WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Johnson Creek Watershed Total Maximum Daily Load

Submittal Report

June 2000
Publication Number 00-10-033
Printed on Recycled Paper

Johnson Creek Watershed Total Maximum Daily Load

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June 2000
Publication Number 00-10-033

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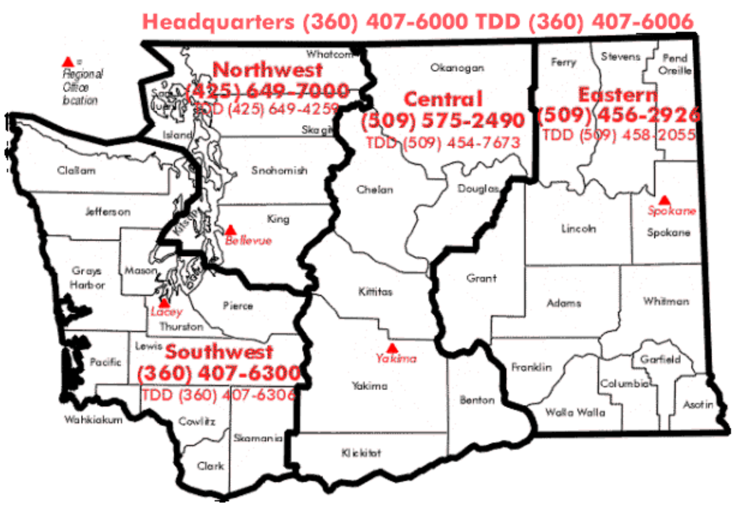

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Table of Contents

List of Tables

List of Figures

Components of the TMDL

The Washington State Department of Ecology (Ecology) is establishing a Total Maximum Daily Load (TMDL) for Johnson Creek watershed for dissolved oxygen and fecal coliform. This TMDL will address potential impairments of beneficial uses on the 18 segments of the streams in the watershed listed in the 1988 Section 303(d) list of impaired surface waters.

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 case of the Johnson Creek watershed, the loading capacity for biologically demanding substances is the natural background since the natural conditions of dissolved oxygen are estimated to be below the criteria. The loading capacity of fecal coliform varies with flow based on the peak loading measured.

Wasteload Allocation: The portion of a receiving water's loading capacity that is allocated to one of the existing or future point sources of pollution. Johnson Creek watershed has no permitted discharges. Therefore the waste load allocations are 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 Johnson Creek watershed load allocations for biologically demanding substances and fecal coliform are equal to the loading capacities. Reductions in biologically demanding substances needed to achieve the load allocations range from 41 percent to 83 percent. Reductions in fecal coliform needed to achieve the load allocations range from 95 percent at low flows to 0 percent at higher flows in some streams.

Margin of Safety: Four conservative assumptions were identified that provide an inherent margin of safety.

Seasonal Variation: Water quality data collected in the Johnson Creek watershed show a pattern of seasonal variation. The critical period for dissolved oxygen in the Johnson Creek watershed is during the months of August and September, corresponding to lower flows and higher temperatures. Fecal coliform is much more variable, with higher counts usually occurring during the summer months.

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Introduction

Section 303(d) of the federal Clean Water Act mandates that the state establish Total Maximum Daily Loads (TMDLs) for surface waters that do not meet standards after application of technology-based pollution controls. The U.S. Environmental Protection Agency (EPA) has established regulations (40 CFR 130) and developed guidance (EPA, 1991) for setting TMDLs.

Under the Clean Water Act, every state has its own water quality standards designed to protect, restore, and preserve water quality. Water quality standards consist of designated uses such as cold water biota and drinking water supply, and criteria (usually numeric criteria), to achieve those uses. When a lake, river or stream fails to meet water quality standards after application of required technology-based controls, the Clean Water Act requires that the state place the water body on a list of "impaired" water bodies and to prepare an analysis called a **Total Maximum Daily Load (TMDL)**.

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 a diffuse source (referred to as a **nonpoint source**) such as a farm, that facility's share is called a **load allocation**.

Background

The Johnson Creek watershed covers an area of approximately 21 square miles in the north-central part of Whatcom County. The drainage area occupies about 40 percent of the total Sumas River drainage area. The Johnson Creek watershed is bounded to the north by the US-Canadian border and to the south by the mainstem of the Nooksack River (Figure 1). Johnson Creek originates from springs just north of the town of Everson and flows northeastward across the nearly flat Sumas Valley floodplain. Three principal tributaries, Squaw Creek, Pangborn Creek, and Sumas Creek, drain uplands along the western and northwestern edge of the basin and contribute year-round flow to Johnson Creek. During periods of high precipitation, additional flow enters Johnson Creek through a series of ditches that drain the floodplain of the basin.

