPA/600/3-87/007. Athens, GA.

U.S. Environmental Protection Agency. 1991. Guidance for Water Quality-based Decisions: The TMDL Process. EPA 440/4-91-001. Washington, DC.

Appendix A

Public Participation Materials

Appendix B

Quality Assurance Project Plan

Appendix C

Technical Report

Gibbons Creek Fecal Coliform
Total Maximum Daily Load Assessment
April 1996
Publication No. 96-316
(Published Separately)

Appendix D

Draft Water Cleanup Plan Outline

GIBBONS CREEK TMDL
DRAFT WATER CLEANUP PLAN
OUTLINE
APRIL 2000

The Washington Department of Ecology wants to know

what you think about the attached plan

Gibbons Creek is one of over 600 waterbodies in Washington that fail to meet state water quality standards. Gibbons Creek does not meet the standards for fecal coliform bacteria. Accordingly, the Department of Ecology (Ecology) is required by the federal Clean Water Act to develop a Water Cleanup Plan also known as a Total Maximum Daily Load (TMDL).

The attached Draft Water Cleanup Plan, developed in conjunction with residents and interested parties in the Gibbons Creek basin, is being offered for public review and comment. After the close of the public comment period on May 12, 2000, we will carefully review and incorporate public comments and develop a responsiveness summary. We will then submit this Plan to the Environmental Protection Agency (EPA) as part of a package of documents known as the Summary Implementation Strategy (SIS). This Draft Water Cleanup Plan in the SIS is meant to serve as an indicator of the general direction to be taken to address pollution issues in the Gibbons Creek Basin. Ecology will be working with local agencies and residents to develop a more detailed implementation plan during the summer and fall of 2000.

A technical study conducted by Ecology in 1994 and 1995, determined fecal coliform bacteria contamination of Gibbons Creek exceeded water quality standards. It also revealed higher than normal levels of three other parameters: nutrients, turbidity and temperature. In addition to developing a water cleanup plan for fecal coliform bacteria, planning participants agreed to also address the other three parameters of concern. Since the four pollution parameters have different sources and control measures, the Plan is divided into four main acitivities or land uses that are the most likely sources of pollution: Farms, Septic Systems, Riparian/Streamside, and Construction/ Landclearing. There is also a section on Monitoring (required by EPA), which will track changes in water quality in the creek. To address the pollution sources, each of the land use activities is divided into five parts: Sources, Control Measures, Resources, Other Needs, and Timeline.

Please submit comments by May 12, to Rusty Post, Department of Ecology - Vancouver Field Office, 2108 Grand Boulevard, Vancouver, Washington 98661-4622, telephone (360) 690-4787. Comments may also be submitted by fax to (360) 690-7166 or by e-mail to rpos461@ecy.wa.gov. Additional information will be available in mid-April on Ecology's website at http://www.wa.gov/ecology/wq/tmdl/index..html

SECTION 1: FARMS

A. Identify Sources
   1. Livestock Inventory
   2. Animal Census
   3. Commercial Operations

B. Identify Control Measures
   1. Best Management Practices
      A) Fencing
      B) Manure Management
      C) Stormwater Management
      D) Stock Watering
   2. Farm Plans
   3. Education

C. Identify Resources
   1. Grange
   2. Conservation District
   3. Cattleman's Association
   4. Department of Agriculture
   5. Clark Public Utilities
   6. Local Farmers and Ranchers

D. Identify Other Needs
   1. Funding (grants, loans, etc.)
   2. Maps and Aerial Photos
   3. Educational Materials, Technical Assistance

E. Timeline
   1. Gather Information
   2. Identify Potential Sources
   3. Provide Information and Technical Assistance
   4. Monitor Waterways

SECTION 2: SEPTIC SYSTEMS

A. Identify Sources
   1. Phased Approach, Begin with Campen Creek Basin
   2. Develop Complete and Accurate List of Septic Systems in Basin
   3. Septic Maintenance Inspection Program (Statewide Requirement for Homeowners)
   4. Use monitoring Results to Focus Efforts

B. Identify Control Measures
   1. Provide List of Certified/Licensed Inspection Contractors
   2. Provide List of Certified Pumpers and Repair Contractors
   3. Provide Educational Materials
   4. Require Repairs or Replacements if Necessary

C. Identify Resources
   1. Lists of Contractors
   2. Local Health Department Records
   3. Clark County GIS

4. Local Resident Knowledge
5. State Health Department
6. Clark County Department of Community Services
7. USDA Rural Development