The total length of Johnson Creek is approximately 12 miles from its headwaters to the confluence with the Sumas River 1.4 miles south of the international border. Johnson Creek reaches the sea via the Sumas River and the Fraser River, which enters Georgia Strait just south of Vancouver, British Columbia. The average gradient of Johnson Creek is a very flat 3.3 feet per mile; its headwaters are only 40 feet higher than its mouth. Consequently, the average stream velocities within Johnson Creek are typically low, usually less than 0.5 feet per second. The average annual discharge within Johnson Creek is approximately 50 cubic feet per second (cfs) near its mouth. Discharge is normally highest in early winter and lowest during the late summer months. The highest and lowest flows recorded were 266 cfs in January and 11 cfs in September (Dickes and Merrill, 1990).

The Johnson Creek watershed has a moderately wet climate. The mean annual rainfall in the basin is about 47 inches (Gillies et al., 1981). During a typical year, approximately 70 percent of the total annual precipitation falls as rain between October and March. A small percentage of this precipitation may also occur as snowfall. Typically, the ground within the basin is saturated by November and additional rainfall runs off as overland flow throughout the wet season. The mean annual air temperature is 48°F, with a mean maximum temperature of 75°F and a mean minimum temperature of 30°F. Shifts in the prevailing winds occasionally cause severe winter weather with reported wind chill temperatures of -49°F. The frost-free period, and the corresponding growing season, is about 140 days from early May to late September.

Land use in the Johnson Creek watershed is primarily agriculture, dominated by dairy farming (Gillies et al., 1981; Dickes and Merrill, 1990). Nearly 80 percent of the watershed is used for pasture and hayland associated with dairy operations. Although the total number of operating dairies has steadily declined, the total herd size has nearly doubled since 1980 (Wills, 1998). About 20 percent of the pasture and hayland are also in rotation with silage corn. The remaining land in the watershed consists of cropland (7%), developed areas (7%), woodlands (5%), and permanent wetlands (1%). The population of the watershed is about 5,000, of which half reside in the rural portions of the basin and the remainder are concentrated in the towns of Everson, Nooksack, and Sumas.

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 low dissolved oxygen, high nutrients, and fecal coliform. The characteristic uses designated for protection in the Johnson 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).

(vi) Commerce and navigation."

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

The water quality standards describe criteria for dissolved oxygen and fecal coliform for the protection of characteristic uses. Listed streams in the Johnson Creek watershed are designated as Class A. Class A waters have assigned dissolved oxygen and fecal coliform criteria to protect the characteristic uses:

"dissolved oxygen shall exceed 8.0 mg/L."

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

"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 43 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)]

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 a lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria."*

[WAC 173-201A-070(2)]

Water Quality and Resource Impairments

As a result of measurements made that show criteria are exceeded, four streams (representing 18 segments) are included on Washington's 1998 Section 303(d) list (Table 1).

***Table 1*.** Johnson Creek Watershed 1998 Section 303(d) Listed Stream Segments

Stream Name	**Listed Parameter**	**Segment Location (Township-Range-Section)**
Johnson Creek	Dissolved Oxygen	40N-04E-03, 40N-04E-04, 40N-04E-05, 40N-04E-08, 40N-04E-17, 40N-04E-18, 41N-04E-34, 41N-04E-35
	Fecal Coliform	40N-04E-03, 40N-04E-04, 40N-04E-05, 40N-04E-08, 40N-04E-17, 40N-04E-18, 41N-04E-34, 41N-04E-35
Sumas Creek	Dissolved Oxygen	41N-04E-34
	Fecal Coliform	41N-04E-34, 41N-04E-35, 41N-04E-36
Pangborn Creek	Dissolved Oxygen	40N-03E-01, 40N-04E-06
	Fecal Coliform	40N-03E-01, 40N-04E-05, 40N-04E-06
	pH*	40N-03E-01, 40N-04E-06
Squaw Creek	Dissolved Oxygen	40N-04E-08
	Fecal Coliform	40N-03E-11, 40N-03E-12, 40N-04E-07, 40N-04E-08
	pH*	40N-03E-12

* not addressed with this TMDL

Water quality data collected in the Johnson Creek watershed show a definite pattern of seasonal variation. Data collected by Wills (1998) were compiled and descriptive statistics generated (Table 2). The critical period for dissolved oxygen in the Johnson Creek watershed is in the months of August and September, corresponding to lower flows and higher temperatures. Fecal coliform is much more variable, although there appears an indication of higher levels during the summer months.

<u>Table 2</u>. Seasonal Variation of TMDL Constituents at the Mouths of Section 303(d) listed Streams in the Johnson Creek Watershed

Month	**Mean Dissolved Oxygen (mg/L)**				**Geometric Mean Fecal Coliform (cfu/100mL)**			
	Johnson Creek	**Pangborn Creek**	**Squaw Creek**	**Sumas Creek**	**Johnson Creek**	**Pangborn Creek**	**Squaw Creek**	**Sumas Creek**
January	8.4	11.8	12.3	9.2	na	na	na	na
February	7.0	11.0	10.5	8.3	64	24	50	4
March	7.8	10.9	11.5	8.1	242	74	22	1400
April	7.2	10.5	10.4	7.8	69	110	140	439
May	6.3	10.2	8.5	7.3	200	270	500	156
June	7.5	9.9	11.9	7.9	320	350	100	159
July	7.1	9.9	9.4	7.1	129	2500	420	220
August	6.7	9.8	7.0	6.5	300	1700	420	309
September	6.3	10.1	6.3	6.8	1400	800	400	3400
October	na	na	na	na	na	na	na	na
November	na	na	na	na	na	na	na	na
December	5.3	10.3	9.3	7.0	na	na	na	na

na - data not available from Wills (1998)

The Johnson Creek watershed TMDL addresses some fisheries concerns resulting from low dissolved oxygen in several of the streams, which reduces the quality of spawning and rearing habitat for salmonids. The streams of the watershed support anadromous fish runs of coho and chum salmon, but the status of these stocks is unknown (SASSI, 1993). In addition, the TMDL addresses some recreation concerns resulting from high fecal coliform. The quality of both primary and secondary contact recreation is impaired by high fecal coliform levels, which puts people at an increased health risk after contact with the water in these streams.

Modeling Approach

Stream models were constructed using spreadsheet format with basic model structure, including equations incorporated to simulate constituent transport, modified from The Enhanced Stream Water Quality Model - QUAL2E (EPA, 1987). All simulations were conducted assuming steady-state conditions and laminar flow. Modeling was confined to the main channel of Johnson Creek from river mile ten to the confluence with the Sumas River. The modeled stream was divided into seven reaches ranging in length from 0.5 miles to 2.3 miles. The hydraulic characteristics over the length are relatively uniform so reach divisions were established principally around the location of sampling sites. Each reach is further subdivided into individual computational sections, each representing 0.1 miles of stream length (Wills, 1998).

Tributary data were collected near each confluence with the main stream, and therefore simulated as point sources. Nonpoint source loading was simulated by incorporating input equations from each computational section. The nonpoint loading equations were configured to input both the discharge and water quality constituent data uniformly within each reach.

Simulations were performed for each of the 12 water quality surveys conducted by Wills (1998) in 1996. Water quality constituent input for each simulation was derived from the corresponding measured data. Data collected during the morning in the dry season were used for dissolved oxygen to represent the worst-case diel variation. After appropriate rate constants were determined, the model was calibrated by adding additional flow and nonpoint source loading to each of the computational section junctions (Wills, 1998).

Loading Capacity

Identification of the loading capacity is an important step in developing TMDLs. 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. EPA defines the loading capacity as "the greatest amount of loading that a water can receive without violating water quality standards."

Through use of the calibrated model, loading sources were identified by model reach and the loads quantified. The model calibration of the September survey represented the worst case condition. On this date, all reaches measured were below the water quality criterion for dissolved oxygen. The loading of five-day biological oxygen demand (BOD) was adjusted to lower values in the calibrated model and the resulting dissolved oxygen concentration assessed. The result showed that the low dissolved oxygen concentrations are the result of natural conditions.

To determine the natural conditions, the natural background BOD was assumed to be 1.0 mg/L, which is one-half of the analytical detection limit. When this concentration was entered into the input of the calibrated model, the dissolved oxygen criterion was not met at any location except one (Squaw Creek). However, at most locations, the natural condition provisions of the water quality standards apply. Due to downstream impacts, the natural background loading was left for Squaw Creek even though the stream itself meets the criterion. The lower dissolved oxygen values predicted for criterion represent the water quality standard that must be met. The loading capacity is figured based on the natural background BOD.

Table 3. Loading Capacity of BOD in the Johnson Creek Watershed

Location	Flow (cfs)	BOD Concentration (mg/L)	BOD Load (lbs/day)	Modeled Dissolved Oxygen Concentration (mg/L)
Johnson Creek RM 8.2	2.6	1.0	0.018	1.3
Squaw Creek RM 0.2	1.9	1.0	0.013	8.4
Pangborn Creek RM 0.1	1.5	1.0	0.010	7.8
Johnson Creek RM 6.6	8.0	1.0	0.054	5.6
Johnson Creek RM 5.9	9.5	1.0	0.064	4.2
Johnson Creek RM 3.6	14.0	1.0	0.095	5.6
Johnson Creek RM 1.5	20.2	1.0	0.137	3.4
Sumas Creek RM 0.1	7.0	1.0	0.048	5.0
Johnson Creek RM 1.0	27.9	1.0	0.190	5.3

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.