D. Identify Other Needs
1. More Detailed Information onNumber, Location and Condition of Systems
2. Funding
    a) Health District Inspection and Maintenance Program
    b) Grants and Loans for Maintenance and Repair

E. Timeline (Approximate)
1. Develop Preliminary List of Septic Systems
2. Develop More Detailed List of Septic Systems
3. Send Inspection Notice and Contractor Lists to System Owners

SECTION 3: RIPARIAN/STREAMSIDE

A. Identify Sources
1. Using Aerial Photos and Mapping
2. Consult State and US Fish and Wildlife Stream Survey Data
3. Focus on Residential Areas, Especially Campen Creek
4. Re-Survey Specific Areas

B. Identify Control Measures/Improve and Maintain Riparian Cover
1. Replanting With Native Vegetation
2. Fencing out Livestock
3. Education and Outreach
    a) Send Flyers to Local Residents
    b) Host Community Events (Invite Master Gardeners)
    c) Newspaper Coverage with Insert on Landscaping Ideas
    d) Involve Large Landowners and Small
    e) City Parks and Other Public Facilities Should Serve as Good Models
    f) Work With Developers Up Front

C. Identify Resources
1. Clark Conservation District and National Resource Conservation Service
2. Casey Center
    a) Master Gardeners
    b) Student Run Nursery of Native Plants
    c) Naturescaping Program
3. City of Washougal
4. Washougal Neighborhood Associations
5. Washougal Schools
6. Clark County

D. Identify Other Needs
1. Funding
2. Activity Coordinators

E. Timeline
1. Gather and Analyze Existing Information
2. Identify Scope of Problem
3. Identify Priority Areas

4. Begin Community Education and Outreach
5. Begin Restoration Activities

SECTION 4: CONSTRUCTION/LANDCLEARING

A. Identify Sources
1. Sediment From Clearing, Grading and New Construction
2. Removal of Vegetation
    a) Construction/Development
    b) Forest Practices
    c) Ditch Maintenance
    d) Farming
    e) Landscaping

B. Identify Control Measures
1. Compliance with Standards in State Stormwater Manual
2. Compliance with Clark County and City Washougal Stormwater Ordinances, Grading and Other Permits
3. Identify list of Best Management Practices (BMPs)
4. Provide Information During Permit Application Process
5. Enforce Existing Rules and Regulations

C. Identify Resources
1. State, County and Municipal Staff Familiar with Regulations and Ordinances
    a) Department of Ecology
    b) Clark County Development Review Services and Code Enforcement
    c) City of Washougal Development Review and Public Works
2. Best Management Practices (BMPs)
    a) State Stormwater Manual
    b) Clark County Homebuilders Association, Builder's Guide
    c) Environmental Consultants and Engineering Firms
3. Training and Education Seminars and Classes

D. Identify Other Needs
1. Available Education and Training Classes
2. Additional Technical Assistance and Enforcement

E. Timeline
1. Gather Available Data and Information
2. Identify Existing Sources and Problem Areas
3. Provide Information and Technical Assistance or Enforcement if Necessary
4. Develop System to Provide Information to Anyone Clearing Land
5. Monitor Water Quality

SECTION 5: MONITORING

A. Identify Existing Sources of Information
1. US Fish and Wildlife
2. State Department Of Ecology
3. State Department of Fish and Wildlife
4. Other Agencies, Organizations or Individuals

B. Develop a Monitoring Plan/Quality Assurance Project Plan (QAPP)
1. Problem Description
2. Project Objectives
3. Sources of Pollution

4. Study Design
    a) Sample Sites (Number and Location)
    b) Survey Schedule
    c) Parameters
        1) Fecal Coliform Bacteria
        2) Turbidity
        3) Nutrients
        4) Temperature
        5) Flow
        6) ph, Conductivity
    d) Quality Control
    e) Budget
    f) Project Organization

C. Identify Resources
1. Technial Staff to Develop Monitoring Plan/QAPP
2. Qualified Personnel to Collect and Analyze Samples
3. Existing Sampling and Monitoring Equipment
4. Available Funds for Sample Collection and Analysis

D. Identify Other Needs
1. Education and Outreach Program
2. Coordinate with Volunteer and/or School Monitoring Programs
3. Funding

E. Timeline
1. Review Existing Data
2. Develop Monitoring Plan/QAPP
3. Develop Budget
4. Begin Monitoring