EPA has developed a methodology for deriving fecal coliform TMDLs for areas with limited data (EPA, 1999). This approach estimates the peak instantaneous load possible per unit of flow. The peak instantaneous load was derived using data from Wills (1998) from the highest measured fecal coliform concentration based on the amount of flow (Table 4). Using the most extreme fecal coliform loading measured is a conservative assumption that serves **as an inherent margin of safety.**

***Table 4*.** Peak Loading of Fecal Coliform in the Johnson Creek Watershed

Location	Sample Date	Flow (cfs)	Fecal Coliform (cfu/100mL)	Peak Fecal Coliform Loading (cfu/day)
Johnson Creek RM 8.2	Aug. 11, 1996	0.2	430	2.1×10^{9}
Johnson Creek RM 5.9	Sept. 4, 1996	10	610	1.5×10^{11}
Johnson Creek RM 1.0	Sept. 4, 1996	28	1400	9.6×10^{11}
Pangborn Creek RM 0.1	July 14, 1996	1.2	2500	7.3×10^{10}
Squaw Creek RM 0.2	Aug. 11, 1996	0.8	420	8.2×10^{9}
Sumas Creek RM 0.1	Sept. 4, 1996	7	3400	5.8×10^{11}

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 by Wills (1999) 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 cfu/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 (Table 5).

***Table 5*.** Loading Capacity of Fecal Coliform in the Johnson Creek Watershed

Location	**Flow(cfs)**	**Fecal Coliform Loading Capacity (cfu/day)**
Johnson Creek RM 8.2	0.2	9.8×10^{8}
	10.5	5.1×10^{10}
	38	1.9×10^{11}
Johnson Creek RM 5.9	7	3.4×10^{10}
	28	1.4×10^{11}
	53	2.6×10^{11}
Johnson Creek RM 1.0	22	1.1×10^{11}
	56	2.7×10^{11}
	115	5.6×10^{11}
Pangborn Creek RM 0.1	0.8	3.9×10^{9}
	5.5	2.7×10^{10}
	9	4.4×10^{10}
Squaw Creek RM 0.2	0.8	3.9×10^{9}
	4	2.0×10^{10}
	16	7.8×10^{10}
Sumas Creek RM 0.1	3	1.5×10^{10}
	7	3.4×10^{10}
	10	4.9×10^{10}

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. Several assumptions and critical conditions used in the modeling analysis of the Johnson Creek Watershed TMDL provide an inherent margin of safety over uncertainty as required by the statute. These conservative assumptions and critical conditions are listed below:

- Morning dissolved oxygen values, which represent the worst-case condition, were used for model calibration and simulations.
- Model calibration for dissolved oxygen was based on the September survey, which also represents the worst-case condition for determining loading capacity.
- The estimated peak instantaneous load per unit of flow based on the highest value measured for estimating the loading capacity.
- The assumed instantaneous fecal coliform loads represent the upper 10^{th} percentile of data in a 30-day averaging period for comparison to the water quality standards.

Seasonal Variation

The mean annual rainfall in the basin is about 47 inches (Gillies et al., 1981). During a typical year, approximately 70 percent of the total annual precipitation falls as rain between October and March.

Seasonal Variation: Water quality data collected in the Johnson Creek watershed show a pattern of seasonal variation. The critical period for dissolved oxygen in the Johnson Creek watershed is during the months of August and September, corresponding to lower flows and higher temperatures. Fecal coliform is much more variable, with higher counts usually occurring during the summer months.

The existing pollutant loads are from nonpoint sources which must be assigned load allocations based on the loading capacity. The load allocations for BOD are established for natural background conditions during the critical low flow, late summer period. The load allocations for fecal coliform are established based on variable flow. Significant reductions from existing loads will be needed to meet the established allocations

Load and Wasteload Allocations

Since there are no discharges in the Johnson Creek watershed that are permitted by Ecology, the waste load allocations for all streams in this TMDL are zero. However, based on the Dairy Nutrient Management Program currently being conducted, some dairies may be issued a discharge permit which would allow only those discharges caused by chronic or catastrophic storm events prompting an overflow from facilities designed for a 25-year, 24-hour storm event. Therefore, the waste load allocations for these streams will remain at zero.

The existing pollutant loads are from nonpoint sources which must be assigned load allocations based on the loading capacity. The load allocations for BOD are established for natural background conditions during the critical low flow, late summer period (Table 5). The load allocations for fecal coliform are established based on variable flow (Table 6). In both cases, significant reductions from existing loads will be needed to meet the established allocations. Due to the uncertainties, these allocations should be considered "gross allotments" based on the "best estimates" of the loading capacity as allowed under federal regulations (40 CRF 130.2(g)). As such, EPA guidance (1991) suggests a phased approach where the TMDL is monitored for effectiveness.

Table 6. Load Allocations of BOD in the Johnson Creek Watershed

Location	BOD Loading Capacity (lbs/day)	Existing BOD Load (lbs/day)	Percent Reduction Needed
Johnson Creek RM 8.2	0.018	0.097	81%
Squaw Creek RM 0.2	0.051	0.013	74%
Pangborn Creek RM 0.1	0.010	0.031	67%
Johnson Creek RM 6.6	0.054	0.180	70%
Johnson Creek RM 5.9	0.064	0.381	83%
Johnson Creek RM 3.6	0.095	0.371	74%
Johnson Creek RM 1.5	0.137	0.261	48%
Sumas Creek RM 0.1	0.048	0.081	41%
Johnson Creek RM 1.0	0.190	0.341	44%

Table 7. Load Allocations of Fecal Coliform in the Johnson Creek Watershed

Location	Flow (cfs)	Existing Peak Load (cfu/day)	Loading Capacity (cfu/day)	Percent Reduction Needed
Johnson Creek RM 8.2	0.2	2.1×10^{9}	9.8×10^{8}	53%
	10.5	2.1×10^{9}	5.1×10^{10}	0%
	38	2.1×10^{9}	1.9×10^{11}	0%
Johnson Creek RM 5.9	7	1.5×10^{11}	3.4×10^{10}	77%
	28	1.5×10^{11}	1.4×10^{11}	9%
	53	1.5×10^{11}	2.6×10^{11}	0%
Johnson Creek RM 1.0	22	9.6×10^{11}	1.1×10^{11}	89%
	56	9.6×10^{11}	2.7×10^{11}	72%
	115	9.6×10^{11}	5.6×10^{11}	41%
Pangborn Creek RM 0.1	0.8	7.3×10^{10}	3.9×10^{9}	95%
	5.5	7.3×10^{10}	2.7×10^{10}	63%
	9	7.3×10^{10}	4.4×10^{10}	40%
Squaw Creek RM 0.2	0.8	8.2×10^{9}	3.9×10^{9}	52%
	4	8.2×10^{9}	2.0×10^{10}	0%
	16	8.2×10^{9}	7.8×10^{10}	0%
Sumas Creek RM 0.1	3	5.8×10^{11}	1.5×10^{10}	98%
	7	5.8×10^{11}	3.4×10^{10}	94%
	10	5.8×10^{11}	4.9×10^{10}	91%

Summary Implementation Strategy

Introduction

A summary implementation strategy (SIS) is needed to meet the requirements of a TMDL submittal for approval as outlined in the 1997 Memorandum of Agreement between the U.S. Environmental Protection Agency and the Washington State Department of Ecology. Its purpose is to present a clear, concise, and sequential concept (i.e. vision statement) of how the waters covered in the TMDL will achieve water quality standards over time.

Overview

The Johnson Creek watershed is dominated by farming activities. The land is level to very gently sloping. The soil is very deep and poorly drained. Over the years the riparian vegetation has been removed from most of the streams to increase the area actively farmed, either for pasture or for forage crops. The result has been a significant amount of runoff from field application of dairy nutrients into surface water. The runoff brings not only nutrients but fecal coliform and changes in pH. Studies in 1990 and 1992 demonstrated high fecal coliform and low dissolved oxygen problems in Johnson Creek, Squaw Creek, Pangborn Creek, Sumas Creek, and Clearbrook Creek.

Implementation Plan Development

The following is a description of the key agencies, and other bodies that have influence, regulatory authority, involvement, or other controls that will be incorporated into a coordinated effort to implement the TMDL. Ecology will lead the coordination effort as needed to affect TMDL implementation.

- **Ecology**

Washington Department of Ecology has been delegated authority under the federal Clean Water Act by EPA to establish water quality standards, administer the NPDES program, and enforce water quality regulations. As part of those duties, Ecology inspects dairy farms and manages dairy permits in the Johnson Creek Watershed. In 1998, Washington State passed the Dairy Nutrient Management Act (DNMA). The act requires all Class A dairies to have a farm plan by July 1, 2002. After receiving a farm plan, dairies must implement them by Dec 31, 2003. All of the dairies in the Johnson Creek basin have been inspected once, prior to the formalization of the dairy inspection program. The dairies with probable pollution problems have received notice of correction, and follow up inspections. Additional inspections by the Department of Ecology dairy inspectors will be made during the wet season. Over the next two years, these actions should result in the control of dairy waste causing FC and BOD loading from entering the streams emptying into Johnson Creek. If voluntary compliance is not obtained from the landowners, enforcement and fines may be employed under the DNMA, Chapter 90.48 and the Clean Water Act.

♦ **Whatcom Conservation District (WCD)**

The Whatcom Conservation District (WCD) works closely with Ecology and National Resource Conservation Service (NRCS) in developing farm plans. The WCD also provides education and technical assistance to farmers. Farmers receiving a Notice of Correction or a formal enforcement action frequently get assistance from the WCD to assist coming into compliance. Ecology will work closely with the WCD and NRCS by identifying and prioritizing referrals for farm planning. It is anticipated that over the next two years this collaborative work will result in meeting the objectives and in a significant reduction of animal waste entering Johnson Creek

♦ **National Resource Conservation District (NRCS)**

The National Resource Conservation Service (NRCS) provides the guidance and general standards and specifications used in developing farm plans. NRCS also does research used to develop the BMPs used on farms to protect water quality. The NRCS administers cost share money that is frequently used by farmers to do farm improvements. Many of the costly farm improvements required for water quality protection such as lagoons are constructed according to designs approved by NRCS and funded in part by grants administered by NRCS. The NRCS will help Ecology and WCD evaluate the effectiveness of the BMPs as they are implemented in the Johnson Creek Watershed.

♦ **Whatcom County**

Whatcom County regulates land use. The county has a Critical Areas Ordinance (CAO) as required under Washington State's Growth Management Act. The CAO requires standard buffers consisting of native vegetation within 100 feet of a fish-bearing stream and within 50 feet of non fish-bearing streams. There is an exemption to the standard buffers for agricultural activities performed in accordance with a farm plan developed to protect water quality. In the fall of 1998, the county council passed a ban on the spreading of manure on ground without growing crops during the winter months. These ordinances are currently in effect. The enforcement of both ordinances will have direct beneficial impacts on water quality. The county has increased the focus on enforcement of the Critical Areas Ordinance provisions. Over the next two years, unlimited animal access to the streams in the Johnson Creek Watershed should be virtually eliminated thereby reducing loading of BOD and FC.

The county has also been very active in updating the code regulating On-Site Sewage Systems (OSS) as part of their OSS Program. Changes effective November 9, 1999 include:

- Certification requirements for operation and maintenance specialists
- Continuing education requirements for licensed installers
- Continuing education requirements for licensed pumpers

The result is expected to produce more reliable septic systems.

Another part of the county-initiated program is mailers sent to OSS owners in a watershed informing them of the operation and maintenance requirements. The Johnson Creek watershed will be addressed as part of the Sumas basin. The Sumas basin owners are to receive the mailings in 2000 and 2001.

If it is discovered that the Johnson Creek watershed has a problem with failing OSS, the county has already demonstrated its willingness and ability to quickly and effectively conduct OSS inspections. Funding for the activity would have to be granted to the county, but similar activities in Drayton Harbor and Portage Bay shellfish closure areas have resulted in identification and repair of many failing systems.

The county received a $300,000 State Revolving Fund loan in 1999 to help owners repair failing OSS. It is expected that the loans should be available to owners in the year 2000 for implementation activities.

- **Consolidated Drainage Improvement District Number 31**

CDID 31 is a taxing district for the purpose of maintaining drainage to facilitate farming. Historically, the drainage improvement districts focused on dredging and vegetation removal. Recently, they have begun to take responsibility to enhance riparian vegetation. This encourages infiltration of field runoff. The infiltrated water has reduced nutrient and bacterial levels. The riparian vegetation will shade water-lowering temperatures further enhancing dissolved oxygen levels. In a letter dated June 22, 1999, CDID 31 committed to preparing a vegetation plan prior to any dredging work. It is anticipated that a plan will be developed in the next year and vegetation establishment will begin prior to any drainage improvements. Over the next 10 to 20 years, all of the streams in the juristiction of CDID should add shading as a result of riparian vegetation.

Approaches to be used to meet load allocations

As part of the Ecology dairy inspection program, dairies with a potential to pollute will be instructed to correct the problem. The services at the Whatcom Conservation District will be recommended. WCD will develop or modify an existing farm plan to eliminate the potential to pollute under the guidance of NRCS. At that point, all three entities will then develop a monitoring plan to measure the effectiveness of the BMPs.

If agricultural sources that are not associated with dairies are identified to be causing pollution, they will be referred to WCD. The WCD will develop or modify an existing farm plan to eliminate the potential to pollute under the guidance of NRCS. At that point, all three entities will then develop a monitoring plan to measure the effectiveness of the BMPs.

If OSS failures are identified, the owners will be referred to Whatcom County. Whatcom County will implement the provisions of their OSS program including making available low interest loans for repairs.

Plans to assess TMDL implementation

The source control issues will be addressed with the implementation of Dairy Nutrient Management Act. The Northwest Indian College (NWIC) has proved a reliable partner in follow up monitoring. They have a lab that is now certified for conducting fecal coliform analysis and are currently funded by a Centennial Clean Water Fund Grant to do monitoring in the Drayton Harbor and Portage Bay shellfish closure districts. Ecology will assist the college in forming the scope of work for their next funding cycle to include monitoring the effectiveness of the TMDL implementation.

Internal/external schedules or milestones that impact implementation

All class A dairies must have their farm plans by July 1, 2002. The plans must be implemented by December 31, 2003, 18 months later.

The county is developing a long-range plan for addressing the establishment of riparian vegetation. Ecology has provided assistance with a grant to Whatcom County to hire crews that are working-off public service commitments. The current priority scheme is based on drainage maintenance needs. CDID 31 has planned on conducting some dredging activity in 1998. The plan was withdrawn until they could prepare an acceptable re-vegetation plan. It is expected that they will conduct some dredging in 2000 or 2001 and concurrently begin re-vegetation. Within ten years virtually all of the streams in the districts jurisdiction will have added shade-producing vegetation.

Implementation Activities

There are 30 dairies located within the Johnson Creek drainage. None of these dairies have been required to obtain a permit under the NPDES general dairy permitting system, because none have been shown by Ecology to be causing pollution.

The Nooksack has had nearly a year of follow up monitoring. The first round of inspections was completed by the fall of 1998. Follow up inspections will be conducted during the wet season of 1999-2000. Discharges identified as a part of the inspection program results in the offending dairy being required to obtain an NPDES dairy permit. No discharges have been documented by Ecology in the Johnson Creek basin at this time.

There are no other facilities permitted in the basin that should have an affect on either fecal coliform or dissolved oxygen levels.

Summary of Public Involvement

The dairy inspectors provided a one-day clinic to dairy farmers entitled “How to avoid an Ecology Penalty” that was well attended. The purpose was to explain the expectation of the dairy program and how it would be implemented. After the approval of the TMDL, a similar clinic could be held by all of the agencies that have regulatory jurisdiction and can provide assistance with meeting the regulations.

Discussions have taken place between Ecology and Whatcom County regarding planned activities of CDID 31 and the implantation of the OSS program. The interaction of the Ecology Dairy inspection program, WCD, and NRCS has been established prior to this TMDL.

Ecology will be working with WCD, NRCS, CDID 31, and Whatcom County to develop the Detailed Implementation Strategy through a process of peer review and periodic stakeholder meetings. With the exception of CDID 31, the members of this stakeholder group have already collaborated with Ecology reviewing the technical work on the Lower Nooksack TMDL. In the work on the Lower Nooksack TMDL, this group has proved highly effective at coming to consensus on difficult issues by focusing on the need to clean up and eliminate pollution.

Adaptive Management Approaches

Dairies have been assumed to be the most significant contributor to fecal coliform and nitrogen contamination problems in Johnson Creek. If after two rounds of inspections of the dairies, the correction of all probable sources of pollution associated with agricultural activities has not brought Johnson Creek to meeting FC standards, Ecology will continue to monitor and investigate to identify additional sources of fecal contamination (FC). It is expected that in the process of conducting dairy inspections all agricultural (both dairy and non-dairy) sources of fecal coliform and nutrients will be subject to the imposition of BMPs similar to those required in dairy nutrient management plans. If OSS is suspected of causing pollution, funding will be obtained to allow Whatcom County to inspect all of the systems in the Johnson Creek area.

The previously noted stakeholders meetings mentioned above will be used to keep all stakeholders appraised of the other's activities and to reach consensus on appropriate corrective actions and timelines.

Monitoring Strategy

Ecology will prepare a report in 2001 summarizing the status of the dairy inspection program within the Johnson Creek basin. Elements of the report will be:

- Farms with current farm plans
- Farms with implemented farm plans
- Follow up actions required on farms as a result of inspections.

In the Lower Nooksack, Ecology's inspection program has resulted in decreased fecal coliform contamination. Ecology funded a NWIC to develop and implement a monitoring program focused on two shellfish bed closures. The focus of the inspection program during that period was the Fishtrap and Bertrand tributaries to the Nooksack River. The monitoring in the Nooksack has helped identify problem areas for additional focus as well as highlighting non-dairy agricultural problems that can be addressed concurrently with the dairy inspection program.

The most beneficial way to continue water quality monitoring is to fund the NWIC for activities in the Johnson Creek Watershed. This effort would be similar to the monitoring that has already been accomplished in Drayton Harbor and Nooksack basins. The Nooksack and Drayton Harbor monitoring efforts have helped the dairy inspectors target the problem areas and have helped to identify non-dairy agricultural sources the dairy inspectors have been able to correct.

The TMDL for a parameter will be accomplished when the criterion has been met for 24 months. For the fecal coliform criterion the last ten samples will used for calculating the geometric mean and the 10 percent exceedance. Ecology, the county, and North West Indian College all have accredited facilities capable of performing the analysis.

Potential Funding Sources

The Centennial Clean Water Fund, Section 319, and SRF grant funds are available to fund activities by jurisdictions to help implementation of the TMDL. 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 TMDL, and to assist with applying for grant opportunities as they arise.

Acronyms and Abbreviations

BMP	Best Management Practice
CDID 31	Consolidated Drainage Improvement 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
NWIC	Northwest Indian College
OSS	On-Site Sewage System (OSS)
WCD	Whatcom Conservation District

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Figures

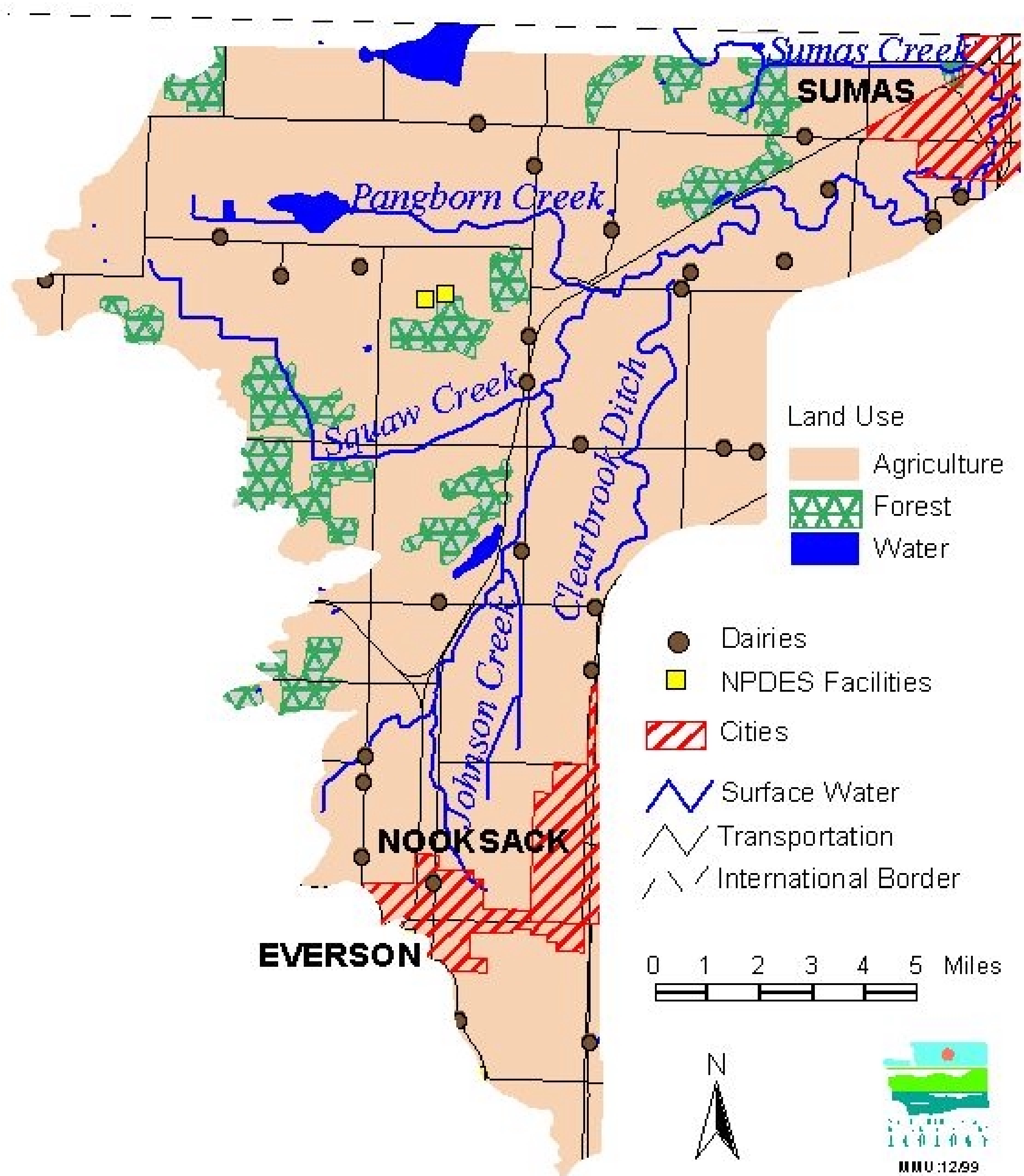

Figure 1. Johnson Creek Watershed Map

Appendix A

Public Participation Materials

Public Participation Materials

Ron I am sending by surface mail the following material for inclusion.

- Affidavit of Publication for public notice that ran on February 11, 2000
- Two related stories from the 2/19/00 edition of the Bellingham Herald
- Copies (4) in color of the Focus sheet that was distributed.
- The 3 pages of address labels for the mailing of the Focus Sheet
- Agenda from the Nooksack City Council Meeting of February 15, 2000
- Agenda from the Everson City Council February 22, 2000

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Presentations on the SIS were made at the Nooksack City Council, and Everson City council as documented above, presentations also made to the Whatcom County Natural Resources Committee at 10 AM on February 22, 2000 and Sumas City Council on February 28, 2000. At each presentation the need and purpose of the TMDL was explained. The SIS was summarized and written public comment, directed to the address given on the focus sheets was solicited. No written public comment was received. Questions were answered after the presentations. The answers to the questions had largely been answered in the Draft SIS and so the Draft is being submitted as Final with no changes.

Appendix B

Quality Assurance Project Plan

Appendix C

Technical Report

Wills, M.T. 1998. Dairy Farming and the effects of Agricultural, Nonpoint-source Pollution on Stream Water Quality, Johnson Creek Watershed, Whatcom County, Washington. Master of Science Thesis, Western Washington University.